Contents – Lighting

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1. Introduction

1.1 This section has been prepared by WSP and considers the likely effects of exterior lighting associated with the Proposed Development upon the surrounding environment.

1.2 This section has been co-ordinated with Chapter 17 – Landscape and Visual, to ensure that corresponding viewpoints are used for analysis where applicable. Additional viewpoints have been included in this chapter where it has been deemed pertinent. Each viewpoint corresponds to a general view of the Proposed Development, or the view from an identified potentially sensitive receptor towards the Site.

1.3 This chapter describes the methodology used for the assessment of lighting, the baseline conditions existing at the site, the likely environmental effects of the development, the mitigation measures required to prevent, reduce or offset any significant adverse effects and the likely residual effects after these measures have been employed.

2. Assessment Methodology

2.1 An assessment of the likely effect of lighting has been prepared in order to:

- Assess the existing baseline lighting conditions on the Site and in the immediate surrounds.
- Assess the potential effect of lighting during the construction of the Proposed Development and caused by the completed development, in relation to sensitive receptors, including local residents, road users and identified sensitive fauna. The wider impact on local ecology and the night-time scene is dealt with in Chapter 8.
- Provide outline mitigation measures to reduce the potential impact of lighting.

2.2 Light likely to be emitted by the internal lighting of proposed residential properties is not considered as part of this assessment. There is currently no mechanism for enforcing conditions on usual and reasonable internal lighting. Should on completion of the development a resident install lighting that creates a nuisance, or that is prejudicial to health, then the local authority may deal with the situation through the provisions of the Clean Neighbourhoods and Environment Act 2005 (Ref. 14.1).

2.3 Applicable guidance for the undertaking of an assessment of this type includes:

- CIE 150:2017 *Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations* (Commission Internationale de l'Eclairage, 2017). (Ref. 14.2)

  The purpose of this document is to help formulate guidelines for assessing the environmental effects of outdoor lighting installations and to give recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels. As the obtrusive effects of outdoor lighting are best controlled initially by appropriate design, the guidance given is primarily applicable to new lighting installations; however, some advice is also provided on

remedial measures which may be taken for existing installations. This guide refers to the potentially adverse effects of outdoor lighting on both natural and human environments, covering situations encountered by most people in most aspects of daily life – from residents, sightseers, transport users to environmentalists and astronomers. The document has the status of an International Standard.

- CIE 126:1997 *Guidelines for Minimizing Sky Glow* (Commission Internationale de l'Eclairage, 1997). (Ref. 14.3)

  This guide gives general guidance for lighting designers and policy makers on the reduction of sky glow. The report gives recommendations on the maximum permissible values for lighting installations. Lighting designers should do everything possible to meet the lowest specifications for the design. Practical implementation of the general guidance is left to National Regulations. The guidelines have the status of an International Standard.

- GN01:2020 *Guidance Notes for the Reduction of Obtrusive Light* (Institution of Lighting Professionals, 2020). (Ref. 14.4)

  The Institution of Lighting Professionals (ILP) has proposed this guidance for local authorities, with a recommendation that it be incorporated at the Local Plan level. The guidance defines various forms of light pollution and describes a series of Environmental Zones, as well as providing suitable criteria against which the effects of artificial lighting can be assessed. GN01 effectively incorporates the guidance from CIE 150 and CIE 126 into a single, relevant, national document; as such it provides the most specific and applicable guidance for mitigating the effects of artificial lighting in the United Kingdom.

- PLG 04 *Guidance on Undertaking Environmental Lighting Impact Assessments* (Institution of Lighting Professionals, 2013). (Ref. 14.5)

  This Professional Lighting Guide provides guidance and methodology for the undertaking and reporting of lighting environmental impact assessments.

- *Lighting in the Countryside: Towards Good Practice* (Office of the Deputy Prime Minister, 1997; latterly, Ministry of Housing, Communities and Local Government). (Ref. 14.6)

  In conjunction with the then Countryside Commission, the Department published this document in 1997, with a revised issue in 2001. The guidance was developed to, 'provide practical advice on the prevention and control of lighting impacts through appropriate action by all those involved with lighting in the countryside.' Its objective is, 'to identify good practice in the planning and design of lighting in rural areas; and advise on how it can be achieved, using case study examples.' The guide aims to provide an overview and common understanding of all aspects of good lighting practice stating that close co-operation and participation is required for all those involved in planning, designing and installing lighting schemes.

2.4 Baseline data collection has been undertaken by way of an on-site survey. The survey was conducted on Thursday 6 December 2018 by lighting specialists from WSP. The procedure and results of the survey are presented in this chapter.

2.5 The following definitions are used to describe lighting effects:

- Glare: the uncomfortable brightness of a light source when viewed against a darker background.

- Sky Glow: the brightening of the night sky.

- Spill Light: the spilling of light beyond the boundary of the property or area being lit.

- Upward Light Ratio (ULR): the percentage of luminaire output that goes directly into the sky.

- Veiling Luminance: an effect requiring increased luminance to view the subject due to disability glare from the installation.

2.6 The criteria used to provide a baseline for the impact of lighting on the surrounding environment are drawn from GN01, based on the derived Environmental Zone. The five zones may be summarised as per Table 14.1 below.

