DFL

· LIGHTING DESIGN · ELECTRICAL · SMART CITIES ·
ENERGY REDUCTION · LIGHTING IMPACT

TREVOR BASIN, WREXHAM

LIGHTING IMPACT ASSESSMENT (INC LIGHTING STRATEGY)

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Designs for Lighting (DFL) is a business built on successfully collaborating with our clients. We have over 20 years proven experience in our industry, listening to the challenges our clients face, developing the best solutions and being innovators in our specialism. Our role is to find the most effective and sustainable outcome to enhance and support your projects. We proudly work with recognised industry bodies to promote and shape the future of the industry and ensure our staff are trained to exceed the required competency levels of our industries. Above all, we ensure each project delivers against our values.



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1. INTRODUCTION

1.1. Executive Summary

1.1.1. This Lighting Strategy has been written by DFL (Designs for Lighting Ltd[1]), a lighting design consultancy specialising in Lighting Impact Assessments, obtrusive light mitigation, and detailed lighting design.

1.1.2. The Lighting Strategy proposes good practice and outlines a suitable approach for the proposed lighting at Trevor Basin, Wrexham, for the purpose of safety, security and wayfinding . The lighting strategy is intended to set out a minimally obtrusive approach to the lighting, whilst ensuring it is necessary and considers the sensitivity of nearby human, environmental and ecological receptors.

1.1.3. Lighting associated with the Proposed Development will comply with relevant British Standards and Institution of Lighting Professionals (ILP) guidance to ensure obtrusive light is minimised in accordance with best practice.

1.1.4. The proposed development consists of a new quayside location for the canal boats with a tuning fork styled docking space with a hire boat business premises, car park, fuel storages and landscaping arrangements.

1.1.5. This report outlines the following:

- Relevant obtrusive light policies in direct relation to the Proposed Development;
- Relevant National and Local Policies;
- Why the Proposed Development requires artificial lighting; and
- Details as to how lighting will be implemented for the Proposed Development.

1.1.6. It has been identified that the Application Site is set within a sparsely inhabited rural area (E2) as stated in ILP Guidance Note GN01/21 with Trevor to the north and Cefn-mawr to the east however the south and west are currently open fields. The Proposed Development is currently within a designated World Heritage Site.

1.1.7. Through careful design and mitigation, this Lighting Strategy ensures the lighting installation at the proposed development will be in accordance with British Standards, Guidance and Local Policy.

1.1.8. The original planning permission submission document included the following planning condition:

‘Prior to first use of the development, an external lighting scheme shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall:

[1] https://www.dfl-uk.com/about/

a) identify those areas and features on site that are particularly sensitive for wildlife and that are likely to cause disturbance in or around their foraging or commuting routes; and

b) indicate where external lighting will be installed and the type of lighting to be used

The scheme shall relate to all parts of the application site and buildings and be of low level, microLED only. The scheme as is approved shall be fully implemented in strict accordance with the details as are approved and no other external lighting shall be installed on any part of the site.'

1.1.9. The reason provided by Wrexham County Borough Council for including this condition is:

'To protect named species/habitats/biodiversity which would otherwise be damaged/lost by the development hereby permitted, and to conserve the AONB's dark sky and nocturnal wildlife in accordance with UDP Policies GDP1 and EC6'

2. LEGISLATIVE FRAMEWORKS AND NATIONAL POLICIES

2.1. 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:

"The following matters constitute "statutory nuisances" for the purposes of this Part, that is to say— [....]

[....] artificial light emitted from premises so as to be prejudicial to health or a 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".

2.2. Planning Policy Wales (PPW) Edition 12 (February 2024)

2.2.1. The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation and resultant duties such as the Socio-economic Duty. A well-functioning planning system is fundamental for sustainable development and achieving sustainable places.

'6.8 Lighting:

6.8.1 "There is a need to balance the provision of lighting to enhance safety and security to help in the prevention of crime and to allow activities like sport and recreation to take place with the need to:

• protect the natural and historic environment including wildlife and features of the natural environment such as tranquillity;

• retain dark skies where appropriate;

• prevent glare and respect the amenity of neighbouring land uses; and

• reduce the carbon emissions associated with lighting.

6.8.2 Dark sky reserves exist in various parts of Wales, including Snowdonia, Brecon Beacons and the Elan Valley. Dark sky reserves can contribute positively to an area in economic and environmental terms and their characteristics should be taken into account when preparing

development plan strategies and policies and when considering individual development proposals.

6.8.3 Lighting to provide security can be particularly important in rural areas or for specific purposes such as defence or to create calming environments. Where this is the case, planning authorities should adopt policies for lighting, including the control of light pollution, in their development plans.

6.8.4 Planning authorities can attach conditions to planning permissions for new developments that include the design and operation of lighting systems, for example, requiring energy-efficient design and to prevent light pollution.

2.3. Future Wales - The National Plan 2021 - 2040

"Future Wales – the National Plan 2040 is our national development framework, setting the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities."

Policy 18 – Renewable and Low Carbon Energy Developments of National Significance

There are no unacceptable adverse impacts by way of shadow flicker, noise, reflected light, air quality or electromagnetic disturbance;"

2.4. Planning Practice Guidance

2.4.1. Guidance for assessing the effects of proposed artificial lighting is outlined in the planning practice guidance (PPG). The guidance states:

"Does an existing lighting installation make the proposed location for a development unsuitable, or suitable only with appropriate mitigation? For example, this might be because:

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

Where necessary, development proposed in the vicinity of existing activities may need to put suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme, reflecting the agent of change principle. Additional guidance on applying this principle is set out in the planning practice guidance on noise.

- *Will a new development, or a proposed change to an existing site, be likely to materially alter light levels in the environment around the site and/or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?*

- *Will the impact of new lighting conflict with the needs of specialist facilities requiring low levels of surrounding light (such as observatories, airports and general aviation facilities)? Impacts on other activities that rely on low levels of light such as astronomy may also be a consideration but will need to be considered in terms of both their severity and alongside the wider benefits of the development.*
    - *Is the development in or near a protected area of dark sky or an intrinsically dark landscape where new lighting would be conspicuously out of keeping with local nocturnal light levels, making it desirable to minimise or avoid new lighting?*
    - *Would new lighting have any safety impacts, for example in creating a hazard for road users?*
    - *Is a proposal likely to have a significant impact on a protected site or species? This could be a particular concern where forms of artificial light with a potentially high impact on wildlife and ecosystems (e.g. white or ultraviolet light) are being proposed close to protected sites, sensitive wildlife receptors or areas, including where the light is likely to shine on water where bats feed.*
    - *Does the Proposed Development include smooth, reflective building materials, including large horizontal expanses of glass, particularly near water bodies? (As it may change natural light, creating polarised light pollution that can affect wildlife behaviour.)"*

3. LOCAL POLICIES

3.1. Wrexham County Borough – Local Development Plan 2013-2028.

3.1.1. The relevant Local Planning Authority (LPA) for the Proposed Development is the Wrexham County Borough Council with policies detailed within the Wrexham Local Development Plan 2013-2028 – Adopted December 2023 applying to the lighting associated with the Proposed Development.

The applicable policies are:

Policy T2: Active Travel

"Facilities that encourage and promote Active Travel including but not limited to appropriate signing, lighting, secure and convenient cycle parking and where appropriate shower and changing facilities are provided".

3.2. Wrexham County Borough – Unitary Development Plan 1996-2011.

3.2.1. The relevant Local Planning Authority (LPA) for the Proposed Development is the Wrexham County Borough Council with policies detailed within the Wrexham Local Development Plan 2013-2028 – Adopted December 2023 applying to the lighting associated with the Proposed Development.

Policy GDP01:

All new development should:-

b) Take account of personal and community safety and security in the design and layout of development and public / private spaces.

c) Make the best use of design techniques, siting and orientation in order to conserve energy and water resources.

d) Ensure safe and convenient pedestrian and vehicular access to and from development sites, both on site and in the nearby locality.

f) Ensure the safety and amenity of the public and safeguard the environment from the adverse effects of pollution of water, land or air, hazards from industry and quarrying, and associated noise, odour or vibration arising from development.

h) Safeguard sites and areas of nature conservation and wildlife interest, and to provide new habitats where there is an unavoidable loss of existing habitats and areas of wildlife interest.

k) Secure the development of sustainable communities, through the promotion of the economic, social and environmental well-being of the area.'

Policy EC6 :

'Development either within or close to sites of biodiversity interest will only be permitted where it can be clearly demonstrated that the need for the development outweighs the need to safeguard the intrinsic nature conservation value of the site. Where such development is permitted, damage should be kept to a minimum, and compensatory measures should be provided. Measures to improve the biodiversity value of sites and enhance their natural conservation interest and landscape quality including the establishment of local nature reserves, will be supported'

4. BRITISH STANDARDS

4.1. BS 5489-1:2020 - Lighting of Roads and Public Amenity Areas - Code of practice.

4.1.1. This standard gives recommendations on the general principles of road lighting, its aesthetics and technical aspects and provides guidance on operational maintenance. It also provides guidance on means of minimizing energy consumption and limiting the impacts on the environment and adjacent properties.

4.2. BS EN 13201-2:2015 - Road lighting. Performance requirements

4.2.1. This British and European standard defines the performance requirements specified as lighting classes for road lighting aiming at the visual needs of the road users, as well as the consideration of the environmental aspects of the road lighting to be applied.

