A46 Coventry Junctions (Walsgrave) Scheme number: TR010066

6.3 Environmental Statement Appendices

Appendix 7.5 Lighting Assessment

APFP Regulations 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

November 2024

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A46 Coventry Junctions (Walsgrave)
Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES
Appendix 7.5 Lighting Assessment

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010066
Application Document Reference	TR010066/APP/6.3
Author	A46 Coventry Junctions (Walsgrave), Project Team & National Highways

Version	Date	Status of Version
Rev 0	November 2024	Application Issue

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1. Introduction

1.1. General

1.1.1. The purpose of this report is to provide an analysis of the potential operational light spill levels associated with the Scheme, to allow an assessment of the potential effects on sensitive receptors.

1.1.2. The Scheme is located at the A46/B4082 junction approximately 5km east of Coventry city centre. The Scheme consists of a new re-aligned B4082 link road to be constructed and to connect to a new grade separated junction with access slips to the A46 north and southbound. The roundabouts will be connected via an overbridge structure across the A46. A full description of the Scheme is provided in Environmental Statement (ES) Chapter 2 (The Scheme) (**TR010066/APP/6.1**).

1.1.3. An assessment in accordance with DMRB TA 501 Road lighting appraisal (Highways England, 2020) has been undertaken and it has been determined that the A46 mainline carriageway does not require lighting. The existing A46 mainline is currently unlit due to the existing Walsgrave Junction which will be removed. The TA501 assessment is provided in Annex D.

1.1.4. The Scheme consists of the following lighting:

- 3 no. single-arm 5m columns and 22no. single-arm 8m columns arranged in a single side arrangement. Located on the B4082 link road up to A46 roundabout junction
- 15 no. single-arm 8m columns. Located on the Western roundabout junction, the on-slip and off-slip road sections.
- 2 no. single-arm 10m columns. Located at the connection bridge between the two junction roundabouts.
- 10 no. single-arm 8m columns. Located on the Eastern roundabout junction, the on-slip and off-slip road sections:

1.1.5. This lighting assessment has been prepared in accordance with drawing HE604820-OIL-HLG-00-DR-EO-35003, provided in Annex A.

1.1.6. The proposed drawings for the Scheme, and associated Isolux Contours, are presented in Annex A.

1.1.7. The lighting impact assessment considers the maximum adverse scenario in relation to the artificial lighting associated with the Scheme to adequately assess the significance of the likely effects on the identified sensitive receptors.

2. Legislative and policy framework

2.1. National policy and legislation

Environmental Protection Act 1990 / Clean Neighbourhoods and Environment Act 2005

2.1.1. Since 2005, artificial light has been incorporated as a potential statutory nuisance. An amendment to section 79 of the Environmental Protection Act 1990, contained within the Clean Neighbourhoods and Environment Act 2005 states:

"Artificial light emitted from premises so as to be prejudicial to health and nuisance constitutes a 'Statutory Nuisance' and it shall be the duty of every local authority to cause its area to be inspected from time to time to detect any statutory nuisances which ought to be dealt with under section 80 and, where a complaint of a statutory nuisance is made to it by a person living within its area, to take such steps as are reasonably practicable to investigate the complaint."

National Networks National Policy Statement 2024

2.1.2. The National Networks National Policy Statement (NPS NN) sets out the need for, and government's policies to deliver development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. The Secretary of State (SoS) uses the NPS NN as the primary basis for making decisions on Development Consent Order (DCO) applications for highway schemes. Paragraphs 5.117 - 5.119 of the NPS NN state that:

"As well as noise and vibration the construction and operation of national networks infrastructure has the potential to create a range of emissions such as odour, dust, steam, smoke and artificial light. All have the potential to have a detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990".

"As a result of the potential effects of these emissions and in view of the availability of the defence of statutory authority against nuisance claims described previously, it is important that the potential for these impacts is considered by the applicant in their application, by the Examining Authority in examining applications and by the Secretary of State in taking decisions on development consents."

"For NSIPs of the type covered by this NPS, some impact on amenity for local communities is likely to be unavoidable. Impacts should be kept to a minimum and should be at a level that is acceptable."

National Planning Policy Framework 2023

2.1.3. The National Planning Policy Framework (NPPF) sets out the government's planning policies for England and how they are expected to be applied and provides a framework for local plans. With regard to light pollution, the NPPF was updated in November 2023 and paragraph 191 requires that the following elements are to be considered:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

National Planning Practice Guidance 2019

2.1.4. National Planning Practice Guidance 2019 is a web-based resource, which includes a dedicated section on light pollution *(National Planning Practise Guidance, 2019)*. The guidance for assessing the effects of proposed artificial lighting states:

"Does a new development proposal, or a major change to an existing one, materially alter light levels outside the development and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?

Does an existing lighting installation make the proposed location for a development unsuitable? For example, this might be because:

- *the artificial light has a significant effect on the locality;*
- *users of the Proposed Development (e.g. a hospital) may be particularly sensitive to light intrusion from the existing light source.*

Does a proposal have a significant impact on a protected site or species e.g. located on, or adjacent to, a designated European site or where there are designated European protected species that may be affected?

Is the development in or near a protected area of dark sky or an intrinsically dark landscape where it may be desirable to minimise new light sources?

Are forms of artificial light with a potentially high impact on wildlife (e.g. white or ultraviolet light) being proposed close to sensitive wildlife receptors or areas, including where the light shines on water?

Does the Proposed Development include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies (because it may change natural light, creating polarised light pollution that can affect wildlife behaviour)?."

2.2. Local policy

2.2.1. The Scheme is situated within the Coventry City Council and Rugby Borough Council administrative areas (ES Figure 2.1 (Scheme Location) (**TR010066/APP/6.2**)). The boundary between these two administrative areas is along the western side of the A46. Rugby Borough Council's administrative area also forms part of Warwickshire County Council's administrative area[1], which shares the same border with Coventry City Council. The Leicestershire County Council boundary is approximately 12.5km north and east of the existing Walsgrave Junction.

Coventry City Council Local Plan (2011 – 2031)

2.2.2. The Coventry Local Plan (2011-2031), (Coventry City Council, December 2017) includes environmental policies relating to the Green Belt and green environment elements. Policies relevant to the Scheme include:

- Policy GE3: Biodiversity, Geological, Landscape and Archaeological Conservation.
  "1. Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs), Ancient Woodlands, Local Wildlife and Geological Sites will be protected and enhanced. Proposals for development on other sites, having biodiversity or geological conservation value, will be permitted provided that they protect enhance and/or restore habitat biodiversity. Development proposals will be expected to ensure that they:

[1] There are five district and borough councils in Warwickshire. They are North Warwickshire Borough Council, Nuneaton and Bedworth Borough Council, Rugby Borough Council, Stratford District Council and Warwick District Council.

a) *lead to a net gain of biodiversity, where appropriate, by means of an approved ecological assessment of existing site features and development impacts.*
b) *protect or enhance biodiversity assets and secure their long-term management and maintenance.*
c) *avoid negative impacts on existing biodiversity.*
d) *preserve species which are legally protected, in decline, are rare within Coventry or which are covered by national, regional, or local Biodiversity Action Plans."*

- Policy DE1 Ensuring High Quality Design relates to Coventry City Council's requirements to *"[…] raise the standard of design in the built and green environments";* and should be considered within the development of design proposals for the Scheme.

2.2.3. There is no specific lighting policy within the Coventry Local Plan (2011-2031).

2.2.4. The new Coventry Local Development Plan (2011-2031), (Coventry City Council, September 2014) pages 37-38, reinforces Policy DE1 by providing key design criteria and considerations for use within new developments but also the need for high quality transport links, which benefit the local community and economy (pages 39-41).

Rugby Borough Council Local Plan 2011 – 2031

2.2.5. Rugby Borough Council's Local Plan 2011-2031 (Rugby Borough Council, 2019), clause 10.21 and 10.40 below states:

- *"10.21. Transport infrastructure, including for example surface treatments, street furniture, signage, road markings and lighting will be expected to be of a high standard of design to conserve and where appropriate enhance the Borough's townscape, and the significance of any affected heritage asset, including their setting.*

- *10.40. Development proposals will take full account of the biodiversity value of watercourses and river corridors and their role in supporting local ecological networks. Impacts from lighting, noise and visual disturbances should be avoided or mitigated and opportunities to create, enhance and restore adjacent habitats for biodiversity will be encouraged.'*

2.2.6. There is no specific lighting policy within the Rugby Borough Council's Local Plan 2011-2031 (Rugby Borough Council, 2019).

2.3. Guidance

Institution of Lighting Professionals. Guidance Note 01/21 The Reduction of Obtrusive Light, 2021

2.3.1. Guidance notes produced by the Institution of Lighting Professional (ILP) are among the most commonly referenced guidance notes for good practice within the lighting design industry. Guidance Note 01/21 (GN01/21) sets out the different types of obtrusive light, as illustrated in Plate 1.

2.3.2. Obtrusive light (or sometimes referred to as light pollution) refers to any light emitted in a direction in which it is not required or wanted and as such is detrimental to other users.

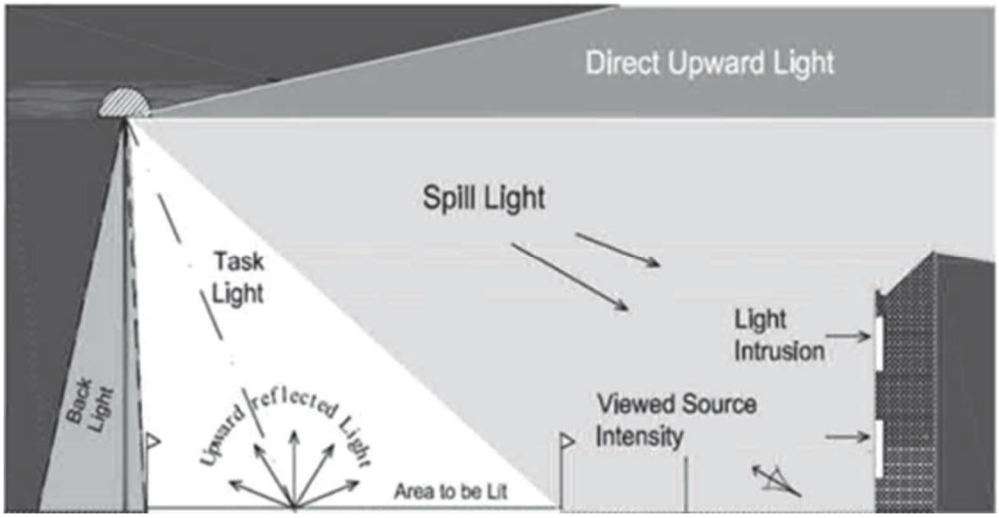
2.3.3. Consideration is given to light intrusion, direct upward light (sky glow) and glare within the context of varying environmental zones.

2.3.4. Light intrusion refers to the spilling of light beyond the boundary of the area to be lit. This includes the intrusion of light into bedroom windows.

