SUBSTATION & TRANSMISSION LINES APPLICATION TO AN BORD AN BORD PLEANÁLA **WICKLOW**	HOMAN O'BRIEN *Engineering Excellence.*

Project Ref.	Document Title	Rev	Prepared by:	Issue Date	Approved by:
2211.3	Lighting Impact Assessment	P01	CM	19-10-22	SOB

Table of Figures

1 INTRODUCTION

1.1 Development Description

This Site Lighting Report prepared by Homan O'Brien is to form part of the planning Submission documentation for a proposed 110 kV substation associated works.

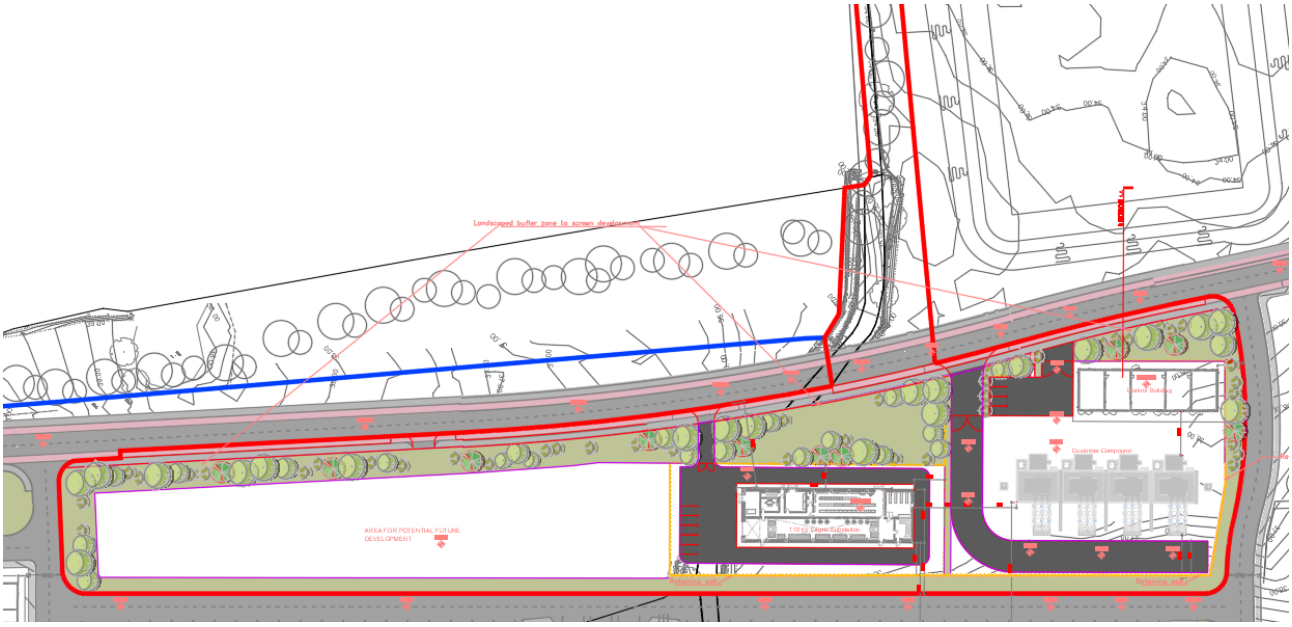


Figure 1-Site Lighting Extent

1.2 Need:

- Enhance safety of movement, such as roads, cycle routes and pathways.
- Provide security by making surveillance possible, such as a car park.
- Enable work to be carried out, such as a transport hub.
- Traffic volume and traffic speed.
- The reduction in accident rates and severity.
- Road lighting may be justified if there is an inhomogeneous traffic environment, poor road alignment, short spacing of junctions, greater than normal number of crossroads and bus stops, a lack of dedicated pedestrian footways, etc.
- Lighting is provided for social reasons; to improve the general amenity, to give safe passage for pedestrians and to provide a sense of personal security.
- Improve Security lighting levels for CCTV Systems.
- For optimum operation and so that facial recognition is not impeded, to fully determine the details of a person's face we must also consider vertical illuminance.
- To protect the night time environment and reduce energy cost, ideally the outdoor lighting would be dimmed and the space illuminated in a warmer white. A further layer would be added into this solution – smart controls – any movement within the lighting scheme can be detected and activate the lighting to a higher level of brightness and more neutral colour of white. A clear visual highlight to security systems and security personnel of any movement activity on site.
- Emergency lighting in the outdoor environment is also required so that occupants can navigate away from the building to a determined location point.

2 Proposed Design Approach

There were six key lighting design elements reviewed in advance of carrying out lighting calculations. The lighting design should conform to all standards listed below.

2.1 Design Criteria

- Lighting Lux Levels, and uniformity on walkways
- Light pollution on surrounding properties
- Luminaire intensity
- Up Light Ratio (ULR)
- Lighting Controls
- Bat disturbance mitigation

Particular design principles for South Dublin County Council are as follows.

- No trees should be installed where the canopy maximum extents is within 3m of an existing, or proposed, Public Lighting column.
- Energy efficient, DALI compatible electronic control gear is to be used for lanterns.
- Electronic driver with LED white light not greater than 4,000k or less then 3,000k
- Design life LM80 for greater than 15 years using TM21-11 test methods
- Driver current not greater than 750mA
- Impact resistance rating: >IK08
- The optic shall be protected to IP 66, the driver housing shall be protected to IP65.
- Switching of the street lighting shall be made by solid-state photoelectric switches, each light being individual controlled, as manufactured by SELC or approved equivalent.
- Cherry picker access needed for wall mounted luminaires for maintenance. This to be taken into consideration when placing fittings.