4.3. BS EN 12464-2:2014 - Light and Lighting – Lighting of workplaces

4.3.1. This British and European standard specifies lighting requirements for outdoor workplaces which meet the needs for visual and performance. All visual tasks are considered with the exclusion of lighting specified for the use of lighting required in an emergency.

5. GUIDANCE

5.1. Guidance Notes for the Reduction of Obtrusive Light (Institution of Lighting Professionals GN01/2021)

5.1.1. The Lighting Strategy is informed by industry guidance notes which aim to reduce the potential for obtrusive light to occur, which is typically caused by poorly designed and installed exterior artificial lighting. The Lighting Strategy is informed by the most relevant sections of GN01/2021 that has recently been published to reduce the potential for obtrusive light from a wide range of exterior lighting applications.

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 outer 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.

Table 1: Environmental Zone Descriptions

Environmental Zones	Sky Glow ULR[2] (Max %)	Light Trespass (Into Windows) E_v (lux)		Building Luminance Average, Pre-curfew
		Pre- Curfew	Post-Curfew[3]	Average L (cd/m²)
E0	0	0	0	0
E1	0	2	0 (1*)	0
E2	2.5	5	1	5
E3	5	10	2	10
E4	15	25	5	25

Table 2: Obtrusive Light Criteria

[2] ULR (Upward Light Ratio) is the maximum permitted percentage of luminaire flux that goes directly into the sky.

[3] Curfew refers to a time when the local planning authority has agreed that the lighting installation should be switched off; this typically refers to 23h00 – 07h00

5.2. GN08/2023 Bats and Artificial Lighting in the UK – Bat Conservation Trust and Institution of Lighting Professionals.

5.2.1. This document is aimed at lighting professionals, lighting designers, planning officers, developers, bat workers/ecologists and anyone specifying lighting. It is intended to raise awareness of the impacts of artificial lighting on bats, and mitigation is suggested for various scenarios. However, it is not meant to replace site-specific ecological and lighting assessments, which states the following.

"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)."

"A warm white light source (2700 Kelvin or lower) should be adopted to reduce blue light component."

*"A buffer zone subdivided to into smaller zones of increasing illuminance limit further away from the Supporting Habitat would ensure light levels (illuminance - measured in lux) do not exceed certain defined limits. This has the effect of a gradual decrease in lighting from the developed zone, rather than a distinct cut-off, which may provide useable area for the project which also limits lighting impacts on less sensitive species, or less well-used habitat." (see **Figure 1**)."*

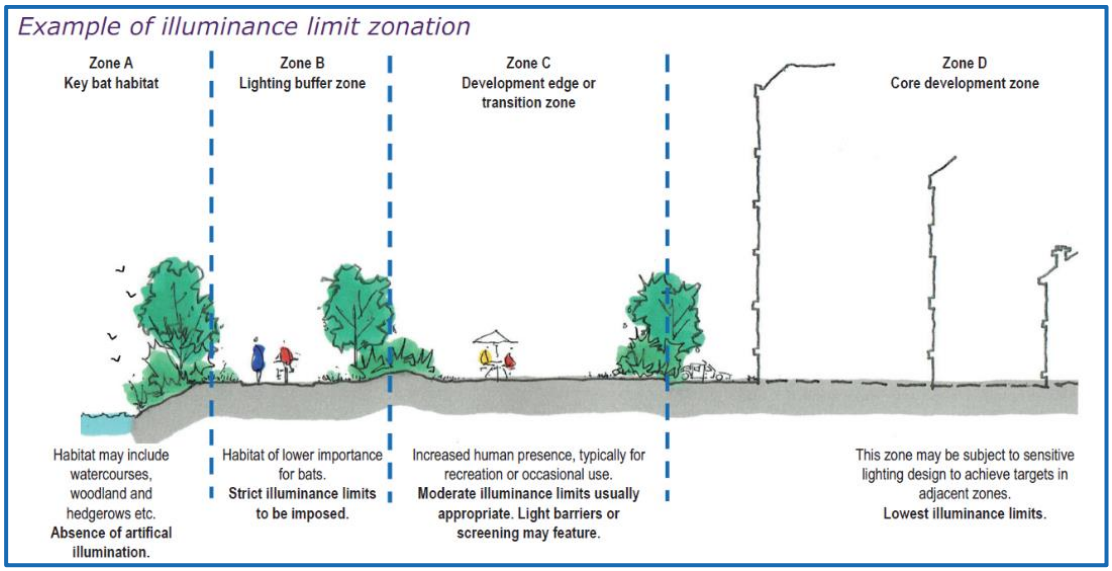


Figure 1 - Example of lighting zonation near sensitive boundaries and known ecological habitat

5.3. PLG04:2013 Guidance on Undertaking Environmental Lighting Impact Assessments

5.3.1. This document provides the methodology and framework used for the undertaking of the Lighting Impact Assessment.

5.3.2. PLG:04:2013 is used throughout the UK by lighting professional when conducting Lighting Impact Assessment, and the method detailed within this document is accepted and required by councils across the UK.

6. DESKTOP STUDY

6.1. Site Description and Context

6.1.1. The Application Site is Trevor Basin, Wrexham, North Wales. "The site sits within the North Wharfs areas of the WHS (World Heritage Site), connecting to the central basin, prior to reaching the Pontycysyllte Aqueduct further South. Within the site, the canal divides within the terminal arm, sometimes describes as an island or basin fork due to the two fingers of water space surrounding a central raise area, formally used for transshipment" – **Lighting Consultants Brief V3 02/05/2023.**

6.1.2. An indicative boundary of the site and proposed layout can be seen in **Figure 2**.

6.1.3. "It is now intended to reintroduce boating activities to this part of Trevor Basin. It is proposed to use the site as the base location for a hire boat operator. This proposal utilises a more suitable location for the hire boat business as it is located at the rear of Trevor Basin, which will ultimately reduce boat, pedestrian and vehicular congestion within the main basin area having a positive impact on manoeuvrability across the site. As part of the proposed use, the site will similarly be the start and finish point from where the boats will leave and return to, which will also include services such as refuelling, water points, refuse and sewage disposal. Designated car parking will be retained on site for use by staff and customers". – **Canal River Trust Planning Statement.**

6.1.4. "It is proposed that a new main permanent building will be introduced on site to replace the previous prefabricated structures, which will accommodate an office, storage/laundry, toilets and a café. A much smaller secondary building is also proposed to provide boat services for refuelling and sewage disposal, which is more suitable located away from the main building. The proposed replacement main building will be a single storey detached structure situated over the footprint of the former office/cafe prefabricated unit on site. A primary acing material of timber larch cladding is proposed accompanied with dark metallic standing seam roof covering material and dark metallic windows". – **Canal River Trust Planning Statement.**

6.1.5. "The central island is retained as an opportunity to present a naturalistic landscape and will only be developed to provide access to moorings. External surfaces surrounding the proposed building and connecting routes will consist of tar and chip surfacing and thin underlying grass reinforcing mesh strip. The larger areas are left as made ground. External walling material around the water space consists of stone masonry to match existing examples". – **Canal River Trust Planning Statement.**