2.3.5. Sky glow refers to the brightening of the sky above towns cause by direct or reflected upward light.

2.3.6. Glare refers to the uncomfortable brightness of a light source when viewed against a dark background.

Plate 1 Obtrusive light diagram (GN01/21, Figure 1)



Institution of Lighting Professionals Guidance Note 08/23 Bats and Artificial Lighting, 2023

2.3.7. The Bats and Artificial Lighting guidance note (GN08/23) has been prepared by the ILP and Bat Conservation Trust (BCT). It provides guidance for artificial exterior lighting in close proximity to light sensitive ecology. The following is stated within the document:

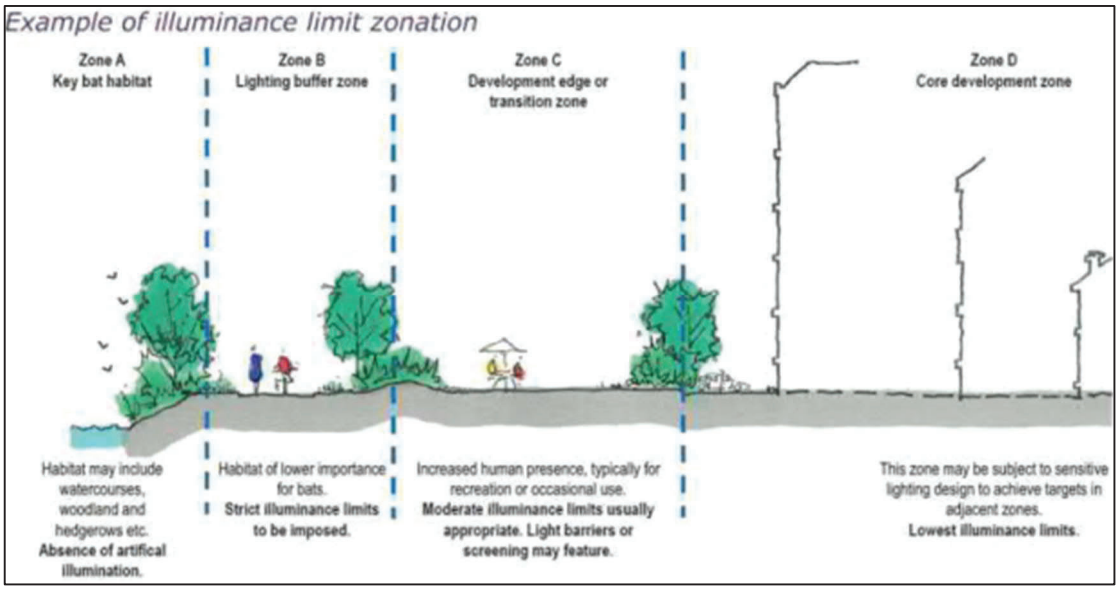
"Lighting in the vicinity of a bat roost causing disturbance and potential abandonment of the roost could constitute an offence both to a population and to individuals (Garland and Markham, 2007).

It is therefore important that the use of an area by bats is thoroughly assessed before artificial lighting is changed or added in the vicinity of a roost or where bats may commute or forage."

"It is acknowledged that, especially for vertical calculation planes, very low levels of light (<0.5 lux) may occur even at considerable distances from the source if there is little intervening attenuation. It is therefore very difficult to demonstrate 'complete darkness' or a 'complete absence of illumination' on vertical planes where some form of lighting is proposed on site despite efforts to reduce them as far as possible and where horizontal plane illuminance levels are zero. Consequently, where 'complete darkness' on a feature or buffer is required, it may be appropriate to consider this to be where illuminance is below 0.2 lux on the horizontal plane and below 0.4 lux on the vertical plane. These figures are still lower than what may be expected on a moonlit night and are in line with research findings for the illuminance found at hedgerows used by lesser horseshoe bats, a species well known for its light adverse behaviour (Stone, 2012)."

"Dark buffers, illuminance limits and zonation dark buffer zones can be used as a good way to separate habitats or features from lighting by forming a dark perimeter around them. Buffer zones rely on ensuring light levels (levels of illuminance measured in lux) within a certain distance of a feature do not exceed certain defined limits. The buffer zone can be further subdivided into zones of increasing illuminance limits radiating away from the feature".

Plate 2 GN08/23 Guidelines for illumination buffer zones (GN08/23, Figure 1)



Institution of Lighting Professionals, Professional Lighting Guide 04 Guidance on Undertaking Environmental Lighting Impact Assessments, 2013

2.3.8. Professional Lighting Guide 4 (PLG04) is used to ensure that the lighting impact assessment is correctly carried out:

"...this document is designed to provide an explanation of, and guidance on, the process for producing a Lighting Assessment…to remove or minimise environmental problems".

Highways England, 2020. Design Manual for Roads and Bridges LA 104 Environmental assessment and monitoring

2.3.9. Design Manual for Roads and Bridges (DMRB) LA 104 details requirements and procedures to be followed when assessing, reporting and monitoring the environmental effects of projects in line with the requirements of the EIA Directive 2014/52/EU.

2.3.10. DMRB LA 104 section 3 sets out criteria for determining the sensitivity of receptors, magnitude of impacts, significance categories of effects, and a matrix for determining the significance of impact upon the environment. These tables have been amended within Section 4 of this document for the purposes of the lighting assessment.

British Standards

2.3.11. The most applicable British Standards (BS) for lighting that relate to the Scheme are:

- BS 5489-1: 2020 – Lighting of Roads and Public Amenity Areas (Code of practice). – This British Standard is applicable to the roads that help to facilitate movement of vehicular traffic about the Scheme.
- BS EN 13201 Part 2: 2015 - Road lighting. Performance requirements is applicable to the selection of lighting classes across the roads throughout the Scheme.

3. Assessment methodology and significance criteria

3.1. Methodology

3.1.1. The assessment has been carried out in accordance with published ILP guidance documents that quantify the levels of direct upward light, light intrusion, viewed source intensity and glare regarded as acceptable for varying environmental zones.

3.1.2. The methodology employed for this assessment is appropriate to the location of the scheme and in accordance with ILP Professional Lighting Guide 04 (PLG04) 'Guidance on Undertaking Environmental Lighting Impact Assessments' (2013). This is industry best practice and guidance. It comprises:

- a desk-top study of the legislative, policy and guidance context
- consultation with the design team
- a desk-top survey followed by a site survey in which the baseline conditions were measured and assessed and the relevant environmental zone in which the Scheme is located was ascertained
- evaluation of the likely effects of the proposed lighting using appropriate assessment criteria (outlined in Table 3.4 to Table 3.7)
- indicative layout and associated light spill modelling

3.1.3. The desktop study involved research into relevant local and national legislation, policy and guidance relating to obtrusive light. It also involved studying of Ordnance Survey maps, plans and aerial photography views to identify likely receptor locations.

3.1.4. Research undertaken during the desktop study identified the assessment locations for the site survey, where baseline conditions were to be measured.

3.1.5. The assessment has focussed on the outdoor lighting of the Scheme. All lighting is provided for safety and security.

Baseline assessment methodology

3.1.6. The guidance provided in ILP PLG04 has been used to undertake the lighting baseline survey.

3.1.7. Receptors in the vicinity of the Scheme were identified through an initial desk study of the area.

3.1.8. The location of each receptor was chosen to allow the identification of baseline conditions, and an assessment of potential impacts on people and the environment in which they live.

3.1.9. An assessment of each receptor location was undertaken during the day and night and evaluated in terms of their direct and intermittent views towards the Scheme, and whether existing screening is likely to prevent light spill, views of luminaire intensity or sky glow. Daytime and night-time photographs were taken from each location at a height of 1.5m which is representative of adult eye height.

3.1.10. At each receptor location, 4 readings of vertical illuminance were taken with the sensor of the light meter pointed north, south, east and west at a height of 1.5m. One reading of horizontal illuminance was taken at ground level. This provides information on the levels of ambient light in each area.

Study area

3.1.11. The desktop study comprised of a review of satellite imagery and landscape visual impact assessment information to assess the potential receptors that could be affected by a change in artificial lighting, in accordance with the criteria outlined in Table 3.4 to Table 3.7. This includes nearby existing residential amenity, roadways, and any identified ecological receptors.

3.1.12. The study area is identified in Plate 3 of section 5 with each receptor viewpoint location. The study area is located within a low to medium level of district brightness, given the generally rural local environment.

Surveys

3.1.13. A baseline survey of the Scheme was undertaken in 2024 by Sweco to identify the existing lighting levels at landscape receptor locations. The results of this assessment are laid out in Section 5 (Baseline Survey results). The results of this baseline survey are considered relevant and valid for informing this assessment, having been carried out in accordance with the relevant guidance and with an industry standard calibrated illuminance meter.

3.1.14. The assessment of the overall effects on landscape and cultural heritage do not form part of the lighting assessment. Effects on landscape are presented in ES Chapter 7 (Landscape and Visual Effects) (**TR010066/APP/6.1**). The assessment upon cultural heritage is presented in ES Chapter 6 (Cultural Heritage) (**TR010066/APP/6.1**).

3.1.15. A limited assessment of the effects on bats and other species forms part of the lighting assessment, however, final considerations of the total effects has been

undertaken by a qualified ecologist and is presented in ES Chapter 8 (Biodiversity) (**TR010066/APP/6.1**).

3.1.16. The baseline survey was carried out during winter 2023 where deciduous vegetation was not developed. It is anticipated where vegetation has been recorded as deciduous this will reduce during the autumn and winter months.

Competent expert evidence

3.1.17. The competent expert holds a BEng Electrical and Electronic Engineering Degree and is and Member of the ILP and an Incorporated Engineer with the Engineering Council. The competent expert has over 20 years' experience in the field of lighting design and in the production of lighting assessments.

Classification of environmental zone

3.1.18. The ILP Guidance Notes quantify the levels of Obtrusive light regarded as acceptable for varying environmental zones E0 to E4. Reference Table 3.1 below for zone categories.

Table 3.1 Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5 +)	Astronomical observable dark skies, UNESCO Starlight reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness (SQM 15 to 20)	Sparsely inhabited rural areas, village or relatively dark our suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, Small town centres or suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

Notes:
1. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.
2. Rural zones under protected designations should use a higher standard of policy.
3. Zone E0 must always be surrounded by an E1 Zone.
4. Zoning should be agreed with the local planning authority and due to local requirements a more stringent zone classification may be applied to protect special/specific areas.
5. SQM (Sky Quality Measurements) referenced by the International Dark-Sky Association (IDA), the criteria for E0 being revised in mid-2019 but not retrospective.
6. Astronomical observable dark skies will offer clearer views of the Milky Way and of other objects such as the Andromeda galaxy and the Orion Nebula.
7. Although values of SQM 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK

Obtrusive light limitations

3.1.19. In the absence of suitable statutory guidance, the ILP Guidance Note for the Reduction of Obtrusive Light (2021) (GN01/21) is typically used to provide suitable assessment criteria against which to assess the likely effects of artificial lighting.