- Columns located in areas inaccessible to standard maintenance equipment must be base-hinged columns as manufactured by Abacus Lighting.
- In the case of cycle ways, the public lighting columns shall in general be located so as to provide a minimum clearance of 1,000mm between the face of the columns and the edges of the cycle track.
- Columns to be fitted with solar clock, wiring to be provided for this in design and CCTV operator informed there is no power to poles during daylight hours.
- Particular attention paid to ensure unobtrusive light as outlined in guidance documents.
- Burn hour calendars to be as agreed as per the CRU guidelines (Commission for Regulation of Utilities).

2.2 Standards

- EN 12464-2 2014 - Light and lighting. Lighting of work places. Outdoor work places
- SLL Code of Lighting 2012
- SLL Lighting Handbook 2018
- SLL Lighting Guide 1: The industrial environment (2018)
- SLL Lighting Guide 4: Sports (2021)
- SLL Lighting Guide 6: The exterior environment (2016)
- SLL Lighting Guide 9 – Lighting for communal residential buildings
- SLL Lighting Guide 14: Control of electric lighting (2016)
- SLL Lighting Guide 21 - Protecting the night-time environment Guide to limiting obtrusive light (2012)
- Institute of Lighting Professionals (ILP):
- PLG05: The brightness of illuminated advertisements (2015)
- GN01: Guidance notes for the reduction of obtrusive light (2021)
- International Commission for Illumination (CIE): CIE 150:2017: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (2nd edn)
- I.S 3217:2013+A1
- Building Regulations Part M
- LG21 Protecting the night-time environment.
- IS EN 13201-2:2015 Road Lighting — Part 2: Performance Requirements.
- IS EN 12665:2011 Light and Lighting – Basic Terms and Criteria for Specifying Lighting Requirements.
- IS EN 13201-3:2015 Road lighting — Part 3: Calculation of performance.
- IS EN 13201-4:2015 Road lighting — Part 4: Methods of measuring lighting performance.
- BS 5489.1 2013 - Code of practice for the design of road lighting Part 1: Lighting of roads and public amenity areas.
- DAC requirements specific for this development.
- HSA Regulations for Electricity.
- NSAI National Rules for Electrical Installations IS 10101:2020 5th Edition.
- ESB National Code of Practice for Customer Interface.

2.3 CIE environmental zones (source: CIE 150 (2017) Tables 2, 5 and 7

2.3.1 Zone Lighting environment Examples

- E0 Intrinsically dark UNESCO Starlight Reserves, IDA Dark Sky Parks, major optical observatories
- E1 Dark National Parks, Areas of Outstanding Natural Beauty, relatively uninhabited rural areas
- E2 Low district brightness Sparsely inhabited rural areas
- E3 Medium district brightness Well inhabited town and urban settlements
- E4 High district brightness Town and city centres, out of town retail parks

Night-time limit values for different environmental zones (source: CIE 150 (2017)

Time Maximum values of vertical illuminance on properties (lux) for stated CIE Environmental zone

	E0	E1	E2	E3	E4
Pre Curfew	0	2	5	10	25
Post Curfew	0	0.1	1	2	5

Item Maximum permitted values of average surface luminance (cd/m2) for stated maximum values of upward light ratio (ULR) of luminaires (%)

	0	0	2.5	5	15
Building façade	<0.1	<0.1	5	10	25
Signs	<0.1	50	400	800	1000

* If the installation is for public (road) lighting then this may be up to 1 lux

The site is classified as an 'E3' environment in accordance with IS EN 12464-2:2014. This represents medium district brightness areas, such as industrial or residential suburban areas. The following lighting criteria must be adhered to when designing a lighting installation for an E3 environment**.**

2.4 Light Pollution (Obtrusive Light) on Surrounding Properties

- 10 lux pre-curfew (maximum value of vertical illuminance on properties)
- 2 lux post-curfew (maximum value of vertical illuminance on properties)

2.4.1 Luminaire Intensity (cd - candela)

- 10000 pre-curfew
- 1000 post-curfew

2.4.2 Upward Light (ULR %)

- 15%

General Task Lighting allows occupants navigate through the site and around building pedestrian pathways. General lighting is required during the normal operation of the building while emergency lighting is required in the case were the normal lighting operation fails due to power loss. The CIBSE lighting guides and IS EN 12464-2: 2014 recommend lighting values for external roadways & path ways.

2.5 General Lighting Design Values

The CIE has developed a structured model for the selection of the appropriate lighting classes. Lighting Classes are grouped into three categories: Class M, Class C and Class P. Class is selected based on the luminance or illuminance concept, taking into account the different parameters relevant for the given visual tasks. Applying for example time dependent variables like traffic volume or weather conditions, the model offers the possibility to use adaptive lighting systems

The selection of an appropriate P Lighting Class for a given area are summarized in CIE 115 Table 6. Results based on this are as follows –

- P2 – Private Roads

Lux levels for P lighting class is confirmed in EN 13201-2:2015 Road lighting — Part 2, Figure 4, CIBSE SLL Lighting Handbook 2018 Table 26.5 Lighting Recommendations for areas adjacent to the carriageway, residential or tasks and activities, Figure 5 and BS 5489.1 2013 – Table A.7.

P2 area an Illuminance of 10 Lux average with a minimum of 2 Lux is required

For guidelines for pedestrian walkways & loading points refer IS EN 12464-2:2014 Table 5.1.