6.1.6. The Proposed Development Site Layout Plan is shown in **Figure 3**.

6.1.7. A desktop assessment was completed to understand its position within the current lit environment.

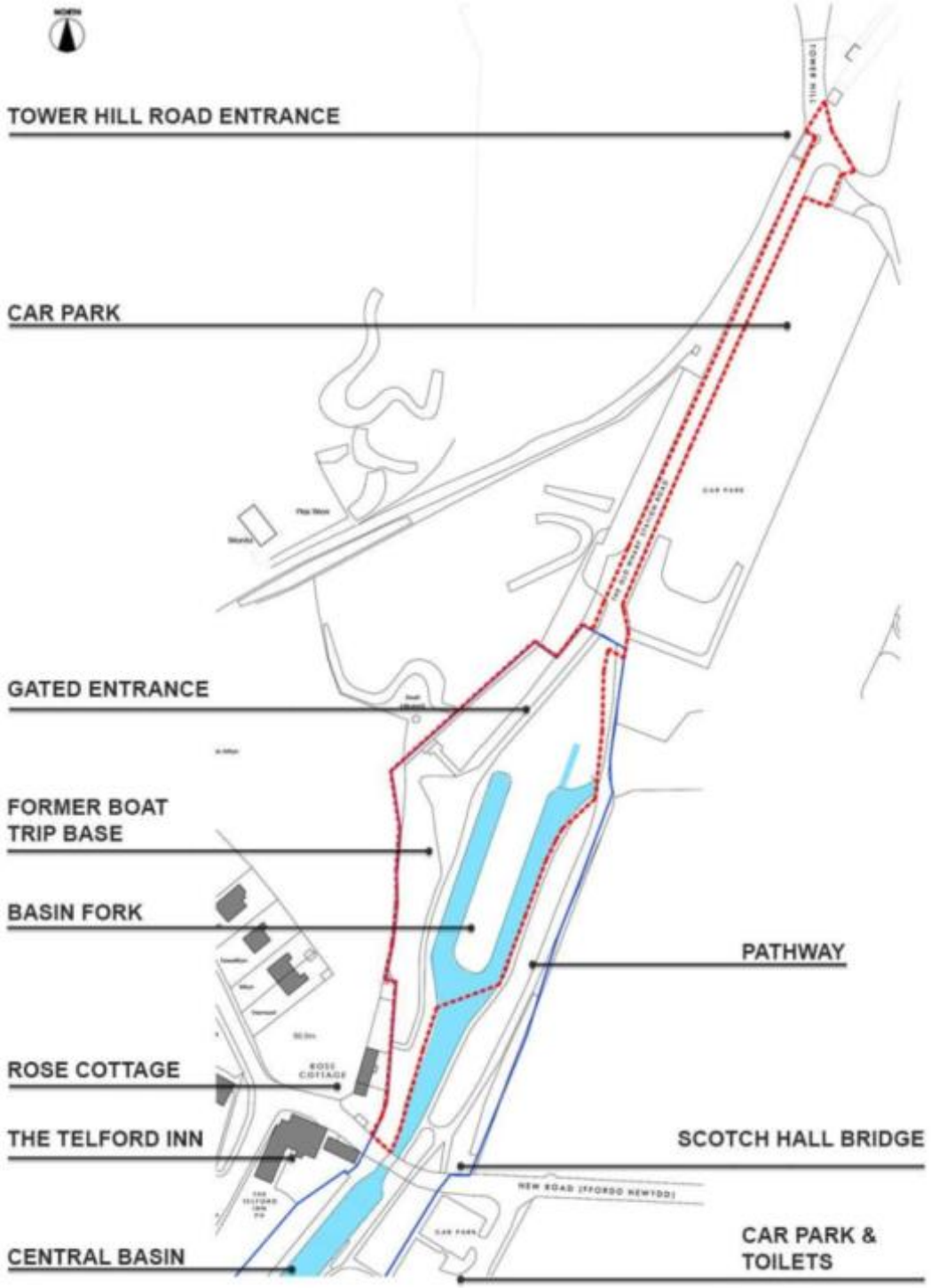


Figure 2 - The Application Site location and boundary



Figure 3 - Proposed Development Site layout plan

6.2. Designations

6.2.1. The area is within a designated World Heritage Site. (Pontcysyllte Aqueduct Traphont Ddŵr Pontcysyllte). The Proposed Development is approximately 300 metres north from the aqueduct, therefore the lighting levels will have minimal effect but it is still important to be aware of.

6.2.2. The River Dee SSSI (Site of Specific Scientific Interest) is also approximately 400 metres south of the Proposed Development. The SSSI is shown in **Figure 4** and the World Heritage Site in **Figure 5**.

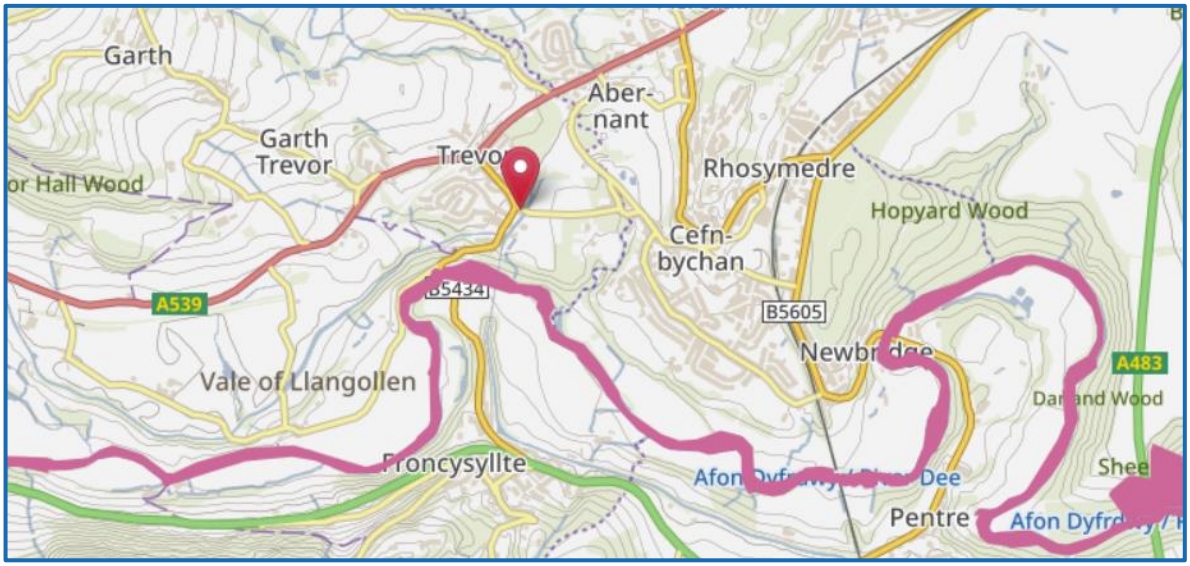


Figure 4 - Site designation - SSSI

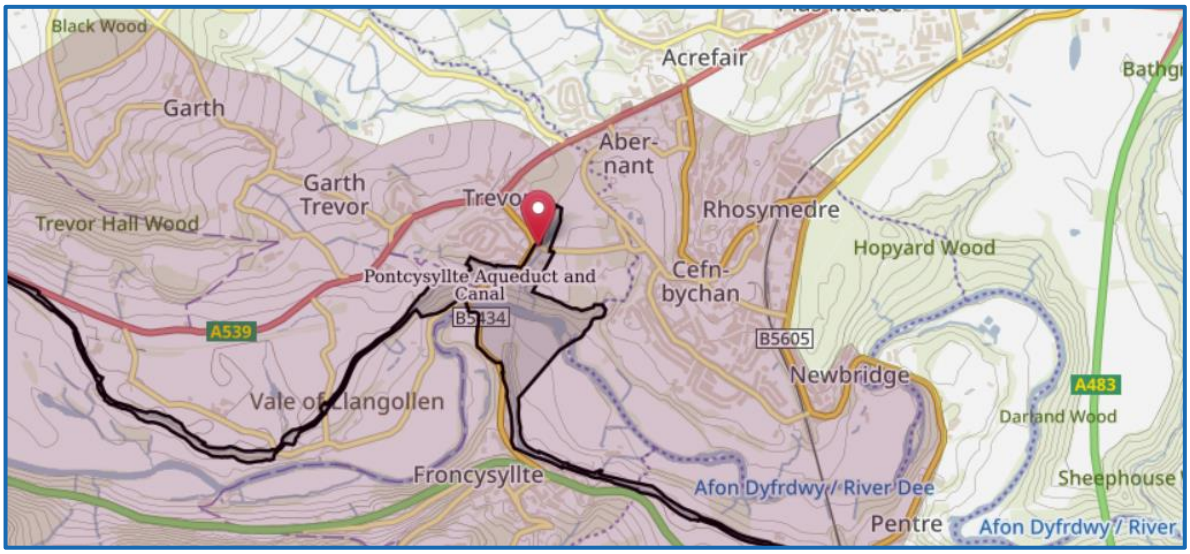


Figure 5 - Site Designation - World Heritage Site

6.3. Baseline lighting

6.3.1. The baseline lighting levels for the Application Site are minimal within the site location but street lighting columns towards the south side of the site on New Road can be seen (**Figure 6**). These are mounted on utility poles at approximately 6 metres. The car park to the north and the approach road appears to not have any lighting.



Figure 6 - New Road Baseline Lighting

6.4. CPRE Night Blight Mapping[4]

6.4.1. To inform our understanding of the nighttime environment, we look to use the CPRE Nightblight map to better appreciate the current baseline light levels. The CPRE Night Blight Mapping confirms the skyward radiance within the vicinity of the Application Site is between 4 - 8 Nano Watts/cm²/sr. As shown in **Figure 7**, the likely levels of skyglow within the vicinity of the Application Site are similar to those expected within an E3 zone.

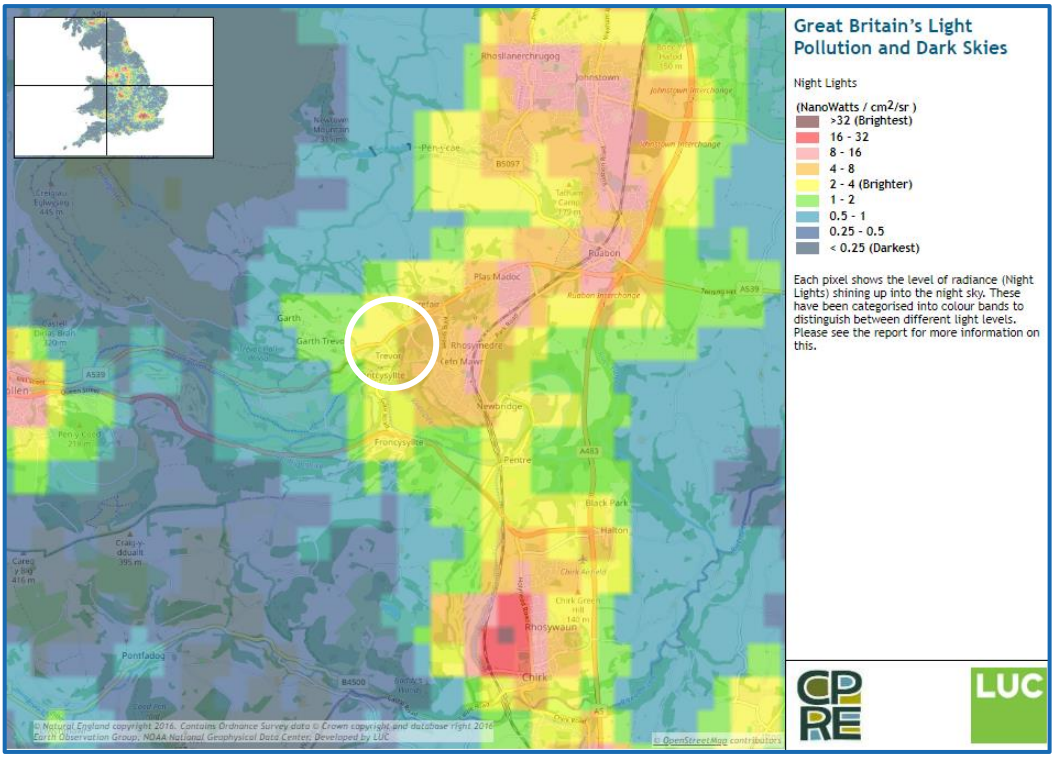


Figure 7 - Surrounding areas/roads

[4] NightBlight Map is a visual representation of light pollution as a view from above the earth's atmosphere and indicates upward light spill based on sky glow.

