



Land North of Swindon
Road, Royal Wootton
Bassett

Lighting Impact Assessment

28 October 2025

Project: 1767

Prepared For: Gleeson Land Limited

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Calculations and predictions of internal and external light spill to ecological dark zones rely on the accuracy of the lighting software, the modelling assumptions, and the implementation of the mitigation measures detailed in this report. The results should be viewed as predictions only, as they are subject to numerous variables. Therefore, although every effort has been taken to ensure the results are reliable, it cannot be guaranteed that the results calculated will be the same as in the real world. It is recommended that post monitoring is undertaken where dark zones are required to be maintained at certain levels of illuminance, and that allowance is made for further remedial action by the developer/ Client if required.

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APPENDICES

Appendix A Lighting Terminology

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1 Introduction

1.1 General

This Lighting Strategy is provided by The Lighting Bee Ltd, a specialist lighting design consultancy with experience and knowledge in lighting impact assessments, mitigation and lighting design in relation to light sensitive ecological receptors.

The author of this report is a fully qualified Lighting Designer and Chartered Electrical Engineer, with full membership of the Institute of Lighting Professionals, Society of Light and Lighting, and Chartered Institute of Building Services Engineers.

The Lighting Bee Ltd have been commissioned by Gleeson Land Limited to provide a Lighting Impact Assessment for the proposed residential development on land north of Swindon Road, Royal Wootton Bassett.

1.2 Scope of the Report

This lighting assessment covers the lighting proposals for the Outline planning application with all matters reserved except for access for up to 135 dwellings, the creation of new vehicular access with footways from Swindon Road, provision of informal and formal open space, together with associated highways, landscape, earth works and level changes, foul and surface water drainage facilities, utilities provision and other associated and necessary infrastructure. Refer to the Illustrative Masterplan prepared for the site.

The aim of the Lighting Impact Assessment is to provide an assessment of the impacts of the external lighting from the proposed development in terms of light pollution and obtrusive light.

The lighting assessment will also identify potential impacts on light sensitive species identified in the ecology reports and will outline the proposed parameters and mitigation measures to limit and mitigate any potential negative effects from all types of artificial lighting.

As this is an outline application, sufficient detail is not available to provide detailed lighting designs, including lux contour plans. The report outlines the lighting strategy for the development, which includes the design parameters, the types of lighting proposed in each area, with details of the parameters of the proposed luminaires. This strategy forms the basis of the assessment. If required, a detailed lighting design with lux contour plans may be conditioned at the Reserved Matter Stage.

Within this report the proposed land take area will be referred to as the 'site'.

1.3 Consultation Response

A consultation response from Public Protection highlighted and requested the following with regards to lighting.

External Lighting - Outdoor lighting can affect neighbours. To reduce this impact:

A Lighting Impact Assessment must be submitted by a qualified lighting engineer. The assessment should look at:

- Sky glow (light pollution)

- *Glare (bright lights that cause discomfort)*
- *Light trespass (light shining into windows)*

Lighting must follow the rules for residential areas (Environmental Zone 3):

- *No more than 10 lux before curfew and 5 lux after curfew at windows.*
- *Use shielded lights, low-glare fittings, and timers to reduce impact.*

1.4 Structure of the Report

This report has been broken down into the following sections:

Section 2 – Outlines the relevant legislation, planning policy and guidance

Section 3 – Summarises the guidance for environmental zone classification and limiting parameters

Section 4 – Describes the assessment methodology and significance criteria

Section 5 – Contains the baseline lighting appraisal

Section 6 – Outlines the proposed external lighting for the proposed development

Section 7 - Provides an assessment of the potential night time effects of the site lighting on the sensitive receptors

Section 8 - Considers further mitigation proposals for the site

Section 9 - Considers the residual effects

Section 10 - Concludes the lighting impact assessment

1.5 Site Location

The Site lies on the northern edge of Royal Wootton Bassett, a market town in Wiltshire, located around 4.5 miles (7km) southwest of Swindon town centre and 11.5 miles (18.5km) northeast of Chippenham.

The site is situated directly to the north of Royal Wootton Bassett in Wiltshire, on a gently rising landform known locally as Church's Hill. It is bordered by the A3102 (Swindon Road) to the south, a private residence to the west, a commercial property to the east and rural farmland to the north. In conjunction with the allocated land to the west at Midge Hall Farm, the Site forms a natural extension to the northern urban edge of Royal Wootton Bassett.

The Site comprises a broadly rectangular shaped field covering approximately 6.50 hectares. The field is currently in agricultural use.

For further information refer to the Design and Access report.

2 Legislation, Planning and Policy Guidance

2.1 Legislative Background

Light pollution was introduced within the Clean Neighbourhoods and Environment Act (2005) as a form of statutory nuisance under the Environmental Protection Act (the 'EPA', 1990), which was amended in 2006 to include the following nuisance definition:

“(fb) artificial light emitted from premises so as to be prejudicial to health or nuisance.”

Although light was described as having the potential to cause statutory nuisance, no prescriptive limits or rules were set for impact assessment purposes. Guidance Notes for the Reduction of Obtrusive Light produced by the Institute of Lighting Professionals (ILP) has, therefore, been referred to for the purposes of this assessment.

Guidance produced by Defra, Statutory Nuisance from Insects & Artificial Light (2006) on s101 to s103 of the Clean Neighbourhoods and Environment Act (2005) has also been referred to which places a duty on local authorities to ensure that their areas are checked periodically for existing and potential sources of statutory nuisances - including nuisances arising from artificial lighting. Local authorities must take reasonable steps to investigate complaints of such nuisances from artificial light. Once satisfied that a statutory nuisance exists or may occur or recur, local authorities must issue an abatement notice (in accordance with s80(2) of the EPA 1990), requiring that the nuisance cease or be abated within a set timescale.

2.2 Planning Policy Context

The National Planning Policy Framework (NPPF) 2024 states that the purpose of the planning system is to contribute to the achievement of sustainable development and constitute the Government's view on what sustainable development in England means in practice for the planning system. Paragraph 198(C) states that with regard to artificial lighting, planning policies and decisions should:

“limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

2.3 Local Policy

Wiltshire Council Adopted Core Strategy (2015)

The site is located within the administrative boundary of Wiltshire Council. The Wiltshire Council Adopted Core Strategy (2015) contains Policy 51, which refers to the landscape character and the need to protect against intrusion from light pollution. See extracts below:

Policy 51 (Landscape) – Proposals need to demonstrate that the following aspects of landscape character have been conserved and where possible enhanced through sensitive design, landscape mitigation and enhancement measures:

Vii: Tranquillity and the need to protect against intrusion from light pollution, noise and motion.