Table 5.1 — General requirements for areas and for cleaning at outdoor work places

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.1.1	Walkways exclusively for pedestrians	5	0,25	50	20	
5.1.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	0,40	50	20	
5.1.3	Regular vehicle traffic (max. 40 km/h)	20	0,40	45	20	At shipyards and in docks, R_{GL} may be 50
5.1.4	Pedestrian passages, vehicle turning, loading and unloading points	50	0,40	50	20	
5.1.5	Cleaning and servicing	50	0,25	50	20	All relevant surfaces

For guidelines for Car Park Areas refer IS EN 12464-2:2014 Table 5.9

Table 5.9 — Parking areas

Ref. no.	Type of area, task or activity	$\bar{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.9.1	Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0.25	55	20	
5.9.2	Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0,25	50	20	
5.9.3	Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose building complexes	20	0,25	50	20	

2.6 Lighting Controls

Lighting controls are essential for all exterior lights. A photo-electric cell (PEC) is proposed for automatic switch-on at dusk and off with time control. Presence detection may also be incorporated for safety purposes & bat consideration, e.g. After curfew when no staff or public are outside, after a set interval time, lighting would reduce to a pre-determined level, e.g. 50%, but as soon as human or vehicular movement is detected, full illumination is restored.

We have not proposed any façade illumination.

2.7 Viewpoints

In addition to the setting we have considered the critical viewpoints which may be affected by the installation. We have reviewed impact on nearby residents, Businesses, Road users. There are no higher ground distant viewpoints to consider for this scheme

3 Road Lighting

The CIE has developed a structured model for the selection of the appropriate lighting classes (M, C, or P), based on the luminance or illuminance concept, taking into account the different parameters relevant for the given visual tasks. Applying for example time dependent variables like traffic volume or weather conditions, the model offers the possibility to use adaptive lighting systems.

3.1 Terms and Definitions

The terms discussed in this clause are defined in the International Lighting Vocabulary (CIE DS 017.2/E:2009) or in CIE 140-2000.

3.1.1 Average Luminance of the Road Surface [Lav]

The values of Lav are the minimum values to be maintained throughout the life of the installation for the specified lighting class(es). They are dependent on the light distribution of the luminaires, the luminous flux of the lamps, the geometry of the installation, and on the reflection properties of the road surface. Higher levels are acceptable when they can be environmentally or economically justified.

The calculation of the average luminance of the road surface should be carried out in accordance with CIE 140-2000.

Calculated values should consider the luminaire and lamp maintenance factors.

Luminaire maintenance factors vary according to the intervals between cleaning, the amount of atmospheric pollution, the quality of the sealing of the lamp housing of the luminaire, and the age of the materials. Their values may be established by field measurements. Lamp flux maintenance factors vary according to lamp type and power.

3.1.2 Overall Uniformity of Road Luminance [Uo]

Uo is the ratio of the minimum luminance at a point to the average road surface luminance and should be calculated according to CIE 140-2000. This criterion is important as regards the control of minimum visibility on the road.

3.1.3 Longitudinal Uniformity of Road Surface Luminance [Ul]

Ul is the ratio of the minimum to the maximum luminance along a line or lines parallel to the run of the road and should be calculated in accordance with CIE 140-2000. It is mainly a criterion relating to comfort and its purpose is to prevent the repeated pattern of high and low luminance values on a lit run of road becoming too pronounced. It only applies to long uninterrupted sections of road.

3.1.4 Threshold Increment TI [fTI]

Disability glare results from the scattering of light within the eye, so reducing contrasts of the retinal image. The effect may be explained by the superimposition of a uniform luminance veil over the scene, which is quantified as the equivalent veiling luminance. The magnitude of this depends on the illuminance on the driver's eye from the luminaires and the angles at which they are seen. While the degree of disability glare increases with the equivalent veiling luminance, it decreases as a function of the average road luminance.

TI is a measure of the loss of visibility caused by the disability glare from the road lighting luminaires. The formula from which it is calculated is based on the percentage increase in the luminance difference needed to make the object visible in the presence of glare when it is just visible in the absence of glare, that is, when the luminaires are screened from the view of the observer.

The mathematical procedure is given in CIE 140-2000 and the calculation is made for a clean luminaire equipped with a lamp emitting the initial luminous flux.

3.1.5 Surround Ratio SR [Rs]

One of the principal aims in road lighting is to create a bright road surface against which objects can be seen. However, the upper parts of tall objects on the road and objects towards the side of the road, particularly on curved sections, are seen against the surrounds of the road. Thus adequate lighting on the surrounds helps the motorist to perceive more of the environment and make speed adjustments in time.

The function of the surround ratio is to ensure that light directed on the surrounds is sufficient for objects to be revealed. In situations where lighting is already provided on the surrounds the use of surround ratio is rendered unnecessary.

Surround ratio is defined in CIE 140-2000.

3.1.6 Discomfort Glare

No fully satisfactory method has yet been devised for quantifying discomfort glare to drivers on traffic routes. Formerly G, the Glare Control Mark (CIE 31-1976), was used but resulted in anomalies. Field evidence suggests that installations designed within the limits of threshold increment recommended in Tables 2 and 5 are generally acceptable as regards discomfort glare.

Bright surroundings, such as lighted buildings, tend to mitigate discomfort glare but as the lighting of buildings is variable and may be extinguished during the night, it is not practicable to allow for this in the design of the road lighting

3.1.7 Need

There are three main purposes of road lighting:
1) to allow all road users, including operators of motor vehicles, motor cycles, pedal cycles, and animal drawn vehicles to proceed safely,
2) to allow pedestrians to see hazards, orientate themselves, recognize other pedestrians, and give them a sense of security,
3) to improve the daytime and night-time appearance of the environment

3.2 Quality Criteria and Lighting Classes

3.2.1 Quality Criteria for Road Lighting

The approach generally used when selecting quality criteria for lighting roads for motor traffic is based on the luminance concept. Illuminance is still used by some countries, but experience has shown this to be an unsatisfactory criterion. In the application of the luminance concept, the aim is to provide a bright road surface against which objects are seen in silhouette. It uses, therefore, level and uniformity of road surface luminance, as well as glare control, as quality criteria. However, many objects on the road are of high reflectance, so they are not seen in silhouette but rather by directly reflected light.

