Rampion 2 WIND FARM

Rampion 2 Wind Farm

Category 6: Environmental Statement

Volume 4, Appendix 15.5: Assessment of aviation and navigation night-time lighting

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1. Introduction

1.1.1 This appendix to **Chapter 15: Seascape, landscape and visual impact assessment, Volume 2** of the ES (Document Reference: 6.2.15) provides an assessment of the visual effects arising from the visible lighting requirements (aviation and marine navigational) of the offshore elements of Rampion 2. The findings are also summarised in **Chapter 15: Seascape, landscape and visual impact assessment, Volume 2** of the ES (Document Reference: 6.2.15).

1.1.2 The effect of the offshore elements of Rampion 2 at night will result primarily from visible Civil Aviation Authority (CAA) guidance requires that 'en route obstacles' at or above 150m above ground level are lit with visible lighting to assist their detection by aircraft. As such, there is potential that parts of the offshore elements of Rampion 2 may be visible at night. The effect of the offshore elements of Rampion 2 at night would result primarily from visible medium intensity (2,000 candela (cd)) red coloured aviation light fittings located on the nacelles of all peripheral WTGs.

1.1.3 This Appendix is structured as followed:

- **Section 2: Regulations and guidance**;
- **Section 3: Consultation**;
- **Section 4: Assessment methodology**;
- **Section 5: Baseline conditions**;
- **Section 6: Environmental Measures**;
- **Section 7: Assessment of visual effects**;
- **Section 8: Summary**; and
- **Section 9: References**.

1.1.4 This visual assessment of WTG lighting is supported by plan figures (**Figure 15-11, Figure 15-12** and **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15)) and night-time photomontage visualisations from five viewpoints:

- **Figure 15-27i-j, Volume 3** of the ES (Document Reference: 6.3.15) Viewpoint 2 Birling Gap;
- **Figure 15-42j-m, Volume 3** of the ES (Document Reference: 6.3.15) Viewpoint 17 - Devil's Dyke;
- **Figure 15-46, Volume 3** of the ES (Document Reference: 6.3.15) Viewpoint 21 – Bignor Hill;
- **Figure 15-50g-h, Volume 3** of the ES (Document Reference: 6.3.15) Viewpoint 27 Hollingbury Hillfort; and

- **Figure 15-54d, Volume 3** of the ES (Document Reference: 6.3.15) Viewpoint 31 Butser Hill.

1.1.5 A description of the proposed lighting is found within **Chapter 4: The Proposed Development, Volume 2** of the ES (Document Reference: 6.2.4) and **Chapter 14: Civil and military aviation, Volume 2** of the ES (Document Reference: 6.2.14).

2. Regulations and guidance

2.1 The Air Navigation Order 2016

2.1.1 The International Civil Aviation Organization (ICAO) (a UN body) sets international Standards; Recommendations and 'Notes' for aviation lighting in its publication 'Annex 14 to the Convention on International Civil Aviation' - Volume I Aerodrome Design and Operations (ICAO, Eighth Edition, July 2018).

2.1.2 ICAO Table 6.1 (page 6-4) identifies the international definitions of daylight; twilight and night based on measured background illuminance as follows.

- Daylight: Above 500cd/m^2;
- Twilight: 50-500cd/m^2; and
- Night: Below 50cd/m^2.

2.1.3 For 2,000cd medium intensity steady or fixed red lights, ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50cd/m^2 or darker. The Civil Aviation Authority (CAA) have confirmed that UK policy broadly aligns with the international standards, including insofar as the point at which lights must be switched on at 'Night' rather than 'Twilight'. For the purpose of this assessment, the end of civil twilight (and therefore the start of nautical twilight), marks the point at which 'Night' is reached and that the WTG aviation lighting is assumed to be switched on (which has been verified as occurring for the operational Rampion 1 WTG lights during field surveys).

2.1.4 The European Aviation Safety Agency (EASA) implements ICAO in European airspace. In pursuit of international standards for use around the globe, a project team has been established to provide clearer direction to lighting manufacturers, as there is scope for interpretation of ICAO in different ways by manufacturers.

2.1.5 Within the UK, the ICAO/EASA requirements for lighting WTGs are implemented through The Air Navigation Order 2016 (Statutory Instruments 2016 No. 765).

2.1.6 The Rampion 2 WTGs, at a maximum of 325m to blade tip and located in UK territorial waters, will require lighting under Article 223 of the Air Navigation Order 2016. Article 223 modifies the Article 222 requirement with respect to offshore WTGs, requiring: WTGs to be lit where they exceed 60m above HAT; with a medium intensity (2000 candela (cd)) steady red light mounted on the top of each nacelle; and with limited downward spillage of light.

2.1.7 When displayed, the angle of the plane of the beam of peak intensity emitted by the light must be (a) elevated to between 3° and 4° above the horizontal plane; (b) not more than 45% or less than 20% of the minimum peak intensity is to be visible at the horizontal plane; and (c) not more than 10% of the minimum peak intensity is to be visible at a depression of 1.5° or more below the horizontal plane.

2.1.8 Air Navigation Order 2016 Article 223 (8) also states that "*If visibility in all directions from every WTG generator in a group is more than 5km the light*

intensity for any light required by this article to be fitted to any generator in the group and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type." This allows the minimum intensities identified above to be dimmed to 10% of their values if meteorological conditions permit (i.e. the 2,000cd minimum intensity may be dimmed to 10%, or 200cd, if visibility is greater than 5km, i.e. in moderate to excellent or 'clear' visibility).

2.1.9 Article 223 also allows for the CAA to permit that not all WTGs are so lit. The CAA will require that all WTGs on the periphery of any wind farm need to be equipped with aviation warning lighting and such lighting, where achievable, shall be spaced at longitudinal intervals not exceeding 900m. There is no current routine requirement for offshore obstacles to be fitted with intermediate vertically spaced aviation lighting.

2.1.10 CAA guidance has been subject to coordination with maritime agencies to avoid confusion with maritime lighting. To that end, the CAA has indicated that the use of a flashing red Morse Code letter 'W' is likely to be approved to resolve potential issues for the maritime community.

2.1.11 The Maritime and Coastguard Agency (MCA) is seeking that WTG blade tips are marked in red, together with markings down the blade, to provide a SAR helicopter pilot with a hover reference point as set out in the OREI SAR Requirements document. The MCA also seeks a lighting scheme comprising 200cd red/infra-red lights on the nacelles of non-Article 223 WTGs, to be operated on demand during SAR operations and a WTG shutdown protocol to be applied during rescue situations. These measures will be undertaken, and an Emergency Response and Cooperation Plan (ERCOP) will be developed and implemented for all phases of the Proposed Development, based upon the MCA's standard template. Appropriate lighting will be utilised to facilitate heli-hoisting if undertaken within the Rampion 2 array area, as outlined in CAP 437.

2.1.12 To satisfy MoD requirements, the WTGs will also be required to be fitted with infra-red lighting in combination with the ANO Article 223 lights. MoD lighting guidance indicates that operational requirements are satisfied provided combination infra-red/2000 cd visible red lights are used to light the WTGs required to be lit under Air Navigation Order, Article 223.

2.2 Guidelines for Landscape and Visual Impact Assessment (GLVIA3)

2.2.1 GLVIA3 (page 103) provides the following guidance on the assessment of lighting effects: *"For some types of development the visual effects of lighting may be an issue. In these cases it may be important to carry out night-time 'darkness' surveys of the existing conditions in order to assess the potential effects of lighting and these effects need to be taken into account in generating the 3D model of the scheme. Quantitative assessment of illumination levels, and incorporation into models relevant to visual effects assessment, will require input from lighting engineers, but the visual effects assessment will also need to include qualitative assessments of the effects of the predicted light levels on night-time visibility."*

2.2.2 GLVIA3 (page 60) also provides the following guidance with regards to mitigation of obtrusive light: *'lighting for safety or security purposes may be unavoidable and may give rise to significant adverse effects; in such cases, consideration should be given to different ways of minimising light pollution and reference should be made to appropriate guidance, such as that provided by the Institution of Lighting Professionals* (ILP, 2011)'.

2.3 Institute of Lighting Professional Guidance

2.3.1 Guidance produced by the Institute of Lighting Professionals (ILP) (2011) (GN01:2011) is useful in setting out some key terminology that is used in this visual assessment of WTG lighting:

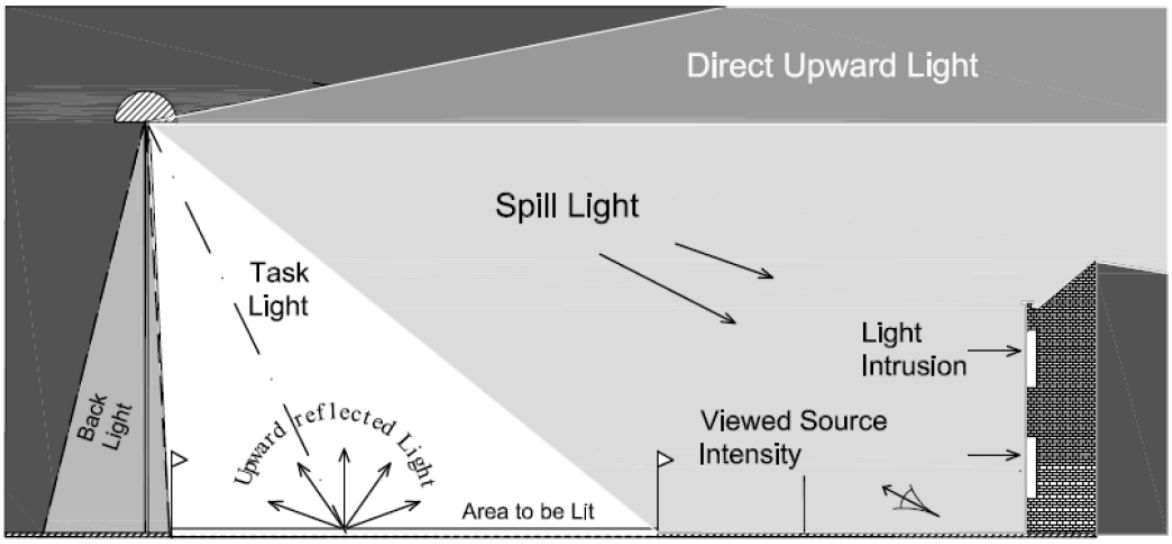
- '***Obtrusive Light**, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task.*
- ***Skyglow** – the brightening of the night sky;*
- ***Glare** – the uncomfortable brightness of a light source when viewed against a darker background; and*
- ***Light Intrusion** – the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others.*

2.3.2 CPRE also identifies these same broad terms as the three types of light pollution:

- *'**Skyglow** – the pink or orange glow we see for miles around towns and cities, spreading deep into the countryside, caused by a scattering of artificial light by airborne dust and water droplets.*
- ***Glare** – the uncomfortable brightness of a light source.*
- ***Light intrusion** – light spilling beyond the boundary of the property on which a light is located, sometimes shining through windows and curtains'.*

2.3.3 Types of obtrusive light are identified in Figure 1 of the ILP (2011) guidance:

Graphic 2-1 Types of Intrusive Light (ILP, 2011)



2.3.4 The following key guidance is noted:

- '*The most sensitive/critical zones for minimising sky glow are those between 90° and 100° (note that this equates to 0-10° above the horizontal).*
- *Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°.*
- *In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape.*
- *Upward Light Ratio (ULR) of the Installation is the maximum permitted percentage of luminaire flux that goes directly into the sky. A ULR of 0 (zero) Candela (cd) is suggested for Dark Sky Parks.*

2.4 NatureScot guidance

Overview

2.4.1 Although NatureScot guidance is a material consideration only to development projects in Scotland, it does represent current and developing thinking and is specifically relevant to the assessment of wind farms, therefore it has been included and referred to within this Appendix in order to ensure the best possible assessment is presented for the Proposed Development.

Visual representation guidance

2.4.2 NatureScot Guidance on WTG lighting is contained in para 174-177 in Visual Representation of Windfarms (NatureScot, 2017) as follows:

2.4.3 'Where an illustration of lighting is required, a basic visualisation showing the existing view alongside an approximation of how the wind farm might look at night with aviation lighting may be useful. This is only likely to be required in particular

situations where the wind farm is likely to be regularly viewed at night (e.g. from a settlement, transport route) or where there is a particular sensitivity to lighting (e.g. in or near a Dark Sky Park or Wild Land Area). Not all viewpoints will need to be illustrated in this way. The visualisation should use photographs taken in low light conditions, preferably when other artificial lighting (such as street lights and lights on buildings) are on, to show how the wind farm lighting will look compared to the existing baseline at night. It is only necessary to illustrate visible lighting, not infrared or other alternative lighting requirements'.

Evolving NatureScot approaches to WTG lighting

2.4.4 Recent NatureScot workshops indicate that a proportionate and pragmatic approach is required, both in terms of the need to assess likely significant effects under the EIA regulations, complying with current civil aviation standards and providing mitigation on a project and site-specific basis.

2.4.5 Mitigation options to eliminate or reduce the need for, and effects of, visible lighting are evolving quickly and developers are exploring these with consultees and the CAA in relation to specific sites. NatureScot has offered a perspective on the efficacy of different mitigation options, noting that the most effective appears to be radar activated, albeit accepting the considerable cost implications inherent in this potential option.

2.4.6 Ministers and planning authorities are using planning conditions to manage effects. It is recognised that developers need flexibility to utilise the most appropriate mitigation once they are ready to start discharging conditions. Conditions provide some flexibility for developers to identify the most appropriate mitigation option(s) post consent and prior to construction, and to agree these with the relevant decision maker.

2.4.7 In terms of visual effects, NatureScot's view (as expressed at a seminar in November 2019) is that lengthy debate about the exact brightness of lights (including in visualisations) is potentially not helpful and that it is better to focus on where they will be visible, how many lights will be visible and the level of change from the baseline situation. This is recognised in the visual assessment in this Appendix. NatureScot has also taken a pragmatic view with night-time visualisations, requesting that decision makers, consultees and communities require visualisations from a small number of relevant viewpoints to understand these effects. NatureScot also recognises the challenges of capturing night-time photography and accept that some post photographic manipulation of images to provide a good representation is acceptable.

2.5 South Downs National Park (SDNP) Dark Skies Technical Advice Note

2.5.1 The South Downs National Park (SDNP) Dark Skies Technical Advice Note (South Downs National Park Authority (SDNPA), 2018) sets out guidance on the SDNPA's approach to lighting design and the protection and enhancement of dark skies within the SDNP.

2.5.2 It sets out general best practice lighting principles, including the following of relevance to the offshore elements of Rampion 2:

- *'New lighting should not adversely degrade the sky quality beyond the immediate area to be lit.*
- *Point where the light is needed, not in a direction that causes a nuisance.*
- *Switch off when not needed. Use proximity sensors. Avoid dusk-till-dawn sensors.*
- *Light to the appropriate illuminance – do not over light needlessly'.*

2.5.3 Dark skies are identified as a special quality of the South Downs and generally defined as '*skies relatively free of light pollution where you can see a clear starry sky and importantly, our own galaxy the Milky Way, stretching as a ribbon of faint stars across the sky'*.