6.5. Environmental Zone Classification

6.5.1. The Environmental Zone criteria detailed within **Table 1** and **Table 2** informs the basis of the Lighting Strategy. The Application Site is considered to be located within an E3 Environmental Zone, however, due to the location of the Proposed Development and its positioning within the World Heritage Site, and the lower lighting levels bordering the western side, we have assessed Site down to a more stringent E2 Environmental Zone (**Table 3**).

6.5.2. The E2 assessment is primarily because of its vicinity to a village and sparsely inhabited rural areas and the criteria mentioned above.

Zone	Surrounding	Examples	Limitations		Sky Glow ULR (Max)
			Pre-curfew	Post-curfew	
E2	Rural	Sparsely inhabited rural areas,Village or relatively dark outer suburban locations	5	1	2.5%

Table 3: Limitations of identified environmental zone.

7. IDENTIFIED RECEPTORS

7.1. Receptors

Sensitivity	Description of Criteria	
High	The environment is fragile, and an impact is likely to leave it in an altered state from which recovery would be difficult or impossible.	
	Human Amenity (PHAR)	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 (PSR)	receptors where a change in the lighting has the potential to either dramatically improve or reduce safety (for pedestrians, drivers or workers).
	Ecological (PSER)	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 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 (PHAR)	receptors which are sensitive to a change in lighting however not such that the quality of life would be affected
	Human Safety (PSR)	receptors where a change in the lighting has the potential to either improve or reduce safety (for pedestrians, drivers or workers).
	Ecological (PSER)	where a change in the lighting affects the movement or feeding patterns of fauna but the receptor can adapt
Low	The environment is adaptable and is resilient to change. Nearly all impacts can be absorbed within it without modifying the baseline conditions.	
	Human Amenity (PHAR)	receptors which would not noticeably be aware of a change in lighting. (i.e. in areas of medium to high luminance) .
	Human Safety (PSR)	receptors where a change in the lighting has limited potential to affect safety (for pedestrians, drivers or workers).
	Ecological (PSER)	The environment is adaptable and is resilient to change. Nearly all impacts can be absorbed within it without modifying the baseline conditions.
Negligible	Receptor has little or no night-time activity	

Table 4: Sensitivity Receptor Table

7.2. Ecological

7.2.1. Within and around the Application Site boundary and identified in ecology report *"ESUK report - bat surveys at Trevor Basin 25-8-2023"* are areas where potentially sensitive ecological receptors may be present, as shown in **Table 5** and **Appendix 3**. Therefore, this lighting strategy has been written in accordance with ILP guidance GN08/2023.

Receptor Type	Receptor No. (Appendix 3)	Description	Sensitivity
Ecology	PSER 001	Eastern Vegetation Corridor	High
Ecology	PSER 002	Middle Fork within Basin West	High
Ecology	PSER 003	Middle Fork within Basin East	High
Ecology	PSER 004	Northwestern side of the Application Site	High
Ecology	PSER 005	Northeastern side of the Application Site	High

Table 5: Potentially Sensitive Ecological Receptors (PSER)

7.3. Human Amenity

7.3.1. To the south and southwest of the site, Potential Human Amenity Receptors (PHAR) have been identified as shown in **Table 6** and **Appendix 3**. Therefore, this lighting strategy has been written in accordance with GN01/2021, **Table 2** - Obtrusive Light Criteria.

Receptor Type	Receptor No. (Appendix 3)	Description	Sensitivity
Human Amenity	PHAR 001	Rose Cottage	Medium
Human Amenity	PHAR 002	Residential dwellings on Station Road	Medium

Table 6: Potential Human Amenity Receptors (PHAR)

8. LIGHTING STRATEGY

8.1. Summary

8.1.1. The Proposed Development will require lighting for safety at limited times during the hours of darkness. Lighting will be fit for purpose and sensitive to nearby human and ecological receptors.

8.1.2. Lighting will be of an appropriate specification and designed in accordance with British Standards.

8.1.3. Amenity lighting for the Proposed Development will be applied sensitively to account for the receptors identified bounding the Application Site and within the Proposed Development.

8.1.4. Luminaires will be used with integral LEDs and only where the luminaire photometry is available from the manufacturer. This is to ensure the photometric footprint of the luminaires can be modelled to ensure the potential effects of light spill are minimised or mitigated.

8.1.5. To achieve dimming requirements as per the design, luminaires to be acquired from competent manufacturers.

8.1.6. The following criteria seeks to ensure that the lighting is not outside of the obtrusive light limits for the Environmental Zone in which the Application Site is located, is sensitive to the area, and provides a recognised standard level of lighting for all adoptable areas requiring illumination. Luminaires will distribute light downwards only to reduce the potential for light spill onto the boundaries surrounding the buildings and upwards towards the sky.

8.1.7. Extra care must be taken to ensure the light spill is minimised as the area is within a designated World Heritage Site as well as safeguarding that the local sensitive receptors are not affected.

8.1.8. All lighting unless otherwise stated is to emit a warm white colour temperature light (3000 Kelvin or less) to reduce the potential for adverse effects onto potentially sensitive receptors.

8.1.9. Lighting in unadopted areas will be required in the following task areas:

- Car Park
- Fuel Storages
- Hire Boat Business Premises
- Bollard Path
- Quaysides
- Southern Ramp

8.1.10. Luminaire performance requirements are all outlined in **Appendix 4.**

8.2. Car Park

8.2.1. The Car Park will be illuminated in accordance with BS 5489-1:2020 for safety and wayfinding purposes. The lowest practicable lighting levels are proposed within this Lighting Strategy.

8.2.2. Car Parking to be lit with street lighting columns that are full cut off and low level. Low traffic area and usage was chosen due to the size of the car park, contextual usage and location.

8.2.3. Performance requirements for the Car Park are outlined in **Figure 8.**

Table 4 — *Maintained lighting levels for outdoor car parks*

Values in lux

Type of area and usage	$\bar{E}$	U_o
Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0.25
Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0.25
Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose sports and building complexes	20	0.25

Figure 8 - Performance requirements – Car Park

8.3. Fuel Storages

8.3.1. The Fuel Storages will be illuminated for safety and wayfinding purposes and the lowest practicable lighting levels are proposed within this Lighting Strategy. Luminaires to require ATEX protection.

8.3.2. Luminaires will be full cut off downlighters that are wall mounted to the fuel storage buildings. This is to provide wayfinding and safety lighting for the buildings.

8.4. Hire Boat Business Premises

8.4.1. The Hire Boat Business Premises will be illuminated for security purposes using the low-level bulkhead lighting.

8.4.2. The luminaires are to be wall mounted with a downward optic to prevent the potential for upward light spill, as well as any unnecessary light spill onto neighbouring properties and the determined receptors.

8.5. Bollard Path

8.5.1. The Bollard path will be illuminated in accordance with BS 5489-1:2020 for safety and wayfinding purposes. The lowest practicable lighting levels are proposed within this Lighting Strategy.

8.5.2. Bollard path is to be lit with full cut off bollards with 180-degree directional light direction. This is to mitigate light spill onto non task areas. This is lit to a road lighting (footpath) standard due to its context and location.

8.5.3. Performance requirements for the Bollard path are outlined in **Figure 9.**

Table A.5 — *Lighting classes for subsidiary roads*

Traffic flow	Lighting class		
	E1 to E4[A)]	E1 to E2[A)]	E3 to E4[A)]
	Pedestrian and cyclists only	Speed limit $v \leq 30$ mph	Speed limit $v \leq 30$ mph
Busy [B)]	P5	P4	P3
Normal [C)]	P5	P5	P4
Quiet [D)]	P6	P5	P4

Figure 9 - Performance requirements – Bollard Path

8.6. Quaysides

8.6.1. The quaysides will be illuminated in accordance with BS EN 12464-2:2014 for safety and wayfinding purposes. The lowest practicable lighting levels are proposed within this Lighting Strategy.

8.6.2. The quayside lighting to be from wall recessed luminaires that assist with wayfinding and hazard detection along each section of the quayside.

8.6.3. Performance requirements for the quaysides are outlined in **Figure 10.**

Table 5.4 — Canals, locks and harbours

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.4.1	Waiting quays at canals and locks	10	0,25	50	20	
5.4.2	Gangways and passages exclusively for pedestrians	10	0,25	50	20	
5.4.3	Lock control and ballasting areas	20	0,25	55	20	
5.4.4	Cargo handling, loading and unloading	30	0,25	55	20	For reading labels: $\bar{E}_m$ = 50 lx
5.4.5	Passenger areas in passenger harbours	50	0,40	50	20	
5.4.6	Coupling of hoses, pipes and ropes	50	0,40	50	20	
5.4.7	Dangerous part of walkways and driveways	50	0,40	45	20	

Figure 10 - Performance requirements – Quaysides

8.7. Southern Ramp

8.7.1. The Southern ramp will be illuminated in accordance with BS 5489-1:2020 for safety and wayfinding purposes. The lowest possible lighting levels are proposed within this Lighting Strategy.