Furthermore, in congested traffic conditions, much of the view of the road surface may be obstructed by vehicles and thus cannot provide a background for revealing objects. Nevertheless, the approach of providing a good level and uniformity of road luminance with adequate glare control has been widely adopted in national and international recommendations. Experience gained in using these criteria for several decades indicates that they provide a satisfactory basis for road lighting design.

Although prescribed values of the criteria were originally arrived at because of experimental work, they have been tempered by experience over this time and the approach suggested in this document represents good present-day practice.

However, in special situations called "conflict areas" in this report, the design of the lighting installation can be based on the illuminance concept. The lighting design for pedestrian and very low speed areas is also based on illuminance requirements.

3.2.2 Quality Criteria

The road lighting should enable pedestrians to discern obstacles or other hazards in their path and be aware of the movements of other pedestrians, friendly or otherwise, who may be in close proximity. For this, the lighting on both horizontal and vertical surfaces, as well as the control of glare and the colour rendering, is important. Environmental issues should be taken into account.

3.2.3 Lighting of Horizontal Surfaces

To ensure that the pedestrian can move over the road and footpath surfaces in safety, the horizontal illuminance, Eh, must be adequate. Horizontal illuminance is measured at ground level in terms of average and minimum values, and applies to the whole of the used surface, which usually comprises the footways and the carriageway surface, unless the carriageway is treated separately under the provisions for motorized traffic.

3.2.4 Lighting of Vertical Surfaces

Adequate lighting of vertical surfaces is necessary for facial recognition, which may also enable an act of aggression to be anticipated. The quantification of this presents a difficulty CIE 115:2010 17 because of the multiplicity of planes at each measurement point which must be taken into account. An attempt to overcome this has been made by considering the illuminance on an infinitesimal vertical half cylinder situated at head height (1,5 m). This measure, the semi-cylindrical illuminance, Esc, has been introduced in CIE136-2000, as an adjunct to horizontal illuminance. For its measurement a special adaptation is required to the mounting of the photoelectric detector which is used to measure planar illuminance.

3.2.5 Control of Glare

The control of discomfort and disability glare is not as critical as for the motorist, because speed of movement is much lower, giving a greater reaction time. No method of quantifying glare has been agreed to internationally, but a number of methods are in current use on a national basis. Methods for quantifying and controlling glare in pedestrian and low speed traffic areas are given in Annex D.

3.2.6 Choice of Light Source

Monochromatic light sources should be avoided for areas where the crime risk is high, that are environmentally sensitive, or where pedestrian activities predominate. Using light sources with better colour rendering properties will improve the possibility to see colour contrasts and contributes to a better facial recognition. This could be of particular importance for elderly or visually impaired users of pedestrian and low speed traffic areas. NOTE The use of low-pressure sodium lighting is considered a positive environmental step in areas with sensitive optical astronomical facilities and near sea turtle nesting areas.

Selection of Lighting Classes Tables quantifying the details of different lighting classes and referred to below can be found in the relevant clauses following, where they are discussed in more detail.
A

3.2.7 Normal Lighting

Normal lighting class is that class which is appropriate if the same level is to be used throughout the hours of darkness. In selecting the normal lighting class the maximum value of the selection parameters likely to occur at any period of operation should be considered, e.g. for traffic volume consider peak hourly value.

3.2.8 Adaptive Lighting

The normal lighting class is selected using the most onerous parameter values, and the application of this class may not be justified throughout the hours of darkness (This might be under changing conditions e.g. weekends, different weather conditions). Temporal changes in the parameters under consideration when selecting the normal lighting class could allow, or may require, an adaptation of the normal level of average luminance or illuminance, usually by reducing the level.

The adapted lighting level or levels should be the average luminance or illuminance from a class or classes in the same table from which the normal lighting class has been selected.

It is important that the changes in the average lighting level do not affect the other quality criteria outside the limits given in the system of M, C or P lighting classes. Reducing the light output from every lamp by the same amount using dimming techniques will not affect luminance or illuminance uniformity, or the object contrast, but the threshold contrast increases. Reducing the average level by switching off some luminaires will not fulfil the quality requirements and is not recommended.

The use of adaptive lighting can provide significant reduction in energy consumption, compared with operating the normal lighting class throughout the night. It can also be used to reduce energy consumption by reducing the lamp light output to the maintained value when the installation is clean, and the lamps are new. Where the pattern of variation in parameter values is well known, such as from a record of traffic counts on traffic routes, or can be reasonably assumed, as in many residential areas, a simple time-based control system may be appropriate. In other situations, an interactive control system linked to real-time data may be preferred. This approach will permit the normal lighting class to be activated in the case of road works, serious accidents, bad weather or poor visibility.

3.3 Lighting Levels for Pedestrian and Low Speed Traffic Areas

The parameters relevant for the selection of an appropriate P lighting class for a given pedestrian or low speed traffic area are summarized in Table 6. The lighting classes P1 to P6 are defined by the lighting criteria given for each class in Table 7. They are intended for pedestrians and pedal cyclists on footways, cycleways, and other road areas lying separately or along the carriageway of a traffic route, and for residential roads, pedestrian streets, parking places, etc.

Results based on this are as follows –

- P2 – Private Roads

CIE 115:2010

Table 6. Parameters for the selection of P lighting class.