Policy 57 refers to high quality design and placemaking, with reference to ensuring consideration is given to impacts from light pollution onto existing occupants, for example considering light intrusion. See extracts below.

Policy 57 (Ensuring high quality design and place shaping) – Applications for new development must be accompanied by appropriate information to demonstrate how the proposal will make a positive contribution of Wiltshire through:

Having a regard to the compatibility of adjoining buildings and uses, the impact on the amenities of existing occupants, and ensuring that appropriate levels of amenity are achievable within the development itself, including consideration of privacy, overshadowing, vibration, and pollution (e.g. light intrusion, noise, smoke, fumes, effluent, waste or litter)

Wiltshire Design Guide

The Wiltshire Design Guide (WDG), a Supplementary Planning Document (SPD), was formally adopted in by the Council in March 2024. The SPD sets out key expectations for new housing and mixed-use developments that respond to local priorities and expectations whilst maintaining regard to each of the 10 characteristics from the NDG. Underpinning their guidance are three “golden threads”: Health, Wellbeing and Community, Sustainability and Climate Resilience, and The right homes in the right places. The guide highlights that ‘*lighting should be sensitively designed to prevent light pollution*’.

2.4 International Guidance

Commission Internationale De L’Eclairage (CIE) 150: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (the ‘CIE 150’, 2017)

The purpose of CIE 150 is to aid in formulating guidelines for assessing the environmental effects of exterior lighting and to provide limits for relevant lighting parameters to control the obtrusive effects of exterior lighting to tolerable levels. CIE 150 also refers to the potentially adverse effects of exterior lighting on both natural and man-made environments.

CIE 126: Guidelines for Minimising Sky Glow (1997)

This document gives general guidance for lighting designers and policy makers on the reduction of sky glow. The report gives recommendations about maximum permissible values for exterior lighting installations. These values are regarded as limiting values. Lighting designers should strive to meet the lowest criteria for the design. Practical implementation of the general guidance is left to national regulations.

2.5 National Guidance

ILP Guidance Note for the Reduction of Obtrusive Light (GN 01/21)

The ILP has proposed lighting guidance and criteria for local authorities with a recommendation that these are incorporated at the local plan level. The ILP Guidance Notes define various forms of light pollution and describe a series of environmental zones. The ILP Guidance Notes provide suitable criteria against which the effects of artificial lighting can be assessed. This assessment has been based upon these criteria.

Institute of Lighting Professionals (ILP) (2013) PLG 04 Guidance on Undertaking Environmental Lighting Impact Assessments

The aim of this guidance is to outline good practice in lighting design and provide practical guidance on the production and assessment of lighting impacts within new developments.

Institute of Lighting Professionals (ILP) and Bat Conservation Trust (BCT) (2023) Guidance Note 08/ 23 Bats and Artificial Lighting At Night

This guidance document was jointly published in 2018 by the ILP and BCT, and subsequently updated in 2023. It is intended to raise awareness of the impacts of artificial lighting on bats, and mitigation is suggested for various scenarios.

3 Environmental Zone Classification and Parameters

All standards consulted in section 2 are nationally recognised documents, (some internationally, also) which deal with all design issues associated with external lighting.

3.1 Environmental Zoning

The CIE Standards, the CIBSE and the Society of Light & Lighting guidance documents all apply a common Environmental Zoning system, which is summarised in Table 3.1 below.

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/ Places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhibited rural areas. National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low District brightness (SQM 15 to 20)	Sparsely inhabited rural areas. Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural or urban settlements. Small town centres or suburban locations
E4	Urban	High district brightness	Town/City centres and other commercial areas with high levels of night-time activity

3.2 Obtrusive Light Limitation for Exterior Lighting Installations

The ILP Guidance Note for the Reduction of Obtrusive Light (GN 01/21) provide guidelines and threshold values applicable to each Environmental Zone, which are reproduced in tables 3.2 – 3.7 with associated notes.

Table 3.2 aims to address light intrusion by providing maximum values of vertical illuminance on properties. Limits apply to nearby dwellings, or potential dwellings, more specifically to their relevant surfaces or parts of surfaces, especially where windows are located. This parameter can also be considered for the management of spill light.

Table 3.3 aims to limit the luminous intensity of bright luminaires. It shows the maximum values for the luminous intensity of luminaires in designated directions where views of bright surfaces of luminaires are likely to be a nuisance to occupants of premises or from positions where such views are likely to be maintained, that is, not momentary or short-term.

Table 3.4 aims to limit the effects on transport systems, applying limits where users of road networks are subject to a reduction in the ability to see essential information.

Table 3.5 and Table 3.6 aim to limit the effects of sky glow. The limits in Table 3.5 represent the primary approach. The limits in Table 3.6 should only be considered in certain scenarios as described.

Table 3.7 aims to limit the effect of over-lit building facades and signs. For illuminated advertising signs the aim should be to achieve the limits advised in PLG05.

Table 3.2 Maximum values of vertical illuminance on properties

Light technical parameter	Application conditions	Environmental Zones				
		E0	E1	E2	E3	E4
Illuminance in 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
Note: * If the installation is for public (road) lighting then this may be up to 1 lx						

Table 3.3 Limits of the luminous intensity of luminaires in designated directions

Light technical parameter	Application conditions	Luminaire group (projected area A_P in m^2)					
		$0 < A_P \leq 0.002$	$0.002 < A_P \leq 0.01$	$0.01 < A_P \leq 0.03$	$0.03 < A_P \leq 0.13$	$0.13 < A_P \leq 0.50$	$A_P > 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	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	2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
	Geometric mean of diameter (cm)	3.2	7.1	14.1	26.3	56.6	>80
	Corresponding A_P representative area (m^2)	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 cutoff in the designated directions;
3. A_P 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 $A_P > 0.5$

Table 3.4 Maximum values of threshold increment and viewing direction in the path of travel

Light technical parameter	Road classification*			
	No road lighting	M6/M5	M4/M3	M2/M1
Veiling luminance [†] (L_v)	0.037 cd/m ²	0.23 cd/m ²	0.40 cd/m ²	0.84 cd/m ²
Threshold increment	15% based on adaption luminance of 0.1 cd/m ²	15% based on adaption luminance of 1.0 cd/m ²	15% based on adaption luminance of 2.0 cd/m ²	15% based on adaption luminance of 5 cd/m ²

Notes:

* Road classifications as given in CIE 115:2010

† The veiling luminance values specified in this table are based upon on a permissible TI value of 15%

Definitions:

TI The measure of disability glare (the reduction in visibility caused by intense light sources in the field of view) expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare.