3.1.20. The relevant criteria of upward light, light intrusion and direct source intensity are discussed below and Table 3.2 provides the criterion for source intensity or glare, whilst Table 3.3 sets limits for the criteria of upward light and light intrusion. Tables are referenced from ILP PLG04.

Table 3.2 Limits for the luminous intensity of bright luminaires

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m²)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)[5]	E0 Pre-curfew Post-curfew	 0 0	 0 0	 0 0	 0 0	 0 0	 0 0
	E1 Pre-curfew Post-curfew	 0.29 *d* 0	 0.63 *d* 0	 1.3 *d* 0	 2.5 *d* 0	 5.1 *d* 0	 2,500 0
	E2 Pre-curfew Post-curfew	 0.57 *d* 0.29 *d*	 1.3 *d* 0.63 *d*	 2.5 *d* 1.3 *d*	 5.0 *d* 2.5 *d*	 10 *d* 5.1 *d*	 7,500 500
	E3 Pre-curfew Post-curfew	 0.86 *d* 0.29 *d*	 1.9 *d* 0.63 *d*	 3.8 *d* 1.3 *d*	 7.5 *d* 2.5 *d*	 15 *d* 5.1 *d*	 10.000 1,000
	E4 Pre-curfew Post-curfew	 1.4 *d* 0.29 *d*	 3.1 *d* 0.63 *d*	 6.3 *d* 1.3 *d*	 13 *d* 2.5 *d*	 26 *d* 5.1 *d*	 25,000 2,500
Aid to gauging A_p Luminaire diameter		**2 to 5 cm**	**5 to 10 cm**	**10 to 20 cm**	**30 to 40 cm**	**40 to 80 cm**	**>80 cm**
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m²)		0.0008	0.004	0.016	0.063	0.251	>0.5

Notes
1. d is the distance between the observer and the glare source in metres
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions
3. Ap is the apparent surface of the light source seen from the observer position
4. For further information refer to Annex C of CIE 150
5. Upper limits for each zone shall be taken as those with column Ap>0.5

Table 3.3 Obtrusive lighting criteria relating to each Environmental Zones

Light technical parameter	Application conditions	Environmental zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (E_v)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

Notes
1.If the installation is for public (road) lighting then this may be up to 1 lx

Significance Criteria

3.1.21. The significance of an effect from artificial lighting has been based upon the sensitivity of the receptor and the magnitude of change at that receptor due to the revised conditions of the Scheme.

3.1.22. The sensitivity of the receptor has been classified as Very High, High, Medium, Low or Negligible according to the descriptions provided in Table 3.4.

3.1.23. The magnitude of impact is determined as being Very High, High, Minor or Negligible and descriptions for each are provided in Table 3.5.

3.1.24. The scale of effect is derived through a matrix (Table 3.7), matching the sensitivity of the receptor, with the magnitude of the impact.

3.1.25. The descriptions that have been adopted for each effect are summarised in Table 3.5, with effects identified as either beneficial or adverse.

3.1.26. Sensitivity criteria, magnitude of impact criteria, scale of effect criteria, and subsequent descriptions, are set out within DMRB LA 104 Environmental assessment and monitoring, however the tables within this document have been amended to suit a lighting specific discipline.

Table 3.4 Criteria for receptor sensitivity – Amended from DMRB LA 104 Table 3.2N

Value (sensitivity) of Receptor	Typical Description
Very High	Very high importance and rarity, international scale and very limited potential for substitution. In the context of lighting receptors are typically split into Human (Amenity), Human (Safety), and Ecological; with the following criteria relevant to Very High receptor value:

Value (sensitivity) of Receptor	Typical Description
	• Human (Amenity) – receptors which are sensitive to a change in lighting such that the quality of life would be greatly affected (i.e. lighting is designated a statutory nuisance) • Human (Safety) - receptors where a change in the lighting has the potential to either dramatically improve or reduce safety (for pedestrians, drivers or workers). • Ecological – where a change in the lighting dramatically affects the habitats, breeding or feeding of fauna (e.g. protected habitats or other special areas) or growth patterns of fauna / crops.
High	High importance and rarity, national scale, and limited potential for substitution. In the context of lighting, the following criteria are relevant to a High receptor value: Human (Amenity) – receptors which are sensitive to a change in lighting such that the quality of life would be affected (i.e. lighting is designated a statutory nuisance) Human (Safety) - receptors where a change in the lighting has the potential to either significantly improve or reduce safety (for pedestrians, drivers or workers). Ecological – where a change in the lighting affects the habitats, breeding or feeding of fauna (e.g. protected habitats or other special areas) or growth patterns of fauna / crops.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution. In the context of lighting, the following criteria are relevant to a Medium receptor value: Human (Amenity) – receptors which are sensitive to a change in lighting however not such that the quality of life would be affected. Human (Safety) - receptors where a change in the lighting has the potential to either improve or reduce safety (for pedestrians, drivers or workers). Ecological – where a change in the lighting affects the movement or feeding patterns of fauna but the receptor can adapt
Low	Low or medium importance and rarity, local scale. In the context of lighting, the following criteria are relevant to a Low receptor value: Human (Amenity) – receptors which would not noticeably be aware of a change in lighting. (i.e. in areas of medium to high luminance) Human (Safety) - receptors where a change in the lighting has limited potential to affect safety (for pedestrians, drivers or workers). Ecological – area with limited wildlife.
Negligible	Very low importance and rarity, local scale

Table 3.5 Criteria for magnitude of impact – Amended from DMRB LA 104 Table 3.4N

Value (sensitivity) of Receptor	Magnitude of impact	Typical Description
Very High	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. For example, levels of obtrusive light in the form of sky glow, light intrusion or glare towards a receptor which exceeds the limits set within the ILP guidance for a higher environmental zone might classify as a major magnitude of change
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
High	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements. In terms of the limits set in the ILP guidance this might equate to exceeding the limit but within the limits set for the next Environmental Zone.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements. In the context of lighting, this will constitute a change which, when compared to background levels, is only just noticeable.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No Change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 3.6 Likely effects description – Amended from DMRB LA 104 Table 3.7

Value (sensitivity) of Receptor	Typical Description
Very large	Effects at this level are material in the decision-making process. In the context of lighting this will represent a major change in the levels of obtrusive light at sensitive receptor positions, and dramatically affect ecological habitats. If the effects are considered adverse, this will represent a major increase in obtrusive light at sensitive receptors and /or to users of the Scheme such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna, and requires extensive remedial works
Large	Effects at this level are likely to be material in the decision-making process. In the context of lighting this may represent a major change in the levels of obtrusive light at sensitive receptor positions, and may significantly affect ecological habitats. If the effects are considered adverse, this may represent a

Value (sensitivity) of Receptor	Typical Description
	significant increase in obtrusive light at sensitive receptors and / or to users of the Scheme such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna, and may require extensive remedial works
Moderate	Effects at this level can be considered to be material decision-making factors In the context of lighting this will constitute a moderate reduction or increase in obtrusive light at sensitive receptors and/or to users of the Scheme. If the effects are considered adverse, this may cause effects such as an increase in Glare, Light Intrusion to properties, increase in Sky Glow or effects on flora and fauna, and requires monitoring and local remedial work.
Slight	Effects at this level are not material in the decision-making process. In the context of lighting this represents a minor increase or reduction in obtrusive light at sensitive receptors and/or to users of the Scheme. Effects are considered reversible or temporary.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

3.1.27. The significance of any effect is determined through the application of Table 3.7. Significant effects are considered where the likely effect is of moderate or greater.

Table 3.7 Significance matrix – Amended from DMRB LA 104 Table 3.8.1

	Magnitude of impact (degree of change)					
		No Change	Negligible	Minor	Moderate	Major
Environmental value (sensitivity)	**Very High**	Neutral	Slight	Moderate or Large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or Large	Large or very large
	Neutral	Neutral	Neutral or slight	Slight	Moderate	Moderate or Large
	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Neutral	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

4. Baseline survey

4.1. General

4.1.1. Baseline photography has been taken at 1.5m above ground level.

4.1.2. As the Scheme is located in a broadly rural area, light spill modelling has been undertaken to determine the potential levels of spill light from the Scheme onto nearby potentially sensitive receptors.

4.1.3. The nearest residential properties to the Scheme are:

- Hungerley Hall Farm - approximately 140m north-west of the existing Walsgrave Junction and approximately 70m west of the existing A46 northbound carriageway
- Walsgrave Hill Farm – approximately 1.5km north-east of the existing Walsgrave Junction
- Valencia Road residential area - approximately 350m south of the existing Walsgrave Junction

4.1.4. The Scheme is not covered by any statutory or non-statutory landscape designations at either a National or Local level, such as National Parks, AONB's, Special Landscape Areas, Registered Parks and Gardens, or Local Green Space designations with the exemption of the SSSI at Coombe Abbey Park, also a Registered Park and Garden.

4.1.5. The Scheme is located within an area of low to medium level of district brightness, given the generally rural local environment. Therefore, the Environmental Zone is categorised as **E2** (Environmental Zone) in accordance with the ILP Guidance Notes. Reference Table 3.1 for zone categories.

4.1.6. The existing lighting consists of:

- Lighting to the existing B4082 link road towards Walsgrave Junction
- Lighting to the existing A46 in the approaches to the existing Walsgrave Junction
- Lighting to the existing Walsgrave Junction

4.1.7. The A46 mainline is currently unlit except the areas noted above.

4.1.8. A baseline survey of the Scheme was undertaken on the 5 of February 2024 at receptor points identified through an initial desktop study of the area.

4.1.9. Weather conditions were dry, slightly overcast and the moon was not visible during the survey due to cloud cover.

4.1.10. Key lighting related survey viewpoint locations have been identified in Plate 3.

4.1.11. A Konica Minolta T-10A illuminance meter (Serial Number 20021022) was used for all on-Scheme light readings in lux (lumen/m²). The hand-held meter is maintained and calibrated in accordance with the manufacturers' instructions (the certificate of calibration can be found in Annex C).