Parameter	**Options**	**Weighting Value V_w**	**V_w Selected**
Speed	Low	1	
	Very low (walking speed)	0	
Traffic volume	Very high	1	
	High	0,5	
	Moderate	0	
	Low	-0,5	
	Very low	-1	
Traffic composition	Pedestrians, cyclists and motorized traffic	2	
	Pedestrians and motorized traffic	1	
	Pedestrians and cyclists only	1	
	Pedestrians only	0	
	Cyclists only	0	
Parked vehicles	Present	0,5	
	Not present	0	
Ambient luminance	High	1	
	Moderate	0	
	Low	-1	
Facial recognition	Necessary	Additional requirements	
	Not necessary	No additional requirements	
		Sum of **W**eighting **V**alues	V_{WS}

Figure 2-Parameters for the selection of P Lighting Class

Table 7. Lighting classes for pedestrian and low speed traffic areas.

Lighting Class	Average horizontal illuminance $E_{h,av}$ in lx	Minimum horizontal illuminance $E_{h,min}$ in lx	Additional requirement if facial recognition is necessary	
			Minimum vertical Illuminance $E_{v,min}$ in lx	Minimum semi-cylindrical illuminance $E_{sc,min}$ in lx
P1	15	3,0	5,0	3,0
P2	10	2,0	3,0	2,0
P3	7,5	1,5	2,5	1,5
P4	5,0	1,0	1,5	1,0
P5	3,0	0,6	1,0	0,6
P6	2,0	0,4	0,6	0,4

NOTE 1. To provide for uniformity the actual value of the maintained average illuminance may not exceed 1,5 times the value indicated for the class.

2. A high colour rendering contributes to a better facial recognition.

Figure 3 Lighting classes for pedestrian and low speed traffic areas.

4 Bat Protection

For Bat protection, the following mitigation measures have been imposed.

Lighting has only been installed where necessary for public safety. These lights have been designed and selected with specific shutters and filters to minimise any potential for back spills into the sensitive locations while still providing the primary function of safely lighting to the circulation routes.

4.1 Reflectance

Downward lighting can be reflected from bright surfaces. To minimize bat disturbance, the design avoids the use of bright surfaces and incorporates darker colour lamp heads and poles to reduce reflectance (RAL Anthracite grey).

4.2 Shielding of Luminaires & Light

To minimize bat disturbance, the design avoids the use of upward lighting by shielding or by downward directional focus.

4.3 Type of Light

To minimize bat disturbance, the design avoids the use of strong UV lighting. The lighting design is based on the use of LED lighting which has minimal or no UV output of significance and use of monochromatic sources and a warm-white (3000K) LED with low blue content.

5 Proposed Lighting Scheme

Pole top lighting is the primary lighting type proposed throughout. The proposed luminaires are utilized to meet all the aforementioned design criteria (minimum lux levels, glare, colour rendering etc.). Lighting specification sheets can be seen in Site Lighting Layout in Appendix 1.

Figure 4 Luminaire X1 Thorn Isaro Pro IP12L50 730 NR C95 CL2 WS3 T60F ANT 929902511

Figure 5 Luminaire X2 Thorn Isaro Pro IP12L70 730 EWR C95 BP 3550 HFX CL2 WS3 T60 ANT 96275919

Figure 6 Luminaire X3 Thorn lighting – Piazza II LED 1690-830 HF ANT 96632757

6 Proposed Lighting Scheme Calculation Results:

The figures below detail the light calculation result generated by Dialux.

Location	Average lux level	Uniformity	P Class
Access Road & Road Adjacent to Egrid Substation	12.1 Lux	0.27	P2 Compliant
Access Road & Road Adjacent to Customer Compound	11.8 Lux	0.29	P2 Compliant
Parking Adjacent to Control building	11.5 lux	0.28	P2 Compliant
Adjacent footpaths to Customer Compound	9.91	0.40	P2 Compliant

Figure 7 Lighting Scheme Calculation Results

On review of the lighting results, light levels achieved are in line with standards and little or no light pollution on adjacent properties exist.

The ULR has been estimated at 1.0% which is less than the design criteria maximum of 15% for an E3 environment.

Access Road & Road Adjacent to Egrid Substation – Average lux level: 12.7 Lux at 0.39 uniformity