Zone	**Surrounding**	**Lighting Environment**	**Examples**
E0	Protected	Dark	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town / city centres with high levels of night-time activity

Table 14.1: Environmental Zones (from GN01)

2.7 The character of the area of the Proposed Development and its surrounds is classified as Environmental Zone E2. The environment is largely rural, with pockets of development in the form of Yarnton, Cassington, Begbroke, Bladon, Oxford Airport and Kidlington – largely in a suburban or rural village setting. Some of these towns and villages are themselves somewhat dark, with limited street lighting. Areas between settlements are generally dark, being largely agricultural or park land. The view towards lit areas, dependent on the local topography, is in some locations completely obscured, creating intrinsically dark locales.

2.8 The limitations imposed by GN01 on exterior lighting for Environment Zone E2 are as per Table 14.2 below.

Sky Glow ULR (Max %)	**Light Intrusion (into windows) E_v (lux)[1]**		**Luminaire Intensity *I* (candelas)[2]**		**Building Luminance Pre-curfew[3]**
	Pre-curfew[4]	**Post-curfew**	**Pre-curfew**	**Post-curfew**	**Average, *L* (cd/m^2)**
2.5	5	1	7,500	500	5

Notes

[1] E_v = vertical illuminance in lux, measured flat on the glazing at the centre of the window.

[2] *I* = light intensity in candelas (cd).

[3] *L* = luminance in candelas per square metre (cd/^{m2}).

[4] Curfew = the time after which stricter requirements for the control of obtrusive light may apply.

Table 14.2: Limitations for Environmental Zone E2 (from GN01)

2.9 The Proposed Development will impact on the surrounding environment in ways that may be measured by magnitude and significance, as described by PLG 04 and presented below in Table 14.3. An indication of the impact of the Proposed Development is made in this Chapter, setting out the mitigations that may be employed to reduce the adverse effects of artificial lighting.

Nature	Ref	Level	Description	Remedial Needs
Positive	1	Major / substantial beneficial effects	Significant improvement in night environment and / or reductions in glare, spill light and sky glow, etc.	None
	2	Moderate beneficial effects	Noticeable improvement in night environment and / or reductions in glare, spill light and sky glow, etc.	
	3	Minor beneficial effects	Slight improvement in night environment and / or reductions in glare, spill light and sky glow	
Neutral	4	None / negligible	No significant effect or overall effects balancing out	
Negative	5	Minor adverse effects	Slight increase in visibility of site, glare and sky glow, etc.	Develop appropriate levels and type of mitigation
	6	Moderate adverse effects	Noticeable increase in visibility of site, glare and sky glow, etc.	
	7	Major adverse effects	Significant problems with increase in visibility or site, glare and sky glow, etc.	

Table 14.3: Effect of lighting (PLG 04)

2.10 The impacts presented by exterior lighting associated with the Proposed Development may have differing durations, dependent on the type of lighting and during which phase of the proposal it is active. The effects will present themselves in three main ways, as described by PLG 04:

- Construction phase – relatively short-term effects as the development is constructed, such as floodlighting of construction activities and offices, compounds and the like being illuminated for safety or security.

- Development phase – long-term effects from infrastructure-related lighting, such as street and amenity lighting.

- Operational phase – long-term effects from the operation of the Proposed Development, such as the use of sports facilities.

3. Legislative and Planning Context

3.1 The applicable legislative framework is summarised as follows:

- The Clean Neighbourhoods and Environment Act 2005 (the 'CNEA') (Ref. 14.1); and
- The Environmental Protection Act 1990.

3.2 The CNEA gives local authorities powers to deal with artificial lighting by classifying artificial light emitted from defined premises as a statutory nuisance.

3.3 The CNEA amends Section 79 of the Environmental Protection Act 1990 (Ref. 14.7) to extend the statutory nuisance regime to include light spill and glare (emitted from certain premises) defined as, 'artificial light emitted from premises so as to be prejudicial to health or a nuisance.' Several defined types of premise are exempt from this provision, including premises where higher levels of light are to be expected for the purposes of safety, such as airports and lighthouses.

3.4 Guidance produced on Sections 101 to 103 of the CNEA by the Department of Environment, Food and Rural Affairs (DEFRA) extends the duty on local authorities to ensure their areas are checked periodically for existing and potential sources of statutory nuisances, including situations where a nuisance arises from the use of artificial lighting.

3.5 It should be noted that a highway is not deemed to be a premise under the CNEA, therefore light emitted from a highway lighting installation cannot be deemed a nuisance.

3.6 The applicable planning framework is summarised as follows:

- At a national level: National Planning Policy Framework (the 'NPPF') (Ref. 14.8)
- At a local level: Cherwell Local Plan 2011-2031 (the 'Local Plan') (Ref. 14.9)

3.7 The NPPF references artificial light, where it is stated that in ‘taking into account the likely effects… of pollution’ developments should, ‘limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.’

3.8 The Local Plan describes policies for rural Cherwell. No specific policy with regard to lighting is mandated for areas at Yarnton, but the document more generally states that ‘provision of appropriate lighting *[should include]* the minimisation of light pollution based on appropriate technical assessment.’