4.1.12. The camera utilised for the on-Scheme photography was a Canon EOS 2000D digital single-lens.

4.1.13. The viewpoint locations of each receptor are shown in Plate 3 below.

Plate 3 Key lighting related viewpoint locations

4.1.14. The viewpoint description and lux measurement of each receptor are shown in Table 4.1.

4.1.15. The viewpoint daylight and darkness photographs are shown in Annex B.

Table 4.1 Summary of key lighting related survey viewpoint locations and lux readings

Viewpoint Number	Description of Area	Measure at Ground level (lux)	Direction of Sensor	Measured at 1.5m above ground level (lux)	Comments
MP1	East of residential area in open space	0.15	North	0.09	Lined with mature trees
			East	0.04	
			South	0.12	
			West	0.09	
MP2	East of Hungerley Hall South of Farm buildings	0.18	North	0.10	Farm land with existing A46 to South-east
			East	0.07	
			South	0.21	
			West	0.13	
MP3	Clifford Bridge Road/ B4082 Roundabout (existing lit road area next to tree line)	4.99	North	2.86	Mature trees approximately 15m height to the south between the housing estate and existing A46.
			East	6.93	
			South	1.81	
			West	7.88	
MP4	Coombe Abbey Park	0.03	North	0.04	Tree lined / view of A46
			East	0.00	
			South	0.02	
			West	0.03	
MP5	Residential area Valencia Road	0.18	North	0.14	Tree line between open space area at housing estate and existing A46
			East	0.08	
			South	0.30	
			West	0.33	
MP6	Walsgrave Hill Farm	0.22	North	0.16	View of A46 tree lines and existing lighting in view (University Hospital Coventry, A46)
			East	0.14	
			South	0.12	
			West	0.21	

Baseline survey description and results

4.1.16. Principal light sources surrounding the Scheme are:

- Highway lighting at the existing Walsgrave Junction
- Lighting to the existing B4082 link road towards the existing Walsgrave Junction
- Lighting to the existing A46 on the approaches to the existing Walsgrave Junction

Viewpoint location MP1 – East of residential area in open space

4.1.17. Viewpoint location MP1 is located on a public right of way open space area between a residential area and the A46.

4.1.18. The residential area is located to the west of the viewpoint and surrounded with mature trees approximately 15m height.

4.1.19. The A46 is located to the east of the viewpoint and surrounded with mature trees approximately 15m height.

4.1.20. During the day-time survey, lighting equipment was not visible from the viewpoint location.

4.1.21. Artificial light sources visible during the night-time survey were negligible and the night-time scene appeared generally dark as indicated by the light measurement readings in Table 4.1.

4.1.22. White sky glow was visible mainly towards the north and west, visible on the heavy clouds and assumed to be from University Hospital Coventry.

Viewpoint location MP2 – East of Hungerley Hall Farm buildings

4.1.23. Viewpoint location MP2 is located on private agricultural land.

4.1.24. The farm buildings are located to the west of the A46 and north of the B4082. The viewpoint has mature trees approximately 15m height to the east lined to the A46 and B4082.

4.1.25. During the day-time survey, lighting equipment was visible from the viewpoint location.

4.1.26. Artificial light sources visible during the night-time survey were intermittent and the night-time scene appeared generally dark as indicated by the light measurement readings in Table 4.1.

Viewpoint location MP3 – Existing Clifford Bridge Road/B4082 roundabout

4.1.27. Viewpoint location MP3 is located on a public footpath at the Clifford Bridge Road/B4082 roundabout. The viewpoint has mature trees approximately 15m height to the south between the housing estate.

4.1.28. During the day-time survey, lighting equipment was visible from the viewpoint location.

4.1.29. Artificial light sources visible during the night-time survey were prominent and the night-time scene appeared generally lit as indicated by the light measurement readings in Table 4.1.

Viewpoint location MP4 – Coombe Abbey Park

4.1.30. Viewpoint location MP4 is located on a public right of way between the residential area and the A46 highway. The viewpoint has mature trees approximately 15m height to the north, south and west.

4.1.31. During the day-time survey, lighting equipment was not visible from the viewpoint location.

4.1.32. Artificial light sources visible during the night-time survey were negligible and the night-time scene appeared generally dark as indicated by the light measurement readings in Table 4.1.

Viewpoint location MP5 – Residential area Valencia Road

4.1.33. Viewpoint location MP5 is located on open space on Valencia Road within a residential area.

4.1.34. The viewpoint is located to the south of the existing Walsgrave Junction and west of the A46. The viewpoint has mature trees approximately 15m height to the east lined to the A46.

4.1.35. During the day-time survey, lighting equipment was visible from the viewpoint location.

4.1.36. Artificial light sources visible during the night-time survey were negligible and the night-time scene appeared generally dark as indicated by the light measurement readings in Table 4.1.

4.1.37. The light measurement towards the south direction is higher as this was towards the residential road lighting.

Viewpoint location MP6 – Walsgrave Hill Farm

4.1.38. Viewpoint location MP6 is located on private agricultural land.

4.1.39. The farm building is located to the north of the existing Walsgrave Junction and east of A46. The viewpoint is in an elevated position to the A46.

4.1.40. During the day-time survey, lighting equipment was visible from the viewpoint location.

4.1.41. Artificial light sources visible during the night-time survey were intermittent and the night-time scene appeared generally dark as indicated by the light measurement readings in Table 4.1.

4.1.42. White sky glow was visible mainly towards the west, visible on the heavy clouds and assumed to be from the University Hospital Coventry.

5. Lighting requirements

5.1. Artificial lighting requirements

5.1.1. The Scheme requires British Standard compliant lighting for the safety and amenity of motorists on the approach to and using the A46/ B4082 junction and the safety and amenity of motorists on the approach to and using the new B4082 link road to be constructed from the new A46 junction.

5.1.2. To ensure consistency in the lighting design approach and compliance with British Standards for lighting levels associated with the Scheme.

5.1.3. External artificial lighting will be provided in accordance with the layout, presented in Annex A (drawing reference HE604820-OIL-HLG-00-DR-EO-35003).

5.1.4. The Scheme provides lighting of joining and exit areas from the main carriageway, entry and exit slip roads, the main junction, and the B4082 link road which connects to the existing B4082. Joining and exit areas, and slip roads, are to be lit to lighting class M3, the main junction is to be lit to lighting class C2, and the B4082 link road is to be lit to lighting class M3 as defined in BS5489-1:2020.

5.1.5. Where lighting is currently provided to the existing Walsgrave Junction and the approaches, these will be removed.

5.1.6. Optics chosen for the Scheme achieve a luminous intensity of G4 with a Imax of 467.9 for National Highways and G3 for local authority with a Imax of 467.9. Lanterns chosen to emit Warm White light, at 3000K colour temperature.

5.1.7. Additional control of the light output will be required by utilising shields mounted on the light-emitting diode (LED) luminaires. In the vicinity of Hungerley Hall Farm buildings front shields will be used to mitigate light spill towards the buildings.

6. Potential effects

6.1. Potential effects from artificial light

6.1.1. The potential effects that can arise from inappropriately designed artificial lighting are discussed below.

Effects from light intrusion from exterior lighting on residents (through windows)

6.1.2. Light intrusion (or light spill) is the term for the spilling of light beyond the boundary of the area being lit. The ILP GN01/21 places a limit on the amount of vertical Illuminance which falls upon the centre of a dwelling window. The suggested maxima values quoted are relative to the amount of light measured as a baseline without the presence of the obtrusive light source.

Effects from viewed source intensity on residents and sightseers

6.1.3. Table 4 within ILP GN01/21 (reproduced as Table 3.2 in this document) advises limits on luminaire intensity or viewed source intensity from flood lighting luminaires towards an observer. The greatest effects are usually encountered from poorly aimed floodlights or security lighting, or from lighting which is located too close to properties.

Effects from upward light (or sky glow)

6.1.4. Light emitted above the horizontal either directly from luminaires or indirectly as reflected light from surfaces such as the landscape or buildings, has the potential to cause sky glow. The ILP GN01/21 places limits on the percentage of direct upward light emitted from the luminaires in their installed attitude, which is dependent upon the environmental zone in which the Scheme lies.

6.1.5. Indirect upward light is subject to surface reflectance properties. It is not easily quantifiable; but is unlikely to be as significant as direct upward light from luminaires.

Effects from disability glare on transport users

6.1.6. The proposals include requirements for lighting to be installed such that glare is minimised in accordance with the ILP GN01/21.

Effects from light on bat roosts and insects

6.1.7. Light falling on a roost access point will at least delay some species of bats from emerging and this shortens the amount of time available to them for foraging. As

the main peak of nocturnal insect abundance occurs at and soon after dusk, a delay in emergence means this vital time for feeding is missed.

6.1.8. Artificial lighting can also affect the foraging behaviour of bats and insects in addition to causing disturbance to bats at the roost. There are two aspects to this - one is the attraction that light from certain types of lamps has to a range of insects; the other is the presence of lit conditions.

6.2. Potential effects from operational artificial lighting (without mitigation)

6.2.1. As a result of the exterior lighting detailed in Section 6 (without mitigation), there is a potential for obtrusive light due to poorly designed or installed lighting equipment if it is not implemented in accordance with the design shown in Annex A.

6.2.2. Poorly designed lighting in a highway setting generally consists of the installation of poor quality luminaires, the use of intrusive tilt angles, inappropriate lighting distribution, or the over lighting of highways in areas of high environmental sensitivity.

6.2.3. Poorly designed lighting can contribute the following obtrusive light components:

- Light spill into windows: this is typical of wall mounted luminaires with high tilt angles.
- Upward light causing sky glow: this is typical of up-lighting.
- Glare: due to high light source intensity from floodlights.
- Intrusive light affecting ecology: caused by excessive height and tilt.

6.2.4. The potential effects from operational lighting without mitigation are likely to be permanent **Moderate Adverse**, based on the above components of obtrusive light, all of which could occur unless mitigation measures outlined in Section 9 are implemented.

7. Scope of mitigation

7.1. Mitigation by design

7.1.1. Many of the potential effects of artificial lighting can be effectively mitigated by good lighting design and choice of suitable lighting equipment and the lighting design being carried out by a suitably qualified and competent lighting professional.

7.1.2. The following paragraphs detail good lighting practices that have been implemented in the design presented in Annex A. These will be required for artificial lighting provided within the Scheme.

7.1.3. The exterior lighting of the Scheme will:

- Be installed according to the design presented in Annex A.
- Use high quality luminaires throughout the design to ensure that light is focussed downwards onto the ground or other surfaces in the horizontal plane, minimising the potential for direct upward light, glare, light spill and light intrusion. Luminaires of this type would be designed to ensure that they are optically efficient, thus reducing the amount of light spilled onto the vertical plane, thereby reducing the potential for obtrusive light.
- Ensure that luminaires are positioned such that light is along the road; and is only applied where needed for the safety of road users.
- Use luminaires with good optical control and an option for installing shields. This would be an effective method of shielding the source intensity and reducing both horizontal and vertical spill light. If during the design of the lighting installation it is decided that luminaires are to be installed with shields, then photometry with the effects of shields would be considered to ensure that the calculated lighting levels are as accurate as possible.
- Emit a warm white colour temperature light (3000K) to reduce the potential for adverse effects on potential ecological receptors.
- Ensure that the peak beam angle of all lights directed towards any potential observer is not to be more than 70 degrees when the luminaire is installed with a tilt angle of 0 degrees.
- Ensure that where luminaires are identified to produce light spill onto sensitive ecological receptors in excess of 0.2 lux, luminaires are fitted with rear shields to limit spill light.
- Ensure that where luminaires are identified to produce light spill onto the main carriageway from the overbridge between the roundabouts, luminaires are fitted with rear shields to limit spill light.