2.5.4 The SDNPA conducted a Sky Quality survey across the SDNP to establish the extent of darkness in a Sky Quality Map, which identified that around 70% of the SDNP has skies dark enough to qualify for a designation under International Dark Sky Association rules.

2.5.5 The South Downs was awarded International Dark Sky Reserve (IDSR) status in May 2016 to reflect the quality of skies and the commitment of the SDNPA in addressing light pollution and having a due regard for dark skies. The IDSR takes in the entire SDNP boundary but is largely defined by a critical core and buffer zone base where the darkest skies can be found.

2.5.6 Using sky quality measurements, the SDNP has been categorised into a number of dark zones, shown in **Figure 15-12, Volume 3** of the ES (Document Reference: 6.3.15) - Dark Sky Core (E0); 2km Buffer Zone(E1a); Transition Zone (E1b); and Urban (E3/4). These zones reflect the quality of the sky overhead, the IDSR designation and the general level of lighting, and are described further in **Section 5.2** of this Appendix with respect to the baseline conditions, and allow application of the guidance in combination with specific planning policy for the dark night skies of the SDNP (**Section 2.6**).

2.5.7 The Dark Skies Technical Advice Note (SDNPA, 2018) identifies that it is useful to regard the protection of dark skies as two distinct landscapes - *'the skies above'* and *'the land below'*. The 'above' landscape is the unobstructed sky full of stars. It is predominately affected by sky glow from the street-lights and lighting within the larger urban environment, but can also be affected by over-bright single sources. The guidance recommends *'lighting designs that minimise light spill into the air'*.

2.5.8 The 'below' landscape is more the 'continuity' of darkness across the Downs themselves, where point sources of light can stand out due to the higher contrast between light and dark. While these sources may contribute less to the overhead quality, *'being able to manage a landscape as a continuous dark habitat is of equal importance to protect this special quality and the relative tranquilly it offers'*.

Graphic 2-2 Illustration of 'dark skies' and 'dark landscape' from SDNPA, 2018

2.5.9 With regards to the 'below' landscape and viewpoints, the Dark Skies Technical Advice Note (SDNPA, 2018) recommends (para 8.2.1.9) (emphasis added) that *'There are many key daytime viewpoints across and outside the park which serve both the daytime and night. Proposals should consider the impact on these viewpoints, **particularly in regard to the disruption of the dark landscape continuity**. As large-scale developments are more likely outside the park, **consideration should be given to their impact on dark skies within the park**.*

2.6 Planning Policy: South Downs Dark Night Skies

2.6.1 Strategic Policy SD8: Dark Night Skies of the South Downs Local Plan (SDNPA, July 2019) identified the specific lighting requirements and policy that developers need to meet with respect to the South Downs IDSR:

2.6.2 *"1. Development proposals will be permitted where they conserve and enhance the intrinsic quality of dark night skies and the integrity of the Dark Sky Core as shown on the Policies Map.*

2. Development proposals must demonstrate that all opportunities to reduce light pollution have been taken, and must ensure that the measured and observed sky quality in the surrounding area is not negatively affected, having due regard to the following hierarchy:

a) The installation of lighting is avoided; and

b) If lighting cannot be avoided, it is demonstrated to be necessary and appropriate, for its intended purpose or use:

i. Any adverse impacts are avoided; or

ii. If that is not achievable, then adverse impacts are mitigated to the greatest reasonable extent.'

Graphic 2-3 Table from Strategic Policy SD8 (SDNPA, 2019)

Location	Requirements for level of protection				
Dark Sky Zone description	ILP guidance[35]	Landscape impact	Maximum Lux level (suggested 10 Lux)	Preferred lights-off curfew	Astronomical darkness curfew
E0 Dark Sky Core and areas outside this zone with a SQM[36] of 20.5+	✓	✓	✓		✓
E1(a) 2km Buffer Zone and areas outside this and the above zone which are of intrinsic rural darkness with a SQM range of 20 to 20.5	✓	✓	✓	✓	
E1(b) Transition Zone and areas outside this and the above zones with a SQM range of ~15 to 20	✓	✓	✓		
E3/4 Urban zone with an SQM of <15	✓	✓			

3. Lighting which is proposed to be installed must meet or exceed the level of protection appropriate to the environmental zone, as shown on the Policies Map, as set out in the table above.

4. Outdoor lighting proposals are required to provide a statement to justify why the proposed lighting is required.

2.6.3 The purpose of Policy SD8 is to ensure that development does not harm the quality of dark night skies. The policy seeks to do this by ensuring that proposed lighting is necessary, and by reducing the unnecessary light spill that is often a result of poor design, in order to minimise the overall impact of light.

2.6.4 Policy SD8 applies across the International Dark Sky Reserve which covers the entirety of the SDNP. The lighting on the offshore elements of Rampion 2 is not located within any of the Dark Sky Zone areas defined in Policy SD8, being a minimum distance of 22.6km outside the Dark Sky Core; 20.6km outside the Buffer Zone; 16.1km outside the Intrinsic Rural Darkness Zone; and 13.5km outside the Transition Zone. Although the visible lighting of Rampion 2 is outside

the IDSR, Policy SD8 aims to conserve and enhance all areas of intrinsic dark sky within the SDNP. The visual impacts of the lighting on the offshore elements of Rampion 2 is therefore assessed in this Appendix, since the aviation and marine navigation lighting may be visible in the seascape outside the IDSR (from locations within the IDSR), in order that the proposals take due consideration of the overall visual impact that the lighting will have on the landscape, in line with policy requirements.

2.6.5 In respect of the darkest areas of the IDSR, the South Downs Local Plan states at para 5.53 (emphasis added) that *'In the darkest areas, where control is more important, **the overall impact of the lighting should not harm the continuity of the dark landscape** and **ideally not be visible in any direction or in any form such as glare, skyglow, spill and reflection**. It also should **not reduce the measured and observed quality of easily visible astronomical features** such as the Milky Way and Andromeda Galaxy.*

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3. Consultation

3.1 Consultation responses

3.1.1 A summary of the consultation responses received with regards to the visual impacts of aviation and marine navigation lighting on dark skies is provided in **Table 3-1**, summarised from the full responses set out in **Appendix 15.1: SLVIA consultation responses, Volume 4** of the ES (Document Reference: 6.4.15.1). Key information provided by consultees relevant to this visual assessment of aviation and marine navigation lighting is provided in **Table 3-1**, which also describes how issues raised by during these consultations have been addressed in this Appendix.

Table 3-1 Summary of consultation relevant to visual assessment of lighting

Consultee	Date/document	Comment	How this is addressed in this ES
PINS	Scoping Opinion August 2020	*"The ES should contain assessment of the impact which the Proposed Development may have on dark skies. It would be helpful if a figure were included to show the study area which is considered for this. Agreement with relevant consultation bodies should be evidenced in the ES".*	Assessment of the impact of Rampion 2 on dark skies undertaken in this **Appendix 15.5, Volume 4. Figure 15-12, Volume 3** of the ES (Document Reference: 6.3.15) shows the SLVIA study area and South Downs IDSR.
MOD	Scoping Opinion August 2020	*"The report considers the requirement for aviation obstruction lighting and states that the development will comply with the legal requirements with regards to aviation marking and lighting. In the interests of air safety, the MOD would request that the development be fitted with MOD accredited aviation safety lighting in accordance with the Civil*	The offshore elements of Rampion 2 will be with MOD accredited aviation safety lighting in accordance with the Civil Aviation Authority, Air Navigation Order 2016 as described in **Chapter 4: The Proposed Development, Volume 2** of the ES (Document Reference: 6.2.4).

Consultee	Date/document	Comment	How this is addressed in this ES
		Aviation Authority, Air Navigation Order 2016".	
South Downs National Park	Scoping Opinion August 2020	*"We welcome the confirmation given, in table 5.13.5, that the effects of the Rampion 2 lighting on the quality of dark night skies in the South Downs National Park is scoped in to the EIA. We also welcome the commitment given, in paragraph 6.2.84, that lighting requirements for the onshore elements of the proposed development will be reviewed and assessed and agreed with stakeholders between scoping and the PEIR".*	Assessment of the impact which the Proposed Development on dark skies undertaken in this Appendix**.** Lighting requirements and the scope of assessment for the offshore elements of the Proposed Development were reviewed and agreed with stakeholders during ETG meetings in September 2020 and March/April 2021. Assessment of lighting of onshore elements of Rampion 2 is contained in **Chapter 18: Landscape and visual impact assessment, Volume 2** of the ES (Document Reference: 6.2.18).
Natural England	Scoping Opinion August 2020	*"Aviation lighting. NE notes the intention to use medium density aviation warning lights (2,000cd intensity) on the significant peripheral WTG. NE notes that other offshore windfarms currently in the design and determination phrases are opting to use 200cd intensity lightening. NE requests that the applicant explores the possibility of using these lower intensity lights when weather conditions permit in order that any potential adverse effects on the South Downs IDSR are*	As described in **Section 4.1** of this Appendix, 2,000cd aviation lights may be dimmed to 10% of their intensity (200cd) where visibility conditions permit, when visibility from every WTG within the Rampion 2 array area is >5km.

Consultee	Date/document	Comment	How this is addressed in this ES
		mitigated as far as possible".	
Arun District Council	Viewpoint Selection Method Statement November 2020	*"Arun District Council would assume also that viewpoints have been selected in consideration of WTG lighting at night".*	Night-time viewpoints have been selected within each of the dark skies zone of the IDSR - Dark Sky Core; 2km Buffer Zone; Transition Zone; and Urban, as described and assessed in **Section 7.2** of this Appendix.
National Trust	ETG Meeting April 2020	*"We have checked the night skies areas and Bignor Hill is promoted for star gazing so we thought that a night-time impact assessment would be a good approach from this location".*	Bignor Hill (Viewpoint 21) (Dark Skies Discovery Site 5) has been included in the assessment, with night-time viewpoint photography undertaken from this location within the core area of the South Downs IDSR (**Figure 15-46, Volume 3** of the ES (Document Reference: 6.3.15)).
NE/SDNP	ETG Meeting April 2020	SDNP to respond with confirmation of agreement or further recommendation of night time skies assessment viewpoints and methodology (as presented in the previous ETG meeting slides).	Bignor Hill (Viewpoint 21) (Dark Skies Discovery Site 5) was agreed as further viewpoint to be n included in the assessment, with night-time viewpoint photography undertaken from this location within the core area of the South Downs IDSR (**Figure 15-46, Volume 3** of the ES (Document Reference: 6.3.15)).

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4. Assessment methodology

4.1 Key maximum assessment assumptions

4.1.1 Based on the description of proposed WTG lighting in **Chapter 4: The Proposed Development, Volume 2** of the ES (Document Reference: 6.2.4) and the ICAO/CAA regulations and standards described in **Section 2**, the following assumptions have been made for the visual assessment with regards to lighting of the offshore elements of Rampion 2:

- the CAA requires that all obstacles at or above 150m above ground level are fitted with medium intensity (2,000cd) visible aviation lighting and, in the case of WTGs, these should be located on the nacelle;
- the CAA requires that a secondary light (of the same specification) is fitted for use only when the primary light fails and will not be lit concurrently; and
- there is an additional requirement for low intensity (32cd) aviation lights to be provided at an intermediate level of half the nacelle height. These will need to be fitted around the towers to allow for 360° horizontal visibility.

4.1.2 The visual assessment of WTG lighting is based on the following key maximum assessment assumptions.

- Red, medium intensity aviation warning lights (2,000cd) will be located on top of the nacelle (177.5m above LAT for 325m WTGs) of all peripheral WTGs of the 325m layout shown in **Figure 15-1, Volume 3** of the ES (Document Reference: 6.3.15).
- Aviation warning lights will flash simultaneously with a Morse W flash pattern and be able to be switched on and off by means of twilight switches.
- Aviation warning lights will have reduced intensity at and below the horizontal and allow a further reduction in lighting intensity when the visibility in all directions from every WTG is more than 5km.
- Search and rescue (SAR) lighting of each of the non-periphery WTGs will be combi infra-red (IR)/200cd steady red aviation hazard lights, individually switchable from the control centre at the request of the MCA (i.e. when conducting SAR operations in or around the Rampion 2 Wind Farm). These low intensity lights are not assessed or shown in the night-time photomontages, as they will not be switched during normal operations and only during SAR operations.
- All WTGs will be fitted with a low intensity light for the purpose of helicopter winching (green hoist lamp). All WTGs will also be fitted with suitable illumination (minimum one 5cd light) for ID signs. These low intensity lights are not shown in the night-time photomontages, as they will not be visible at such long distances.

- Marine navigational lights (aid to navigation lights) will be fitted at the platform level on significant peripheral structures (SPS) as shown in **Figure 15-1, Volume 3** of the ES (Document Reference: 6.3.15). These lights will be synchronized to display simultaneously an IALA “special mark” characteristic, flashing yellow, with a range of not less than five (5) nautical miles. The marine navigational lights will be located at platform level.
- It is assumed that the aviation lighting and marine navigational lighting of the existing Rampion 1 WTGs will remain in place and operate as per the current baseline conditions i.e. they will not be ‘switched off’ even though Rampion 2 WTGs will become the new peripheral WTGs to the west, south and east of Rampion 1.
- It is understood and assumed that the aviation lights operating on the Rampion 1 WTGs are 2,000cd, which are not currently reduced in intensity when the visibility is more than 5km. The visible Rampion 1 aviation lights therefore illustrates worst-case in terms of light intensity that may be visible on the Rampion 2 aviation lights; however, further mitigation will be applied to Rampion 2 as the lighting intensity will be reduced in good visibility (when visibility is greater than 5km).

4.1.3 On the basis of the CAA requirements, it is evident that the effect of the visible lights will be dependent on a range of factors, including the intensity of lights used, the clarity of atmospheric visibility and the degree of negative/ positive vertical angle of view from the light to the receptor. In compliance with EIA regulations, the likely significant effects of a ‘worst-case’ scenario for WTG lighting are assessed and illustrated in this visual assessment.

4.1.4 A worst-case approach is applied to the assessment that considers the potential effects of medium-intensity 2,000cd lights in clear visibility, replicating the intensity of the Rampion 1 WTG aviation lights in the photomontages (which are understood to be 2,000cd i.e. not dimmed in good visibility). It should be noted however, that medium intensity lights are only likely to be operated at their maximum 2,000cd during periods of poor visibility. A further assessment of the likely residual effects is therefore made factoring in embedded measures, described in **Section 6**, i.e. that the 2,000cd Rampion 2 aviation lights will be dimmed to 10% of their value (200cd) if meteorological conditions permit (when visibility is greater than 5km).

4.1.5 It should be noted that the WTGs will also include infra-red lighting on the WTG hubs, which will not be visible to the human eye. Details of the lighting would be agreed with the MoD. The focus of the night-time visual assessment in this Appendix is on the visible lighting requirements of the offshore elements of Rampion 2.

4.2 Spatial scope

4.2.1 Based on relevant guidance and the consultation responses received from relevant stakeholders, the assessment of visual effects of WTG lighting in this Appendix includes both – an assessment of the effects of lighting on users of the South Downs IDSR (with reference to viewpoints and key routes/visitor locations

within the South Downs IDSR); and an assessment of the effects of lighting on people in other nearby locations, outside the South Downs IDSR, where current lighting levels are low.