4. Area of Study

4.1 The area of study is centred around the village of Yarnton. The Proposed Development would be located to the west of the village, between Yarnton and Begbroke Wood. Nine viewpoints have been identified for assessment as part of the visual impact study, which have been incorporated as sample sites within the lighting assessment. These viewpoints are:

- 1: On a PROW (Public Right of Way) at the southern edge of Begbroke Wood, facing east towards the Proposed Development.
- 2: On a PROW east of Begbroke Wood, facing south-east across the Proposed Development towards Yarnton.
- 3: On Dolton Lane PROW at the north of the Proposed Development, facing south-east towards Yarnton.
- 4: On a PROW west of the A44, facing west across the Proposed Development towards Begbroke Wood.
- 5: On the A44 between Yarnton and Begbroke, facing south towards Yarnton.
- 5A: On the A44 in advance of Begbroke travelling north, facing south towards Yarnton.
- 6: On a PROW south of properties at Fernhill Road, Begbroke, facing south-west towards the Proposed Development.
- 7: On a PROW east of Bladon, facing south-east towards the Proposed Development.
- 8: On a PROW off the A44 south of the Oxford Canal, looking north-west across Yarnton towards the Proposed Development.
- 9: On Rutten Lane outside Yarnton Residential and Nursing Home, looking beyond the line of buildings north-west towards the Proposed Development.

4.2 In addition, it has been considered prudent to add the following sample viewpoints to the lighting assessment:

- 10: On Yarnton Road at Worten, facing north-east towards the Proposed Development. While the topography of the land is likely to shield the village of Worten from direct view of the Site, it has been considered prudent to establish a baseline level in this location.

- 11: On Langford Lane south of Oxford Airport, facing south towards the Proposed Development. It is considered prudent to understand the impact of the Proposed Development at the perimeter of the airport, if any.

4.3 A plan view of the distribution of viewpoints is shown below.

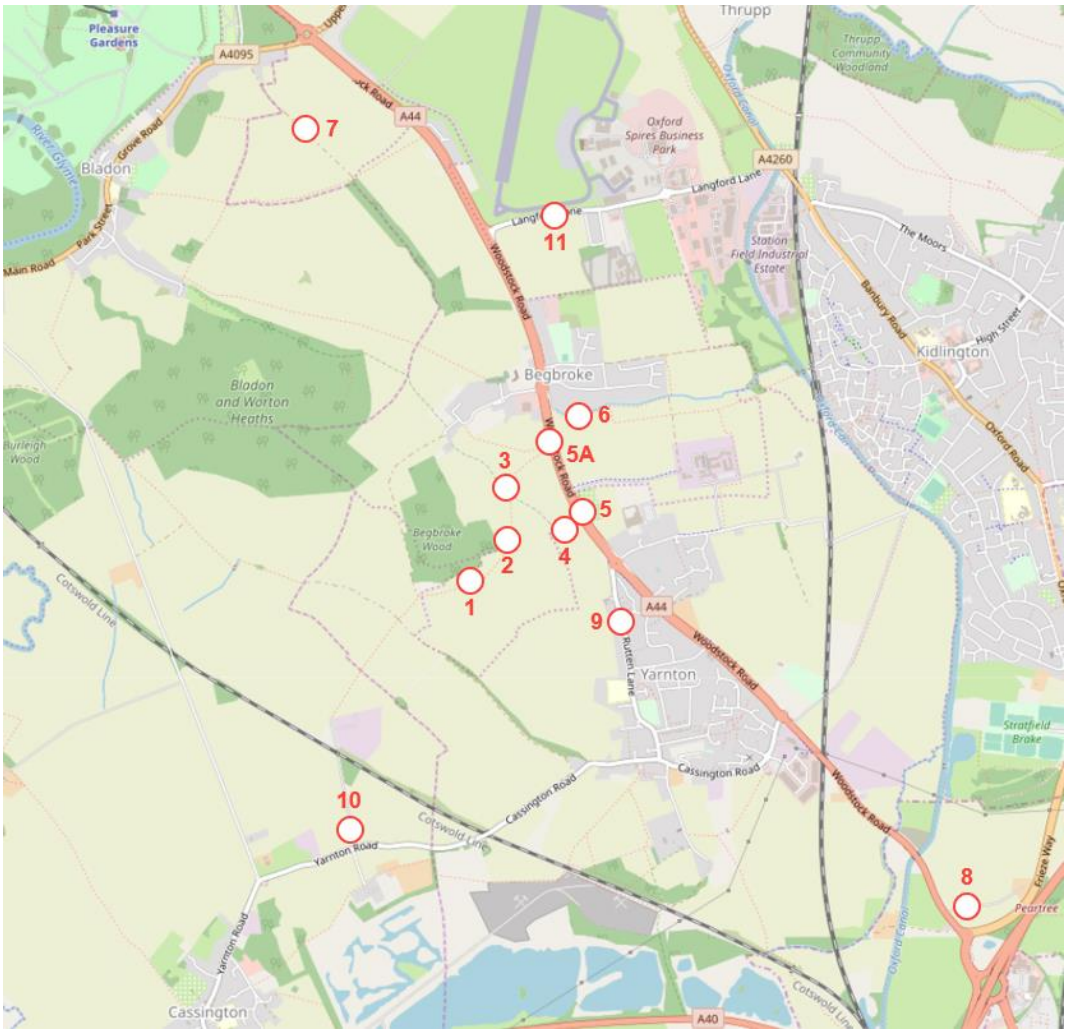

Figure 14.1: Location of viewpoint sites

5. Site Survey and Baseline

5.1 WSP lighting specialists attended the area of study on Thursday 6 December 2018. A daylight reconnaissance visit was conducted between 13.00 and 15.30 hours, followed by a dark survey between 16.30 and 20.00 to take ambient light measurements and record the lighting conditions at each of the sample viewpoints.