L_v The luminance that would need to be superimposed on a scene in object space to reduce the scene's contrast by an amount equal to the added retinal illuminance from scattered light on the scene's retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view.

Table 3.5 Maximum values of upward light ratio (ULR) of luminaires

Light technical parameter	Environmental Zones				
	E0	E1	E2	E3	E4
Upward light ratio (ULR)/%	0	0	2.5	5	15

Note:

1. This is the primary approach to limit skyglow and is suitable to compare different single luminaires and mitigate the contribution of each luminaire within an installation.
2. This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow.
3. Some lighting schemes will require the deliberate and careful use of upward light, e.g. ground recessed luminaires, ground mounted floodlights and festive lighting, to which these limits cannot apply. However, care should always be taken to minimise any upward waste light by the proper application of suitably directional luminaires and light controlling attachments.

Table 3.6 Maximum values of upward flux ratio of installation (of four or more luminaires)

Light technical parameter	Type of installation	Environmental Zones				
		E0	E1	E2	E3	E4
Upward flux ratio (UFR)/%	Road	n/a	2	5	8	12
	Amenity	n/a	n/a	6	12	35
	Sports	n/a	n/a	2	6	15

Notes:

- *The table allows the effect of both direct and reflected upward components of a whole installation to be considered. The factor being the upward flux ratio (UFR).*
- *n/a within the table denotes that lighting of this type is not usually expected within these zones*
- *This should only be considered where an installation consists of four or more luminaires that form an installation with a defined performance requirement or specialised fauna growth lighting systems (such as those use to promote grass growth in sports stadia) and is in proximity to:*
 - *Optical observatories*
 - *Lies within dark (E1) zones which abuts a protected (E0) dark sky zone*
- *The effect of distance must be considered which is a factor of the artificial lighting installation size. A small lighting installation will have an effect on an optical observatory 30km away whereas a large lighting installation of many luminaires will have an effect from a greater distance up to 100km. Specific guidance is given in CIE126 and CIE150.*
- *All external surfaces will have varying reflectance depending upon their condition and climatic conditions (wet, dry, frost etc,) as well as their varying angles, therefore the level of uncertainty in any assessment may be considerable.*
- *Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULP and UFR.*
- *Light emitted just above the horizontal in a zone between 90° and 110° is extra critical for sky glow in large open areas around observatories. An additional measure in these areas limits the luminous intensities ($I_{90} - I_{110}$) as follows:*
 - *between 90° and 100° $< 0.5 \text{ cd}/1000\text{lm}$;*
 - *between 100° and 110° 0 cd.*
- *All proposed luminaires must have been photometrically measured so that results can be verified for Gamma angles 0 to 180°*

Table 3.7 Maximum permitted values of average surface luminance (cd/m²)

Light technical parameter	Application conditions	Environmental Zones				
		E0	E1	E2	E3	E4
Building façade luminance (L_b)	Taken as the product of the design average illuminance and reflectance divided by π	< 0.1	< 0.1	5	10	25
Sign luminance (L_s)	Taken as the product of the design average illuminance and reflectance divided by π , or for self-luminous signs, its average luminance	< 0.1	50	400	800	1000

Note:

The values apply to both pre- and post-curfew, except that in zones 0 and 1 the values shall be zero post curfew. The values for signs do not apply to signs for traffic control purposes.

For illuminated advertising signs the aim should be to achieve the limits advised in PLG05

4 Assessment Methodology and Significance Criteria

4.1 Scope of Assessment

The extent of the study area for this assessment includes the Site and its immediate surroundings and the key sensitive receptors which may be subject to a change in the existing lighting conditions. Sensitive receptors may include local residents, ecological receptors, dark skies, the night-time amenity, and road users.

The existing baseline conditions on site and in the surrounding area have been assessed by a desktop review only.

An outline external lighting strategy has been prepared for the planning application stage of the development which details the types of lighting proposed in each area, with details of the parameters of the proposed luminaires. This strategy forms the basis of the assessment. A detailed design has not been prepared at this stage but will be prepared in accordance with this strategy and the parameters outlined at the Reserved Matters Stage.

Night-time visual impacts are not included in the scope of this report, refer to the LVA for further detail.

4.2 Impact Assessment and Significance Criteria

The effect attributed to each impact has been based on the magnitude of change as a result of the Proposed Development. The criteria used to assess the effects of artificial lighting has been derived from the Institute of Lighting Professionals (ILP) (2021) Guidance Notes for the Reduction of Obtrusive Light and PL04 Guidance on Undertaking Environmental Lighting Impact Assessments and is shown in Tables 4.1 - 4.4.

This methodology assesses potential impacts on receptors sensitive to light associated with the Proposed Development in comparison with the existing baseline conditions. The approach to this impact assessment is outlined below:

- The nature of a receptor (receptor/ resource sensitivity) was classified as either high, medium, or low based on the criteria shown in Table 4.1;
- The potential magnitude of impact is described as high, medium, low or negligible based on the criteria shown in Table 4.2;
- The classification of effects associated with the Proposed Development are then assessed as major, moderate, minor, or negligible, in accordance with the matrix shown in Table 4.3; and
- These effects are then described as significant or not significant according to the definitions set out in Table 4.4.

4.2.1 Sensitivity of a Receptor

There is currently no specific guidance on determining the sensitivity of a receptor in terms of lighting impact. Therefore, for the purpose of this assessment it has been based on the descriptions shown in Table 4.1.

When considering natural resources/ receptors such as the effect on an area in terms of sky glow, it is deemed appropriate to assign sensitivity based on the current baseline conditions

and Environmental Zone, with the highest sensitivity being applied to an E0 intrinsically dark zone, and the least to an E4 urban zone.