8. Residual effects assessment

8.1. Operational phase

8.1.1. The effects associated with the Scheme would be minimised by the application of the mitigation measures outlined in Section 8, in combination with the application of the lighting design set out in Annex A.

8.1.2. Whilst the lighting levels present within the Order Limits of the Scheme will increase, it is unlikely that potential human receptors with views of the Scheme would be subjected to an increase in obtrusive light, due to the mitigation measures, the Scheme layout and compliance with lighting standards. Implementation of the lighting design will also minimise light spill, ensuring that lighting is focussed only towards areas where it is required.

8.1.3. Although lighting is required for the Scheme and is likely to be noticeable from the residential receptors identified, it is unlikely to be obtrusive through limiting the luminaire tilt angles and height. The visibility of lighting alone is not considered an obtrusive light component, and the effect on landscaping is considered in ES Chapter 7 (Landscape and Visual Effects) (**TR010066/APP/6.1**). The levels of lighting proposed are neither excessive nor are they uncommon for the particular environmental zone in which the Scheme is situated (E2), as shown in Table 3.1. The residential receptors identified have been considered as having medium or low sensitivity to changes in lighting depending on their perspective of the Scheme and whether their view is obstructed or unobstructed.

8.1.4. Views of the Scheme from residential properties to the south and west or north and west will be largely obscured by the existing and proposed vegetation when in leaf, this will be reduced during winter months, with the proposed lighting columns being set among a raised area for the roundabouts and overbridge.

8.1.5. Whilst the Isolux contours presented in Annex A present a negligible risk of light spill onto adjacent receptors, the levels presented assume an absolute adverse scenario of a flat landscape; whereas the existing and proposed vegetation present throughout will further reduce the potential for spill light when in leaf.

8.1.6. The magnitude of change with regard to artificial lighting associated with the Scheme falling onto the identified receptor positions is considered ‘negligible’ in line with Table 8.1 This is because the proposed lighting is highly unlikely to breach the relevant E2 environmental zone limits outlined in Table 3.1, or breach standards and guidance.

8.1.7. The artificial exterior lighting within proximity to potential ecological receptors is unlikely to give rise to significant effects.

8.1.8. The lighting design developed for the Scheme, which have been informed by appropriate guidance on sensitive ecological receptors (GN08/23), luminaire mounting height, tilt, and the implementation of effective lighting control will reduce the potential for obtrusive light.

8.1.9. The lighting layout is provided in Annex A. This demonstrates that the light levels at ground height onto the identified receptor positions will be minimised to less than 0.2 lux.

8.1.10. Residual effects associated with the artificial external lighting for the Scheme are outlined in Table 8.1.

Table 8.1 Likely residual effects description

Environmental effect	Receptor type	Sensitivity of receptor	Impact magnitude	Nature of impact (permanent / temporary)	Residual effects
MP1	Human Amenity / Ecological	Medium	Negligible	Permanent	Neutral
MP2	Human Amenity / Ecological	Medium	Negligible	Permanent	Neutral
MP3	Human Amenity / Ecological	Medium	Negligible	Permanent	Neutral
MP4	Human Amenity / Ecological	Medium	Negligible	Permanent	Neutral
MP5	Human Amenity / Ecological	Medium	Negligible	Permanent	Neutral
MP6	Human Amenity / Ecological	Medium	Negligible	Permanent	Neutral

8.1.11. Following the implementation of mitigation measures as outlined in Section 8, and the implementation of the lighting layout proposed in Annex A the residual effects upon the identified viewpoints are assessed to be Neutral because the increase in levels is beneath levels of perception (at less than 0.2 lux increase). Furthermore, the lighting would be implemented in line with relevant British Standards and guidance.

9. Conclusion

9.1. Introduction

9.1.1. This report considers the effects resulting from artificial lighting associated with the Scheme and its surroundings. It assesses the potential effects from obtrusive light associated with the proposed road lighting design. The principal objective is to assess the significance of likely residual effects.

9.2. Baseline conditions

9.2.1. The Scheme is within a rural environment which is assessed to be an E2 environmental zone due to the natural landscape buffering the Scheme.

9.2.2. A baseline survey was undertaken to assess the baseline conditions on nearby potentially sensitive receptor positions, which were assessed to be of low ambient luminance.

9.3. Potential significant effects

9.3.1. The requirement for artificial lighting to support the Scheme means that there could be some potential effects caused by some parts of the required lighting including light spill, direct source luminance or glare (onto receptor views) and sky glow or upward light. Without mitigation, the potential effects are likely to be **Moderate Adverse**, as poor-quality light sources could be installed, and lighting levels are non-compliant with British Standards or guidance documents. To avoid this, mitigation measures are implemented.

9.4. Mitigation and enhancement

9.4.1. The mitigation measures deployed through the lighting layout presented in Annex A along with the mitigation measures outlined in Section 8 would ensure that artificial lighting is not obtrusive.

9.5. Residual effects

9.5.1. Due to the mitigation measures outlined in Section 8, the residual effects of the operational phase are assessed to be **Neutral**. This is due to the low potential for obtrusive light to affect human and ecological receptors, through the implementation of the lighting layout.

9.5.2. Potential human sensitive receptors located outside the boundaries of the Scheme are unlikely to be subjected to obtrusive light from the Scheme, due to the design of the lighting for the Scheme.

9.5.3. In combination, the design implementation seeks to ensure that light is only focussed where it is needed, and the layout of the Scheme including the vegetation will provide shielding to sensitive receptors from the effects of obtrusive light. This will help reduce the potential for the levels of glare and light spill to be greater than those permitted within Table 3.

9.5.4. Lighting levels following the application of the mitigation measures outlined in Section 8 are not expected to exceed limitations on light pollution, as reasonable steps have been taken to minimise light pollution wherever possible.

9.5.5. Further to this, lighting levels following the application of the mitigation measures outlined in Section 8 and the implementation of the lighting layout presented in Annex A are expected to comply with necessary guidance presented in ILP GN01/21, PLG04, and GN08/23; meeting the tests identified for this installation.

9.5.6. In conclusion, lighting levels associated with the Scheme will be sympathetic to the surroundings and consist of the lowest possible lighting levels whilst meeting relevant British Standards. As such, there will be no significant effects from artificial lighting installed as part of the Scheme.

Acronyms

Acronym	Meaning
ILP	Institution of Lighting Professionals
LED	Light emitting diode
LVIA	Landscape and Visual Impact Assessment
m	metre
DMRB	Design Manual for Roads and Bridges

Glossary

Term	Definition
Artificial Light Source	Manmade lighting such as floodlights, illuminated bollards and street lighting.
Candela	International System of Units (SI) for Luminous Intensity, a common candle emits light with a luminous intensity of approximately 1 candela.
Illuminance	Measurement of Luminous Flux at a point on a surface.
Light Intrusion	Light that falls beyond the boundary of the area being lit.
Light Spill	See Light Intrusion.
Luminaire	Complete light fitting housing the lamp, control gear and optical distribution control.
Luminaire Intensity	Measured in Candelas, this is a measure of the amount of light that a source radiates in a given direction. This can be considered as the power of light in 1 specific angle (or given direction) often to an observer
Luminance	Luminance is an indicator of how bright a surface will appear.
Lux	SI unit for Illuminance, 1 lumen per square metre.
Obtrusive Light	Light that falls, or can be viewed beyond the boundary of the area being lit which causes annoyance, discomfort or distraction
Sky Glow	The illumination of the sky at night by artificial light sources including light emitted directly upward from the light source and also reflected from the ground or a surface
Scheme, the	The concept or design proposed i.e. the road layout and associated earthworks, drainage,structures, lighting, etc

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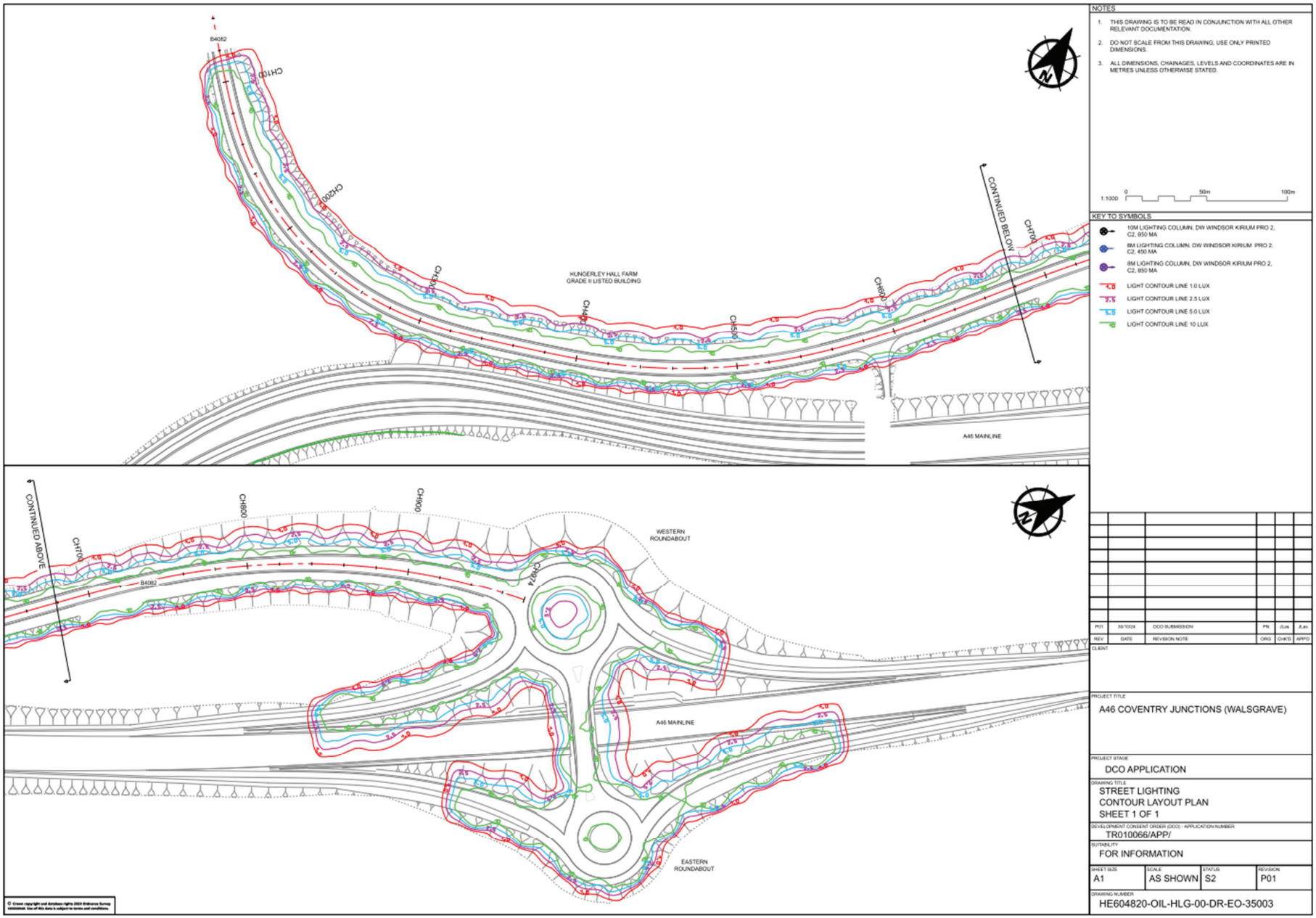
Annex A– Lighting design contour plan