4.2.2 The study area for the visual assessment of WTG lighting is shown in **Figure 15-12, Volume 3** of the ES (Document Reference: 6.3.15) and is coincident with the 50km SLVIA study area, however, it is particularly focused on the area within 30km of the wind farm Proposed DCO Order Limits extending to include the closest parts of the 'dark sky core' of the South Downs IDSR at the Goodwood to Arundel Wooded Estate Downland (LCT B1), as well as the 2km buffer zone and transition zones of the IDSR extending eastwards covering the Open Downlands (LCTs A1, A2 and A3) to the coast at Beachy Head; and the urbanised coastline to the south of the IDSR.

4.3 Types of effect

4.3.1 The assessment of the lighting of the offshore elements of Rampion 2 in this **Appendix 15.5** is intended to determine the likely effects on the visual resource i.e. it is an assessment of the visual effects of aviation lighting on views experienced by people at night.

4.3.2 The assessment of WTG lighting in this Appendix does not consider effects of aviation lighting on landscape character (i.e. landscape effects).

4.3.3 ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50cd/m^2 or darker. It does not require 2,000cd medium intensity to be on during 'twilight', when landscape character may be discerned.

4.3.4 The aviation and marine navigational lights may be seen for a short time during the twilight period when some recognition of landscape features/ profiles/ shapes and patterns may be possible. It is considered however, that level of recognition does not amount to an ability to appreciate in any detail landscape character differences and subtleties, nor does it provide sufficient natural light conditions to undertake a landscape character assessment.

4.3.5 The proposed aviation lighting will not have significant effects on the perception of landscape character, which is not readily perceived at night in darkness, particularly in rural areas. The matter of visible aviation and marine navigation lighting assessment is wholly a visual concern and the assessment presented in this Appendix focusses on that premise.

4.3.6 This approach is supported by the recent Report to the Scottish Ministers for Crystal Rig IV Wind Farm (January 2021)[1] (page 8, Reporter's conclusions), which found that the proposed lighting *'is indeed a visual concern'* and that *'without being able to see and fully appreciate the features of the landscape and the composition*

[1]The Scottish Government (2021). Report to the Scottish Ministers: Section 36 of the Electricity Act 1989 and Section 57 of Town and Country Planning (Scotland) Act 1997 [online]. Available at: https://www.dpea.scotland.gov.uk/Document.aspx?id=732056 [Accessed December 2022].

of views it is not possible to carry out a meaningful landscape character assessment'.

4.3.7 In summary, it is considered that the proposed aviation and marine navigation lighting will not result in effects on landscape character, which is not readily perceived at night in darkness, particularly in rural areas. The effects of aviation lighting on landscape character are therefore scoped out of this assessment, which focuses on the likely visual effects of aviation and marine navigational lighting.

4.4 Assessment of significance

Overview

4.4.1 The nature of the daytime and night-time effects from visible aviation and marine navigation lighting are clearly very different, in that during day light hours visibility of the large-scale moving WTGs gives rise to effects that are very different to the pinpoint effects of lighting at night.

4.4.2 It is considered therefore, that the same criteria should not be used to assess these differences in daytime and night-time effect. For example, the criteria provided in **Table 1-5** in **Appendix 15.2: SLVIA methodology, Volume 4** of the ES (Document Refence: 6.4.15.2) underpinning the magnitude of visual effect, as a component of significance, includes definitions that are not appropriate or relevant to a night-time assessment.

Sensitivity to change

4.4.3 In relation to the sensitivity of visual receptors, this is defined through the application of professional judgement in relation to the interaction between the 'value' of the view experienced by the visual receptor and the 'susceptibility' of the visual receptor (or 'viewer', not the view) to the particular form of change likely to result from the Proposed Development. 'Value' and 'Susceptibility are identified separately in this judgement, as per the GLVIA 3 Guidance as described in **Appendix 15.2: SLVIA methodology, Volume 4** of the ES (Document Refence: 6.4.15.2).

4.4.4 Factors are applied to determine whether the value attached to a view is classified as 'high'; 'medium' or 'low', which in turn is considered in the assessment of sensitivity of a receptor. It follows that the most highly valued views will add weight to the assessment of overall sensitivity. It is considered, however, that the factors weighed in reaching a decision on value are not all applicable at night-time, in the same way they may be during the day.

4.4.5 For example, with the exception of a viewpoint location within a Dark Sky Park/IDSR (where one clear objective to is observe the night sky) or from a residential property that has windows facing a wind farm, it is not appropriate to attribute value to views at night when the detail of the view, or of elements that add value to it within a landscape, cannot readily be discerned. Furthermore, the popularity of a viewpoint during the day may be completely different to its use at

night. The offshore elements of Rampion 2 are not located within a Dark Sky Park/IDSR, although the aviation and marine navigational lights are likely to be visible from viewpoints within the South Downs IDSR, so heightened value to views may be ascribed in respect of viewing locations where one objective to is observe the night sky, however other value factors assessed for day-time viewpoints may of less relevance to the value judgement.

4.4.6 Descriptions of 'susceptibility' provided from **Section 1.6** in **Appendix 15.2: SLVIA methodology, Volume 4** of the ES (Document Refence: 6.4.15.2) are considered appropriate for the purposes of establishing receptor sensitivity at night-time. The susceptibility of people to changes in their night-time amenity should form the main consideration when formulating sensitivity, with less weight attached to value at night.

4.4.7 In reaching a view on the significance of the likely visual effects from the visible aviation lighting, it is relevant to consider what parts of the landscape - where darkness qualities are well displayed - are likely to be affected by visibility of the aviation lights and, in turn, to understand what people might be doing in these areas at night to be susceptible to visibility of aviation lights.

4.4.8 The susceptibility of people experiencing night-time outdoors will depend on the degree to which their perception is affected by existing baseline lighting. In brightly lit areas, or when travelling on roads from where sequential experience of lighting may be experienced, the susceptibility of receptors is likely to be lower than from within areas where the baseline contains no or limited existing lighting.

Magnitude of change

4.4.9 In relation to the other key component in determining significance of effect, the magnitude of change, reference to 'loss of important features' and 'composition of the view' are not readily discernible or relevant at night and, on this basis, a distinct set of criteria to explain the magnitude of change at night, as a consequence of the appearance of aviation lights, is set out in **Table 4-1** below.

Table 4-1 Magnitude of change criteria for visible aviation and marine navigation lights

Level of Magnitude	Definition of magnitude
High	Addition of aviation and marine navigation lighting results in large scale of change/ large intrusion to the existing night-time baseline conditions/ darkness in the view, due to a full and/or close range view of visible aviation lighting and/ or a high degree of contrast/low degree of integration with level of baseline lighting in the view. Results in obtrusive light which compromises or diminishes the view of the night sky.
Medium	Addition of aviation lighting results in moderate scale of change/moderate intrusion to the existing night-time baseline

Level of Magnitude	Definition of magnitude
	conditions/darkness in the view, due to partial and/or middle distance view of visible aviation lighting and/ or moderate level of contrast/integration with level of baseline lighting in the view. Results in light that may partially compromise or diminish the view of the night sky, but which is not considered obtrusive.
Low	Addition of aviation and marine navigation lighting results in small scale of change/minor intrusion to the existing night-time baseline conditions/darkness in the view, due to limited and/or distant view of aviation lighting and/or low degree of contrast/high degree of integration with level of baseline lighting in the view. Results in light that does not compromise or diminish the view of the night sky, nor is it considered obtrusive.
Negligible	Addition of aviation and marine navigation lighting results in a largely indiscernible change/negligible intrusion to the existing night-time baseline conditions/darkness in the view, due to glimpsed view of lighting and/or slight degree of contrast/very high degree of integration with level of baseline lighting in the view. Results in light that does not compromise or diminish the view of the night sky, nor is it considered obtrusive.

4.4.10 Intermediate levels of effect may be identified between these levels where, on the application of professional judgement, the assessor considers a level of change lies between the two definitions. The term 'obtrusive' used in the above definitions is interpreted as having the following meaning: *"noticeable or prominent in an incongruous or intrusive way"*.

Assessing significance

4.4.11 The significance of effects of aviation and marine navigation lighting is assessed through a combination of the sensitivity of the visual receptor and the magnitude of change that will result from the visible aviation lighting, taking into account the considerations described above, and informed by the matrix in **Section 1.8** and **Table 1-6** in **Appendix 15.2: SLVIA methodology, Volume 4** of the ES (Document Refence: 6.4.15.2). The matrix in **Table 1-6** gives an understanding of the threshold at which significant effects may arise.

4.4.12 Significant effects relate to all those effects that result in a 'Major' or a 'Major / Moderate' level of effect. Moderate levels of effect (shaded mid grey) may be significant or not significant subject to the assessor's professional judgement. A significant effect occurs where the aviation and marine navigation lighting will provide a defining influence on a view or visual receptor. A not significant effect will occur where the effect of the aviation and marine navigation lighting will not provide a defining influence on a view or visual receptor, and the baseline

characteristics of the view or visual receptor continue to provide the defining influence.

4.4.13 In determining significance, particular attention is paid to the potential for 'Obtrusive Light' i.e. whether the lighting impedes a particular view of the night sky; creates sky glow (brightening of the night-sky); glare (uncomfortable brightness; or light intrusion (the spilling of light beyond the site or area being lit) (ILP) (2011) (GN01:2011).

4.5 Visual representations

ZTVs

4.5.1 A ZTV map has been produced to show the areas from which the medium-intensity aviation lights may be seen (**Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15)). This ZTV can be used to identify where the aviation lights may theoretically be visible and how many lights may be theoretically visible from different locations. The ZTV illustrates the 'bare ground' situation and does not take into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility. It also does not indicate the decrease in visibility of the lights that occurs with increased distance. The nature of what is visible from 5km away will differ markedly from what is visible from 15km or 30km away, although both are indicated on the Nacelle Light ZTV as having the same level of visibility in terms of number of aviation lights visible,

Photomontage visualisations

4.5.2 Night-time baseline view panoramas and photomontage visualisations showing medium-intensity nacelle mounted aviation lighting and platform level marine navigational lighting are presented from four viewpoints in **Volume 3** of the ES (Document Reference: 6.3.15) – **Figure 15-27i-j** Viewpoint 2 Birling Gap; **Figure 15-42j-m** Viewpoint 17 - Devil's Dyke; **Figure 15-46** Viewpoint 21 Bignor Hill; **Figure 15-50g-h** Viewpoint 27 Hollingbury Hillfort; and **Figure 15-54d** Butser Hill.

4.5.3 Article 223 of Air Navigation Order 2016 allows for the CAA to permit that not all WTGs are so lit and as the CAA will require that all WTGs on the periphery of any wind farm need to be equipped with aviation warning lighting, the night-time photomontages presented in these figures show aviation lighting only on the assumed peripheral WTGs of the Rampion 2 MDS layout, as shown in **Figure 15.1, Volume 3** of the ES (Document Reference: 6.3.15).

4.5.4 Although aviation lighting manufacturers must meet the minimum requirements, their products may vary in relation to recommended limits set out in ICAO standards, which makes it difficult producing accurate visualisations as the lighting characteristics of different light fittings, of the same intensity, may vary outside the minimum requirements stipulated by ICAO. The night-time photomontages shown in these figures have been produced to show 2,000cd lighting, to inform the assessment of worst-case effects assessed and replicating the 2,000cd intensity of the operational Rampion 1 aviation lights visible. If the horizontal meteorological

visibility in all directions from every WTG in a group is more than 5km, the CAA allows that the intensity for the light may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type, or 200cd in this case. The night-time photomontage representations assume full lighting intensity of the 2,000cd warning lights as a worst-case and are therefore likely to substantially over-represent the likely visibility of aviation warning lighting experienced in reality as visibility is likely to be poorer when they operate at that level.

4.5.5 The night-time photography has therefore been captured in low light conditions, after the end of civil twilight, when 'night' has been reached and when other artificial lighting, such as streetlights, car headlamps and lights on buildings are on, to show how the aviation lighting will look compared to the existing baseline at such times.

4.5.6 Existing lights shown in the photographs appear larger and more blurred than those seen to the naked eye in the field when the photographs were captured. The term used in photography to describe this effect is 'Bokeh' which has been defined as 'the way the lens renders out-of-focus points of light'. This has proved difficult to avoid when taking photographs of light at varied distances across a view. The blurred nature of the lights is also exacerbated by their movement, particularly on vehicle headlights. Where the lights of the offshore elements of Rampion 2 have been added to the night-time photomontages, this effect has been emulated.

4.5.7 The WTGs used in the night-time visualisations have been positioned so that so that all the lights are visible within the visualisations, representing a worst-case impression. As the blades turn around in front of the lights there may are also incidences whereby the emitted light spills across the blades producing a further incidental effect. These effects associated with WTG rotor movement cannot be captured within the limitations of the photomontages.

5. Baseline conditions

5.1 Study area

Overview

5.1.1 The study area for the SLVIA is shown in **Figure 15-11, Volume 3** of the ES (Document Reference: 6.3.15) relative to the South Downs IDSR.

5.1.2 The baseline lighting conditions across the study area vary considerably and OPEN is not aware of a single data source that serves to provide a detailed or quantitative evidence base. The assessment of night-time effects is not based on quantitative measurement of light levels but relies on the professional judgement of Chartered Landscape Architects.

5.1.3 To provide some context to the assessment, **Figure 15-11, Volume 3** of the ES (Document Reference: 6.3.15) illustrates information relating to light pollution in the study area information provided by Campaign to Protect Rural England (CPRE), who have produced interactive maps of the UK's light pollution and dark skies as part of a national mapping project. This is based upon data from the National Geophysical Data Centre, part of the National Centre for Environmental Information (NCEI) in the USA. Land Use Consultants (LUC) has processed this satellite data to prepare a map showing the areas of relative light pollution across England (LUC/CPRE, 2016). This Open Source data has been used to help understand and illustrate the existing baseline lighting levels of the Study Area and is mapped in **Figure 15-11, Volume 3** of the ES (Document Reference: 6.3.15).

5.1.4 Each pixel in the mapping shows the level of radiance (night lights) shining up into the night sky, which have been categorised into colour bands to distinguish between different light levels, from colour band 1 (darkest) to 9 (brightest). The map clearly identifies the main concentrations of night-time lights, creating light pollution that spills up into the sky.

5.1.5 Most notably, this is in, and around the main settlements due to the influence of street and building lighting, particularly it identifies that the majority of the urban coastal strip between Bognor Regis, Brighton and Seaford falls within the brightest light influence category, with high night light pollution at the greatest, light-influenced end of the spectrum. Other large settlements such as Gosport, Portsmouth, Havant and Chichester in the west, and Eastbourne in the east, also have similarly high levels of light influence, as do the main settled areas on the Isle of Wight such as Ryde, Newport, Sandown and Shanklin.