5.2 Readings of illuminance enable baseline lighting condition values to be determined for the Proposed Development and its surrounds. Such readings were taken at each sample site:

- Vertically in each of the cardinal directions.
- Horizontally.

5.3 Illuminance readings were taken using a Minolta T-10 light meter, calibrated on 6 September 2018 by an independent calibration service.

5.4 Photographs from each viewpoint, in the predetermined direction of interest, were taken in daylight and again after dark. Where viewing directions were intrinsically dark (such as at site 4) a view towards the exterior of the Proposed Development was taken, to show the general setting of the viewpoint. A 12.3 megapixel camera was used, with white balance adjusted to provide as accurate a depiction of reality as possible.

5.5 The baseline lighting conditions recorded at each viewpoint are as follows.

Viewpoint Ref.	Recorded Illuminance (lux)				
	Facing North	Facing East	Facing South	Facing West	Horizontal
1	0.03	0.08	0.05	0.01	0.06
2	0.04	0.09	0.08	0.02	0.08
3	0.04	0.11	0.03	0.01	0.08
4	0.07	0.09	0.03	0.02	0.11
5	2.08	8.29	2.3	0.15	3.9
5A	3.92	11.72	4.17	0.26	7.7
6	0.04	0.09	0.11	0.41	0.1
7	0.02	0.05	0.04	0.03	0.04
8	0.06	0.06	0.03	0.03	0.06
9	0.57	0.12	0.53	0.45	0.19
10	0.02	0.03	0.03	0.01	0.03
11	0.18	0.24	0.06	0.04	0.18

Table 14.5: Recorded lighting levels

5.6 A commentary on each viewpoint (VP) is as follows, together with day and selected night-time imagery. Note that night-time images exaggerate the amount of skyglow and cloud reflection slightly – the remainder of the image is a close representation of reality.

VP Ref.	Commentary
1	The viewpoint is open grassland with woodland to the north and fields, meadows, hedgerows and treelines to the east and south. The viewpoint is intrinsically dark, with no local lighting. Road lighting at the A44 is located approximately 350m to the east. There is a direct view of premise flood lights adjacent to the A44. Skyglow to the south (assumed over Oxford) is the most apparent source of lighting in the surrounds. Additional skyglow (pictured) is assumed over Kidlington.  

VP Ref.	Commentary
2	The viewpoint is grassland / meadow with woodland to the west, bounded by hedgerows and treelines. The viewpoint is intrinsically dark, with no local lighting. Road lighting at the A44 is located approximately 200m to the east. Skyglow to the south (assumed over Oxford) is the most apparent source of lighting in the surrounds.  
3	The viewpoint is a grass track bounded by hedgerows and treelines. Dense foliage is present for the most part on both sides. The viewpoint is intrinsically dark, with no local lighting. Road lighting at the A44 is located approximately 200m to the east. Some skyglow is visible to the east.  

VP Ref.	Commentary
4	The viewpoint is a wide grass / dirt track bounded by hedgerows and treelines. Quite dense foliage is present for the most part on both sides, with fields and meadows beyond. The viewpoint is intrinsically dark, with road lighting at the A44 located approximately 100m to the east. The viewpoint is at a lower elevation than the surroundings, resulting in less visible distant lighting, although some skyglow is apparent to the east.  
5	The viewpoint is located at the highway boundary of the A44, with road lighting immediately adjacent. A hedgerow / treeline separates the highway from grassland and meadows to the west. The view towards the Proposed Development (pictured) is near total darkness. The view to the east and south is more urban, with road lighting providing context. A house is located on the opposite side of the A44, adjacent to the southbound carriageway, but does not contribute any spill light.  

VP Ref.	Commentary
5A	The viewpoint is located at the highway boundary of the A44, with road lighting immediately adjacent. A hedgerow / treeline separates the highway from grassland and meadows to the west. The view towards the Proposed Development (pictured) is near total darkness. The view to the east and south is more urban, with road lighting providing context.  
6	The viewpoint is a field separated from premises to the north by a treeline. A hedgerow / treeline separates the field from the A44 to the west. The viewpoint is intrinsically dark, with no local lighting. Road lighting at the A44 is located approximately 50m to the west. Some glare is present from floodlights to the south-west – the source could not be determined. The Proposed Development would be situated beyond the road lighting pictured.  

VP Ref.	Commentary
7	The viewpoint is a wide dirt / grass track with an intermittent treeline and hedgerow providing field and property boundary on the east side. Lower level foliage on the west side separates the track from fields. The view is largely open to the south. The viewpoint is intrinsically dark, with some distant skyglow to the south (assumed over Oxford). Properties to the north provide some local lighting, with minimal light spill outside property boundaries. Lighting at Oxford Airport and the A44 is visible to the east, approximately 500m distant.  
8	The viewpoint is a farm access road, elevated above and to the east of the A44. The site is intrinsically dark, with the only visible lighting being road and domestic lighting in Yarnton to the north-west. Minimal and sporadic direct view of assumed domestic lighting in the direction of the Proposed Development is present.  