8.7.2. The southern ramp will be lit using linear LED strip that follow the course of the ramp downwards.

8.7.3. Performance requirements for the Quaysides are outlined in **Figure 11.**

Table A.5 — *Lighting classes for subsidiary roads*

Traffic flow	Lighting class		
	E1 to E4[A)]	E1 to E2[A)]	E3 to E4[A)]
	Pedestrian and cyclists only	Speed limit $v \leq 30$ mph	Speed limit $v \leq 30$ mph
Busy [B)]	P5	P4	P3
Normal [C)]	P5	P5	P4
Quiet [D)]	P6	P5	P4

Figure 11 - Performance requirements - Southern Ramp

9. SUMMARY OF RESULTS

9.1. Overview

9.1.1. The Light Spill Diagram shown in **Appendix 1** demonstrates that the Light Spill Levels associated with the proposed lighting would comply with the obtrusive light guidance set out in ILP GN01/2021, at sensitive receptors.

9.1.2. To ensure the worst-case scenario has been modelled, the highest potential light levels have been modelled / presented in the light spill diagram, with the project maintenance factors set at MF = 1.0[5]. This demonstrates the light levels at their highest (initial light levels at the start of luminaire life).

9.2. Summary of Results

9.2.1. The proposed lighting within the task area(s) is compliant to the relevant policies, standards and guidance.

9.2.2. The task area lighting results can be seen in **2982-DFL-HLG-XX-RP-EO-13003-S3-P01.**

9.2.3. Where ecological receptors are potentially sensitive to vertical light spill the light levels based on the modelling do not exceed >0.40 Lux, keeping the light levels within the guidance given within GN08/2023.

9.2.4. However, one result does exceed this at 0.44. This considers the worst-case scenario at a maintenance factor of 1.0 with a calculation allowance of ± 10% this being 0.04. Therefore, the non-compliance is not significant and acceptable.

9.2.5. In line with section 4.56 of GN08/2023, the vertical grids will be mounted at a height of 1.5 metres above the ground level to simulate the likely flight path of a light sensitive bat.

Receptor No	GN08/2023 requirements	Maximum vertical Illuminance (Lux)	Pass/fail
PSER 001	0.40	0.44	Fail (Insignificant)
PSER 002	0.40	0.28	Pass
PSER 003	0.40	0.02	Pass
PSER 004	0.40	0.12	Pass
PSER 005	0.40	0.13	Pass

Table 7: PSER results table, maximum illuminance.

[5] https://www.dfl-uk.com/knowledge-hub/faqs/

9.2.6. Where human receptors are potentially sensitive to vertical light spill, a vertical illumination grid has been modelled, as shown in **Appendix 2**. The light levels based on the modelling do not exceed 1 Lux, keeping the light levels within the guidance given within GN01/2021 for an area identified as an E2 environment.

Receptor No	GN01/2021 requirements		Maximum vertical Illuminance (Lux)	Pass/fail
	Pre-curfew	Post Curfew		
PHAR 001	5 Lux	1 Lux	0.05	Pass
PHAR 002	5 Lux	1 Lux	0.37	Pass

Table 8: PHAR results table, maximum illuminance

9.3. Mitigation

9.3.1. Careful design ensures the lighting has been minimised onto sensitive receptors in accordance with standards and guidance.

9.3.2. Where applicable, shields are proposed in particularly sensitive areas to further minimise spill.

9.3.3. Through the use of the control methods detailed in **Appendix 4,** it limits the amount of light in the affected Application Area to minimum amount of time for amenity and safety purposes.

9.3.4. Luminaires that have been specified are full cut off resulting in 0% ULOR. The chosen wall mounted downlighter luminaire has full cut off minimising vertical light spill which also provides an Upward Light Output Ratio of 0%.

9.3.5. All luminaires will be mounted at the minimum practical mounting height for the area or task. This will reduce the visibility of the luminaires in the landscape, by allowing surrounding trees and buildings to act as blocking features to direct views of luminaires.

9.3.6. The chosen wall mounted downlighter luminaire has full cut off minimising vertical light spill which provided an Upward Light Output Ratio of 0%.

9.3.7. The detailed design is to be completed by a competent person or persons in accordance with the details within this Lighting strategy.

10. CONCLUSION

10.1. General

10.1.1. Lighting associated with the Proposed Development shall be designed in accordance with the Lighting Strategy for the Application Site outlined in **Section 8.**

10.1.2. This lighting strategy has been written in accordance with the relevant British Standards, industry guidance and local policies to ensure it is unlikely to give rise to obtrusive light with the potential to affect human, environmental and ecological receptors.

10.1.3. Through the application of this lighting strategy sensitive receptors will not be adversely affected by obtrusive light, as shown in **Appendix 1**. The effects of the proposed lighting on the sensitive receptors will be Negligible.

10.1.4. Through careful design and mitigation, this Lighting Strategy ensures the lighting installation at the proposed development will be in accordance with British Standards, Guidance and Local Policy.

10.1.5. The requirements of Planning Condition 29 had been met by the submission of the light spill diagram and the inclusion of vertical grids to calculate the spill light onto the identified sensitive areas as shown in **Appendix 2** and **3**. The equipment specifications have been submitted in **Appendix 4** and the positions shown on the accompanying Lighting Spill Diagram in **Appendix 1**. The luminaires chosen have been dimmed where necessary to meet the lighting requirements without overlighting. The biodiversity and the dark skies policy of the AONB have been preserved through the use of low output luminaires with 0% ULOR meeting the lowest acceptable lighting class for the appropriate task.

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ENERGY REDUCTION · LIGHTING IMPACT