The Environmental Zones are defined in Table 3.1 and the classification of sensitivity of natural resources / receptor will correspond to each Environmental zone as shown in Table 4.1 below.

For other receptors such as residential receptors the description will be used to determine sensitivity.

Table 4.1 Sensitivity Criteria

Sensitivity	Description of Criteria
High	The receptor/ environment is fragile, and has limited capability to accommodate change in artificial light conditions without fundamentally altering its present state or character, or is of international or national importance. Recovery would be difficult or impossible. 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 dramatically improve or reduce safety (for pedestrians, drivers or workers). Natural Receptors i.e., Artificial Sky Glow – Sensitivity of receptor based on assigned Environmental Zone – E0 or E1 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	The receptor/ environment has moderate ability to accommodate change in artificial light conditions without significantly altering its present state/ character. The receptor/ environment has a degree of adaptability and resilience and is likely to accommodate the changes caused by an impact, although there may still be some residual modification as a result. 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). Natural Receptors i.e., Artificial Sky Glow – Sensitivity of receptor based on assigned Environmental Zone – E2 Ecological – where a change in the lighting affects the movement or feeding patterns of fauna but the receptor can adapt.
Low	The receptor/ environment is tolerant of and can accommodate change in artificial light conditions without detriment to its character, or is of low or local importance. The receptor/ environment is adaptable and is resilient to change. Nearly all impacts can be absorbed within it without modifying the baseline conditions. 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). Natural Receptors i.e., Artificial Sky Glow – Sensitivity of receptor based on assigned Environmental Zone – E3 or E4 Ecological – area with limited wildlife.

4.2.2 Magnitude of Impact

The impact magnitude is considered to be a function of extent, duration, frequency and reversibility, and these aspects have been considered in the criteria. The criteria described in Table 4.2 have been used.

Table 4.2 Magnitude of Change Criteria

Magnitude of Change	Description
High	Significant deterioration/ improvement in local conditions or circumstances. A large change compared to the natural variations in background levels. A clear breach of limits and standards may occur. For example, levels of obtrusive light in the form of sky glow, light trespass or glare towards a receptor which exceeds the limits set within the ILP guidance for a higher environmental zone might classify as a high magnitude of change. For example, for ecological receptors levels of illuminance predicted in designated dark zones far exceed the levels recommended by current ILP/BCT guidance.
Medium	Readily apparent change in conditions or circumstances. Change which is noticeable and may be a breach of limits and standards. 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. For example, for ecological receptors levels of illuminance predicted in designated dark zones slightly exceed the levels recommended by current ILP/BCT guidance.
Low	Perceptible change in conditions or circumstances.
Negligible	No discernible change in conditions or circumstances

4.2.3 Classification of Effects

The classification of effects associated with the Proposed Development are then assessed as major, moderate, minor, or negligible, using the matrix shown in Table 4.3 as a guide:

Table 4.3 Classification of Effects

Sensitivity of Receptor	Magnitude of Change			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor to Negligible
Medium	Major	Moderate	Minor to Moderate	Negligible
Low	Moderate	Minor to Moderate	Negligible	Negligible

4.2.4 Significance Criteria

The threshold values stated in the obtrusive light standards and guidance (refer to 3.2) aim to control obtrusive light by limiting:

- the illumination on surrounding properties, referred to as light intrusion, and limited by the vertical illuminance measured typically at the window of a neighbouring property;
- bright luminaires in the field of view, referred to as glare, and limited by the luminous intensity in designated directions;
- sky glow, limited by upward light ratio (ULR) and upward flux ratio (UFR); and
- the effects of over lit building facades and signs, limited by the average luminance on the surface.

These parameters form the primary basis for considering potential effects from artificial lighting and defining the effect criteria (refer to Table 4.4). However, this assessment also gives consideration to light spill, 'over' lighting, energy consumption and the effect on flora and fauna, as these are also identified as being of environmental concern with regard to lighting installations.

These factors are described in more detail below.

Light Intrusion (into windows)

Light intrusion is light that impacts on to a surface outside of the area designed to be lit by the installation concerned. It is somewhat subjective because it is difficult to define when, where and how much light is unwanted. An example of light intrusion is when spill light from a streetlight enters a window and illuminates an indoor area. The ILP guidance specifies limits for light intrusion entering windows in terms of environmental zones. The values in the table are the suggested maximum and need to also take into account the existing light intrusion at the point of measurement. Light intrusion is measured in illuminance on the vertical plane. Other forms of light intrusion are not specifically limited in the guidance, however it is becoming increasingly common to assess light spill at the boundary of a development, especially in ecologically sensitive areas.

Light spill

Light spill, sometimes referred to as stray light, is light emitted by a lighting installation, which falls outside the boundary of the property on which the installation is sited. This is usually measured in illuminance on a horizontal plane.

Glare

Glare is the uncomfortable brightness of a light source against a darker background. It can cause discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or to extreme contrasts.

The ILP guidance sets limits for the luminous intensity in designated directions for each luminaire in a potentially obtrusive direction, outside of the site being lit, in an attempt to control glare. It should only be applied to viewing directions that are likely to cause discomfort or disability glare. The guidance suggests that glare should be minimised by ensuring that the

main beam angle of all lights directed towards any potential observer is not more than 70 degrees.

Sky Glow

Sky glow is the brightening of the night sky caused by outdoor lighting and natural atmospheric and celestial factors. Outdoor lighting contributes to sky glow by producing light that is either emitted directly upward by luminaires or reflected from the ground. This light is then scattered by dust and gas molecules in the atmosphere, producing a luminous background. The part of the sky glow which is attributed to man-made sources of luminous radiation is called Artificial Sky Glow. (Note: this assessment considers the impact of artificial sky glow only)

A major effect of sky glow at night is to reduce contrast in the sky. It has the effect of reducing one's ability to view the stars. This is the most pervasive form of light pollution and can affect areas many miles from the original light source.

Sky glow is highly variable depending on immediate weather conditions, quality of dust and gas in the atmosphere, amount of light directed skyward, and the direction from which it is viewed.

Measuring and predicting sky glow from artificial lighting is a very challenging task due to the number of factors involved. Sky glow caused by artificial light can be minimised by limiting the upward light output of luminaires used in a lighting installation, and limiting the amount of reflected light from the installation by considering the levels of illuminance provided to the areas being lit, and reflectance of surfaces being lit and in the immediate surrounding areas.