VP Ref.	Commentary
9	The viewpoint is a suburban residential road, with properties on both sides of the highway. The route provides a western link to Yarnton's road network and is the limit of urban development – open fields lying behind the properties on the west side. Low pressure sodium road lighting is present at larger spacings, with some local high pressure sodium units at pedestrian crossings. The road is lit to a low level, with a rural feel to the lighting provision. The daytime photograph below is taken from a Visual Assessment document and defines the view of reference 9 used for that exercise – that of the entrance to a nursing home with open fields visible beyond (towards the Proposed Development). However, the night-time light level readings were taken away from the nursing home entrance due to the disproportionate amount of local lighting present (including illuminated bollards) that would have skewed results. The night-time photograph shown is more representative of the road and residential area in general. Unlike the daytime visual assessment photograph, after dark no direct view of the fields to the rear could be established, due to glare from the nursing home's local lighting.  

VP Ref.	Commentary
10	The viewpoint is a paved access road, separating two fields with low hedgerows, with rising topography and a treeline to the north-east in the direction of the Proposed Development. The setting is largely agricultural. The viewpoint is intrinsically dark, with minimal lighting visible approximately 100m south from isolated premises. Some limited skyglow is visible to the south and east. The skyglow pictured is in the direction of the Proposed Development and is assumed to be over Kidlington.  
11	The viewpoint is adjacent to Langford Lane, providing access to Oxford Airport, and is bounded by an intermittent hedgerow / treeline to the south and lower level foliage at the airport boundary to the north. The view to the south (pictured) towards the Proposed Development is almost entirely dark. The view to the north-east includes minimal lighting within the airport premises.  

6. Baseline Analysis

6.1 The results of the baseline survey support the classification of the area as Environmental Zone E2. The situation is rural with generally low brightness away from major highways. Agricultural and green areas are intrinsically dark, with a village or relatively dark suburban character to the surrounding settlements.

6.2 It is anticipated that if the Proposed Development were not to be constructed then the baseline lighting conditions in the area would not change from those recorded. Should the area remain undeveloped then the categorisation of Environmental Zone E2 would be retained.

6.3 As an extension of the village of Yarnton, and being as it would be surrounded by dark, green spaces to the west, it is not considered that the construction of the Proposed Development would alter the classification of the area from Environmental Zone E2. While the Proposed Development would somewhat alter the balance between an urbanised area and rural space, there is sufficient and significant unlit agricultural, park and wooded land present to retain, from a lighting perspective, the relatively (and in places intrinsically) dark rural character.

7. Embedded Mitigation

7.1 This section defines the performance criteria and other requirements to which the lighting of the Proposed Development would adhere. Such requirements provide 'embedded mitigation' against the adverse effects of artificial lighting. Effects and mitigation are described below generally and in relation to construction and operational lighting.

General Embedded Mitigation

7.2 All lighting would be designed under the most efficient principles practicable. This means:

- Right Light: Look to the correct application of the lighting standards, defining the required lighting levels dependent on the task being undertaken and the level of activity and risk. Right light refers to the correct selection of light source, with due consideration of the most energy efficient modern sources, such as LED. Balanced against these requirements is the need to consider the impact of lighting on local sensitive flora and fauna, especially bats.

- Right Time: The lighting standards permit levels to be adjusted dependent on the use of an area, such as when traffic or pedestrian activity falls. Lowering levels to the minimum required for safety and security, or even full switch-off regimes, may be considered at certain times. Such an approach may be across the Proposed Development or suitably zoned.

- Right Place: Ensure that only the areas required are illuminated. Reductions in spill and obtrusive light to at least the constraints imposed by the applicable Environmental Zone should be achieved, through the careful consideration of luminaires and how they are installed.

- Right System: The most energy efficient lighting installations require a suitable control system. Dependent on the operator and operating regime, a system that allows monitoring and control may be considered.

Construction Lighting Embedded Mitigation

7.3 During the construction phase of the Proposed Development there may be the need to provide temporary lighting for construction tasks and security.

7.4 Lighting provided during construction would generally be standard fixings and equipment. Working areas may be surrounded by hoarding onto which lighting may be attached. Such lighting may perform directional and security tasks. Cranes, where required, may be lit for safety and lighting may be provided within buildings during internal fit-out activities. Construction works would be limited to agreed working hours and works during the hours of darkness may be required.

7.5 The semi-permanent (fixed for the duration of construction) aspects of temporary and construction lighting may be assessed as part of a temporary lighting design, undertaken by a competent lighting professional. All such lighting would meet the constraints of the applicable Environmental Zone. Purely temporary task lighting may not be subject to a design process, but should adhere to the same constraints during its operation.

7.6 Specifically, construction lighting would:

- be required to provide the correct levels of lighting to ensure the safety of workers and general users of the site.
- be designed such that, where practicable, all luminaires are installed internal to the site (such as on the inside of hoarding) and are directed towards the working area.
- be operational only during construction works, except where lighting is required for out-of-hours security or safety reasons.
- adhere to industry best practice, including guidance from industry bodies (such as the Construction Industry Research and Information Association, CIRIA). CIRIA guidance, for example, notes that lighting on construction sites is typically required for security and safety, whilst

at the same time being required to minimise impact on surrounding receptors in accordance with current best practice.