5.1.6 By contrast, **Figure 15-11, Volume 3** of the ES (Document Reference: 6.3.15) also identifies areas where there is little night-time lighting. Much of the SDNP falls within the lowest three colour bands, containing areas where the sky would be expected to be 'dark', particularly as experienced from the inland downs of the western and central parts of the SDNP, where they are set back from the light influenced urban areas around the periphery of the SDNP, but also from the tops

of the open downs extending to the maritime coastline of the SDNP between Beachy Head and Seaford Head. The South Downs uplands, within the eastern and western extents of the study area demonstrate most association with darker skies. There are however, a number of areas within the SDNP where there is a transition between these areas that experience darker night-skies, with those that experience light pollution around the edges of settlements, such as the northern edges of the urbanised coastline between Seaford, Brighton and Worthing; the lights of Eastbourne influence the eastern edges of the SDNP; as well as around smaller settlements in the SDNP such as Lewes, Findon, Arundel, Petworth and Petersfield; and on its northern edges such as Storrington, Steyning and Burges Hill. Car lights along main transport routes such as the A3, A23, A24 and A27 also have a notable influence to the baseline levels of lighting within the SDNP.

5.1.7 **Figure 15-11, Volume 3** of the ES (Document Reference: 6.3.15) is definitive in illustrating the geographic position of the dark landscape of the core downs of the SDNP, set-back and separated from the seascape by the existing night lighting of the intervening urbanised coastal strip, which disrupts the dark landscape continuity between the majority of the SDNP and the seascape. The exception is the 12km maritime section of the SDNP between Beachy Head and Seaford Head, where the coastline and adjacent sea is within colour band 1 (darkest) and there is direct landscape continuity from this dark coastline out to sea. The relatively less light influenced, darker coastal areas coincide with the headlands of Selsey Bill and Beachy Head. The seascape of Sussex Bay includes visible aviation lighting and fixed marine navigational lighting on the existing Rampion 1 WTGs, as well as lit vessels and cardinal buoys that are visible in the sea at night.

5.1.8 The impression gained from **Figure 15-11, Volume 3** of the ES (Document Reference: 6.3.15) is borne out by the assessment experience from visiting and inspecting the study area at night. Higher levels of darkness are experienced from the more remote, north-west core areas of the South Downs, with a general transition of reducing darkness moving eastwards through the SDNPs open downland and towards the swathe of urban development along coastline which is more heavily influenced by visible lighting at night that arises as consequence of a number of light sources including:

- towns and settlements (street lighting/buildings/retail areas);
- roads and road junctions, including service areas;
- industrial developments including Shoreham Port and Shoreham combined cycle gas-fired power station;
- vehicles using the road network, including occasional construction vehicles with flashing lights;
- lighting of entertainments on several piers, including at Brighton, Worthing and Bognor Regis that extend into the sea and spill light onto the water;
- red aviation lights on tall structures including construction cranes, communication masts, the i360 Tower at Brighton seafront and the Shoreham power station chimney;
- lighting of cardinal buoys and vessels in the sea;

- the operational 2,000cd Rampion 1 aviation lights situated at the nacelle level of perimeter WTGs. There are 45 locations where aviation lights are displayed, including the offshore substation where one aviation light is displayed. There are two red aviation lights on each WTG, which flash in a morse 'W' sequence; and
- Rampion 1 marine navigational lights consist of yellow visible lights at platform level on all the Rampion 1 WTGs, positioned to ensure 360° visibility.

5.1.9 Lighting at these locations provides a considerable level of baseline illumination which is apparent when travelling through and around the coastal parts of the study area, from the transition between this urban environment and the southern periphery of the SDNP and in views from the open downs of the SDNP looking towards the seascape. Lighting within this urbanised coastline is demonstrably intrusive in interrupting the transition between dark landscape and dark skies above in views south towards the seascape.

5.1.10 While the skies above the northern part of the study area to the north of the SDNP and experienced across the Low Weald and High Weald is generally darker than coastline to the south of the SDNP, it is not devoid of light altogether and, where longer-range views open up, a discernible level of scattered baseline lighting from residential property, village and towns can be experienced across the landscape of the Weald in views from the tops of the South Downs. This most commonly is characterised by distinct points of white light, transport routes and concentrations of lighting within towns and villages, rather than through sky glow, which is notable to the south over the urban coast.

5.2 South Downs IDSR

Introduction

5.2.1 The South Downs was awarded International Dark Sky status in May 2016 to reflect the quality of skies and the commitment the SDNPA and its partners have shown in addressing light pollution and having a due regard for dark skies.

5.2.2 An IDA International Dark Sky Reserve (IDSR) is '*a public or private land possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, educational, cultural, heritage and/or public enjoyment'*.

5.2.3 The South Down IDSR takes in the entire SDNP boundary but is largely defined by a critical 'core' and 'buffer zone' base where the darkest skies can be found.

Dark Sky Zones

Overview

5.2.4 Mapping has been undertaken of the quality of dark skies across the entire National Park in the SDNP Dark Skies Technical Advice Note (SDNPA, 2018). Using sky quality measurements, the SDNP has been categorised into a number

of dark sky zones, replicated in **Figure 15-12, Volume 3** of the ES (Document Reference: 6.3.15). These dark sky zones are as follows:

- Dark Sky Core (E0);
- Intrinsic Rural Darkness and Buffer (E1a);
- Transition Zones (E1b); and
- Urban Area (E3 and E4).

5.2.5 Categorising the landscape according to general darkness, allows the SDNPA to take a weighted zoning approach to policies to ensure that lighting is appropriate to the environment within the South Downs IDSR. Policies are largely concerned with lighting of developments within the South Downs IDSR, however, reference is also made to the consideration of the potential effects of large-scale developments outside the SDNP on dark skies within the IDSR.

5.2.6 These zones are described as follows, referring to definitions in the SDNP Dark Skies Technical Advice Note (SDNPA, 2018) and Policy SD8: Dark Night Skies of the South Downs Local Plan (SDNPA, July 2019).

Dark Sky Core (E0)

5.2.7 The Dark Sky Core (E0) is defined as follows:

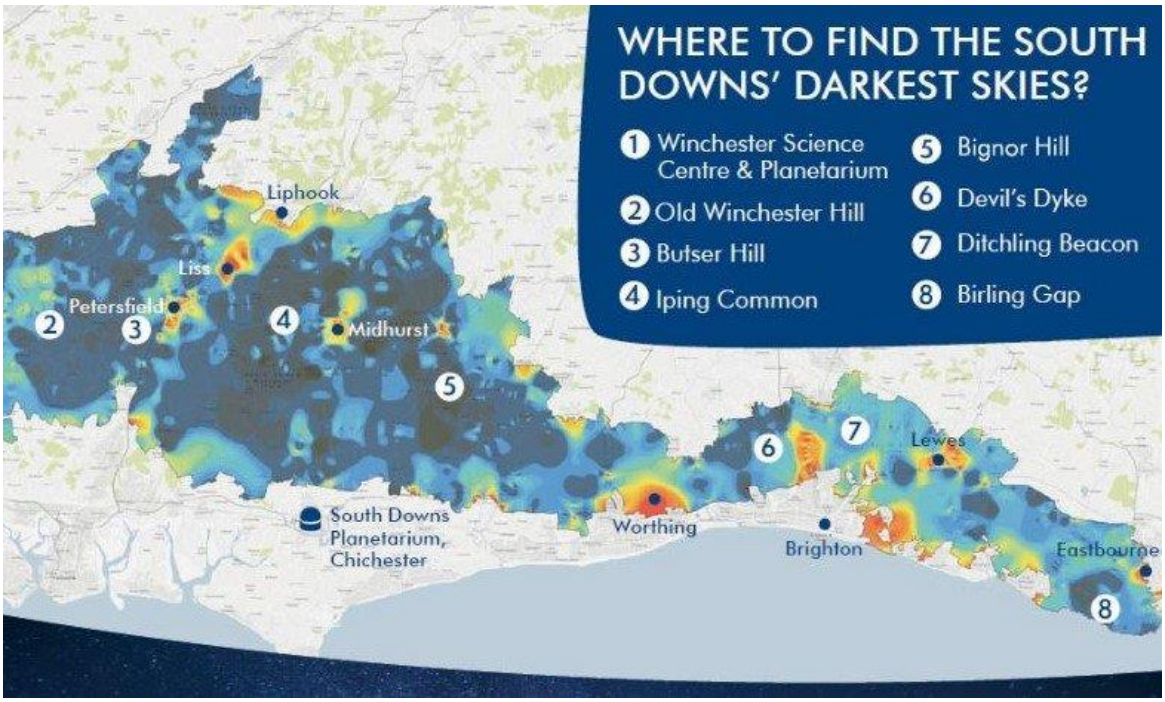
5.2.8 *'These are large areas which have skies that can be classified as intrinsically dark. These areas form a continuous dark sky core (and 2km Buffer Zone) to the International Dark Sky Reserve, as shown on the Policies Map, which contain some of the darkest areas of the National Park'* (SDNPA, July 2019).

5.2.9 *'The International Dark-Sky Reserve was drawn using geographical boundaries (roads, woodland boundaries, RoW) under skies measuring 20.5 SQM. This value was the general measurement where the Milky Way can be easily seen by a non-astronomical expert in the South Downs with the naked eye. The map shows the main core boundary and a required buffer zone surrounding it, which was determined as the distance (2km) from an urban to intrinsic ambient sky. The conditions in the core zone are generally the best within National Park, and the South East of England, and as such will receive every protection to retain them as such. The ILP classify this zone as E0 – Dark Skies Reserves'* (SDNPA, 2018).

5.2.10 The skies above the Dark Sky Core are generally the darkest within the South Downs IDSR, formed by a secluded rural environment in the central area of the SDNP where the skies have been classified as intrinsically dark and have a measured and observed quality of easily visible astronomical features, such as the Milky Way and Andromeda Galaxy.

5.2.11 The Dark Sky Core attracts people wishing to appreciate the night-time sky with an absence of night-time light pollution. The SDNP promotes eight 'dark sky discovery sites', as locations to find the South Downs darkest skies, which offer specific points to view the night sky. These are shown in **Graphic 5-1**.

Graphic 5-1 Dark Skies Discovery Sites (SDNPA)



5.2.12 Four of the dark sky discovery sites are within the Dark Sky Core, three of which are within the SLVIA study area – Butser Hill, Iping Common and Bignor Hill, as shown in **Figure 15-12, Volume 3** of the ES (Document Reference: 6.3.15). The sensitivity of these viewing locations to the potential effects of the aviation lights is considered to be higher than other areas of the South Downs IDSR, as they are specifically promoted by the SDNPA to encourage visitors to these sites with the express intention of viewing the night sky and this experience could be affected by other sources of light.

5.2.13 Two of these dark sky discovery sites have been identified and assessed as representative viewpoint locations within the Dark Sky Core, to illustrate the night-time baseline conditions and consider the visual effects of the proposed aviation lighting. These are located at Bignor Hill and Butser Hill, as mapped in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15). Night-time baseline panoramas from these two viewpoints are presented from Viewpoint 21: Bignor Hill (**Figure 15-46, Volume 3** of the ES (Document Reference: 6.3.15)) and Viewpoint 31 Butser Hill **(Figure 15-54d, Volume 3** of the ES (Document Reference: 6.3.15)**)**. The baseline conditions from these viewpoints at night are described in the assessment of these viewpoints in **Section 7.2**.

5.2.14 The Dark Sky Core is however, located 22.6km from the Rampion 2 array area at its closest point, with these three dark sky discovery sites located 28.1km (Bignor Hill), 40.7km (Iping Common) and 45.1km (Butser Hill) from the Rampion 2 array area respectively, at considerable distance.

5.2.15 The Dark Sky Core is also separated from the seascape by the coastal plain and extensive urban coastline with the highest levels of night lighting influence, where streetlights, building and vehicle lights create skyglow brightening of the night sky

around the towns and cities, spreading into the countryside of the intervening coastal plain, caused by a scattering of artificial light. The seascape is generally viewed 'through' or beyond the skyglow of the intervening urban areas, that forms existing light influenced section between the 'dark landscape' of the Dark Sky Core and the 'dark skies' above.

Intrinsic Rural Darkness and Buffer Zone (E1a)

5.2.16 The Intrinsic Rural Darkness and Buffer Zone (E1a) is defined as follows:

5.2.17 '*These are areas that measure 20 SQM and above, excluding the core zone. They include other areas in the National Park that would be classified as a 'dark sky' and includes isolated areas that may not be connected to the main core. The Milky Way will be visible and in some areas measurements may approach 21 SQM and are therefore of great importance. The ILP would classify this as E1 – National Park'* (SDNPA, 2018).

5.2.18 Broadly this area is defined as being around the edges or buffer zone around the Dark Sky Core, including the Wooded Estate Download and the South Downs Upper Coastal Plain to the west of Arundel; sections of open downs between the Arun, Adur and Ouse (set-back to the north of Worthing, Shoreham and Brighton; and the open downs to the east of the Ouse and Cuckmere valleys extending to the maritime coast of the SDNP between Beachy Head and Seaford Head.

5.2.19 Three of the dark sky discovery sites are within the Intrinsic Rural Darkness and Buffer Zone – Devil's Dyke, Ditchling Beacon and Birling Gap as shown in **Figure 15-12, Volume 3** of the ES (Document Reference: 6.3.15). Two of these dark sky discovery sites have been identified and assessed as representative viewpoint locations within the Intrinsic Rural Darkness and Buffer Zone, to illustrate the night-time baseline conditions and consider the visual effects of the proposed aviation lighting. These are located at Birling Gap and Devil's Dyke, as mapped in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15). The dark sky discovery site at 'Birling Gap' identified in **Graphic 5-1** is at the car parking area on Crowlink Lane near East Dean and has been moved to the National Trust site at Birling Gap to allow consideration of the visual effects of aviation lighting from the coastal viewpoint location at Birling Gap. Night-time baseline panoramas from these two viewpoints are presented in **Figure 15-27i, Volume 3** of the ES (Document Reference: 6.3.15) (Viewpoint 2 Birling Gap) and **Figure 15-42j, Volume 3** of the ES (Document Reference: 6.3.15) (Viewpoint 17: Devil's Dyke).

5.2.20 The Buffer Zone is however, located 20.6km from the Rampion 2 array area at its closest point, and the area of Intrinsic Rural Darkness 16.2km, with these two dark sky discovery sites located 21.9km (Birling Gap) and 20.3km (Devil's Dyke) from the Rampion 2 array area respectively, at considerable distance. The baseline conditions from these viewpoints at night are described in the assessment of these viewpoints in **Section 7.2**.

Transition Zones (E1b)

5.2.21 The Transition Zones (E1b) are defined as follows:

5.2.22 *'Areas that lie between the larger urban settlements and the surrounding darker skies notably vulnerable to light pollution. These areas are generally in the buffer zones and rural transition areas. Generally, this will be where the sky quality changes from poor to the edge of an intrinsic dark sky zone typically with SQM39 values of 10 Lux'* (SDNPA, July 2019).

5.2.23 *'These are areas that lie between dark zones and the urban environment and measure between 15 and 20 SQM. Conditions in this zone will be variable but most rural areas will measure near to the 20 SQM darkness limit. While the skies are relatively brighter it is still important to reduce light pollution as these areas have the potential to become dark zones in the future. The ILP would classify these zones under E2 rural but - is superseded by the South Downs NP designation. In areas where the buffer zone overlays these transitional skies, stronger buffer zone policies will apply. This is to afford the core the strongest level of protection* (SDNPA, 2018).