Building and Signage Luminance

Building and signage luminance should be limited to avoid 'over' lighting and to relate to general district brightness. Building luminance is applicable to buildings directly illuminated as a night time feature as opposed to the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

Building and Signage Luminance is not applicable to this installation.

Over' Lighting

'Over' lighting is when an area is lit to a higher level of illuminance than the task/use requires. It is identified by the ILP guidance as being a major cause of obtrusive light and for wasting energy. Good design practice and adherence to the published lighting standards prevents 'over' lighting areas, which in turn helps to minimise upward reflected light.

Energy Consumption

Consideration should be given to the energy efficiency of the existing lighting installed on site and to minimising the energy consumption of any proposed lighting. Energy efficient luminaires, light sources and lighting controls should be selected.

The Effect on Flora and Fauna

Liaison with the project ecologist is required to identify any light sensitive receptors in terms of flora and fauna, so an assessment of the effect can be established.

Table 4.4 Significance Criteria

Nature	Level of Significance	Descriptions	Remedial Needs
Positive	Major / substantial beneficial effects (Significant)	Substantial reduction in obtrusive light at sensitive receptors such that large scale improvements to visual amenity, human safety or health is delivered, with a noticeable or major improvement in baseline conditions. Significantly improves ecological habitats.	None
	Moderate beneficial effects (Significant)	Moderate reduction in obtrusive light at sensitive receptors such that noticeable improvements to visual amenity, human safety or health are delivered, resulting in moderate improvement to in current baseline conditions. Improves ecological habitats.	
	Minor beneficial effects (Not Significant)	Minor reduction in obtrusive light at sensitive receptors such that perceptible improvements to visual amenity, human safety or health is delivered, resulting in perceptible improvement to in current baseline conditions. Perceptible improvement to ecological habitats.	
Neutral	None / negligible (Not Significant)	No appreciable effect on sensitive receptors, and effects are within the recommended ILP guidance levels for the environmental zone, and/ or overall effects balancing out, resulting in a negligible or barely discernible change to current baseline conditions.	None
Negative	Minor adverse effects (Not Significant)	Minor increase in obtrusive light at sensitive receptors which are slightly above recommended CIE guidance levels but where current uses could still be maintained, such as an increase in Glare, Light Trespass to properties, increase in Sky Glow or effects on flora and fauna. Resulting in a perceptible change in baseline conditions.	Develop appropriate levels and type of mitigation
	Moderate adverse effects (Significant)	Moderate increase in obtrusive light at sensitive receptors such as an increase in Glare, Light Trespass to properties, increase in Sky Glow or effects on flora and fauna. Requires monitoring and local remedial work. For example, lighting which is visible and causes nuisance to a sensitive receptor outside the Application Site. Resulting in a noticeable change in baseline conditions.	
	Major adverse effects (Significant)	Major increase in obtrusive light at sensitive receptors such as an increase in Glare, Light Trespass to properties, increase in Sky Glow or effects on flora and fauna. Requires extensive remedial works. For example, a floodlighting installation which directs light into the eyes of oncoming motorists causing disability glare and potential reduction in visual performance leading to an increased risk of collision. Resulting in a major effect on baseline conditions.	

5 Environmental Baseline

5.1 Baseline Lighting Conditions

The Application Site is currently unlit agricultural land. The site is situated directly to the north of the town of Royal Wootton Bassett in Wiltshire.

It is bordered by the A3102 (Swindon Road) to the south with the adjacent section of road currently unlit. It is bordered by a private residence known as Elmcroft House to the west, a commercial property to the east, and rural farmland to the north.

In the consultation response received from the council the site has been confirmed to be considered within Environmental Zone E3 (refer to table 3.1), in accordance with a medium district brightness area.

A review of the Light Pollution and Dark Skies (Night Blight) sky brightness mapping provided by CPRE shows that the site (shown approximately by a red dot) is located in the 4th brightest colour band, with the brighter area of Royal Wootton Bassett to the south and west and with the industrial areas of Swindon to the north east. Refer to figure 4.1.