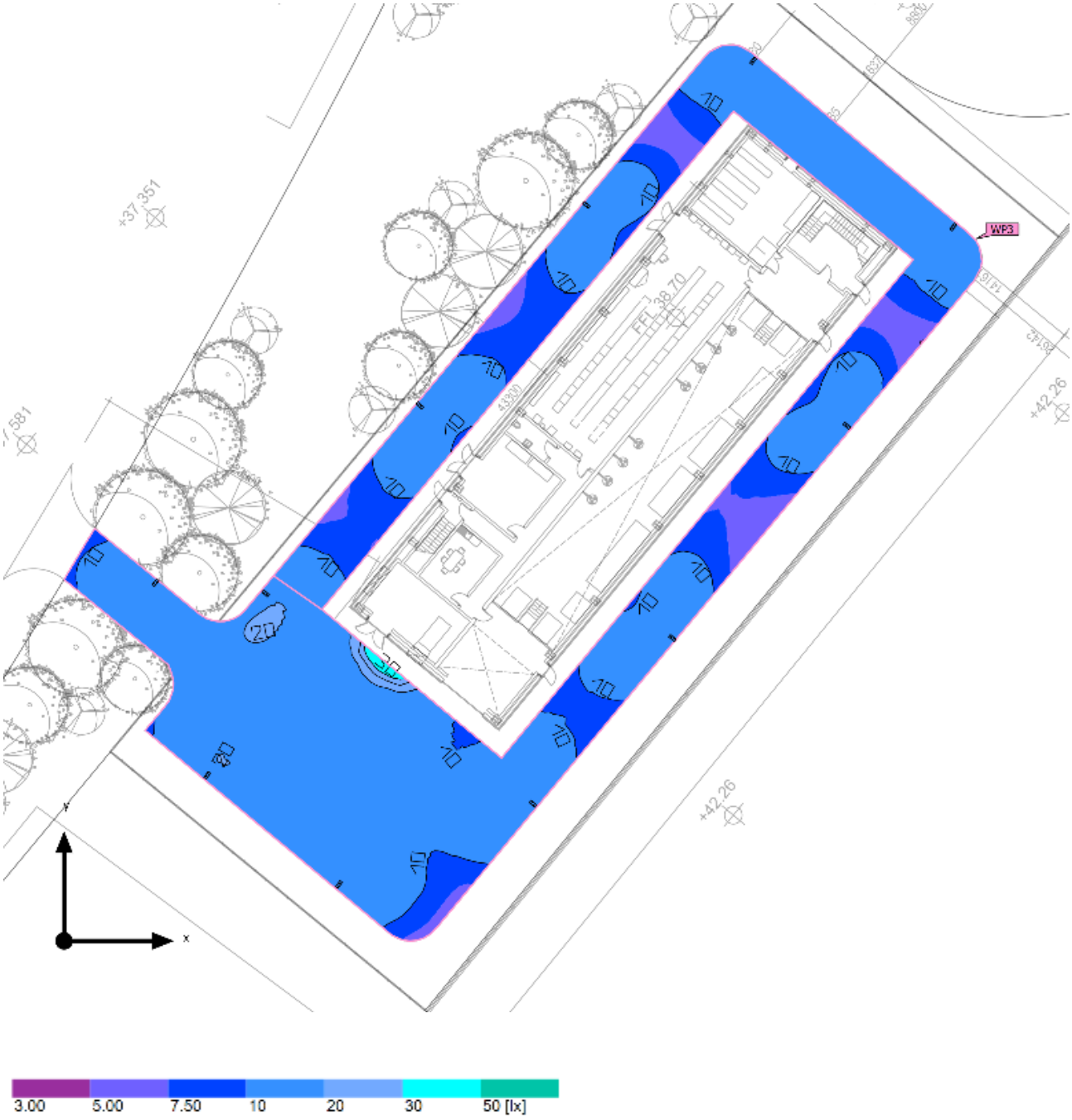


Figure 8 Access Road & Road Adjacent to Egrid Substation False Colours

Access Road & Road Adjacent to Customer Compound – Average lux level: 11.1 Lux at 0.54 uniformity

Results

	Symbol	Calculated	Target	Check	Index
Working plane	$\bar{E}_{perpendicular}$	11.1 lx	≥ 10.0 lx	✓	WP1
	g_1	0.54	-	-	WP1

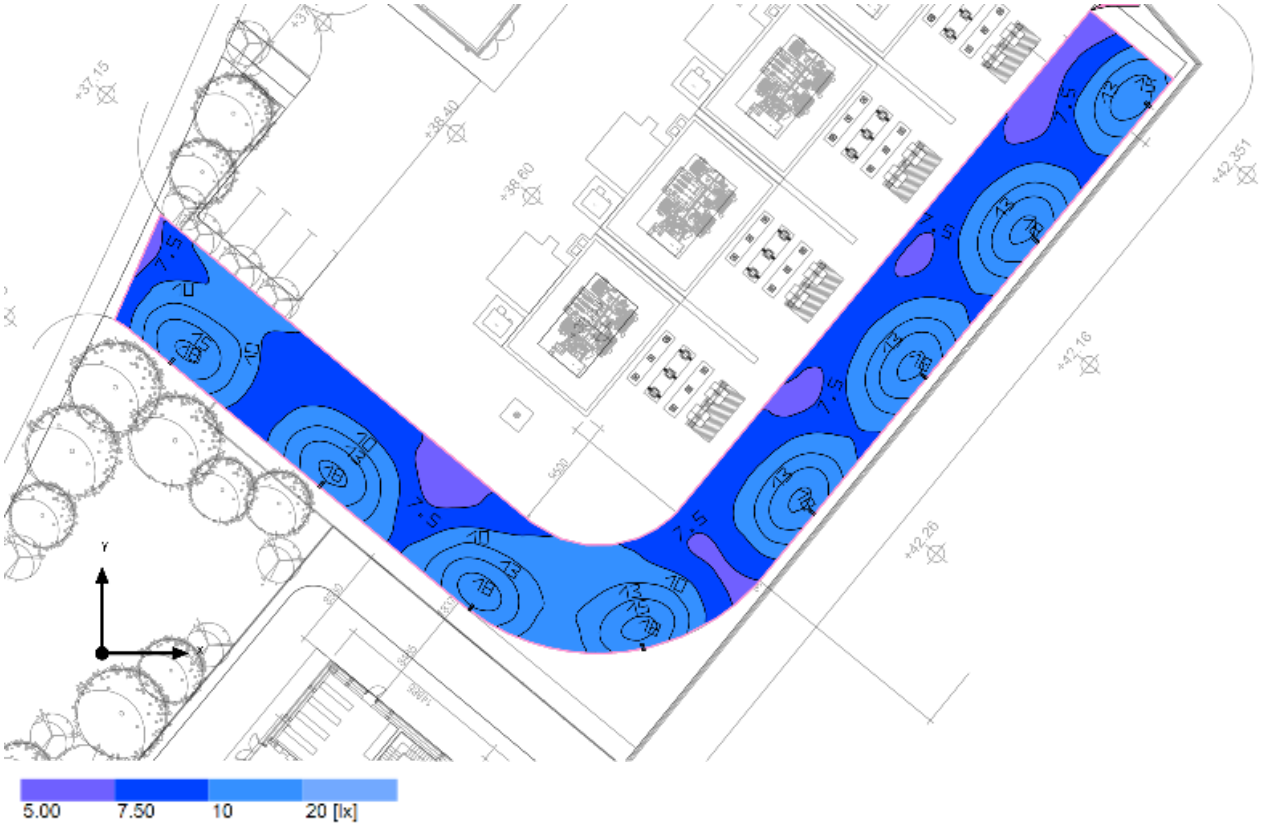


Figure 9 Access Road & Road Adjacent to Customer Compound False Colours

Parking Adjacent to Control Building – Average lux level: 12.8 Lux at 0.39 uniformity