5.2.24 These areas of the SDNP are consistently brighter than the Dark Sky Core and Buffer Zones but have skies of sufficient IDSR quality they remain of value to protect and distinguish from other areas of the SDNP that are brighter, e.g. urban areas.

5.2.25 Broadly this area is defined as being around the edges of the SDNP, between the darker zones (E0/E1a) and the urban environment, often around the periphery of the SDNP where there is a transition into landscapes where that have a greater degree of night lighting in the baseline environment. It includes the southern slopes of the South Downs immediately to the north of the coastal plain and urbanised coastline, along the northern edges of Littlehampton, Worthing, Shoreham, Brighton, Newhaven, Peacehaven and Seaford. It also includes the main sections of maritime coast of the SDNP, consisting of the chalk cliffs and shoreline between Seaford Head and Beachy Head; the eastern edges of the SDNP on the periphery of Eastbourne; and the northern periphery of the SDNP along the Low Weald.

5.2.26 None of the dark sky discovery sites are within the Transition Zones, however Viewpoint 2 at Birling Gap, is on the edge of the Transition Zone (E1b) and Buffer Zone (E1a), within a notable section of the transition zone along the maritime coast of the SDNP consisting of the chalk cliffs and shoreline between Seaford Head and Beachy Head. The night-time baseline panorama from Viewpoint 2 Birling Gap is shown in **Figure 15-27i, Volume 3** of the ES (Document Reference: 6.3.15). A further night-time viewpoint has been included within the Transition Zone in this preliminary assessment on the northern edges of Brighton at Viewpoint 27 Hollingbury Hillfort (**Figure 15-50g, Volume 3** of the ES (Document Reference: 6.3.15)). The baseline conditions from these viewpoints at night are described in the assessment of these viewpoints in **Section 7.2**.

5.2.27 The Transitions Zone is however, located 13.5km from the Rampion 2 array area at its closest point, with Viewpoint 27 Hollingbury Hillfort located 17.9km from the Rampion 2 array area, at relative distance.

Urban Area (E3 and E4)

5.2.28 The Urban Areas (E3 and E4) are defined as follows:

5.2.29 *'Larger settlements of the National Park have substantially lower quality of dark night sky, primarily due to street lighting and light spill from buildings'* (SDNPA, July 2019).

5.2.30 *'These are areas that have high ambient brightness and generally measure below 15 SQM. Street lighting will typically be present in town centres, larger roads and residential streets. The ILP classify these areas as E3 (small town centres or suburban locations) and will include most parts of the larger towns in the National Park such as Midhurst, Lewes and Petersfield'* (SDNPA, 2018).

5.2.31 Broadly this area is defined as being the larger settlements within the SDNP, including Lewes, Ditchling, Petworth, Midhurst, Femhurst, East Liss and Petersfield. There is no visibility of the aviation and marine navigational lighting from these urban areas within the SDNP, as shown in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15), with the exception of very low levels of theoretical visibility from Petworth at a distance of approximately 35km from the Rampion 2 array area.

5.2.32 None of the dark sky discovery sites are within Urban Areas, however a night-time viewpoint has been included in Brighton at Viewpoint 8 (**Figure 15-33l-o, Volume 3** of the ES (Document Reference: 6.3.15)) in order to illustrate the inform the assessment of effects of aviation lighting at night from one of the closest urban areas outside the SDNP. The baseline conditions from Viewpoint 8 Brighton Seafront at night are described in the assessment in **Section 7.2**.

6. Environmental measures

6.1 Proposed environmental measures

6.1.1 Rampion 2 will incorporate environmental measures set out in **Table 6-1** in respect of the visual effects of WTG aviation lighting.

Table 6-1 Proposed environmental measures in respect of visual effects of aviation lighting

Embedded measure	How it works
Reduce intensity of lights from 2,000cd to 200cd	Provided for in Air Navigation Order 2016 article 223 (8). If visibility in all directions from every WTG is more than 5km the light intensity for any 2,000cd light required by this article may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type. Visibility conditions are measured using a visibility sensor, which can then be dimmed automatically to respond to prevailing meteorological conditions. 2,000cd lights will therefore only be experienced in visibility of <5km; and their intensity would be dimmed to not less than 200cd in visibility conditions of >5km.
Directional intensity	Provided for in Air Navigation Order 2016 article 223 (5), that when displayed (a) the angle of the plane of the beam of peak intensity emitted by the light must be elevated to between 3° and 4° above the horizontal plane; (b) not more than 45% or less than 20% of the minimum peak intensity is to be visible at the horizontal plane; and (c) not more than 10% of the minimum peak intensity is to be visible at a depression of 1.5 degrees or more below the horizontal plane. This will mean that the peak intensity of the aviation lights will be directed to between 3° and 4° above the horizontal plane (and will only be viewed at its brightest from locations within this narrow angle of view above the lights); and that the intensity of the light experienced will be less when viewed at or below the horizontal plan (i.e. from areas below the aviation lights).

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7. Assessment of visual effects

7.1 Zone of Theoretical Visibility (ZTV)

Nacelle aviation light ZTV

7.1.1 Visual effects of the aviation lighting will only occur where their introduction influences the visual amenity and views experienced by people in the area. The geographic areas where these visual effects may occur is defined by the ZTV shown in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15). The nacelle aviation light ZTV (**Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15)) can be used to identify where the aviation lights may theoretically be visible and how many lights may be visible from different locations. It is based on the hub height ZTV, given the location of the aviation lights on the hub/nacelle of each of the perimeter WTGs (**Figure 15-1, Volume 3** of the ES (Document Reference: 6.3.15)). The base mapping has been darkened to give an indication of those areas that will not be affected by visibility of the aviation lighting.

7.1.2 There are extensive areas of the study area that will afford no visibility of the aviation lights, including the vast majority of the Low Weald and High Weald landscapes to the north of the SDNP, where there are only limited and scattered areas with 1-9 lights visible at distances between 25-50km from the Rampion 2 array area. The landscape to the north of the South Downs, and to the north-east of the study beyond Beachy Head/Eastbourne, is largely screened by the intervening landform and generally affords either no visibility of the aviation lights, or scattered, limited areas of low theoretical visibility, at long distances.

7.1.3 The majority of the Isle of Wight will also afford no visibility of the aviation lights, with visibility concentrated to the East Wight coastline between Nettlestone Point and Dunnose, including Foreland (Bembridge) and the coastal settlements of Sandown and Shanklin in Sandown Bay, at distances of 30-40km from the Rampion 2 array area. The ZTV indicates very limited visibility of the aviation lights from the wider landscape of the Isle of Wight, other than occasional scattered areas of elevated downs with open views.

7.1.4 The majority of the Dark Sky Core of the South Downs IDSR has no visibility of the aviation lights, with the principal area of the Dark Sky Core with theoretical visibility of the aviation lights occurring along a limited area of the east-west ridgeline of elevated tops of the wooded downlands to the north-west of Arundel and extending to Queen Elizabeth Country Park, at distances between approximately 23km – 45km from the Rampion 2 array area.

7.1.5 The areas of the South Downs IDSR that are likely to afford higher visibility of the aviation lights occur along the tops of the open downs between the Arun, Adur and Ouse to the north of the urban coastal conurbations of Worthing, Shoreham, Brighton and Peacehaven; and from the eastern open downs between the Ouse, Cuckmere and Beachy Head, falling within either the Intrinsic Rural Darkness and

Buffer Zone (E1a) or Buffer Zone or Transition Zones (E1b) of the South Downs IDSR. Areas of high and most consistent geographic spread of visibility of the aviation lighting of Rampion 2 occur along the urban coastal conurbations outside the South Downs IDSR between Selsey, Bognor Regis, Littlehampton, Worthing, Brighton, Peacehaven, Newhaven and Seaford.

7.1.6 While the theoretical visibility of the aviation lights spreads across quite a notable proportion of the study area coastline between Selsey and Seaford, within approximately 13-18km of the Rampion 2 array area, it is relevant to note that this coincides in the majority of instances with locations where people will experience high levels of urban lighting in the baseline at night, which will alter their perception of the aviation lights.

7.2 South Downs IDSR

7.2.1 The assessment of effects of aviation lighting on users of the South Downs IDSR is informed by the nacelle light ZTV (**Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15)) and an understanding of the nature of the likely effects of the proposed lighting, gained from observing windfarm aviation lighting at operational windfarms, including the operational Rampion 1 aviation lights. The ZTV and wirelines of Rampion 2 have been used to review the visibility of lighting from viewing locations within the South Downs IDSR and consider the potential effects. As described in the baseline in **Section 5.2**, there are eight dark sky discovery sites mapped and promoted by the SDNPA as specific viewing sites. These viewpoints, in particular, have been considered in the visual assessment due to their potential sensitivity as viewing sites that people visit with the express intention of viewing the night sky.

Dark Sky Core (E1)

Overview

7.2.2 The majority of the Dark Sky Core of the South Downs IDSR has no visibility of the aviation lights, as illustrated in ZTV in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15). The Dark Sky Core covers 417.83 km^2. There is only theoretical visibility of the aviation lighting from 68.3 km^2 of the Dark Sky Core, with the remaining 349.53km^2 of the Dark Sky Core (or 83.62% of its total area) affording no visibility of the Rampion 2 aviation lights. A considerably large majority of the geographic area of the Dark Sky Core will therefore not be affected by visibility of the aviation lights.

7.2.3 Within the area of theoretical visibility from within the Dark Sky Core, the number of visible lights varies. ‘Low’ visibility of 1-9 WTGs occurs for approximately 27 km^2 of the Dark Sky Core (around 6.5% of its area), whereas ‘high’ visibility of 34-42 aviation lights (the highest visibility in terms of number of lights) is limited to approximately 11 km^2 of the Dark Sky Core, only 2.6% of its total area. The geographic area of high visibility of aviation lights is relatively small in comparison to the overall area of the Dark Sky Core.

7.2.4 The ZTV in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15) indicates that the principal area of the Dark Sky Core with theoretical visibility of the aviation lights occurs along the east-west ridgeline of elevated tops of the wooded downlands to the north-west of Arundel. This principal band of visibility extends from the area around Bignor Hill/Glatting Beacon/Burton Down (near dark sky discovery site 5), westwards along the ridgeline of wooded and open tops of Heyshott Down; Linch Down/Cocking Down; Harting Downs and Queen Elizabeth Forest/Butser Hill (near dark sky discovery site 3). Many of these areas of the Dark Sky Core of the South Downs IDSR have dense areas of woodland which limit visibility of lighting in the wider landscape and seascape at night. Changes to views at night will occur principally from the remaining sections of isolated open hill tops of the downs in this area of the Dark Sky Core, which allow longer range views to the seascape to the south where the aviation lighting of the offshore elements of Rampion 2 may be visible.

7.2.5 With reference to **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15), visible aviation lighting of the offshore elements of Rampion 2 will not be seen by people viewing the night sky from two of the dark sky discovery sites with the dark sky core (2 – Old Winchester Hill; and 4 – Ipping Common) as they are all outside the area of theoretical visibility shown in the ZTV. Aviation lighting of the offshore elements of Rampion 2 will be theoretically visible from the other two dark sky discovery sites within the Dark Sky Core, 2 – Butser Hill (Viewpoint 31) and 5 - Bignor Hill (Viewpoint 21).

7.2.6 An assessment of the effects of the aviation lighting on views experienced from the Dark Sky Core of the South Downs IDSR is undertaken with reference to these representative viewpoints in the following assessment.

Viewpoint 21 Bignor Hill

Baseline Conditions and Sensitivity

7.2.7 The viewpoint is located on the South Downs Way at Bignor Hill and is representative of the view seen by people viewing the night sky from dark skies discovery site 5 with the dark sky core of the South Downs IDSR, which can be accessed via a short walk along the South Downs Way from the nearby car parking area at end of the minor road leading from Bignor village. The view extends from the scarp looking north across the Rother Valley to the Greensand Hills but also extends but also affords a panoramic view south over the wooded estate downlands between Goodwood and Arundel, to the seascape of Sussex Bay beyond. The immediate landscape of arable land and mature estate woodlands of the South Downs around the viewpoint is essentially dark landscape at night, with existing lighting concentrated in the views north over the Weald and south within the settled coastal plain and coastline of almost contiguous lit urban development. The Rampion 1 WTG aviation lights and marine navigation lights are visible in the seascape backdrop to the south approximately 30km from the viewpoint and are discernible as faint point features of light with low intensity, arranged in an array low to the sea horizon, and are situated beyond more intense urban lighting at the coast.

7.2.8 The sensitivity of the viewpoint at night is considered to be **Medium-high**, reflecting that the view has high value at night-time and the receptors experiencing the view have a medium susceptibility to change at night. The viewpoint is within the Dark Sky Core of the South Downs IDSR which are generally the darkest within the South Downs IDSR, formed by a secluded rural environment in the central area of the SDNP where the skies have been classified as intrinsically dark that are of importance and value to protect. Bignor Hill is a dark sky discovery site, which is considered to have higher sensitivity to the potential effects of the aviation lights than other areas of the IDSR, as it is specifically promoted by the SDNPA to encourage visitors to this site with the express intention of viewing the night sky and this experience could be affected.

7.2.9 The viewpoint is popular and well-used at night, it is accessible from the nearby visitor parking area, with many people likely to visiting to either look at the night sky or watch the sunset. The stars and moon are distinct and evident on a clear night. The viewpoint is however remote the seascape and separated by settled areas and urbanised coastline that are well lit at night, which reduces its susceptibility to change as viewers are unlikely to perceive the aviation or marine navigation lights to any degree of intensity at such long range and beyond intervening lighting. There are many readily discernible light sources that are visible in the view both south across the coastal plain/coastal conurbations and north across the Low Weald. Although there is some continuity between the dark landscape of the downs below to the dark skies above when looking along the undeveloped spine of the South Downs, there are sources of baseline lighting such as red lights on communications masts, as well as skyglow from urban areas. The relatively high levels of baseline lighting in the intervening landscape reduce susceptibility to further lighting in this direction, and the reduced ability of receptors to perceive the intensity of lights out to sea through the skyglow to the south is such that the 'susceptibility' of receptors to aviation lighting on the proposed Rampion 2 WTG is reduced.

Magnitude of Change and Significance of Effect

7.2.10 The predicted view of the aviation lights at 2,000cd is shown in the photomontage in **Figure 15-46, Volume 3** of the ES (Document Reference: 6.3.15).

7.2.11 Aviation and marine navigation lighting of the proposed Rampion 2 WTGs will be visible in the view at night, from 28.1 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs. These lights will extend the existing array of multiple small points of red and yellow light extending across the seascape in the view behind the lighting of the urban coastline of Bognor, Littlehampton and Worthing. The principal effect of the lighting of the Rampion 2 WTGs will be to extend the lateral spread of existing multiple point features of red and yellow light over a wider portion of the view, adding to the visual influence of offshore lighting in the existing view of the sea at night, due to the wider spread of lighting.

7.2.12 The extension of the lighting effect occurs to west of Rampion 1, viewed next to the existing offshore WTG lighting, primarily beyond the city lights and through the skyglow of the intervening urban areas, which will reduce the perceived intensity of

the lights out to sea. The continuity between the dark landscape of the downs below and the dark skies above is already interrupted by urban lighting along the coast and the proposed Rampion 2 WTG lighting does not affect the 'continuity' of darkness, which is already fundamentally interrupted by the urban lighting, and to a lesser extent the discernible Rampion 1 WTG lighting beyond. The view of the dark skies above is predominately affected by skyglow from the street-lights and lighting within the larger urban environment, rather than the additional influence of the Rampion 2 aviation and marine navigational lighting.