B4082
CH100
CH200
CH300
HUNGERLEY HALL FARM
GRADE II LISTED BUILDING
CH400
CH500
CH600
CONTINUED BELOW
CH700
A46 MAINLINE
CONTINUED ABOVE
CH700
CH800
CH900
WESTERN
ROUNDABOUT
CH974
B4082
A46 MAINLINE
EASTERN
ROUNDABOUT
NOTES
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DOCUMENTATION.
2. DO NOT SCALE FROM THIS DRAWING, USE ONLY PRINTED DIMENSIONS.
3. ALL DIMENSIONS, CHAINAGES, LEVELS AND COORDINATES ARE IN METRES UNLESS OTHERWISE STATED.
1:1000 0 50m 100m
KEY TO SYMBOLS
10M LIGHTING COLUMN, DW WINDSOR KIRIUM PRO 2, C2, 850 MA
8M LIGHTING COLUMN, DW WINDSOR KIRIUM PRO 2, C2, 450 MA
8M LIGHTING COLUMN, DW WINDSOR KIRIUM PRO 2, C2, 850 MA
LIGHT CONTOUR LINE 1.0 LUX
LIGHT CONTOUR LINE 2.5 LUX
LIGHT CONTOUR LINE 5.0 LUX
LIGHT CONTOUR LINE 10 LUX
P01 30/10/24 DCO SUBMISSION PN JLm JLm
REV DATE REVISION NOTE ORG CHK'D APP'D
CLIENT
PROJECT TITLE
A46 COVENTRY JUNCTIONS (WALSGRAVE)
PROJECT STAGE
DCO APPLICATION
DRAWING TITLE
STREET LIGHTING
CONTOUR LAYOUT PLAN
SHEET 1 OF 1
DEVELOPMENT CONSENT ORDER (DCO) - APPLICATION NUMBER
TR010066/APP/
SUITABILITY
FOR INFORMATION
SHEET SIZE A1
SCALE AS SHOWN
STATUS S2
REVISION P01
DRAWING NUMBER
HE604820-OIL-HLG-00-DR-EO-35003

Annex B – Viewpoint location photographs

Viewpoint location MP1 – East of residential area in open space

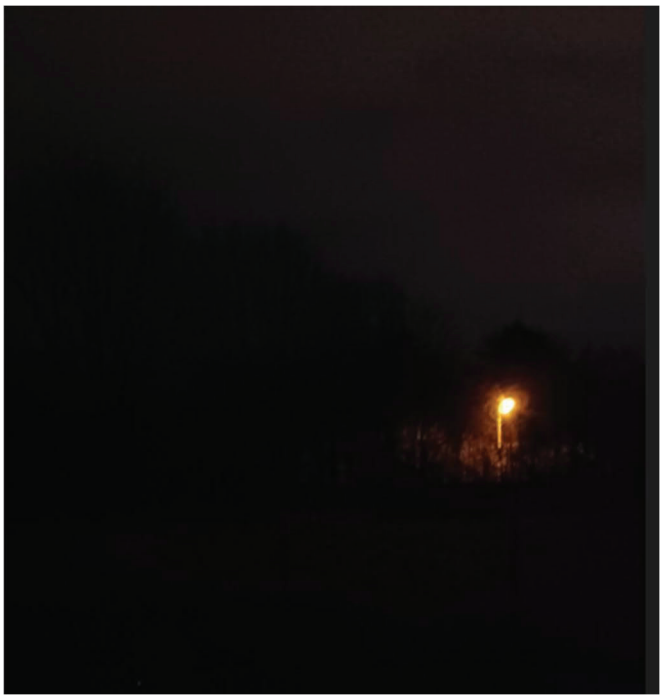
Plate 4 East of residential area in open space - day

Plate 5 East of residential area in open space - darkness

Viewpoint location MP2 – East of Hungerley Hall Farm buildings

Plate 6 East of Hungerly Hall Farm buildings - day

Plate 7 East of Hungerly Hall Farm buildings - darkness



Viewpoint location MP3 – Existing Clifford Bridge Road/B4082 roundabout

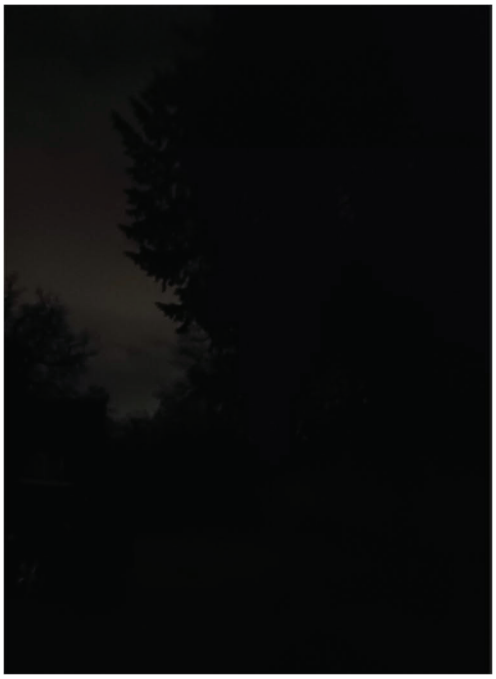
Plate 8 Existing Clifford Bridge Road/B4082 roundabout - day

Plate 9 Existing Clifford Bridge Road/B4082 roundabout - darkness

Viewpoint location MP4 – Coombe Abbey Park

Plate 10 Coombe Abbey Park - day

Plate 11 Coombe Abbey Park - darkness



Viewpoint location MP5 – Residential area Valencia Road

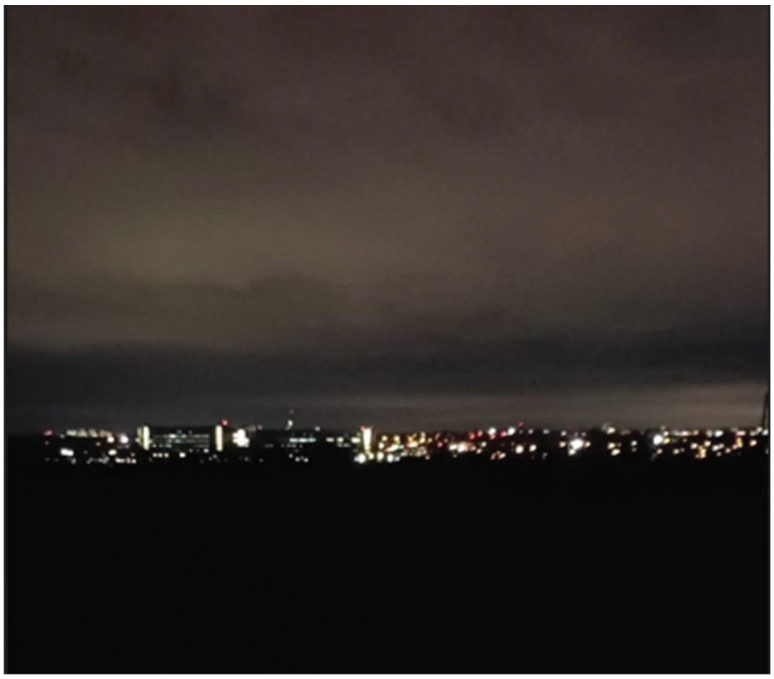
Plate 12 Residential area Valencia Road - day

Plate 13 Residential area Valencia Road - darkness

Viewpoint location MP6 – Walsgrave Hill Farm

Plate 14 Walsgrave Hill Farm - day

Plate 15 Walsgrave Hill Farm - darkness



Annex C – Lux Meter calibration certificate

CERTIFICATE OF CALIBRATION

ISSUED BY OPTICAL TEST and CALIBRATION LTD.

DATE OF ISSUE: 04 April 2023 Certificate Number 144410/ABU

UKAS CALIBRATION
0286

Optical Test and Calibration Ltd.

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Approved Signatory

Name Jenny Harris

Signature QC028

Customer: SWECO Ltd
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139 Fountainbridge
EDINBURGH
EH3 9QG
SCOTLAND

Equipment Information

Make: KONICA MINOLTA

Model:	**Description:**	**Serial No:**	**Reference No:**
T10A	LUXMETER	20021022	
T-10A	SENSOR	30022570	

Date of Calibration: 04 April 2023

Calibrated By: J Grabowski

This instrument has been calibrated by direct intercomparison to traceable standards in accordance with approved procedure RAD02 which follows the general principles of BS 667:2005.

The calibration was undertaken with the instrument being operated in accordance with the manufacturer's handbook where appropriate.

The uncertainties shown are consistent with the requirements of M3003 and are inclusive of the uncertainty contribution of the instrument under test. The results, statements and uncertainties relate only to the measured values as displayed by the instrument, and do not carry any implication regarding the stability of the instrument or its performance outside the measured range.

Laboratory Conditions: Temperature 21 °C ± 2 °C
Relative Humidity 50 %rh ± 20 %rh

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k = 2$ unless otherwise shown, providing a coverage probability of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0286

Certificate number
144410/ABU

Page 2 of 2 Pages

Calibration Undertaken

Illuminance in the range 1 lux to 20000 lux using a tungsten lamp at a colour temperature of 2856 K.
The reference plane of the sensor was taken to be the front face of the diffuser, with a diameter of 25 mm.
The zero offset has not been taken into account.
Results shown on receipt, no adjustment made
Manufacturer specification: ± 2% + 1 digit of displayed value (Ref: 14328)

Calibration Results

Reference Meter CAL1070 & CAL616B	Unit Under Test			
	Range	As Despatched		
Applied		Displayed		p_c
0.00 lux	Auto	0.00 lux *	*N/A*	*N/A*
1.00 lux	Auto	0.99 lux	*PASS*	*81.2%*
2.00 lux	Auto	1.97 lux	*PASS*	*70.1%*
5.00 lux	Auto	4.92 lux	*PASS*	*63.4%*
10.0 lux	Auto	10.08 lux	*PASS*	*78.9%*
50.0 lux	Auto	50.1 lux	*PASS*	*92.8%*
150.0 lux	Auto	149.6 lux	*PASS*	*92.4%*
500.0 lux	Auto	497 lux	*PASS*	*93.3%*
1500 lux	Auto	1488 lux	*PASS*	*86.4%*
5000 lux	Auto	4950 lux	*PASS*	*84.9%*
15000 lux	Auto	14800 lux	*PASS*	*70.1%*

Calibrations marked '*' in this certificate are not UKAS accredited and have been included for completeness.