APPENDIX 1

Light Spill Diagram - 2982-DFL-HLG-XX-LD-EO-13001

APPENDIX 2

Vertical Light Spill Calculations

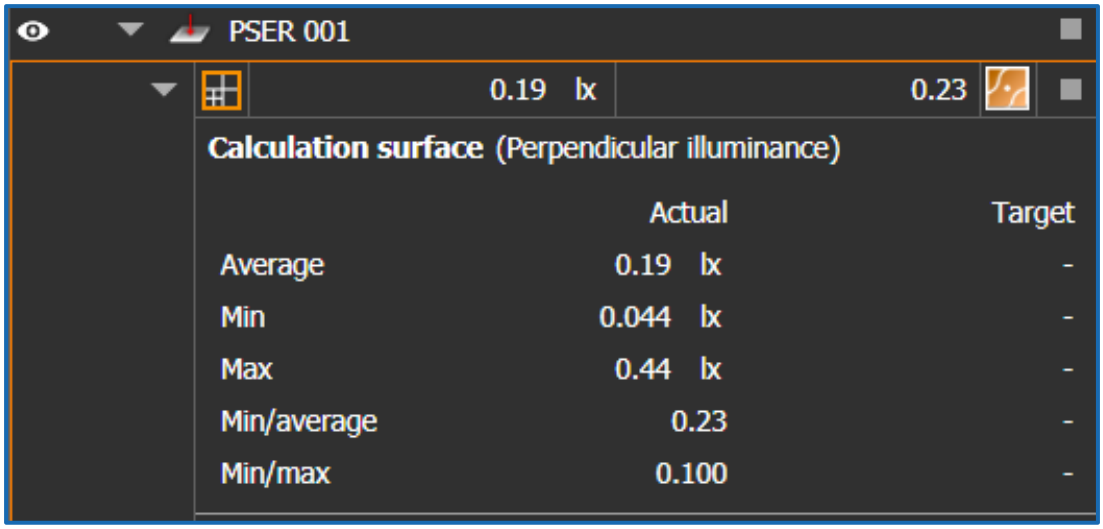


Figure 12 - PSER 001

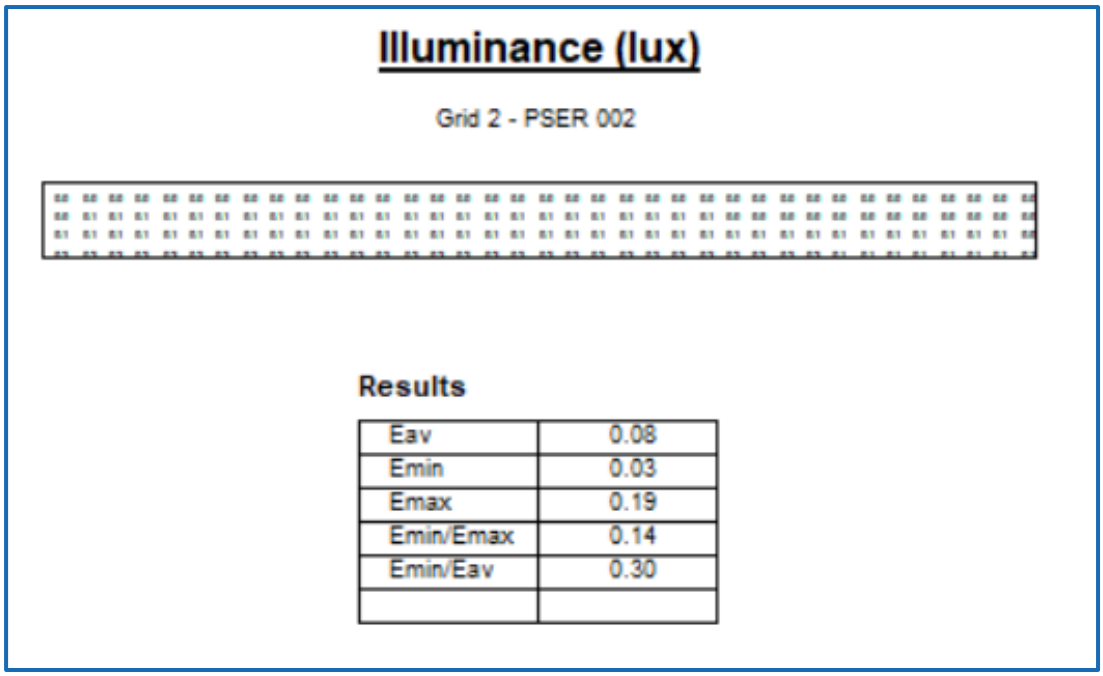


Figure 13 - PSER 002

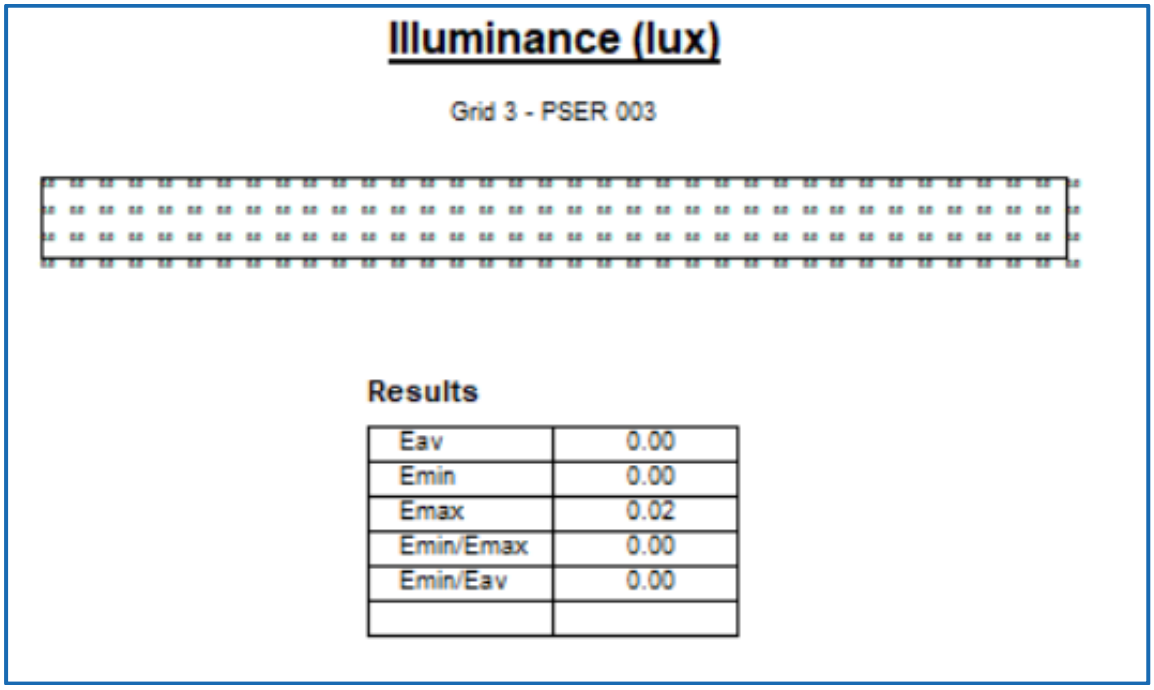


Figure 14 - PSER 003

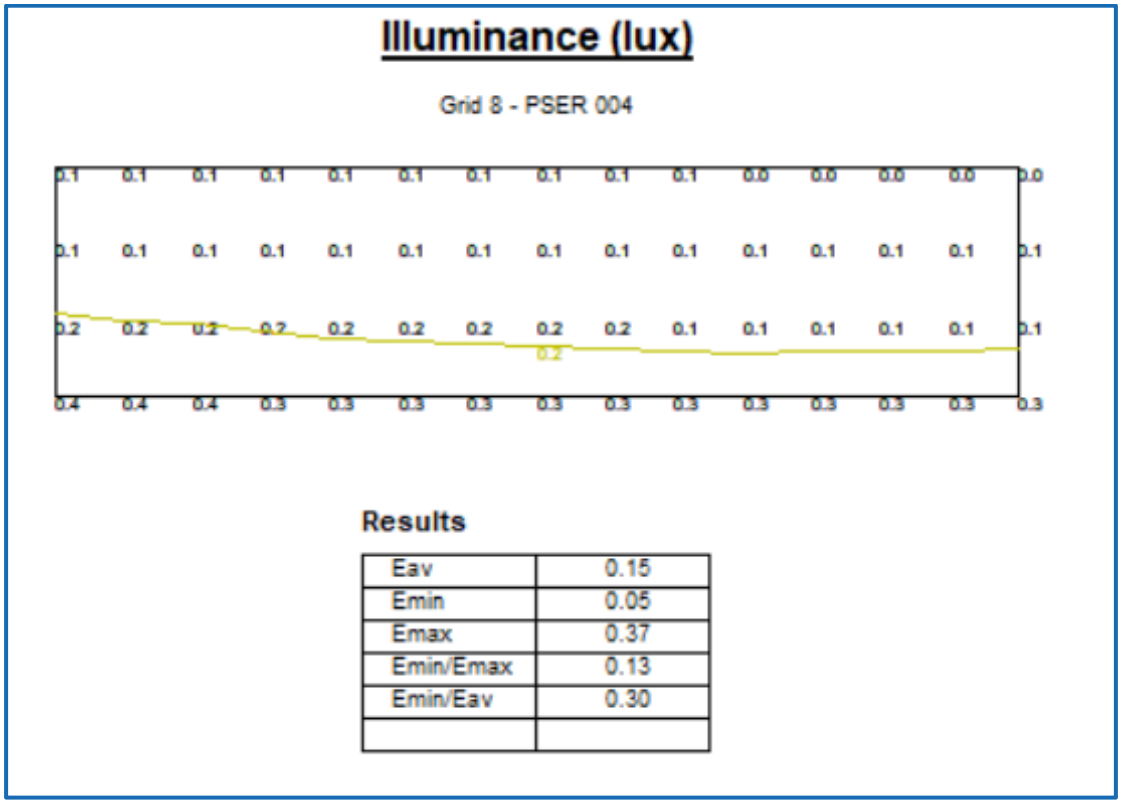


Figure 15 - PSER 004

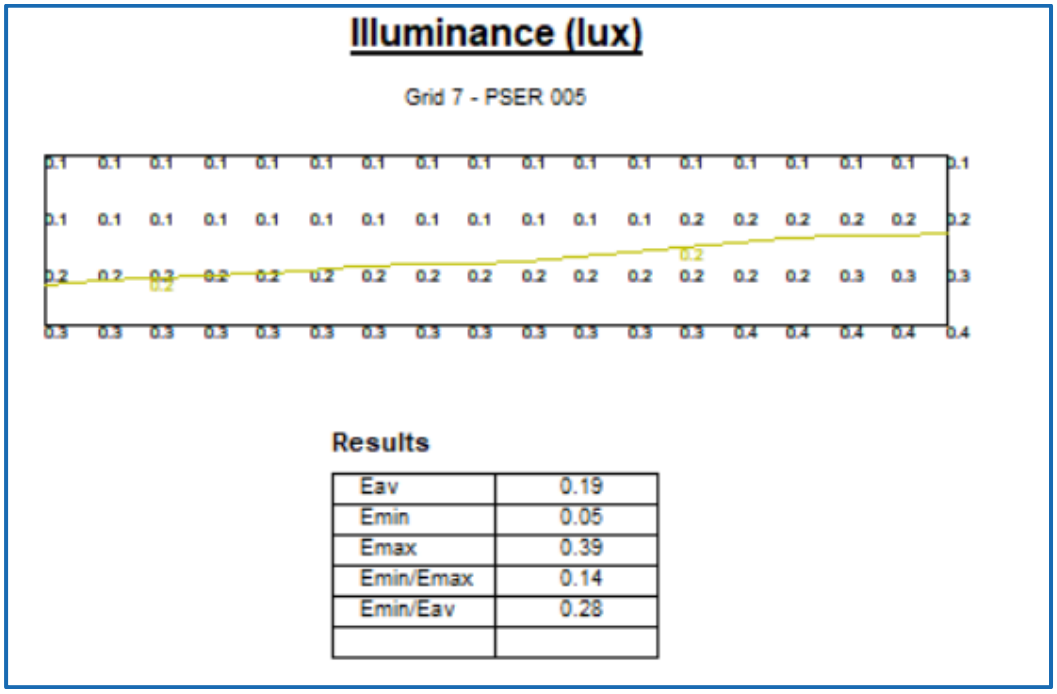