Results

	Symbol	Calculated	Target	Check	Index
Working plane	$\bar{E}_{perpendicular}$	12.8 lx	≥ 10.0 lx	✓	WP2
	g_1	0.39	-	-	WP2

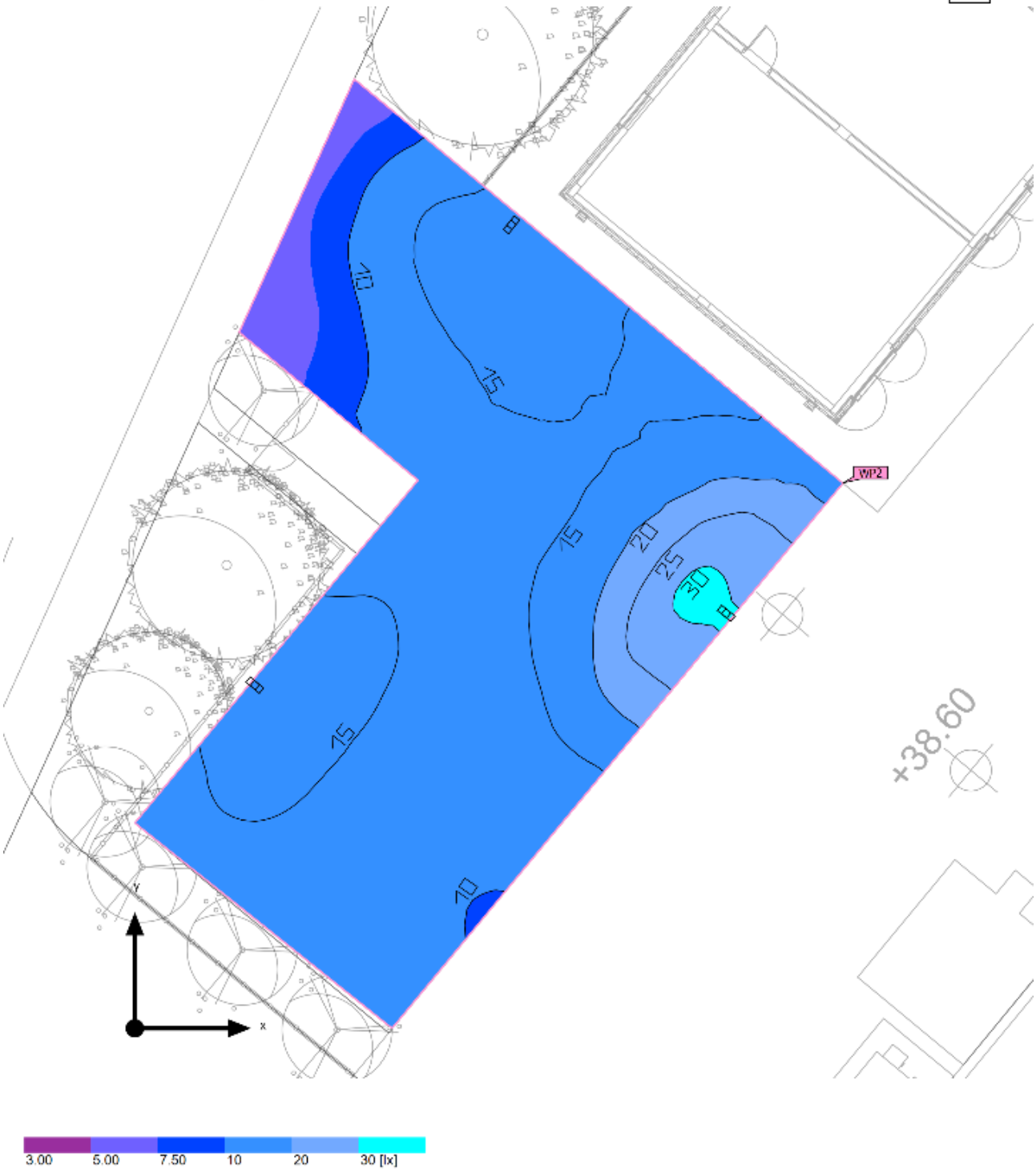


Figure 10 Parking Adjacent to Control Building False Colours

Adjacent footpaths to Customer Compound – Average lux level: 9.91 Lux at 0.40 uniformity

Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Calculation surface 2 Perpendicular illuminance Height: 0.000 m	9.91 lx	3.94 lx	26.8 lx	0.40	0.15	CG2