- be mindful of temporary impact on sensitive flora and fauna and limit the intensity and duration of lighting to the minimum required.

Operational Lighting Embedded Mitigation

7.7 Where roads are to be adopted by the Local Authority then the street lighting design and equipment would conform to their adoption criteria, whilst ensuring compliance with the constraints of the Environmental Zone.

7.8 Permanent lighting would be provided to identify and illuminate pedestrian and vehicular routes, together with public amenities, within the Proposed Development. Lighting would be provided to enhance the safety and security of users.

7.9 Lighting would be suitably controlled by way of photoelectric control units (PECUs) or other control systems, such as a Central Management System (CMS), dependent on the aspirations of the operator. In any event, lighting would only be provided during the hours of darkness and be dependent on operational requirements. Controls would allow temporal changes in lighting levels where appropriate, such as dimming or switch-off during the early hours of the morning.

7.10 Lighting would be implemented with due consideration given to the best practicable means to prevent, or to counteract, the effects of artificial light on the surrounding environment – including any sensitive receptors that have views of the Proposed Development.

7.11 Lighting would be designed by competent designers and in accordance with documents listed in this chapter, as well as other industry and site-specific documents dealing with lighting. Pertinent standards and guidance include:

- BS 5489-1:2020 *Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas* (BSI, 2020). (Ref. 14.10)

- BS 13201 (all parts) *Road lighting* (BSI, 2014-2015). (Ref. 14.11)
- BS EN 12464-2:2014 *Light and lighting – Lighting of work places – Part 2: Outdoor work places* (BSI, 2014). (Ref. 14.12)
- As well as documents previously listed in this chapter.

7.12 In general, all lighting columns provided for the public highway would be in keeping with the surrounding environment and the heights of adjacent buildings, subject to adoption criteria.

7.13 Sensitive design and careful selection of equipment would ensure that the impact of any permanent lighting may be mitigated. Design of the Proposed Development would demonstrate compliance with the recommendations of GN01, where such recommendations have been incorporated.

7.14 Begbrooke Wood, to the north of the site, is designated ancient woodland. Additional planting is proposed through the Site, with the aspiration for 'dark corridors' to be created. Ecological investigations have revealed bats to be active along most of the hedgerows in the vicinity of the Proposed Development, with least activity recorded in the hedgerows adjacent to the A44 – likely due to the existing road lighting and the severance between east and west habitats that this creates.

7.15 The presence of ancient woodland, the aspiration for dark corridors and the retention of habitats generally, necessitate that light spill to these areas be avoided. Light spill to off-site habitats, both retained and created, would be kept low, and eliminated entirely where practicable.

7.16 The presence of bat populations in the area necessitates specific design requirements to mitigate the impact of lighting:

- Light spill onto confirmed or suspected bat roosts would be prohibited, through good design, and secondarily by physical shields where necessary.
- Light spill onto trees and hedgerows would be minimised through good design, with physical shields installed where necessary.

- Luminaires with maximum colour temperatures of 3000K would be used, to minimise the blue-light component and the Proposed Development's impact on the bat population, subject to adoption criteria.

- Luminaires with a minimum glare rating of G4 would be utilised, with an aspiration to use units at the maximum rating of G6, to remove any light emission above the horizontal and to reduce source intensity over greater distances, subject to adoption criteria.

- Luminaires would be installed at 0° to the horizontal to preserve their glare rating.

- Lighting column heights would be constrained as discussed above.

- A system of part-night dimming could be employed to reduce lighting levels during the periods of the night with the least user flow. A system of part-night switch-off could be employed following a safety analysis and coordination with the highway authority's lighting control policy.

- The extent of lit sections would be constrained to the absolute minimum required for safety.

- Selected lighting levels would be reduced to the absolute minimum required for safety and would be balanced against the need to provide an ecologically sensitive environment.

- Lighting would be removed from areas where its impact on particularly sensitive fauna (such as bats) cannot be appropriately mitigated.

8. Construction Effects

8.1 Construction lighting effects on each baseline viewpoint are considered in the table below.

VP Ref.	Effects
1	The viewpoint is at a higher level than the Proposed Development, which would sit to the east, and as such it is anticipated that any construction lighting would be more visible compared to viewpoints at lower levels. Effects from poorly implemented lighting would include glare and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
2	The viewpoint is within the Proposed Development. It is anticipated that construction activities would take place to the east of the viewpoint, at approximately the same elevation. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
3	The viewpoint is located on the boundary of the Proposed Development, at approximately the same elevation. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.

VP Ref.	Effects
4	The viewpoint is within the Proposed Development, adjacent to direct construction activities. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
5	The viewpoint is located adjacent to the A44, immediately to the east of the Proposed Development. Construction activities have the potential to produce a marked difference in view compared to the intrinsically dark view that currently exists. Additional effects at this viewpoint could include glare towards road users on the A44 from construction lighting, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
5A	The viewpoint is located adjacent to the A44, immediately to the east of the Proposed Development. Construction activities have the potential to produce a marked difference in view compared to the intrinsically dark view that currently exists. Additional effects at this viewpoint could include glare towards road users on the A44 from construction lighting, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.