Figure 16 - PSER 005

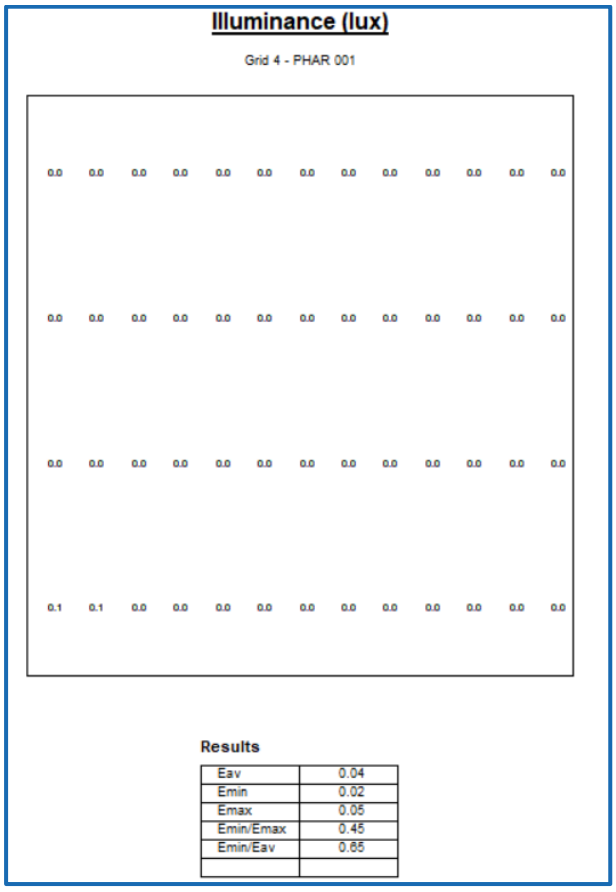


Figure 17 - PHAR 001

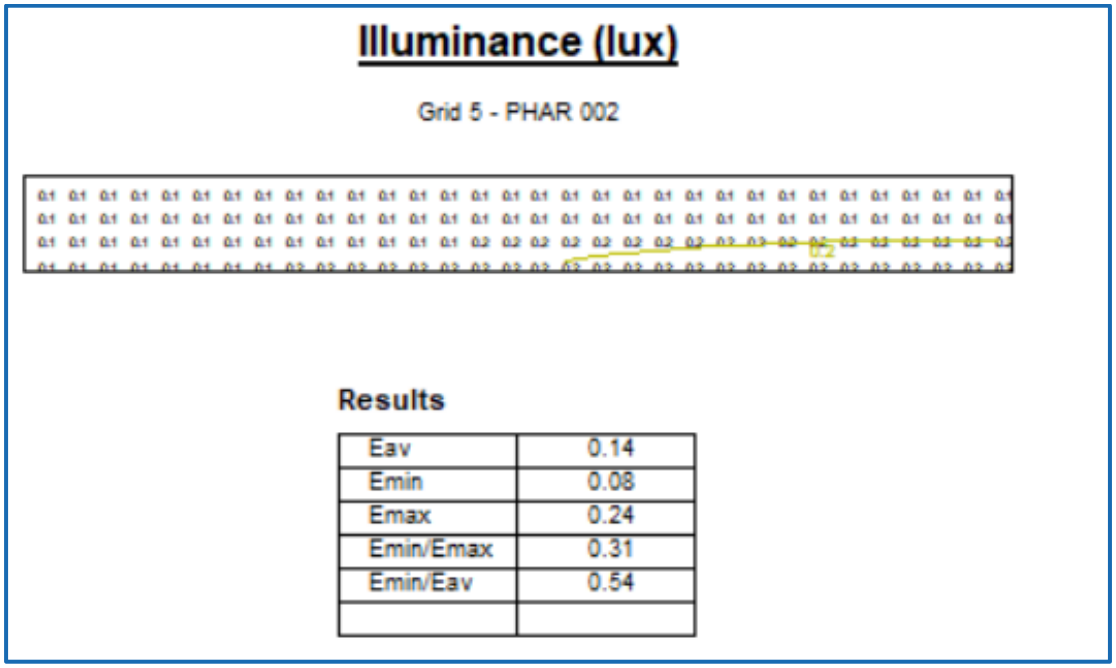


Figure 18 - PHAR 002

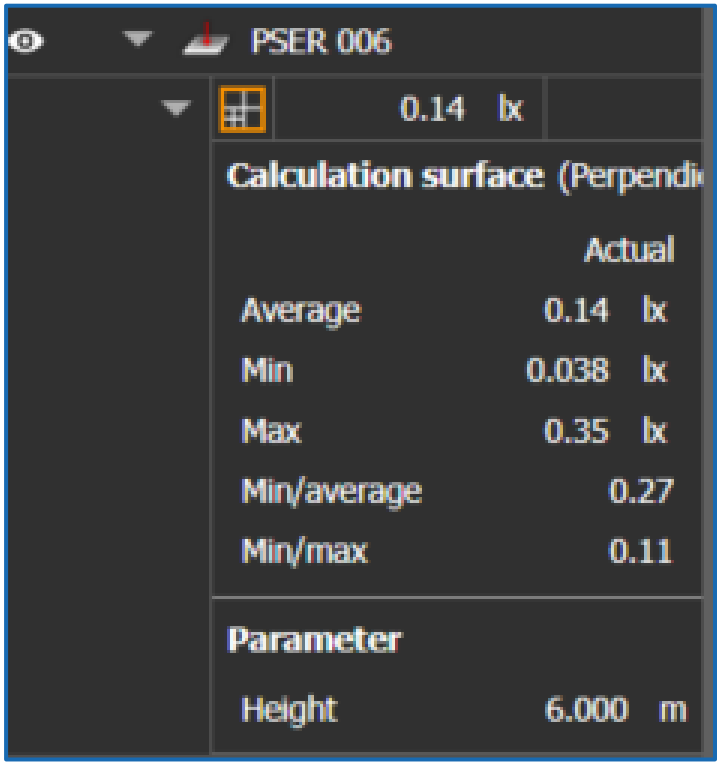


Figure 19 - PSER 006

APPENDIX 3

Sensitive Receptors

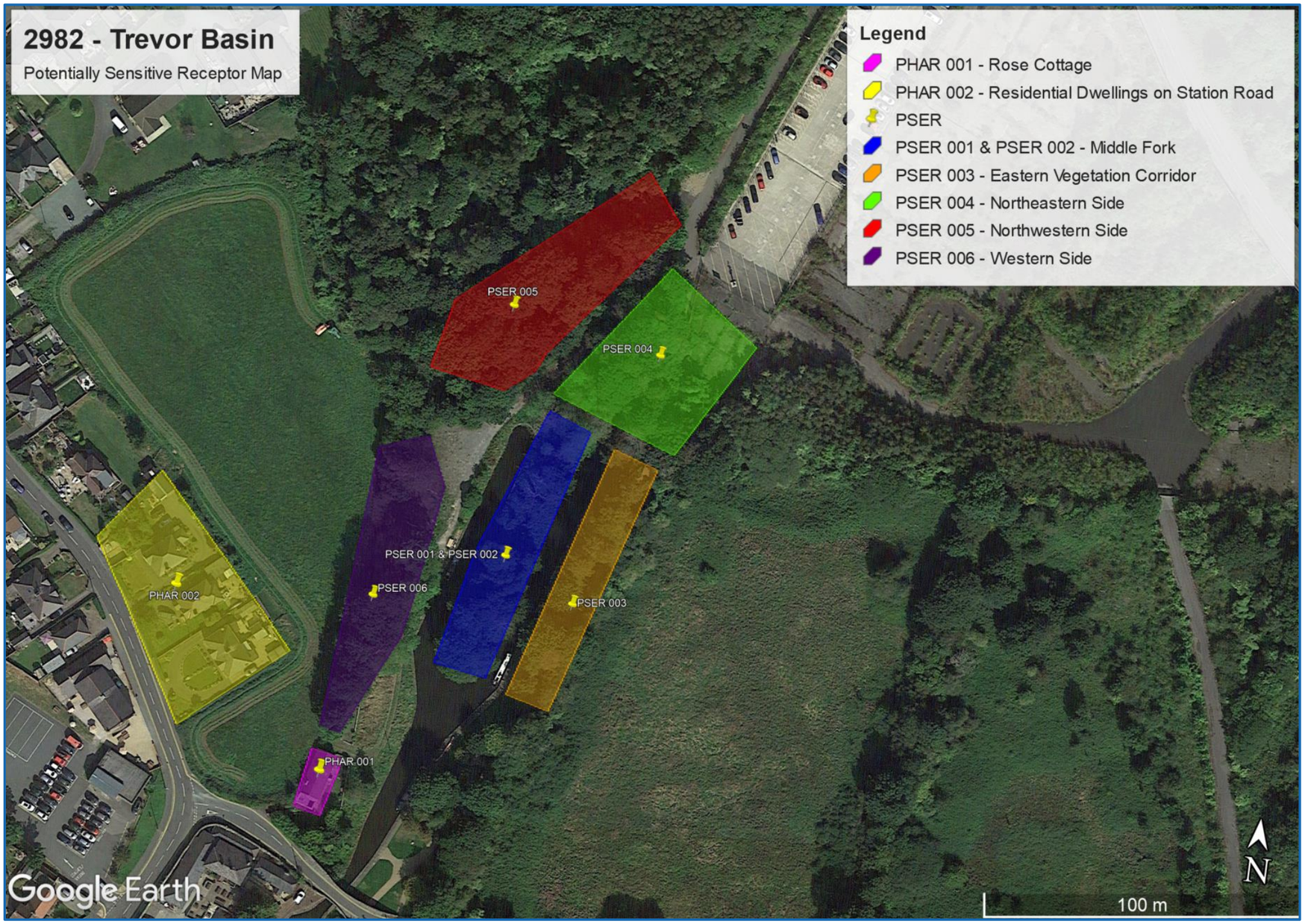


Figure 20 - Sensitive receptors

APPENDIX 4

Equipment Specification

Performance requirements for each luminaire are outlined below.