7.2.13 The majority of the aviation lights will be visible above the Rampion 1 WTG aviation lights, due to the higher nacelle height and will be backdropped by dark sky, however, the aviation lights will be low to the horizon and do not extend high into the sky, thus limiting the amount of the night-sky that is impeded and having limited influence on the view of stars in the night-sky. The stars were observed in the dark skies above and will continue to be visible and unimpeded in the skies above the viewer. The aviation lights are not expected to result in obtrusive light that impedes the wider expanse of night sky, which can be experienced readily above the aviation lights, nor result in brightening of the night sky (skyglow) or glare on to the sea surface and would therefore not be of detriment to the overall experience of the night skies in this view.

7.2.14 A result of these factors, the magnitude of change on the night-time view as a result of the aviation lights operating at 2,000cd is assessed as **Medium-low** and when combined with the Medium-high sensitivity of the viewpoint, this results in a **Not Significant (Moderate)** visual effect, occurring primarily due to the extended spread of existing and familiar visible lights in the seascape and slightly interrupting part of the continuity between dark landscape and skies in the view west over the downs. The effect of the aviation and marine navigation lights is considered not significant on balance, because the lights integrate with the baseline WTG lighting in the view forming an extension of a familiar feature, they are viewed primarily beyond the intervening urban lighting and through its skyglow, and at long distance, such that their perceived intensity is lessened and does not compromise or diminish the view of the night sky or the dark landscape of the visible parts of the South Downs to the west.

7.2.15 The operation of aviation lights at the lower intensity of 200cd when visibility from every WTG is >5 km will provide further mitigation and reduction in the perceived intensity of the visible lighting.

Viewpoint 31 Butser Hill

Baseline Conditions and Sensitivity

7.2.16 The existing night-time view from Butser Hill is shown in **Figure 15-54d, Volume 3** of the ES (Document Reference: 6.3.15). Butser Hill is the highest hill within Queen Elizabeth Country Park and Butser Hill NNR, forming a natural observation point over the South Downs. The night-time viewpoint has been sited near to the visitor facilities/car parking area, which provides relatively easy and safe access to people visiting the Country Park to view the night-skies, compared to the hill-top OS viewpoint. The viewpoint is located within an area of wooded downs within the Dark Sky Core of the South Downs IDSR. The outline of the undulating landform

of the spine of the South Downs extends to the west and falls away to the south-east and south, affording views across the lights of the south coast plain.

7.2.17 The view looks out across the 'dark landscape' of the South Downs extending eastwards, within which there are no visible forms of lighting, other than the slight skyglow beyond the downs caused by the distant urban areas beyond, which are not visible in this direction, but do give rise to some visible skyglow beyond the dark landscape of the downs. The view south-east and south across the coastal plain has a higher degree of baseline night-time lighting. Vehicle lights on the main A3 road corridor are notable below the viewpoint, interrupting the dark landscape below, and leading to the urban lighting of the Portsmouth and Gosport, which are illuminated at night with street lighting, lighting within housing and tall buildings, and red aviation lights on tall structures. There are a number of distinct and relatively brighter light sources at the coastal edge. The lighting extends eastwards along the coast forming a clear strip of visible lighting between the dark landscape below, and the dark skies above, in the views south-east. The aviation and marine navigation lighting of Rampion 1 Wind Farm, which is located 54.7km from the viewpoint, were not observed to be visible in the view during the survey visit, likely due to the substantial intervening distance and atmospheric conditions.

7.2.18 The sensitivity of the viewpoint at night is considered to be **Medium**, reflecting that the view has high value at night-time and the receptors experiencing the view have a low susceptibility to change at night. The viewpoint is within the Dark Sky Core of the South Downs IDSR which are generally the darkest within the South Downs IDSR, formed by a secluded rural environment in the central area of the SDNP where the skies have been classified as intrinsically dark that are of importance and value to protect. Butser Hill is a dark sky discovery site, which is considered to have higher sensitivity to the potential effects of the aviation lights than other areas of the IDSR, as it is specifically promoted by the SDNPA to encourage visitors to this site with the express intention of viewing the night sky and this experience could be affected. The viewpoint is popular and well-used at night, it is accessible from the nearby visitor parking area, with many people likely to visiting to either look at the night sky or watch the sunset.

7.2.19 The viewpoint is however, located some 45.1km from the potential source of light within the Rampion 2 array area, which reduces its susceptibility to change as viewers are unlikely to perceive the aviation or marine navigation lights to any degree of intensity at such long range. There are also many readily discernible light sources that are visible in the view across the coastal plain and intervening urban coastal conurbations to the south-east in the direction towards the Rampion 2 array area. Although there is a continuity between the dark landscape of the downs below to the dark skies above when looking east along the undeveloped spine of the South Downs, the relatively high levels of baseline lighting in the intervening landscape to the south-east and south reduce susceptibility to further lighting in this direction, and the ability of receptors to perceive the intensity of lights out to sea, through the skyglow, such that the 'susceptibility' of receptors to aviation lighting on the proposed Rampion 2 WTG is reduced in the view.

Magnitude of Change and Significance of Effect

7.2.20 The magnitude of change on the night-time view as a result of the aviation and marine navigation lighting of the proposed Rampion 2 WTGs, with the aviation lights operating at 2,000cd, is assessed as **Negligible** and when combined with the Medium sensitivity of the viewpoint, this results in a **Not Significant (Minor/negligible)** visual effect.

Intrinsic Rural Darkness and Buffer Zone (E1a)

7.2.21 The ZTV in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15) indicates that the principal areas of the Intrinsic Rural Darkness and Buffer (E1a) with theoretical visibility of the aviation lights occurs along South Downs Upper Coastal Plain between Chichester and Arundel; the south-facing slopes of the open downs between the Arun, Adur and Ouse (set-back to the north of Worthing, Shoreham and Brighton), such as from Dark Skies Discovery Site 6 (Viewpoint 17 - Devil's Dyke); and the tops of the open downs to the east of the Ouse and Cuckmere valleys extending to the maritime coast of the SDNP between Beachy Head and Seaford Head, such as from Dark Skies Discovery Site 8 (Viewpoint 2 - Birling Gap).

7.2.22 Changes to views at night will occur principally from the elevated sections of isolated open hill tops of these downs in these areas of Intrinsic Rural Darkness and Buffer Zone, which allow longer range views to the seascape to the south where the aviation lighting of the offshore elements of Rampion 2 may be visible.

7.2.23 Views from the open downland of the SDNP are set-back and separated from the seascape by the existing night lighting of the intervening urbanised coastal strip to the south, which disrupts the dark landscape continuity between the downs and the seascape. This area of Intrinsic Rural Darkness and Buffer Zone is also separated from the seascape by an extensively lit townscape, with the highest levels of night lighting influence, where streetlights, building and vehicle lights create skyglow brightening of the night sky around the towns and cities lining the coast and there are views through this to the seascape and the existing Rampion 1 aviation lights and marine navigation lights, as illustrated in Viewpoint 17 - Devil's Dyke (**Figure 15-42j-m, Volume 3** of the ES (Document Reference: 6.3.15)).

7.2.24 The exception is the 12km maritime section of the SDNP between Beachy Head and Seaford Head, where there is direct landscape continuity from this dark coastline out to sea. The relatively less light influenced, darker coastal areas coincide with the headlands, chalk cliffs and shoreline between Seaford Head and Beachy Head, where there are direct views out to a relatively dark seascape, interspersed with the baseline lighting of cardinal buoys, vessels and the visible aviation lighting and fixed marine navigational lighting on the existing Rampion 1 WTGs, as illustrated in Viewpoint 2 – Birling Gap (**Figure 15-27i-j, Volume 3** of the ES (Document Reference: 6.3.15)).

7.2.25 An assessment of the effects of the aviation lighting on views experienced from the Intrinsic Rural Darkness and Buffer of the South Downs IDSR is undertaken with reference to these representative viewpoints in the following assessment.

Viewpoint 2 Birling Gap

Baseline Conditions and Sensitivity

7.2.26 The existing night-time view from Birling Gap is shown in **Figure 15-27i, Volume 3** of the ES (Document Reference: 6.3.15). The viewpoint is located at Birling Gap, on the platform at the top of the steps that provide a specific viewing point, a specific and well-known viewpoint at the National Trust site on the maritime coast of the SDNP, which is within the Intrinsic Rural Darkness and Buffer Zone of the South Downs IDSR. The view looks directly out to sea over the beach and along the chalk cliffs of the Seven Sisters.

7.2.27 There is limited existing lighting in the view across the open seascape, with the overall impression of the night-time view of a dark seascape and dark skies above, with only lighting from cardinal marks, transient lights on boats, occasional building lighting on the cliff tops, night lighting at the nearby National Trust cafe and the night-time lighting on the distant Rampion 1 WTGs visible in the sea skyline. The red, medium intensity aviation lighting of the existing Rampion 1 WTGs is visible in the view at night, from 29.0 km to the closest WTG, on peripheral WTGs (which flash in sequence). The visible aviation lights form a distant array of multiple small points of relatively faint red light on the horizon to the south-west. The Rampion 1 aviation lights, lights on vessels and cardinal marks stand out as point sources of light due to the higher contrast with the otherwise dark seascape. The marine navigational lighting is not visible in this view, due to the curvature of the earth which results in the lights at platform level being situated behind the horizon. Fundamentally it is a view that has a relatively low level of lighting in the existing seascape in the baseline, with no urban lighting visible and relative continuity between the sea below and skies above.

7.2.28 The sensitivity of the viewpoint at night is considered to be **Medium-high**, reflecting that the view has medium-high value at night-time and the receptors experiencing the view have a medium-high susceptibility to change. The viewpoint is within the area of Intrinsic Rural Darkness and Buffer Zone of the South Downs IDSR which has skies classified as ‘dark sky’ that are of importance and value to protect, being distinguishable from other brighter areas of the SDNP. Birling Gap is a dark sky discovery site, which is considered to have higher sensitivity to the potential effects of the aviation lights than other areas of the IDSR, as it is specifically promoted by the SDNPA to encourage visitors to this site with the express intention of viewing the night sky and this experience could be affected. The viewpoint is relatively remote from main settlements and has accessible at night from the nearby visitor parking area, with people likely to visit to view the night skies in the context of the chalk cliffs and seascape. The viewpoint is unrestricted out to sea overlooking the relatively dark seascape context of the maritime coast of the SDNP and does not take in any intervening urban lighting. This general lack of readily discernible light sources in the view, other than the Rampion 1 WTG lighting, cardinal marks and vessels in the seascape, increases the susceptibility to further lighting, and the ability of receptors to perceive the intensity of lights out to sea against a relatively dark background. There is relative continuity between the dark seascape below, to the dark skies above, when

looking out to sea from this coastal edge, which has potential to be interrupted by further lighting.

Magnitude of Change and Significance of Effect

7.2.29 The predicted view of the aviation lights at 2,000cd is shown in the photomontage in **Figure 15-27j, Volume 3** of the ES (Document Reference: 6.3.15).

7.2.30 Aviation and marine navigation lighting of the proposed Rampion 2 WTGs will be visible in the view at night, from 28.8 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs. The principal effect of the lighting of the Rampion 2 WTGs will be to extend the lateral spread of existing multiple point features of red and yellow light over towards the viewpoint, over a slightly wider portion of the view, increasing the visual influence of offshore lighting in the existing view of the sea at night, due to the wider spread and closer proximity of the lighting.

7.2.31 The extension of the lighting effect occurs to the east of Rampion 1, viewed next to the existing offshore WTG lighting, and is therefore seen as a continuation of an existing lighting effect in the seascape, rather than an entirely new or unfamiliar feature. The eastwards extension of the array of lights does, however, increase the lateral extent of skyline effected by the lights, bringing them closer to the viewpoint this maritime coastline of the South Downs IDSR. In doing so, the Rampion 2 aviation lights slightly increase the interruption of continuity between the dark sea below and the dark skies above, in a relatively contained part of the view which is already affected by the Rampion 1 WTG lighting. In the main however, the proposed Rampion 2 WTG lighting does not affect the 'continuity' of darkness, which will continue to occur across the wide expanse of seascape in the offshore panorama.

7.2.32 The majority of the aviation lights will be visible above the Rampion 1 WTG aviation lights, due to the higher nacelle height and will be backdropped by dark sky, however the aviation lights are low to the horizon and do not extend high into the sky, thus limiting the amount of the night-sky that is impeded and having limited influence on the view of stars in the night-sky. The stars were observed in the dark skies above and will continue to be visible and unimpeded in the skies above the viewer. The aviation lights are not expected to result in obtrusive light that impedes the wider expanse of night sky, which can be experienced readily above the aviation lights, nor result in brightening of the night sky (skyglow) or glare on to the sea surface and will therefore not be of detriment to the overall experience of the night skies in this view.

7.2.33 A result of these factors, the magnitude of change on the night-time view as a result of the aviation lights operating at 2,000cd is assessed as **Medium-low** and when combined with the Medium-high sensitivity of the viewpoint, this results in a **Not Significant (Moderate)** visual effect, occurring primarily due to the extended spread of existing and familiar visible lights in the seascape and a slight additional interruption of part of the continuity between dark seascape and dark skies. The effect of the aviation and marine navigation lights is considered not significant on balance, because the lights integrate with the baseline WTG lighting in the view

forming an extension of a familiar feature and at long distance, such that they do not compromise or diminish the view of the night sky or the dark landscape of the visible parts of the South Downs maritime coastline.

7.2.34 The operation of aviation lights at the lower intensity of 200cd when visibility from every WTG is >5 km will provide further mitigation and reduction in the perceived intensity of the visible lighting.

Viewpoint 17 Devil's Dyke

Baseline Conditions and Sensitivity

7.2.35 The existing night-time view from Devil's Dyke is shown in **Figure 15-42j-k, Volume 3** of the ES (Document Reference: 6.3.15). The viewpoint is located at the trig marked high point (217m AOD) on the route of the South Downs Way, close to the visitor car park, however the formal Devil's Dyke viewpoint orientates northwards over the Low Weald away from the coast. The viewpoint is located within the open area of undeveloped downs between the Adur and Ouse to the north of Brighton, within the Intrinsic Rural Darkness and Buffer Zone of the South Downs IDSR. The view looks out across the 'dark landscape' below in the immediate foreground, over the urban areas of Brighton and its seascape setting beyond, as well as the wider conurbations extending along the coast. The city is illuminated at night with street lighting, lighting within housing and tall buildings, retail areas, vehicles using the road network, and red aviation lights on tall structures such as cranes, the i360 Tower at Brighton seafront and the Shoreham power station chimney. These combine to create notable skyglow brightening of the night sky, visible as a pink/orange glow over the coastal conurbations, caused by the scattering of artificial light.