'p_c' indicates probability of conformance to the specification used.

Calibrated by: J. Grabowski Date: 04 April 2023

UNCERTAINTY OF MEASUREMENT

The estimated uncertainty in the measured value of illuminance from 1 lux to 20000 lux when the instrument is used under the same conditions as when calibrated is ± 1 incremental digit in the least significant figure of the displayed value due to the resolution of the meter plus:

a) ± 3.1 % in the 1.0 lux to 10.0 lux range (k = 2.00)
b) ± 2.8 % in the 10 lux to 20 lux range (k = 2.00)
c) ± 2.2 % in the 20 lux to 200 lux range (k = 2.00)
d) ± 1.9 % in the 200 lux to 1000 lux range (k = 2.00)
e) ± 2.2 % in the 1000 lux to 2000 lux range (k = 2.00)
f) ± 2.3 % in the 2000 lux to 10000 lux range (k = 2.00)
g) ± 2.7 % in the 10000 lux to 20000 lux range (k = 1.99)

Annex D – TA501 assessment

A46 COVENTRY JUNCTIONS (WALSGRAVE)

Road lighting assessment report

PCF STAGE 3
FOR INFORMATION | S2
HE604820-OIL-HLG-00-RP-EO-30001 | P03
12/02/24

National Highways Programme Leader: [redacted]

National Highways Project Manager: [redacted]

Octavius Delivery Integration Partner, Project Manager: [redacted]

PCF STAGE 3 Supplier: [redacted]

Document control

Client	OCTAVIUS INFRASTRUCTURE LIMITED
Project	A46 COVENTRY JUNCTIONS (WALSGRAVE)
Document title	Road lighting assessment report
Document reference	HE604820-OIL-HLG-00-RP-EO-30001

Revision history

Revision	Purpose description	Originator	Checked	Approved	Authorised	Date
P03	Updated after Arcadis review	[redacted]			---	12/02/24
P02	Updated related to comments from first review				---	20/11/23
P01	FOR REVIEW AND COMMENT				---	24/07/23

Reviewer List

Name	Role

Approvals

Name	Signature	Title	Date of Issue	Version

Table of contents

Figures

Tables

1. Introduction

1.1. Introduction and background

1.1.1 This report documents an economic assessment of the requirement for road lighting on the A46 Coventry Junctions (Walsgrave) project. The assessment includes the road lighting requirements on the realigned A46, proposed junction (two new roundabouts with the slip roads) within the project extent and road lighting on the B4082.

1.1.2 The location of the works is shown in following Figure 1-1.

Figure 1-1 : Overall location

1.2. Existing road lighting

1.2.1 There is existing road lighting at the Walsgrave roundabout of the A46 and B4082 and on the B4082. The existing luminaires are high-pressure sodium luminaires mounted on a variety of columns with different heights located in the

verge and around the roundabout. Those in A46 and roundabout are 8m columns and under the 132kV overhead lines the columns are 5m.

1.3.1 The existing roundabout will be removed and thereby also the existing road lighting at the roundabout. On the B4082, the immediate suggestion is to reuse the columns on the part of the B4082 that is not redesigned, as they appear to be newer columns. As part of the works the existing luminaires would require replacement to LED light. The same type of columns from this section of the B4082 could then be used on the new alignment of the B4082 road.

1.3. Road lighting guidance and standards

1.3.1. The road lighting economic assessment has been undertaken in accordance with the latest National Highways guidance. The following International, British and National Highways standards have been used to carry out the road lighting assessment:

- International Commission on Illumination (CIE) – CIE115: 2010 – Technical Report – Lighting of roads for motor and pedestrian traffic
- British Standards (BS) – BS 5489-1: 2020 – Design of road lighting – Part 1: Lighting of roads and public amenity areas
- National Highways – TA 501 – Road lighting appraisal
- National Highways – TD 501 - Road lighting design

- National Highways – CD 122 - Geometric design of grade separated junctions
- National Highways – CD 116 - Geometric design of roundabouts

TA 501 – Road lighting appraisal

1.3.2. TA 501 sets out the requirements for the appraisal of road lighting on the strategic road network and is used in conjunction with the National Highway's Scheme Appraisal Report (SAR) documentation process.

1.3.3. The primary purpose of road lighting is to reduce personal injury accidents (PIAs). This is an assessment of the quantifiable benefit. Consequently, the most important consideration is the predicted accident cost saving, which should be greater than the lighting installation and 30 year operation costs in order to provide economic justification for road lighting.

TD 501 – Road lighting design

1.3.4. TD 501 sets out the design standards applicable to road lighting on highways and describes how to apply the British Standard BS 5489-1 to the design of road lighting for the strategic road network.

CIE 115/2010 – Lighting of roads for motor and pedestrian traffic

1.3.5. The advice given in CIE 115/2010 regarding the extent of road lighting at conflict areas, such as highway junctions, has been applied in establishing the extents of road lighting for the individual junctions and highway links in this assessment.

1.3.6. The extent of road lighting should be the distance that a vehicle would travel for five seconds at the expected traffic speed. At a speed of 50mph this equates to 112m. The minimum distance of lighting on the slip roads, at a junction roundabout that is illuminated, should extend to 112m from the joining line to A46 mainline of the off-slip road.

CD 116 – Geometric design of roundabouts

1.3.7. The advice given in CD 116 is that all roundabouts shall be illuminated. This advice is followed; therefore, the two new dumbbell roundabouts will be illuminated according to current regulations.

2. Highway A46 - TA501 appraisal

2.1.1. The appraisal is based on TA501, but also on the appraisal made for the A46 Coventry Junctions (Binley) upgrade project to achieve a consistent decision basis. The consideration is based on estimations, while the detailed design of the lighting system, will be performed at a later stage.

2.2. Collision analysis

2.2.1. Collected data from Crashmap.co.uk shows there have been 11 collisions in the project area during five years from 2017-2021. The collisions were divided into the groups Fatal, Serious and Slight as shown in Figure 2-1 and Table 2-2, with locations of collisions shown in Figure 2-1.

Table 2-1 : Collisions in project area.

	Severity			Total
	Fatal	Serious	Slight	
2017			1	1
2018		1	1+1	3
2019		1+1	1+1+1	5
2020			1	1
2021			1	1
Total		3	8	11
Red marked number are collisions occurring at the roundabout, which will be removed in the new design.				

Table 2-2 : Detailed information of the collisions.

	Date	Year	Time	Light conditions	Severity
Collision 1	October 17	2019	5:40:00 PM	Daylight: regardless of presence of streetlights	Slight
Collision 2	October 09	2020	7:00:00 AM	Daylight: regardless of presence of streetlights	Slight
Collision 3	September 09	2018	3:53:00 PM	Daylight: regardless of presence of streetlights	Slight
Collision 4	September 24	2019	5:32:00 PM	Daylight: regardless of presence of streetlights	Slight
Collision 5	January 31	2019	5:50:00 PM	Darkness: streetlights present	Slight
Collision 6	March 26	2018	4:05:00 PM	Daylight: regardless of presence of streetlights	Serious

Collision 7	December 07	2018	12:29:00 PM	Daylight: regardless of presence of streetlights	Slight
Collision 8	June 01	2019	03:05:00 PM	Daylight: regardless of presence of streetlights	Serious
Collision 9	May 12	2021	05:15:00 PM	Daylight: regardless of presence of streetlights	Slight
Collision 10	February 01	2017	02:21:00 PM	Daylight: regardless of presence of streetlights	Slight
Collision 11	May 23	2019	06:25:00 AM	Daylight: regardless of presence of streetlights	Serious
Red marked collision happened during darkness.					

Figure 2-1 : Location of collisions

2.2.2. The historical collision data shows only one collision in the severity 'Slight' during darkness and during a period of five years. Based on these facts, it will only be this collision, that will be considered in the following PIA saving calculations.

2.2.3. Furthermore, it is worth mentioning, that the one collision in darkness was located near the roundabout connecting the B4082 and the A46 mainline.

2.3. PIA saving calculation

Table 2-3 : Collisions during hours of darkness summary.

	Severity			Total
	Fatal	Serious	Slight	
Darkness – road lighting present and lit			1	1

2.3.1. As recommended by TA501, it is assumed that the forecast number of PIAs for the opening year is the same as the average for the preceding five years. Therefore, the forecast numbers of collisions for the opening year are – 0.2 Slight collisions.

2.3.2. The percentage darkness PIA saving due to lighting for a highway link is given as 10%. Where the highway link is already illuminated, the percentage saving is calculated as follows: 10% / (100%-10%) = 11.11%. This accounts for the fact the PIAs are already being saved due to the existing lighting.

Table 2-4 : PIA saving rate.

	Severity		
	Fatal	Serious	Slight
Darkness – road lighting present and lit			0.022

2.3.3. The PIA cost savings due to street lighting considering 2015 costs (Ref: Reported Road Casualties Great Britain, 2017).

Table 2-5 : PIA savings.

	Severity		
	Fatal *£2,005,664	Serious *£229,575	Slight *£24,194
Darkness – road lighting present and lit			532.29

2.3.4. Applying a capitalisation factor CF (from table C.3b og SAR 2020 user notes) of 22.4 to the PIA savings to the opening year discounted to 2015, the present value of benefits (PVC) amounts to £11,923.

2.4. SAR and BCR calculation

2.4.1. Basis of the calculation

The following calculation is based on the potential lighting system that could be required on the A46 mainline. The dumbbell with connecting slip roads and B4082 will be illuminated according to CD 116 and will therefore not be a part of the SAR and BCR calculation.

2.4.2. Working cost

Works costs include those that would be incurred by preparing and installing the proposed scheme if a lighting system should be establish on the A46 mainline. The detailed breakdown of all the items, activities, quantities, and costs required for construction of the scheme have been obtained from other projects (e.g. Coventry Junctions Binley).

Table 2-6 : Working cost

	Working cost		
	Pcs	Unit price [£]	Total cost [£]
Luminaires incl. mounting	130	695	90,350
Column 10 m + traverse incl. installation	65	1,273	82,745
Foundation (fitting for concrete barrier) incl. mounting	65	463	30,095
Fusebox incl. mounting	65	145	9,425
Cable	3000 m	8.70	26,100
Cable laying (cable trench)	2600 m	15.30	39,780
Cabinet incl. installation and mounting	2	3,495	6.990
Total working cost			285,485

2.4.3. Maintenance cost

Whole life cycle maintenance costs for proposed installation are summarised in table 2-7.

Table 2-7 : Whole life cycle maintenance cost

	Maintenance cost		
	Pcs	Unit price [£]	Total cost [£]
Cleaning	130	104	13,520
Electrical testing	130	104	13,520
Non destructive testing	65	347	22,555
Traffic management	1	9,600	9,600
Total maintenance cost			59,195
$OYMC_{(maintenance)}$	Total maintenance cost / appraisal period (30)		1,973

2.4.4. Energy cost

Annual energy costs for proposed installation are summarised in table 2-8.