VP Ref.	Effects
6	The viewpoint looks towards the Proposed Development across the A44, which has a system of road lighting. Construction activities have the potential to add to the lighting present in the view. Effects from poorly implemented lighting would include glare and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
7	Any construction lighting has the potential to be visible from the viewpoint, across relatively flat land to the south. Effects from poorly implemented lighting would be associated mainly with increased sky glow. Direct glare is unlikely to be significant across the distances involved. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
8	The viewpoint is at a higher level than the Proposed Development, which would sit to the north-west, and as such it is anticipated that any construction lighting would be more visible compared to viewpoints at lower levels. Effects from poorly implemented lighting would be associated mainly with increased sky glow. Direct glare is unlikely to be significant across the distances involved. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.

VP Ref.	Effects
9	The viewpoint is located immediately east of the Proposed Development in a residential area. Any construction lighting has the potential to effect receptors at this location. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.
10	The viewpoint is at a lower level than the Proposed Development, which would sit to the north-east. It is anticipated that construction lighting would be less visible from this location, with increased sky glow from construction activities being the primary effect. Mitigation that will reduce the effects at this viewpoint include the appropriate use of directional fittings and consideration that lighting is only in operation when required.
11	Any construction lighting has the potential to be visible from the viewpoint, across relatively flat land to the south-west. Effects from poorly implemented lighting would be associated mainly with increased sky glow. Direct glare is unlikely to be significant across the distances involved. Mitigation that will reduce the effects at this viewpoint include physical obstructions, such as hoarding, the appropriate use of directional fittings and consideration that lighting is only in operation when required.

8.2 Adopting the principles outlined above would ensure that lighting during construction does not cause a nuisance and is not obtrusive to the surrounding environment. The residual effects of construction lighting are likely to be negligible and medium term (neutral, reference 4 from PLG 04).

9. Operational Effects

9.1 It is anticipated that permanent lighting at the Proposed Development would include:

- Street lighting on access and residential roads, mounted on lighting columns.
- Lower level lighting on some footpaths and pedestrian routes, by way of shorter lighting columns or illuminated bollards.
- Area lighting for public spaces, mounted on lighting columns.
- Task lighting to sports facilities, provided by floodlights mounted on lighting columns.

9.2 In keeping with existing street lighting in the immediate area (such as on Rutten Lane), it is likely that street lighting within the Proposed Development would be constrained at 6-8m in height. Lighting columns on pedestrian routes would likely be limited to 6m in height.

9.3 Dependent on the activities planned at proposed sporting facilities, floodlighting columns at these locations may appear much higher than the surrounding environment. Floodlighting columns for full-size football pitches can reach heights of around 15m, when lit in this manner. While the use of lit sporting facilities is likely to be limited to a number of hours on darker evenings, careful consideration of the impact of such equipment would be made.

9.4 Operational effects on each baseline viewpoint are considered in the table below.

VP Ref.	Effects
1	The viewpoint is at a higher level than the Proposed Development, which would sit to the east, and as such it is anticipated that any operational lighting would be more visible compared to viewpoints at lower levels. It is anticipated that lighting across the Proposed Development would be visible. Effects from poorly implemented lighting would include glare and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.
2	The viewpoint is within the Proposed Development. Lighting within the western central section of the Site would be directly visible from this location, anticipated to be street lighting up to 8m in height. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.

VP Ref.	Effects
3	The viewpoint is located on the boundary of the Proposed Development, at approximately the same elevation. Lighting within the central area of the Site would be directly visible from this location, anticipated to be street lighting up to 8m in height and pedestrian route lighting up to 6m in height. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.
4	The viewpoint is within the Proposed Development. Lighting within the central area of the Site would be directly visible from this location, anticipated to be street lighting up to 8m in height and pedestrian route lighting up to 6m in height. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.

VP Ref.	Effects
5	The viewpoint is located adjacent to the A44, immediately to the east of the Proposed Development. Lighting within the northern area of the Site would be directly visible from this location, anticipated to be street lighting up to 8m in height and pedestrian route lighting up to 6m in height, including lighting that interfaces and coordinates with existing lighting on the A44. Additional effects at this viewpoint could include glare towards road users on the A44 from construction lighting, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.
5A	The viewpoint is located adjacent to the A44, immediately to the east of the Proposed Development. Lighting within the northern area of the Site would be directly visible from this location, anticipated to be street lighting up to 8m in height and pedestrian route lighting up to 6m in height, including lighting that interfaces and coordinates with existing lighting on the A44. Additional effects at this viewpoint could include glare towards road users on the A44 from construction lighting, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.

VP Ref.	Effects
6	The viewpoint looks towards the Proposed Development across the A44, which has a system of road lighting. Lighting across the central and northern areas of the Site would be added to the existing lighting in the scene. Effects from poorly implemented lighting would include glare and increased sky glow. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.
7	Any operational lighting has the potential to be visible from the viewpoint, across relatively flat land to the south. Effects from poorly implemented lighting would be associated mainly with increased sky glow. Direct glare is unlikely to be significant across the distances involved. Mitigation that will reduce the effects at this viewpoint include the use of luminaires with good upward light cut-off characteristics, lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.