7.2.36 The night-time lighting on the Rampion 1 WTGs, cardinal marks and transient lights on boats in the seascape are visible 'through' and beyond this skyglow. Lighting of the existing Rampion 1 WTGs is visible in the view at night, from 20.3 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs, forming an array of multiple small points of red and yellow light extending across the view beyond the City of Brighton. Fundamentally it is a view that is highly influence by lighting in the intervening urban environment and seascape in the baseline, however the dark landscapes of the South Downs are present in the foreground and extending westwards along the chalk ridge of the downs.

7.2.37 The sensitivity of the viewpoint at night is considered to be **Medium-high**, reflecting that the view has medium-high value at night-time and the receptors experiencing the view have a medium susceptibility to change. The viewpoint is within the area of Intrinsic Rural Darkness and Buffer Zone of the South Downs IDSR which has skies classified as 'dark sky' that are of importance and value to protect, being distinguishable from other brighter areas of the SDNP. Devil's Dyke is a dark sky discovery site, which is considered to have higher sensitivity to the potential effects of the aviation lights than other areas of the IDSR, as it is specifically promoted by the SDNPA to encourage visitors to this site with the express intention of viewing the night sky and this experience could be affected.

The viewpoint is popular and well-used at night, it is accessible from the nearby visitor parking area and Devil's Dyke pub, with many people visiting to watch the sunset to the west. The main formal viewpoint is however overlooking the darker landscape of the Weald to the north, rather than the intervening urban landscape to the south. There are the many readily discernible light sources that are visible in the view, across the urban coastal conurbations, including the i360 tower and existing Rampion 1 WTG lighting in the seascape beyond. To the south, there is a visible transition between the dark landscape below, into landscapes that have a greater degree of night lighting; whereas to the west, there is a continuity between the dark landscape of the downs below, to the dark skies above, when looking along the undeveloped spine of the South Downs. The relatively high levels of baseline lighting in the intervening landscape to the south reduce susceptibility to further lighting in this direction, and the ability of receptors to perceive the intensity of lights out to sea, through the skyglow, such that the 'susceptibility' of receptors to aviation lighting on the proposed Rampion 2 WTG is reduced in the view.

Magnitude of Change and Significance of Effect

7.2.38 The predicted view of the aviation lights at 2,000cd is shown in the photomontage in **Figure 15-42l-m, Volume 3** of the ES (Document Reference: 6.3.15).

7.2.39 Aviation and marine navigation lighting of the proposed Rampion 2 WTGs will be visible in the view at night, from 24.4 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs. These lights will extend the existing array of multiple small points of red and yellow light extending across the seascape in the view behind the City of Brighton, Shoreham and Worthing. The principal effect of the lighting of the Rampion 2 WTGs will be to extend the lateral spread of existing multiple point features of red and yellow light over a wider portion of the view, adding to the visual influence of offshore lighting in the existing view of the sea at night, due to the wider spread of lighting.

7.2.40 The extension of the lighting effect occurs to the east and west of Rampion 1, viewed next to the existing offshore WTG lighting, primarily beyond the city lights and through the skyglow of the intervening urban areas, which will reduce the perceived intensity of the lights out to sea. The westwards extension of the array of lights does however, slightly interrupt some of the continuity between the dark landscape of the downs below and the dark skies above, in the view west across the rolling landscape of the downs, where the downs obscure the coastal strip. In the main however, the proposed Rampion 2 WTG lighting does not affect the 'continuity' of darkness, which is already fundamentally interrupted by the urban lighting, and to a lesser extent the existing Rampion 1 WTG lighting beyond. The view of the dark skies above is predominately affected by skyglow from the street-lights and lighting within the larger urban environment, rather than the additional influence of the Rampion 2 aviation and marine navigational lighting.

7.2.41 The majority of the aviation lights will be visible above the Rampion 1 WTG aviation lights, due to the higher nacelle height and will be backdropped by dark sky, however the aviation lights are low to the horizon and do not extend high into the sky, thus limiting the amount of the night-sky that is impeded and having

limited influence on the view of stars in the night-sky. The stars were observed in the dark skies above and will continue to be visible and unimpeded in the skies above the viewer. The aviation lights are not expected to result in obtrusive light that impedes the wider expanse of night sky, which can be experienced readily above the aviation lights, nor result in brightening of the night sky (skyglow) or glare on to the sea surface and will therefore not be of detriment to the overall experience of the night skies in this view.

7.2.42 A result of these factors, the magnitude of change on the night-time view as a result of the aviation lights operating at 2,000cd is assessed as **Medium-low** and when combined with the Medium-high sensitivity of the viewpoint, this results in a **Not Significant (Moderate)** visual effect, occurring primarily due to the extended spread of existing and familiar visible lights in the seascape and slightly interrupting part of the continuity between dark landscape and skies in the view west over the downs. The effect of the aviation and marine navigation lights is considered not significant on balance, because the lights integrate with the baseline WTG lighting in the view forming an extension of a familiar feature, they are viewed primarily beyond the intervening urban lighting and through its skyglow, and at long distance, such that their perceived intensity is lessened and does not compromise or diminish the view of the night sky or the dark landscape of the visible parts of the South Downs to the west.

7.2.43 The operation of aviation lights at the lower intensity of 200cd when visibility from every WTG is >5 km will provide further mitigation and reduction in the perceived intensity of the visible lighting.

Transition Zone (E1b)

7.2.44 The ZTV in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15) indicates that the principal areas of the Transition Zone (E2) with theoretical visibility of the aviation lights occurs along the southern periphery of the SDNP, including the southern slopes of the South Downs immediately to the north of the coastal plain and urbanised coastline, along the northern edges of the coastal conurbations, the areas of open coastal downland between Brighton and Peacehaven, the eastern edge of the SDNP alongside Eastbourne, and the main section of maritime coast of the SDNP between Seaford Head and Beachy Head. Visibility of the aviation lights occurs from these areas where there is generally a transition into landscapes that have a greater degree of night lighting in the baseline environment, between the darker zones (E0/E1a) and the urban environment.

7.2.45 None of the dark sky discovery sites are within the Transition Zones, however Viewpoint 2 at Birling Gap, is on the edge of the Transition Zone (E1b) and Buffer Zone (E1a), and a further night-time viewpoint has been included within the Transition Zone on the northern edges of Brighton at Viewpoint 27 Hollingbury Hillfort (**Figure 15-50g, Volume 3** of the ES (Document Reference: 6.3.15)).

7.2.46 An assessment of the effects of the aviation lighting on views experienced from the Transition Zone of the South Downs IDSR is undertaken with reference to these representative viewpoints in the following assessment.

Viewpoint 27 Hollingbury Hillfort

Baseline Conditions and Sensitivity

7.2.47 The existing night-time view from Hollingbury Hillfort is shown in **Figure 15-50g, Volume 3** of the ES (Document Reference: 6.3.15). The viewpoint is located on the hillfort within Hollingbury Golf Course, within an open area of undeveloped downs and recreational land within the Transition Zone of the South Downs IDSR. The view looks out across the 'dark landscape' below in the immediate foreground, over the urban areas of Brighton and its seascape setting beyond, as well as the wider conurbations extending along the coast. The city is illuminated at night with street lighting, lighting within housing and tall buildings, retail areas, vehicles using the road network, and red aviation lights on tall structures such as cranes and the i360 Tower at Brighton seafront. These combine to create notable skyglow brightening of the night sky, visible as a pink/orange glow over the coastal conurbations, caused by the scattering of artificial light.

7.2.48 The night-time lighting on the Rampion 1 WTGs, cardinal marks and transient lights on boats in the seascape are visible 'through' and beyond this skyglow. Lighting of the existing Rampion 1 WTGs is visible in the view at night, from 18 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs, forming an array of multiple small points of red and yellow light extending across the view beyond the City of Brighton. Fundamentally it is a view that is highly influence by lighting in the intervening urban environment and seascape in the baseline, however the dark landscape of the South Downs are present in the foreground, and the stars are visible at night and can be seen in **Figure 15-50g, Volume 3** of the ES (Document Reference: 6.3.15).

7.2.49 The sensitivity of the viewpoint at night is considered to be **Medium**, reflecting that the view has medium value at night-time and the receptors experiencing the view have a medium-low susceptibility to change. The viewpoint is within the Transition Zone of the South Downs IDSR which is consistently brighter than the Dark Sky Core and Buffer Zones but has skies that they remain of value to protect and distinguish from other brighter areas. It is not identified as a dark sky discovery site or promoted as a particular location for viewing the night sky, however it does provide a natural vantage point from which to experience night-time views over the City of Brighton, is relatively accessible, however is likely to be valued at least in part for the view over the lights of the city at night, rather than its darkness as such. The main attention and points of interest include the many readily discernible light sources that are visible, including the i360 tower and existing Rampion 1 WTG lighting in the seascape. There is a visible transition between the dark landscape below, into landscapes that have a greater degree of night lighting. The relatively high levels of baseline lighting in the intervening landscape reduce susceptibility to further lighting and the ability of receptors to perceive the intensity of lights out to sea, through the skyglow, such that the 'susceptibility' of receptors to aviation lighting on the proposed Rampion 2 WTG is reduced in the view.

Magnitude of Change and Significance of Effect

7.2.50 The predicted view of the aviation lights at 2,000cd is shown in the photomontage in **Figure 15-50h, Volume 3** of the ES (Document Reference: 6.3.15).

7.2.51 Aviation and marine navigation lighting of the proposed Rampion 2 WTGs will be visible in the view at night, from 22.5 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs. These lights will extend the existing array of multiple small points of red and yellow light extending across the seascape in the view behind the City of Brighton. The principal effect of the lighting of the Rampion 2 WTGs will be to extend the lateral spread of existing multiple point features of red and yellow light over a wider portion of the view, adding to the visual influence of offshore lighting in the existing view of the sea at night, due to the wider spread of lighting. The aviation and marine navigation lighting of the proposed Rampion 2 WTGs will, however, be viewed next to the existing offshore WTG lighting, beyond the city lights and through the skyglow of the intervening urban areas, which will reduce the perceived intensity of the lights out to sea.

7.2.52 The view of the dark skies above is predominately affected by skyglow from the street-lights and lighting within the larger urban environment, rather than the additional influence of the Rampion 2 aviation and marine navigational lighting. The continuity of the dark landscape of the downs ‘below’ to the dark skies ‘above’ is already fundamentally interrupted by the urban lighting, and to a lesser extent the existing Rampion 1 WTG lighting beyond. The proposed Rampion 2 WTG lighting does not affect the ‘continuity’ of darkness across the Downs in the landscape below, not does it influence the existing level of discontinuity between the dark landscape and skies above.

7.2.53 The majority of the aviation lights will be visible above the Rampion 1 WTG aviation lights, due to the higher nacelle height and will be backdropped by dark sky, however the aviation lights are low to the horizon and do not extend high into the sky, thus limiting the amount of the night-sky that is impeded and having limited influence on the view of stars in the night-sky. The stars were observed and will continue to be visible in the skies above the viewer, as shown in **Figure 15-50h, Volume 3** of the ES (Document Reference: 6.3.15). The aviation lights are not expected to result in obtrusive light that impedes the wider expanse of night sky, which can be experienced readily above the aviation lights, nor result in brightening of the night sky (skyglow) or glare on to the sea surface and will therefore not be of detriment to the overall experience of the night skies in this view.

7.2.54 A result of these factors, the magnitude of change on the night-time view as a result of the aviation lights operating at 2,000cd is assessed as **Medium-low** and when combined with the medium sensitivity of the viewpoint, this results in a **Not Significant (Moderate/minor)** visual effect. The effect of the aviation and marine navigation lights is considered not significant on balance, because the lights integrate with the baseline WTG lighting in the view forming an extension of a familiar feature, they are viewed primarily beyond the intervening urban lighting of the City of Brighton and through its skyglow, and at long distance, such that their perceived intensity is lessened and does not compromise or diminish the view of

the night sky or the dark landscape of the visible parts of the South Downs in the foreground and to the east.

7.2.55 The operation of aviation lights at the lower intensity of 200cd when visibility from every WTG is >5 km will provide further mitigation and reduction in the perceived intensity of the visible lighting.

Urban (E3/4)

7.2.56 Broadly this area is defined as being the larger settlements within the SDNP, including Lewes, Ditchling, Petworth, Midhurst, Femhurst, East Liss and Petersfield. There is no visibility of the aviation and marine navigational lighting from these urban areas within the SDNP, as shown in **Figure 15-25, Volume 3** of the ES (Document Reference: 6.3.15), with the exception of very low levels of theoretical visibility from Petworth at a distance of approximately 35km from the Rampion 2 array area.

Urban areas out outside the South Downs IDSR

7.2.57 Areas of high theoretical visibility of the aviation lighting of Rampion 2 and most extensive geographic spread of visibility of the aviation lighting of Rampion 2 occur along the urban seafront and across the urban coastal conurbations outside the South Downs IDSR, between Selsey, Bognor Regis, Littlehampton, Worthing, Brighton, Peacehaven, Newhaven and Seaford. Visibility of the aviation and marine navigation lights will be considerably reduced due to the extensive screening provided by buildings within these urban environments, with views of the aviation and marine navigational lights focused along the seafront areas of these settlements, where there are direct views out to sea, and areas of higher ground set back from the coast where there are more open views out to sea from within these settlements.

7.2.58 Visibility of the proposed aviation and marine navigational lights occurs from these urban areas where there are clear views of the Rampion 1 aviation and marine navigation lights at night and where the influence of existing urban lighting in the night-time baseline is greatest. The existing Rampion 1 aviation and marine navigation lights are clearly visible out to sea from this urban coastline at distances between approximately 13.5km – 16km offshore, forming an array of white navigation lights on the horizon with red aviation lights above them on the peripheral WTGs. There are high levels of lighting caused by street-lights, building lights and vehicle lighting, but also from the many and varied lighting of entertainments and visitor attractions along the seafronts, including piers at Bognor Regis, Worthing and Brighton which extend into the nearshore waters and spill light onto the sea.

7.2.59 An assessment of the effects of the aviation lighting on views experienced from the Brighton seafront, representative of the closest urban areas outside the South Downs IDSR is undertaken with reference to the night-time Viewpoint 8 (**Figure 15-33l-o, Volume 3** of the ES (Document Reference: 6.3.15)).

Viewpoint 8 Brighton Seafront

Baseline Conditions and Sensitivity

7.2.60 The existing night-time view from Brighton seafront is shown in **Figure 15-33i-m Volume 3** of the ES (Document Reference: 6.3.15). The viewpoint is located on the seafront promenade to the west of Brighton pier on a brightly lit seafront promenade with street lighting, lighting at beach shelters, adjacent building frontages and passing car lights on the busy main road. The view looks out across Brighton beach to the sea, in which Brighton Palace Pier is illuminated at night with bright lighting within its arcades, restaurants/bars and rides. There is a red light at the top of the helter-skelter. The lighting of Brighton Palace Pier spills light reflections onto the nearshore sea. The red lights on the i360 tower are visible to the west of the viewpoint.

7.2.61 The seascape includes visible night-time lighting on the Rampion 1 WTGs, cardinal marks and transient lights on boats in the inshore waters. Lighting of the existing Rampion 1 WTGs is visible in the view at night, from 13.9 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs, forming an array of multiple small points of red and yellow light extending across the view between the dark sea below and dark sky above. Fundamentally it is a view that is highly influence by lighting in urban environment and seascape in the baseline.