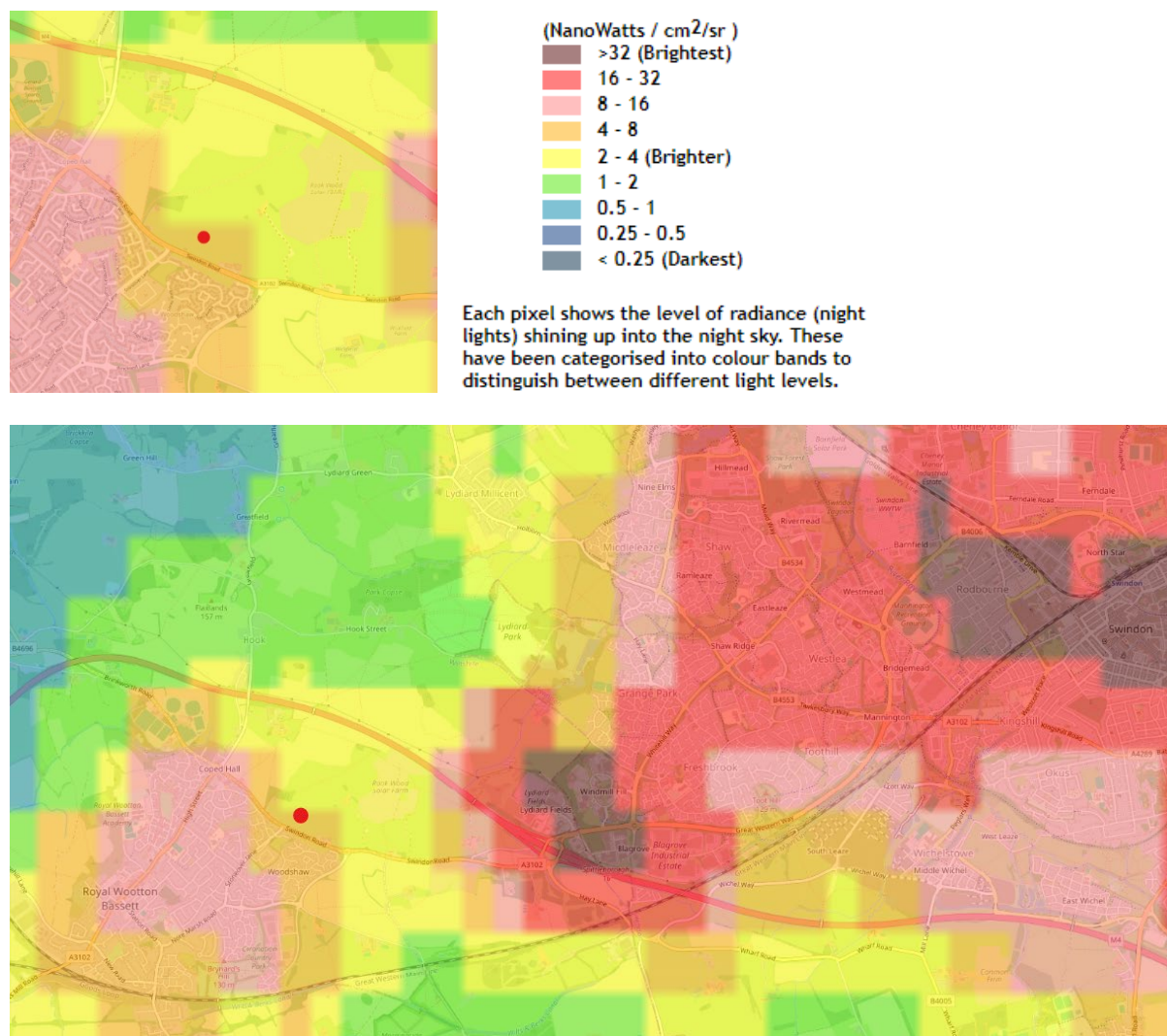


Figure 5.1: shows an extract from the CPRE Light Pollution and Dark Skies mapping for the Application Site and surrounding area. (Reference: <https://www.nightblight.cpre.org.uk/maps/>)

5.2 Ecological Receptors

Bat species recorded within the Site that are considered to be particularly sensitive to light comprised Myotis species, long-eared species, lesser horseshoe bat and barbastelle.

Myotis species and long-eared bat activity was recorded at all static detector positions, with the highest levels of activity recorded on the northern boundary of the Site for Myotis species and on the eastern boundary of the Site for long-eared species.

Lesser horseshoe bat activity was very low and was recorded on the southern and eastern boundaries of the Site. Barbastelle activity was also very low and was recorded on the northern and southern boundaries. The Site is not considered to be a core commuting or foraging location for either species.

A 5m wide dark corridor is proposed to the northern boundary, with levels of illuminance to be maintained at <0.5 lux.

For further information refer to the Ecological Impact Assessment report prepared by EAD Ecology.

5.3 Residential Receptors

The only neighbouring residential receptor is Elmcroft House to the west, with the closest elevation of the main building being approximately 20m from the site boundary, and a smaller building being approximately 14m from the site boundary. This property is enclosed by a semi-mature woodland copse of mixed tree species.

Residential Properties to the south are at least 30m or more from the site boundary, with vegetation screening along Swindon Road, and vegetated green spaces to the south of Swindon Road providing further screening.

6 Proposed Lighting

6.1 Construction Phase

The primary reasons for lighting provision within the construction site will be for health and safety and security requirements.

The sources of artificial light that have been assumed to be present during the construction phase are:

- Temporary floodlighting particularly during winter months;
- Floodlighting and security lighting associated with site access, on-going work areas, temporary car parking areas and on the exterior of construction compounds;
- Lighting at height associated with construction of structures;
- Interior lighting within any temporary office units within any construction compounds.
- Crane warning lights.

The working hours for construction are anticipated to be typical industry hours (i.e. 08:00 to 18:00 Monday to Friday and 09:00 to 13:00 on Saturday). It is assumed there will be no working on Sundays or Bank Holidays. Therefore, it is likely that temporary sources of artificial lighting will be required to enable the safe continuation of works in the early morning and late afternoons during the winter months when working hours fall within the hours of darkness. Lighting associated with the construction works is assumed to be temporary and intermittent in nature. It is assumed that some level of security lighting will be required at all times during the hours of darkness.

6.2 Operational Phase – Proposed Lighting

The external lighting scheme proposed is intended to be as minimal and sensitive as possible, whilst providing lighting to adoptable standards to the S38 roads and footpaths, in accordance with Wiltshire County Council's requirements.

The external lighting for the proposed development will be designed in accordance with industry standards, guidance and recommendations in order to provide an adequate level of illuminance for security, safety and amenity throughout the site, whilst minimising light pollution, obtrusive light, over-lighting, and impacts to ecological receptors.

The sources of lighting for the operational phase of the proposed development will be as follows:

- Street lighting to the S38 roads and footpaths throughout the site;
- Lighting to private roads and parking areas, if required;
- Lighting to residential building entrances/ exits.

Consideration has not been given to any S278 access lighting requirements at this stage.

6.2.1 Recommended Lighting Levels

Typically recommended lighting levels for a residential development would be derived from industry standards, guidance and recommendations in order to provide an adequate level of illuminance for security, safety and amenity throughout the site. Standards and guidance consulted would normally include:

- BS 5489-1: Code of practice for the design of road lighting. Lighting of roads and public amenity areas, 2013
- BS EN 13201: Road lighting
- Secured by Design New Homes

The design standards recognise road lighting in three classes; traffic routes where the needs of the driver are dominant, subsidiary roads where the lighting is primarily intended for the pedestrian and the cyclist, and urban centres, where the lighting is designed to enhance public safety and security, while also providing an attractive night time environment (SLL Lighting Handbook). The photometric recommendations for all types of road lighting in the UK are given in BS EN 13201: Part 2. Advice on implementation of these recommendations is given in BS 5489-1.

The various roads within the site will be designed in accordance with these recommendations and Wiltshire County Council's specification and requirements.

The road lighting classifications for the site will be agreed with Wiltshire County Council at the technical design stage. The required lighting class for the residential roads is expected to be a P4 class, which requires 5 lux average illuminance and 1 lux minimum.

6.2.2 Strategy for Luminaire Type and Light Source

The luminaires selected for the street lighting throughout the development will be provided in accordance with Wiltshire Councils specification. Luminaires to the residential roads will be mounted on 5m or 6m columns depending on the road widths.

The street lighting luminaires will have good light control and cut off angles to reduce light spillage, control glare and limit sky glow. The Upward Light Output Ratio of the street lighting luminaires will be 0%. The street lighting luminaires selected will have a warm white colour temperature, expected to be 3000K in most areas, with the option to reduce to 2700K in ecologically sensitive areas in accordance with Wiltshire County Council's specification.