VP Ref.	Effects
8	The viewpoint is at a higher level than the Proposed Development, which would sit to the north-west, and as such it is anticipated that any operational lighting would be more visible compared to viewpoints at lower levels. Effects from poorly implemented lighting would be associated mainly with increased sky glow. Direct glare is unlikely to be significant across the distances involved. Mitigation that will reduce the effects at this viewpoint include the use of luminaires with good upward light cut-off characteristics, lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.
9	The viewpoint is located immediately east of the Proposed Development in a residential area. Street and sports lighting in the southern area of the Site would be directly visible from the viewpoint. Effects from poorly implemented lighting would include glare, spill light and increased sky glow. Mitigation that will reduce the effects at this viewpoint include the use of luminaires with good upward light cut-off characteristics, lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone. Specific assessment of the impact of sports lighting would be undertaken as the height of such lighting is likely to be higher than other forms (such as street lighting). Using sports luminaires with controlled distributions and physical shielding will reduce the direct effects at this location.

VP Ref.	Effects
10	The viewpoint is at a lower level than the Proposed Development, which would site to the north-east. No direct view of lighting at the Proposed Development would be possible, however the impact of additional sky glow may be more noticeable. Mitigation that will reduce the effects at this viewpoint include the use of luminaires with good upward light cut-off characteristics, lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone.
11	Any operational lighting has the potential to be visible from the viewpoint, across relatively flat land to the south-west. Effects from poorly implemented lighting would be associated mainly with increased sky glow. Direct glare is unlikely to be significant across the distances involved. Mitigation that will reduce the effects at this viewpoint include lowering lighting levels to the minimum required for safety and security, dynamic operation through the hours of darkness (through dimming or switch-off as mandated by the adopting authority), and compliance with the limitations of spill and obtrusive light mandated by the applicable Environmental Zone. It is not anticipated that the operational lighting at the Proposed Development will impact the operations of the adjacent airport.

9.5 It is anticipated that, subsequent to lighting being designed and installed to the parameters outlined within this chapter (with mitigation measures implemented from the options presented), no further mitigation measures would be required.

9.6 Any residual effects of permanent lighting are likely to be direct and long term. With appropriate mitigations employed the effects should be negligible (neutral, reference 4 from PLG 04). It may be the case that any

residual effects are additionally reduced and mitigated over time by the maturation of proposed planting, in addition to the continued maturation of existing flora.

10. Summary

10.1 The baseline survey undertaken has established that the Proposed Development is located within an area of rural and relatively dark suburban character, corresponding with Environmental Zone E2, as defined by GN01. The construction of the Proposed Development is not considered to affect the future categorisation of the Environmental Zone.

10.2 The impact of temporary construction lighting, where required, can be mitigated by way of assessment in accordance with industry best practice, subject to review by a competent lighting professional and adherence to the obtrusive light constraints imposed by the applicable Environmental Zone.

10.3 Permanent infrastructure lighting would be designed in accordance with the standards and guidance listed in this chapter, be designed by a competent lighting professional and would adhere to the obtrusive light constraints imposed by the applicable Environmental Zone. Lighting equipment and operation would satisfy the requirements listed in this chapter with regard to mitigation for bats and other identified sensitive species, when known.

10.4 Following the mitigation practices outlined in this chapter, the residual effects of temporary construction lighting are anticipated to be negligible and medium term. The residual effects of permanent infrastructure lighting are anticipated to be negligible, direct and long-term.

10.5 Cumulative residual effects could be anticipated if the extent of development goes beyond the Proposed Development considered by this Chapter and alters the rural / developed landscape to a greater degree. It is likely that an increase in sky glow would be the most visible product of such a situation, were it to occur. Following the mitigation measures presented in this Chapter would likely reduce the impact of further lighting to the lowest possible level.

11. Chapter References

Documentary References

Ref. 14.1 Clean Neighbourhoods and Environment Act 2005.

Ref. 14.2 CIE 150:2017 *Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations* (Commission Internationale de l'Eclairage, 2017).

Ref. 14.3 CIE 126:1997 *Guidelines for Minimizing Sky Glow* (Commission Internationale de l'Eclairage, 1997).

Ref. 14.4 GN01:2020 *Guidance Notes for the Reduction of Obtrusive Light* (Institution of Lighting Professionals, 2020).

Ref. 14.5 PLG 04 *Guidance on Undertaking Environmental Lighting Impact Assessments* (Institution of Lighting Professionals, 2013).

Ref. 14.6 *Lighting in the Countryside: Towards Good Practice* (Office of the Deputy Prime Minister, 1997; latterly, Ministry of Housing, Communities and Local Government).

Ref. 14.7 Environmental Protection Act 1990.

Ref. 14.8 National Planning Policy Framework (July 2021).

Ref. 14.9 Cherwell Local Plan 2011-2031.

Ref. 14.10 BS 5489-1:2020 *Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas* (BSI, 2020).

Ref. 14.11 BS 13201 (all parts) *Road lighting* (BSI, 2014-2015).

Ref. 14.12 BS EN 12464-2:2014 *Light and lighting – Lighting of work places – Part 2: Outdoor work places* (BSI, 2014).

Online Sources

Construction Industry Research and Information Association (CIRIA)
www.ciria.org

Institution of Lighting Professionals (ILP)
www.theilp.org.uk