To consider the unpredictable difference between energy charges and Retail Price Index (RPI) over the appraisal period, the proposed annual energy cost has been multiplied by a Capitalisation Factor $CF_{(energy)}$.

Table 2-8 : Whole life energy cost

	Energy cost		
	Pcs	Unit price [£]	Total cost [£]
Luminaires (130 pcs) Estimated to have an energy consumption of 100W/luminaire. Operating hours estimated to 4108 h. Wattage price is estimated to 17,9 p/kWh	130	(100x4108x0.179)/1000= 73.53	73.53x130= 9559.32
Capitalisation factor for energy – $CF_{(energy)}$*	$CF_{(energy)}$ = 89.62		
CF – Capitalisation factor for assessment period (30 years)	CF = 22.4 from table C.3b og SAR 2020 user notes		
$OYMC_{(energy\ component)}$	$OYMC_{(energy\ component)}$ = Total cost x ($CF_{(energy)}$/CF) = 9559.32 x (89.62/22.4)		38,378.50

*Capitalisation factor for energy, $CF_{(energy)} = (1-X^{a+1})/(1-X)$.

X = {1+/e/100)}/{1(d/100)} = 1.063

a = appraisal period = 30 years

e = the energy inflation rate above RPI

d = discount rate, 3.5% from table C.3b of SAR2020 user notes.

2.4.5. Decommissioning cost

The cost of decommissioning including disposal and recycling has been calculated. It has been assumed that the lighting will be decommissioned at the end of the appraisal period with or without a replacement scheme.

Table 2-9 : Decommissioning cost

	Decommissioning cost		
	Pcs	Unit price [£]	Total cost [£]
Luminaires	130	116	15,080
Column + foundation	65	579	37,635
Cabel	3000 m	2.30	6,900
Cabinet incl. demounting	2	289	578
Traffic management	2	810	1,620
Total decommissioning cost			64,513
CF – Capitalisation factor for assessment period (30 years)	CF = 22.4 from table C.3b og SAR 2020 user notes		
$OYMC_{(decommissioning)}$	Total decommissioning cost / CF		2,880

2.4.6. Proposed scheme Benefit Cost Ratio (BCR)

BCR = PVC (Annual benefit) / PVB (OYMC*)

*OYMC = $OYMC_{(maintenance)}$ + $OYMC_{(energy)}$ + $OYMC_{(decommissioning)}$

BCR = 11,923 / (1,973 + 38,371.50 + 2,880) = 0.28

When the BCR in under 1, the cost for establishment of the proposed lighting system is higher than the benefits by having a lighting system.

2.5. Operational Safety Analysis

2.5.1. Current layout

The current layout of the A46 features no mainline illumination between the Binley junction to the south and its junction with the M6 motorway to the north. Street lighting is provided on the approaches to and on the Walsgrave Roundabout which is a standard lighting arrangement for complex junctions of this type on high speed dual carriageways. The A46 dual carriageway is currently subject to the national speed limit.

2.5.2. Proposed layout

The proposed layout has a grade separated interchange that will feature lighting on the slip roads leading to and from the roundabout junctions with the local road network. No illumination will be provided on the mainline of the A46 dual carriageway and a 50mph speed limit will be implemented.

2.5.3. Collision history

The reported injury collision data over the three year period 2017 to 2019 inclusive which predates changes in traffic due to the Covid pandemic have been reviewed by the Operational Safety Team in relation to darkness collisions.

Over this period a total of nine collisions occurred on the A46 dual carriageway in the vicinity of the scheme (defined within the Safety Plan HE604820-OIL-GHS-ZZ-PL-ZM-30001). Only one darkness collision occurred involving a vehicle striking the central reservation barrier whilst swerving to avoid a tyre on the carriageway.

Over the same period the percentage of collisions that have occurred during darkness on English dual carriageways subject to the national speed limit or 70mph speed limits is 32%. This demonstrates that the A46 in the scheme area is performing better than national averages.

The proposed scheme will have a 50mph speed limit on the A46 dual carriageway. The percentage of darkness collisions on English dual carriageways over the same period as above is 31%.

2.5.4. Key safety challenge

A key safety challenge of the scheme as detailed in the Safety Plan is the alignment curvature south of the proposed interchange. Measures are being developed to ensure that this feature is clearly identified for the likely approach speeds using traffic signing and road markings.

It is not anticipated that street lighting would give significant benefits that would make it cost effective over this section.

3. Surrounding A46 - TD501 / BS5489-1

3.1. Evaluation of lighting requirements

3.1.1. The A46 Walsgrave junction consists of a dumbbell roundabout junction, slip roads and local link road in addition to the A46 carriageway realignment.

3.1.2. CIE 115/2010 regarding the extent of road lighting at conflict areas, such as highway junctions, has been applied in establishing the extents of road lighting for the individual junctions and highway links in this assessment.

3.1.3. According to CD 116 all roundabouts shall be illuminated, therefore the two new roundabouts should be illuminated according to current regulations.

3.1.4. The slip roads will be lit to a distance calculated by travel speed and differs between the approach to the roundabout and A46 carriageway, detailed in Section 3.2. A traffic model is currently being calculated and the result will give the potential queue length on B4082 and on slip roads which will contribute to the determination of the extent of lighting.

3.1.5. The B4082 road link should be illuminated as the existing B4082 is illuminated. Further clarification with local authorities will be undertaken during detailed design.

3.2. Lighting classes

3.2.1. The illuminated areas in this project will be the B4082, both dumbbell junction roundabouts, the connection between the dumbbell roundabouts and all four slip roads. The recommended lighting classes are shown in the table below.

Table 3-1 : Lighting classes and level of light

	Recommended lighting class	Lighting requirement
Slip roads	M3	Lm ≥ 1 cd/m² U0 ≥ 0.4
Roundabout	C2	Em ≥ 20 lux U0 ≥ 0.4
B4082	M3	Lm ≥ 1 cd/m² U0 ≥ 0.4

3.2.2. The various lighting classes are found in BS 5489-1: 2020 and the level of lighting for each class is found in CIE 115/2010 both according to BS/EN 13201-1. Resulting from the TA501 appraisal, the A46 will not be illuminated. Therefore, the extent of lighting on the slip roads from the roundabout to the A46 would be for 60m along each on-slip road where there is no lighting on the main carriageway. This will also provide guidance for drivers approaching on the A46.

3.2.3. From the A46 off-slip roads to the roundabout, the length of illuminated road area is determined by the calculation from CIE 115/2010, with the speed of 50mph in five seconds equating to 112m. This prevents the driver from being blinded by coming from an unilluminated road to an illuminated conflict area.

3.2.4. The link road B4082 will have a speed limit of 40 mph and will be illuminated for class M3. The need of lighting on the B4082 will be developed with consultation with Coventry City Council.

Figure 3-1 : Overview of illuminated areas and lighting classes

3.2.5. Regarding the proposed lighting layout scope for the project, LED light of 100 W shall be proposed. The following initial details of different column types, heights and disposition arrangement shall be used to simulate solutions. LED wattage and column spacing shall be fine-tuned for the best lighting design solution for the project.

- B4082 link road up to A46 roundabout junction: 3 single-arm 5m columns and 22 single-arm 8m columns arranged in a single side arrangement.
- Western roundabout junction, the on-slip and off-slip road sections: 15 single-arm 8m columns
- Connection bridge between the two junction roundabouts: 2 single-arm 10m columns.
- Eastern roundabout junction, the on-slip and off-slip road sections: 10 single-arm 8m columns.

3.3. Assessment of non-quantifiable impacts

3.3.1. Non-quantifiable impacts (benefits and dis-benefits) as a result of the proposed road lighting scheme are assessed and recorded as part of this lighting appraisal.

3.3.2. Non-quantifiable impacts assessed and recorded for this project cover the following:

3.3.3. Government Policy - Road lighting would consume energy; thus this is against the Government's long-term strategy to reduce greenhouse gas emissions. In the project LED light sources will be used to minimise the impact given the fact that they consume much less energy compared with the older generation high pressure sodium light source and with a much longer lifespan. Every practicable means would be considered and kept in view to further reduce the impact, such as the use of intelligent light dimming scheme and renewable energy sources.

3.3.4. Promote active transport - This refers to the encouragement of walking and cycling activities in the project roadway. In this light, a pedestrian crossing has been proposed on the east arm of the Clifford Bridge Road roundabout. From this point and on the verge of the realigned B4082 link road up to the Hungerley Hall Farm access bridge, sufficient space within the verge would be allowed to deliver the proposed cycleway/footway. This would have a positive impact to the local community.

3.3.5. Accidents: This should be read in conjunction with section 2.5 Operational Safety Analysis of this Report regarding comments from the Road safety Engineer. In the project, the realigned carriageway at the existing A46 Walsgrave roundabout would create a wide curvature turn to the trunk road users. Measures such as zone signage painted on the ground and arrow signs erected at side of the curvature zone plus speed restriction would alleviate the impact to the minimum.

3.3.6. Security: Road lighting is generally considered having little difference to the security of road users and should normally be assessed as having a neutral impact in this project.

3.3.7. Journey ambience: It is moderately true that a journey in darkness may be less stressful if the road is lit. However, in the A46 improvement project, the trunk road would be relatively straight and flat geometry, without too much winding in the route. This would mitigate the psychological and visual stresses and allow a longer view ahead during steering. In the daytime, spacing of the lighting columns on the B4082 link road and the small numbers would not have significant visual impact on the road users.

3.3.8. Biodiversity: The proposed lighting scheme could affect protected species, such as bats, breeding and wintering birds, badgers and barn owls. Wildlife habitats

that could also be affected include Coombe Pool SSSI, River Sowe tributaries, local non-statutory designated sites and local habitats such as woodland, floodplain grazing or arable foraging. As the scale of the lighting scheme is relatively small on the lit sections, the impact on the wildlife habitats would be minimal.

4. Conclusion and recommendations

4.1. Evaluation of lighting requirements

4.1.1. The advice in the current lighting standards and the economic results of this road lighting assessment are based on works of the recently open Bindley junction to the south of the proposed Walsgrave junction. Given the smaller scale of lighting scope required in the new Walsgrave junction, it is concluded that full lighting of the A46 mainline is not profitable according to TA501.

4.1.2. According to National Highways CD116, it is recommended that roundabouts and slip roads should be illuminated. The B4082 link road will be illuminated as consulted with Coventry City Council.

4.1.3. The recommendations regarding illumination of the A46 mainline has been reviewed by the project safety team with project agreement that the lighting is also not required.

4.1.4. The actual position of the lighting columns, columns height, type of luminaries etc. will be determined during the detailed design stage of the project.

4.1.5. The lighting is to be designed using the latest technologies and control systems to ensure a sustainable and efficient lighting installation.

4.1.6. No streetlighting on the A46 mainline will have a positive effect for bats commuting along and across the A46 and for other species on site (including birds, badger and other mammals).