For any roads or turning heads that are positioned to the edge of the development, street lights and bollard lighting will be positioned wherever possible, so that they are orientated in towards the site with back shields utilised, to limit lighting impacts.

Where low level lighting is proposed within the site, to any of the private roads or parking areas, this will consist of specialist downward directional low level bollard luminaires, 1m approx. height, with either a single sided light distribution, or a symmetrical distribution that is provided with the option of a 180 degree shield, so that light can be directed away from the northern dark corridor, or any unlit areas of the site.

The specified luminaires selected at the detailed design stage will comply with the requirements for an E3 Environmental Zone, with <5% ULR, to limit upward light output.

6.2.3 External Luminaire Control Strategy

It is expected that the S38 adoptable street lighting to the residential roads will operate on a dimming profile, whereby the streetlights will dim for periods during the night, subject to Wiltshire Councils requirements. (Current protocol is that luminaires operate at 100% output from Dusk till 8pm, 75% output from 8pm-11pm, 50% output from 11pm- 6am, 100% output from 6am-Dawn.)

Any bollard lighting, if required, is expected to be privately managed and operate dusk till dawn, via a time switch and photocell, so that times of operation can be reduced if required.

Luminaires provided to the residential properties will operate via PIR's (movement detectors) on short 1-2 minute timers, to limit their impact on the environment and ecological receptors.

6.2.4 Mitigating Lighting Impacts on Ecological Receptors

The site is ecologically sensitive, with light sensitive bat species present. Refer to section 5.2 for further detail. A 5m wide dark corridor will be provided to the northern site boundary.

Light spill from the proposed development into the dark corridors will be to be limited to <0.5 lux horizontally at ground level, and vertically up to 2m in height.

Levels of illuminance from lighting within the site will be limited to the required parameters by adopting a lighting strategy that includes some or all of the parameters/mitigation measures listed below. Measures are included to limit spill from both internal and external lighting.

Separate detailed analysis and assessment will be required for the development at the detailed submission/ Reserved Matters stage to ensure that light spill from street lighting, external lighting and internal light spill from buildings will meet these ecological requirements.

These measures are derived in accordance with the latest Bats and Lighting Guidance (ILP/ BCT Guidance Note 08/23).

- No artificial lighting to be proposed within the northern green spaces or dark corridor, including to the standalone footpaths in this area.
- Careful consideration to be given to the locations of the residential roads within the site and their hierarchy. Private roads/drives may be required to be located to the northern edge of the development, as these areas can be left un-lit, or be provided with lower levels of illuminance, and luminaires with lower mounting heights than Section 38 adoptable standards will require.
- Street lighting luminaires with either back shields, or a narrow optic designed for the road width, may be used to limit light spill into the proposed dark corridor.
- External lighting adjacent to the dark corridors to be carefully positioned, limited in number, and to operate by PIR (movement) detectors with short 1-2 minute timers.
- Luminaires adjacent to the dark corridors will be selected to be downward directional (0% ULR) with good light control and cut off angles to limit light spill into the proposed dark corridor.
- It is expected that the street lighting will operate on a dimming regime, refer to section 6.5, which will further reduce its impact.

- All external lighting is proposed to utilise LED lights sources, therefore emitting no UV light, and will have warm white colour temperatures of 2700K or less. This is with the exception of the S38 street lighting which will require a colour temperature of 3000K in accordance with Wiltshire County Council's requirements in most areas, with the options to reduce to 2700K in ecologically sensitive areas.
- Careful consideration to be given to the locations and orientations of proposed dwellings located adjacent to the proposed dark corridor . Where possible these should be positioned with their gable end elevation facing the dark corridor. Where the front elevations of any proposed dwellings face the dark corridor, sufficient offsets will be required between the two.
- If required, recessed lighting should be provided in dwellings facing the proposed dark corridor. Typically, downlight luminaires used, and sold for use, in residential properties will have beam angles of 30-40 degrees. The recessed nature of downlights, and smaller beam angles reduces light spill, compared with pendant luminaires.
- Consideration may also be given to window locations, head heights and size, to reduce impacts from internal light spill into the proposed dark corridor.
- Additional screening in the form of hedgebanks, hedgerows and/or fencing may be provided as necessary to further screen light spill to the dark corridor.

7 Assessment of Impacts

7.1 Construction Phase

Construction impacts are temporary in their nature, however prior to mitigation there is potential for the development to result in adverse effects. Mitigation and residual effects are further discussed in Sections 8 and 9.

7.2 Operational Phase

The site is assumed to be classified as Environmental Zone E3, with the proposed lighting for the site being assessed in accordance with the limiting criteria for that zone, refer to Table 3.1, in order to limit obtrusive light and light pollution to an acceptable level.

Light Pollution

The upward light ratio (ULR) of the installation based on the strategy outlined will be within the requirements for an E3 Environmental Zone. The obtrusive light guidance allows for 5% ULR in an Environmental Zone E3, however is expected that the lighting installation will have a much lower ULR as the street lighting will have 0% upward light output, and any building mounted lighting adjacent to the northern dark corridor will be downward directional with 0% ULR to meet the ecological requirements.

The effect in terms of light pollution is considered to be negligible, as the natural receptor sensitivity is low, with a low magnitude of change predicted, as the limits set for ULR in an E3 Environmental Zone will be met and actually improved upon.

Obtrusive Light and Residential Receptors

The obtrusive light guidance states that Light Intrusion into windows (vertical illuminance) should be limited to 10 lux pre curfew and to 2 lux post curfew, in Environmental Zone E3.

In terms of light intrusion, considering the distance between any lit areas proposed within the site to neighbouring residential receptors, refer to section 5.3, and the types of lighting proposed, there is no potential for light spill from the installation on to any existing neighbouring residential properties to be above the limits of an E3 Environmental Zone.

The limits for luminaire intensity apply to luminaires situated in potentially obtrusive directions outside of the area being lit. The luminaires proposed will be downward directional, and have defined cut-off angles, therefore the requirements for Environmental Zone E3 in terms of luminaire intensity and glare will be met by the final design in accordance with this strategy. Considering the proximity to the neighbouring residential properties, the lighting types specified, and based on the illustrative masterplan there is no potential for these values to be exceeded.