7.2.62 The sensitivity of the viewpoint at night is considered to be **Low**, reflecting that the view has low value at night-time and the receptors experiencing the view have a low susceptibility to change. The value of the view is assessed to be low at night-time, since it is not a location that people visit to experience a dark landscape or dark skies, in fact people value and are attracted to the area at night for the 'bright lights' of the seafront and its night-time attractions. The viewpoint is located on the promenade overlooking Brighton beach which provides access for visitors to other seafront visitor facilities, however it is within a brightly lit urban landscape outside the South Downs IDSR. Although it is visited by a large number of people, their main attention and interest includes the many readily discernible light sources that are visible, including the lighting of Brighton Palace Pier, the i360 tower and existing Rampion 1 WTG aviation and marine navigation lighting in the seascape. There are high levels of baseline lighting around the viewpoint that reduce susceptibility to further lighting and the ability of receptors to perceive the intensity of lights out to sea, such that the 'susceptibility' of receptors to aviation lighting on the proposed Rampion 2 WTG is reduced in the view.

Magnitude of Change and Significance of Effect

7.2.63 The predicted view of the aviation lights at 2,000cd is shown in the photomontage in **Figure 15-33n-o, Volume 3** of the ES (Document Reference: 6.3.15).

7.2.64 Aviation and marine navigation lighting of the proposed Rampion 2 WTGs will be visible in the view at night, from 18.4 km to the closest WTG, including both the red medium intensity lighting at nacelle height on peripheral WTGs (which flash in sequence) and yellow marine navigational lighting at platform level of all WTGs.

These lights will extend the existing array of multiple small points of red and yellow light extending across the view between the dark sea below and dark sky above. The lighting of the Rampion 2 WTGs will extend the lateral spread of multiple point features of red and yellow light over a wider portion of the view, adding to the visual influence of offshore lighting in the existing view of the sea at night, due to the contrast of the lights with the dark seascape and sky into which the lights extend primarily westwards in the view. The aviation and marine navigation lighting of the proposed Rampion 2 WTGs will however, always be viewed next to the existing offshore WTG lighting and in the context of the bright baseline lighting around the viewpoint, which will reduce the perceived intensity of the lights out to sea.

7.2.65 The majority of the aviation lights will be visible above the Rampion 1 WTG aviation lights, due to the higher nacelle height and will be backdropped by dark sky, however the aviation lights are relatively low to the horizon and do not extend high into the sky above the viewpoint, thus limiting the amount of the night-sky that is impeded. The stars were observed and will continue to be visible in the skies above, as shown in **Figure 15-33n-o, Volume 3** of the ES (Document Reference: 6.3.15). The aviation lights are not expected to result in obtrusive light that impedes the wider expanse of night sky, which can be experienced readily above the aviation lights, nor result in brightening of the night sky (skyglow) or glare on to the sea surface and will therefore not be of detriment to the overall experience of the night skies and seascape in this view.

7.2.66 A result of these factors, the magnitude of change on the night-time view as a result of the aviation lights operating at 2,000cd is assessed as **Low** and when combined with the Low sensitivity of the viewpoint, this results in a **Not Significant (Negligible)** visual effect, occurring primarily due to the extended spread of existing and familiar visible lights in the seascape, from a viewpoint that is used at night for the purpose of enjoying the bright lights and attractions of the seafront.

7.2.67 The operation of aviation lights at the lower intensity of 200cd when visibility from every WTG is >5 km will provide further mitigation and reduction in the perceived intensity of the visible lighting.

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8. Summary and conclusions

8.1.1 An assessment of the likely effects that will arise from visibility of the proposed aviation and marine navigation lighting has been undertaken in this Appendix. It has formed the basis of the following conclusions on the effects of the proposed lighting.

8.1.2 An assessment of effects from visible aviation lighting rests to a large extent on a perceptual appreciation of the lighting effects that someone might experience in different levels of darkness at night.

8.1.3 Acknowledging the subjectivity of the impact metrics, the role of this assessment in this Appendix is to identify where, and to what degree, parts of the study area may be significantly affected by visibility of part or all of the aviation lights and to present a judgement on the significance of those effects.

8.1.4 The study area for the assessment focuses on landscapes with defined dark skies qualities - '*skies relatively free of light pollution where you can see a clear starry sky and importantly, our own galaxy the Milky Way',* within the South Downs IDSR. It also considers effects arising from urban areas outside the South Downs IDSR, which do not have dark skies.

8.1.5 The offshore elements of Rampion 2 are not located within the South Downs IDSR, although the aviation and marine navigational lights are likely to be visible from viewpoints within the South Downs IDSR

8.1.6 The IDSR takes in the entire SDNP boundary but is largely defined by a critical 'Dark Sky Core', a Buffer Zone and Transition Zone. These zones reflect the quality of the sky overhead, the IDSR designation and the general level of lighting.

8.1.7 The Dark Sky Core is located 22.6km from the Rampion 2 array area at its closest point; the Buffer Zone is 20.6km and Transition Zone 15.8km.

8.1.8 The large majority of the Dark Sky Core of the South Downs IDSR will afford no visibility of the aviation lights to people viewing the night sky. The aviation lighting will also not be seen by people viewing the night sky from two of its four dark sky discovery sites (2 – Old Winchester Hill; and 4 – Ipping Common) as they are outside the ZTV.

8.1.9 The principal area of the Dark Sky Core with theoretical visibility of the aviation lights occurs along the east-west ridgeline of elevated tops of the wooded downlands to the north-west of Arundel around Bignor Hill (dark sky discovery Site 5) extending across the tops of the downs to Harting Downs and Queen Elizabeth Forest/Butser Hill (dark sky discovery site 3).

8.1.10 The Dark Sky Core is also located 22.6km from the Rampion 2 array area at its closest point, with the three dark sky discovery sites in the study area located 28.1km (Bignor Hill), 40.7km (Iping Common) and 45.1km (Butser Hill) from the Rampion 2 array area respectively, at considerable distance.

8.1.11 Many of these areas of the Dark Sky Core of the South Downs IDSR have dense areas of woodland which limit visibility of lighting in the wider landscape and seascape at night.

8.1.12 Changes to views at night will therefore occur principally from the sections of isolated open hill tops of the downs in long distance views from this area of the Dark Sky Core, which allow longer range views to the seascape to the south where the aviation lighting of the offshore elements of Rampion 2 may be visible under certain atmosphere conditions.

8.1.13 Based on the assessment of the representative viewpoints considered in the assessment at dark sky discovery sites 3 (Butser Hill) and 5 (Bignor Hill), the visual effect of the aviation and marine navigation lighting of the proposed Rampion 2 WTGs on the night-time views from the Dark Sky Core is assessed as Not Significant.

8.1.14 Views from the Dark Sky Core are located at long distances from the potential source of light within the Rampion 2 array area, which reduces its susceptibility to change as viewers are unlikely to perceive the aviation or marine navigation lights to any degree of intensity at such long range. It is unlikely that the Rampion 2 WTG lights will be visible at all from the more distant parts of the Dark Sky Core, towards the outer parts of the study area, at 45-50km, as the Rampion 1 WTG lights have not been observed at such distances.

8.1.15 There are also many readily discernible light sources that are visible in the views from the tops of the downs of the Dark Sy Core across the coastal plain and intervening urban coastal conurbations to the south-east in the direction towards the Rampion 2 array area.

8.1.16 In views along the undeveloped spine of the South Downs, there is a continuity between the dark landscape of the downs below to the dark skies above. The Rampion 2 aviation and marine navigation lighting does not interrupt this continuity.

8.1.17 There are relatively high levels of baseline lighting in the intervening landscape to the south-east and south which reduce the effects of further lighting in this direction, and the ability of receptors to perceive the intensity of lights out to sea, sometimes through the skyglow of the intervening developed coastal strip.

8.1.18 Similarly, in views from the open downs within the Buffer Zone, such as Devil's Dyke, the visual effects of the aviation and marine navigation lighting of the proposed Rampion 2 WTGs are assessed as not significant. The lighting of the Rampion 2 WTGs will be visible at long distances, with the principal effect of the lighting of the Rampion 2 WTGs being to extend the lateral spread of existing Rampion 1 WTG lights over a wider portion of the view.

8.1.19 While this adds to the visual influence of offshore lighting in the existing view of the sea at night, due to the wider spread of lighting, the aviation and marine navigation lights will be familiar elements viewed next to the existing Rampion 1 WTG lighting and viewed primarily beyond the city lights and through the skyglow of the intervening urban areas, which will reduce the perceived intensity of the lights out to sea and diminishes the effects of distant aviation lighting.

8.1.20 The proposed Rampion 2 WTG lighting does not affect the ‘continuity’ of darkness, which is already fundamentally interrupted by the urban lighting, and to a lesser extent the existing Rampion 1 WTG lighting beyond. The view of the dark skies above is predominately affected by brightness and skyglow from the street-lights and lighting within the larger urban environment, rather than the additional influence of the Rampion 2 aviation and marine navigational lighting.

8.1.21 In views from both the Dark Sky Core and Buffer Zone, the aviation lights will be visible low to the horizon and do not extend high into the sky, thus limiting the amount of the night-sky that is impeded and having limited influence on the view of stars in the night-sky.

8.1.22 The aviation lights are not expected to result in obtrusive light that impedes the wider expanse of night sky, which can be experienced readily above the aviation lights, nor result in brightening of the night sky (skyglow) or glare on to the sea surface and will therefore not be of detriment to the overall experience of the night skies in this view.

8.1.23 The aviation and marine navigation lights are considered to integrate with the baseline WTG lighting in views from these areas of the South Downs IDSR, forming an extension of a familiar feature, they are viewed primarily beyond the intervening urban lighting and through its skyglow, and at long distance, such that their perceived intensity is lessened and does not compromise or diminish the view of the night sky or the dark landscape of the visible parts of the South Downs.

8.1.24 In summary, the assessment has considered the impact on the zones of the south Downs IDSR with reference to viewpoints within each area, particularly in regard to the potential disruption of the dark landscape continuity and impact on dark skies above the South Downs IDSR. It has found the following.

- The proposed aviation and marine navigation lighting will not result in effects on landscape character, which is not readily perceived at night in darkness, particularly in rural areas. The effects arising are wholly a visual concern.
- Rampion 2 lights will generally be viewed 'through' or beyond the brighter lights and skyglow of the intervening urban area, that forms an existing light influenced section of views between the 'dark landscape' of the South Downs below and the 'dark skies' above.
- Rampion 2 will not affect people’s ability to see a clear starry sky and the Milky Way galaxy in night-time views from the South Downs IDSR, including from its dark sky discovery sites.
- The overall impact of the lighting will not harm the continuity of the dark landscape of the South Downs IDSR and will not be visible as glare, skyglow, spill or reflection. It will also not reduce the measured and observed quality of easily visible astronomical features.
- People within the South Downs IDSR will be located considerably greater than 5km from the Rampion 2 array area, and therefore experience the aviation lights at 200cd during periods of ‘clear’ visibility; and only at 2,000cd in periods of poor visibility (when the influence of the lights will be reduced in poor visibility conditions).

- A relatively small number of people will be affected by visibility of the aviation lights, with a low likelihood of people being present at the viewpoints at night and only for periods of relatively short duration.
- Visual effects arising for a relatively small number of people at night-time on the South Downs Way, for example, cannot be as important as significant visual effects that arise from that same location during daytime, that may affect a vastly greater number of people. The relatively few people that are likely to experience these visual effects cannot be overstated.
- The likelihood of people visiting the Dark Skies Discovery Sites having some form of personal light sources with them for their own safety, which will create some element of baseline light.
- There are no settlements or communities will experience significant visual effects.
- The duration of the effect of the lights on receptors is likely to be over a relatively short period, more commonly experienced during evening and morning hours of darkness, after dusk and before sunrise, when people are not sleeping. The ICAO standard requires for 2,000cd medium intensity red lights, to be switched on when 'Night' has been reached, as measured at 50cd/m^2 or darker, removing the likelihood of visible lighting during twilight.
- The nature of red medium intensity aviation lights, of the type proposed at Rampion 2, is that they tend to appear as a point of light when seen in the seascape, rather than causing any discernible 'glare' or 'sky glow'.
- All opportunities have been made to reduce light pollution. The lighting cannot be avoided, however adverse impacts are mitigated to the greatest reasonable extent through the use of omni-directional lights which mitigate the perceived intensity of light below 3° and above 4° from the horizontal plane; and through the operation of the lights in accordance with Air Navigation Order 2016 (CAP393) Article 223 (8), which allows the 2,000cd aviation lights to be dimmed to 200cd, if visibility is greater than 5km.
- One of the key findings of the visual assessment of the aviation lights is that they are considered unlikely to result in 'obtrusive' light, nor impede the expanse of night sky to the point of being obtrusive. Generally this is because the aviation lights will be viewed relatively near the horizon, or even below the skyline from elevated parts of the dark sky core of the South Downs IDSR, so while they may have effects by breaking into the darkness as point features of light, appearing visible in the seascape to the south, they are not expected to result in obtrusive light that will harm the enjoyment of the night-skies.
- The proposed aviation and marine navigational lighting therefore do not significantly affect the intrinsic quality of dark night skies and the integrity of the Dark Sky Core of the South Downs IDSR.

9. Glossary of terms and abbreviations

Table 9-1 Glossary of terms and abbreviations

Term	Abbreviation
AOD	Above Ordnance Datum
CAA	Civil Aviation Authority
CPRE	Campaign to Protect Rural England
Development Consent Order (DCO)	This is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects, under the Planning Act 2008.
EASA	European Aviation Safety Agency
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
Environmental Statement (ES)	The written output presenting the full findings of the Environmental Impact Assessment.
ERCOP	Emergency Response and Cooperation Plan
ETG	Expert Topic Group
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HAT	Highest Astronomical Tide

IALA	International Association of Lighthouse Authorities
ICAO	International Civil Aviation Organization
IDSR	International Dark Sky Reserve
IEMA	Institute of Environmental Management and Assessment
LAT	Lowest Astronomical Tide
LCA	Landscape Character Area
LUC	Land Use Consultants
LVIA	Landscape and Visual Impact Assessment
MCA	Marine Coastguard Agency
MOD	Ministry of Defence
NCEI	National Centre for Environment Information
NE	Natural England
NP	National Park
NNR	National Nature Reserve
OREI	Offshore Renewable Energy Installations
Preliminary Environmental Information Report (PEIR)	The written output of the Preliminary Environmental Impact Assessment undertaken for the Proposed Development. It was developed to support Statutory Consultation and presented the preliminary findings of the assessment to allow an informed view to be developed of the Proposed Development, the assessment

	approach that was undertaken, and the preliminary conclusions on the likely significant effects of the Proposed Development and environmental measures proposed.
Rampion Extension Development Limited (RED)	Rampion Extension Development Ltd (the Applicant)
SAR	Search and Rescue
SDNP	South Downs National Park
SDNPA	South Downs National Park Authority
SLVIA	Seascape, landscape and visual impact assessment
SPS	Significant Peripheral Structures
SQM	Square Meter
UK	United Kingdom
ULR	Upward Light Ratio
WTG	Wind Turbine Generator
ZOI	Zone Of Influence
ZTV	Zone of Theoretical Visibility

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10. References

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Rampion 2
WIND FARM