Equipment Specification	
Application Area	Car Park
Correlated Colour Temperature (Kelvin)	≤ 3000K
Luminaire Manufacturer	ASD Lighting
Luminaire Model	HWD2 3K12 500-F0-CLO Gen 5
Light Source	LED ≤ 2.11 klm
Height	≤ 6 metre
Mounting Arrangement	Post Top
Luminaire Tilt	0 Degrees
Upward Light Output Ratio **E2 < 2.5%**	0% Upward Light
Example Luminaire Image	
Controls[6]	Photocell – 35 on 18 off

Table 9: Performance requirements – Car Park

[6] Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

Equipment Specification	
Application Area	Fuel Storages
Correlated Colour Temperature (Kelvin)	≤ 3000K
Luminaire Manufacturer	BEGA
Luminaire Model	24 727 K3
Light Source	LED ≤ 0.48 klm
Height	≤ 2 metre
Mounting Arrangement	Wall mounted
Luminaire Tilt	0 Degrees
Upward Light Output Ratio **E2 < 2.5%**	0% Upward Light
Example Luminaire Image	
Controls[7]	Timeclock on/off Dimmed to 70%

Table 10: Performance requirements – Fuel Storages

[7] Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

Equipment Specification	
Application Area	Hire Boat Business Premises
Correlated Colour Temperature (Kelvin)	≤ 2700K
Luminaire Manufacturer	ASD Lighting
Luminaire Model	Stealth Elite
Light Source	LED ≤ 1.41 klm
Height	≤ 2 metre
Mounting Arrangement	Wall mounted
Luminaire Tilt	0 Degrees
Upward Light Output Ratio **E2 < 2.5%**	0% Upward Light
Example Luminaire Image	
Controls[8]	Timeclock on/off Dimmed to 25%

Table 11: Performance requirements – Hire Boat Business Premises

[8] Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

Equipment Specification	
Application Area	Bollard Path
Correlated Colour Temperature (Kelvin)	≤ 3000K
Luminaire Manufacturer	BEGA
Luminaire Model	85016K3
Light Source	LED ≤ 0.65 klm
Height	≤ 1 metre
Mounting Arrangement	Bollard
Luminaire Tilt	0 Degrees
Upward Light Output Ratio **E2 < 2.5%**	0% Upward Light
Example Luminaire Image	
Controls[9]	Timeclock in feeder pillar PIR option Dimmed to 25%

Table 12: Performance requirements – Bollard Path

[9] Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

Equipment Specification	
Application Area	Quaysides
Correlated Colour Temperature (Kelvin)	≤ 3000K
Luminaire Manufacturer	BEGA
Luminaire Model	24062K3
Light Source	LED ≤ 1.46 klm
Height	0.5m from the ground (Variable heights dependant on location onsite)
Mounting Arrangement	Wall recessed
Luminaire Tilt	0 Degrees
Upward Light Output Ratio **E2 < 2.5%**	0% Upward Light
Example Luminaire Image	
Controls[10]	Timeclock in feeder pillar Variable dimming dependant on location

Table 13: Performance requirements – Quaysides

[10] Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

Equipment Specification	
Application Area	Southern Ramp
Correlated Colour Temperature (Kelvin)	≤ 3000K
Luminaire Manufacturer	VarioFlex
Luminaire Model	VarioFlex Venus SV W930
Light Source	LED ≤ 0.18 klm
Height	0.15 metres
Mounting Arrangement	Wall recessed
Luminaire Tilt	0 Degrees
Upward Light Output Ratio **E2 < 2.5%**	0% Upward Light
Example Luminaire Image	
Controls[11]	Timeclock in feeder pillar Dimmed to 30%

Table 14: Performance requirements – Southern Ramp

[11] Dimming: when dimming is applied it is announced as a percentage still in use of the total percentage output (dimmed too, not dimmed by).

TECHNICAL DECRIPTIONS, DEFINITIONS & ABBREVIATIONS

PHAR: is an abbreviation for a potential human amenity receptor, a location where an observer could have the potential to be affected by the proposed lighting to be installed *Abbreviation used by DFL LI&P.*

PSER: is an abbreviation for an area identified as or treated as a location that may host a potentially sensitive ecological receptor. This is generally used where light sensitive bats have the potential to live, forage or use as a flight path, other ecologically sensitive receptors such as (but not limited to) the Great Crested Newt may also be identified by this term. *Abbreviation used by DFL LI&P.*

PSR: is an abbreviation for an area where an individual maybe susceptible to light brightness (Light intensity) which may have the potential to cause a hazardous situation. *Abbreviation used by DFL LI&P.*

Obtrusive Light: refers to excessive or bothersome artificial light that goes where it shouldn't, causing discomfort and disruption. *Spill light which because of quantitative, directional or spectral attributes in a given context gives rise to annoyance, discomfort, distraction or reduction in the ability to see essential information.* CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Sky glow: When lights are directed upwards or light is scattered by particles in the air, like dust or water droplets, it creates a glow that makes it hard to see stars. *The increase in diffuse illuminance of the night sky above that produced by natural sources such as the moon and visible star.* CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Vertical Illuminance: is how much light lands on upright surfaces like walls. It's measured in lux or footcandles and matters for places where the view from a vertical angle is important. *Lighting of vertical surfaces such as walls, windows, statues, sculptures and people's faces*. CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Correlated colour temperature (CCT): the appearance of light emitted by a light source measured in Kelvin (K), Lower CCT values such as 2700K represent warmer, more yellowish light, *similar to the light from older incandescent lamps. (Tcp)The temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions, measured in absolute temperature on the kelvin (K) scale.* CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Lux: measures the brightness of light as perceived by the human eye at a specific point on a surface. *The SI derived unit of illuminance, measuring luminous flux per unit area (1 lux =1 lumen/m2).* CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Lumens: measure how bright a light appears to our eyes. *The SI derived unit of luminous flux; a measure of the total quantity of visible light emitted by a source or received by a surface (unit: lumen).* CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Glare: refers to an excess of bright light that makes you uncomfortable or hinders your vision. It happens when there's a big difference between a bright light and the rest of the surroundings. *Glare: condition of vision in which there is discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or by extreme contrasts.* BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.1.8

Luminous intensity: is light brightness or how intense the light source is. light intensity is how intense a light source is emitted or received in a particular direction, this is measured candelas and is termed as luminous intensity *Iv <of a source, in a given direction> quotient of the luminous flux, dΦv, leaving the source and propagated in the element of solid angle dΩ containing the given direction, by the element of solid angle (unit: cd =lm · sr -1.* BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.2.

Candela: is a measurement for the brightness of a light source, taking into account the direction in which the light is emitted. *Base unit of luminous intensity in the International System of Units (SI); the luminous power per unit solid angle emitted by a point light source in a particular direction.* CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

Uniformity (Uo): is an explanation for the even distribution of light across an area or surface. *The overall uniformity shall be calculated as the ratio of the lowest luminance, occurring at any grid point in the field of calculation, to the average luminance.* BS EN 13201-3-2015, Calculation of Performance Section 8.3.

Luminance: is how bright a surface appears to our eyes. It considers the light coming from or reflected by an object. *Lv <in a given direction, at a given point of a real or imaginary surface> quantity defined by the formula (unit: cd · m-2 = lm · m-2 · sr-1)* BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.3.

Illuminance is how much light lands on a surface per square meter. It's measured in lux. More lux means a brighter area. *Ev (unit: lx = lm · m-2) 1. <at a point of a surface> quotient of the luminous flux dΦv incident on an element of the surface containing the point, by the area dA of that element 2. <at a point of a surface> equivalent definition: integral, taken over the hemisphere visible from the given point, of the expression.* BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.10.

Luminaire: a light fixture, this is also sometimes referred to as a lantern or a light fitting, is a product that produces artificial light. *apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply* BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.3.3

ULOR: upward light output ratio or ULOR refers to the amount of light the light fixture will produce upwards as a percentage of its total light output. *RULO <of a luminaire> ratio of the upward luminous flux of the luminaire, measured under specified practical conditions with its own lamp(s) and equipment, to the sum of the individual luminous fluxes of the same lamp(s) when operated outside the luminaire with the same equipment, under specified conditions* BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.3.12.

Maintenance factor (MF): is an allowance for how well the lights keep working overtime. It considers things like dirt on the light fittings and "wear and tear". *DEPRECATED: light loss factor ratio of illuminance produced by the lighting installation after a certain period to the illuminance produced by the installation when new Note 1 to entry: The term depreciation factor has been formerly used to designate the reciprocal of the above ratio. Note 2 to entry: The maintenance factor takes into account light losses caused by dirt accumulation on luminaires and room surfaces (in interiors) or other relevant surfaces (in exteriors, where appropriate), and the decrease of the luminous flux of lamps*. BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.5.18.

***Tilt**: is how much the luminaire is lifted based on the fitting facing flat to the ground.*

***Outreach:** how far away the fitting is from the column/wall its mounted on to the light source*.

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- **Residential** teams that cover all aspects of new development and redevelopment spanning private, section 38 and section 278 design packages.
- **Public Realm** teams that are experts in enhancing night-time public spaces to create inviting spaces and opportunity for local economies to thrive during the hours of darkness.
- **Electrical** teams – we don't just put a light in the ground, we can help you get power to it as well! Additionally, we also offer design services for EV charging. As this market rapidly expands, make sure you have the experts managing the load, otherwise your EV charging solutions might not live up to expectations.
- **Strategic Infrastructure** teams that offer Lighting and Electrical expertise for complex transport networks and interchanges.
- **Consultancy Services** teams that help when you know what you want but you need someone to help you turn the idea into a project.

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