The residential receptors identified are considered to be low sensitivity, with a low magnitude of change resulting from the development, as the limits set for lighting in an E3 Environmental Zone will be met, resulting in a negligible effect.

Ecological Receptors

The proposed dark corridor along the northern boundary will be achieved by the provision a lighting scheme in accordance with the parameters and mitigation measures as outlined in

Section 6. Detailed calculations, including lux contour plans, will be provided as part of the detailed/ Reserved Matters submission to demonstrate that the dark corridors will remain dark.

For further information refer to the Ecological Impact Assessment report prepared by EAD Ecology.

Overall

It can be concluded that the lighting scheme will have Negligible Effect/ Not Significant. The lighting installation for the proposed development will meet the requirements for an E3 Environmental Zone, considering sky glow, light trespass and glare.

8 Mitigation Measures

8.1 Construction Phase

Mitigation of the effects of the lighting installation during the construction phase will include:

- No lighting to be sited within any proposed dark corridors or landscape buffers.
- Specifying working hours, uses of lighting, location of temporary floodlights and construction compound and agreeing these with the local council
- Lighting to be switched off when not required specifically for construction activities or required for health and safety or security
- Glare will be minimised by ensuring that the main beam angle of all luminaires are directed away from any potential observer into the centre of site wherever possible, and angled at less than 70 degrees from the horizontal
- Light spill will be minimised by avoiding poorly sited luminaires located at the boundary of the development
- Sky glow will be minimised by using modern flood lights with good photometric control, angled at less than 70 degrees from the horizontal and by using additional shields as appropriate
- The selection of luminaires, including those required for night-time security, that are designed to minimise any obtrusive light

These measures will form part of a Construction Environmental Management Plan.

8.2 Operational Phase

Mitigation of the effects of the lighting installation during the operational phase will be achieved by providing the lighting in accordance with the strategy outlined in this report.

No additional mitigation is considered necessary beyond that inherent in the lighting design.

9 Residual Effects

9.1 Construction Phase

It is predicted that following implementation of the mitigation measures outlined in section 8, overall there will be a minor adverse residual effect of lighting at the construction phase.

9.2 Operational Phase

There are no significant residual effects predicted for the operational phase of the Proposed Development.

10 Conclusion / Summary

The external lighting scheme proposed is intended to be as minimal and sensitive as possible, whilst providing lighting to adoptable standards to the S38 roads and footpaths, and to other key areas. The external lighting and street lighting proposed for the development will be designed in accordance with industry standards, guidance and recommendations in order to provide an adequate level of illuminance for security, safety and amenity throughout the site, whilst limiting obtrusive light, over-lighting, energy consumption and impacts to ecological receptors.

The site has been assessed as Environmental Zone E3, with lighting proposed to be provided as a minimum, in accordance with the lighting parameters for this zone. Mitigation measures are also proposed to minimise the impacts to ecological receptors.

In summary, it is our considered opinion that by the use of a well-designed lighting strategy, adopting the criteria, parameters and mitigation measures outlined in this report, that the impact from the proposed development on sensitive receptors in terms of lighting will not be significant.

It is anticipated that separate detailed analysis, including lighting calculations and assessment will be provided at the reserved matters application stage based on the detailed proposals to demonstrate that light spill from street lighting, external lighting and internal light spill from buildings will meet the ecological requirements outlined.



Lighting Terminology and
Abbreviations

APPENDIX A

Lighting Terminology and Abbreviations

Glossary of Terms

For the purpose of this report, the definitions given below apply. For further definitions the International Lighting Vocabulary (ILV), published by the CIE, can be found at <http://eilv.cie.co.at/>

Colour Rendering Index (CRI): A scale of the colour appearance of an object under a particular light source compared to its colour appearance under a reference light source. Expressed on a scale of 1 to 100 Ra, where 100 Ra represents the colour rendering of natural daylight i.e. perfect colour.

Curfew: The time after which stricter requirements (for the control of obtrusive light) will apply; often a condition of use of lighting applied by a government controlling authority, usually the local government (CIE, 2003).

Disability Glare: Glare which impairs the vision of objects but may not cause discomfort.

Discomfort Glare: Glare causing discomfort which may not impair the ability to see objects.

Environmental Zones: Area where specific activities take place or are planned and where specific requirements for the restriction of obtrusive light are recommended. Zones are indicated by the zone rating (E1... E4) (CIE, 2003).

Illuminance: Illuminance is the quantity of light, or luminous flux, falling on a unit area of a surface. It is designated by the symbol E. The unit is the lux (lx). One lux equals one lumen per square metre (lm/m²).

Horizontal Illuminance: Illuminance incident on a horizontal surface or calculation plane.

Vertical Illuminance: Illuminance incident on a vertical surface or calculation plane.

Isolux Diagram: A diagram showing lines joining points of equal illuminance. Sometimes also referred to as Isolines.

Light Pollution: The spillage of light into areas where it is not required.

Light Intrusion: Light that impacts on a surface outside of the area designed to be lit by a lighting installation.

Obtrusive Light: Spill light which because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information (CIE, 2003).

Photocell: A unit which senses light to control luminaires.

Residential Property: Land upon which a dwelling exists (CIE, 2003).

Sky Glow: The brightening of the night sky caused by artificial lighting resulting from the reflection of radiation (visible and non-visible), scattered from the constituents of the atmosphere (gas molecules, aerosols and particulate matter), in the direction of observation. It comprises two separate components as follows:

(a) *Natural sky glow* - That part of the sky glow which is attributable to radiation from celestial sources and luminescent processes in the Earth's upper atmosphere.

(b) *Man-made sky glow* - That part of the sky glow which is attributable to man-made sources of radiation (e.g. outdoor electric lighting), including radiation that is emitted directly upwards and radiation that is reflected from the surface of the Earth (CIE, 2003).

Spill Light (Stray Light): Light emitted by a lighting installation which falls outside the boundaries of the property for which the lighting installation is designed (CIE, 2003).

Upward Light Ratio: The maximum permitted percentage of luminaire flux for the total installation that goes directly into the sky.

Abbreviations

CIBSE	Chartered Institute of Building Services Engineers
CIE	International Commission on Illumination
CNEA	Clean Neighbourhoods and Environment Act
ILP	Institute of Lighting Professionals
SLL	Society of Light and Lighting



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