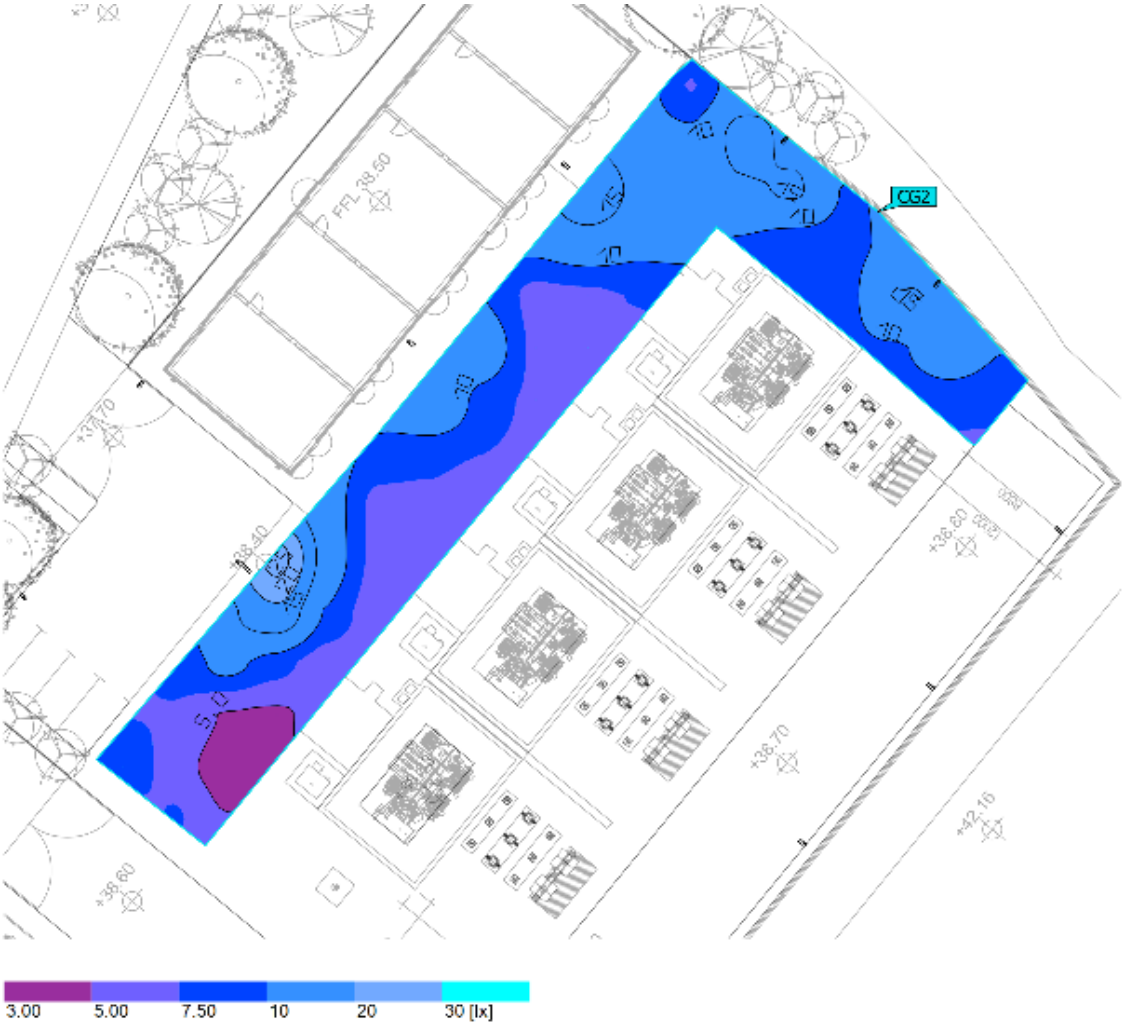


Figure 11 Adjacent footpaths to Customer Compound False Colours

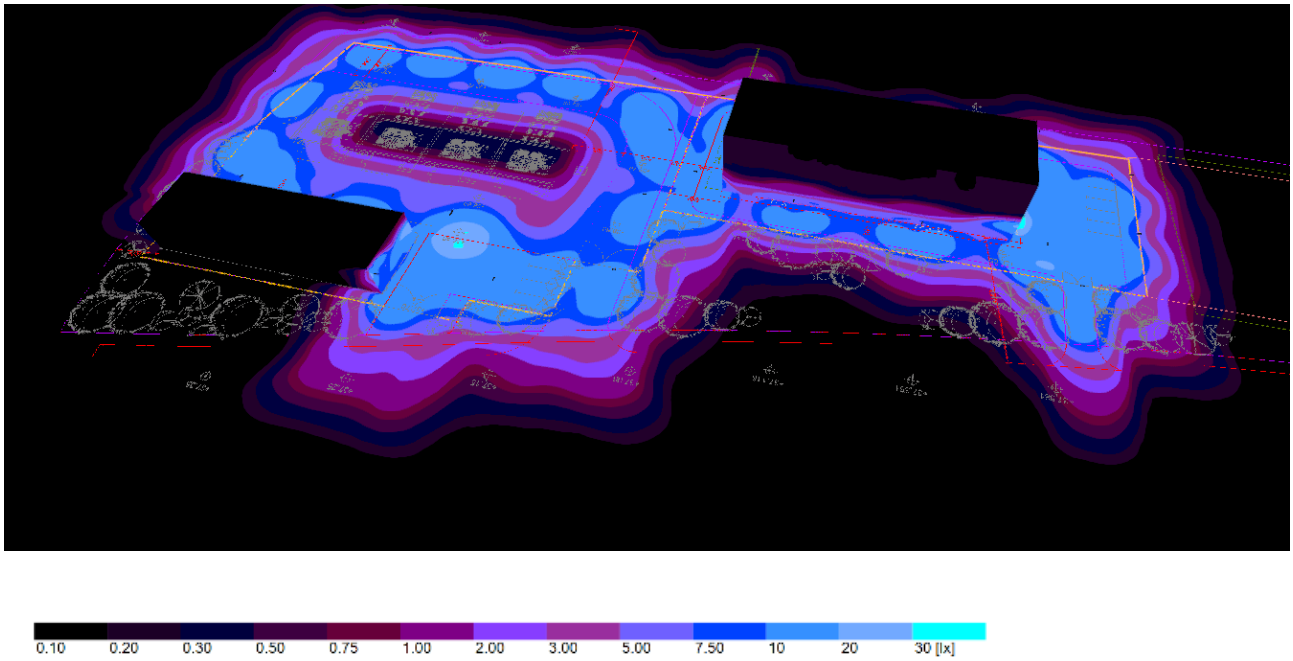


Figure 12 3D Model false colour rendering visualization from Public Road

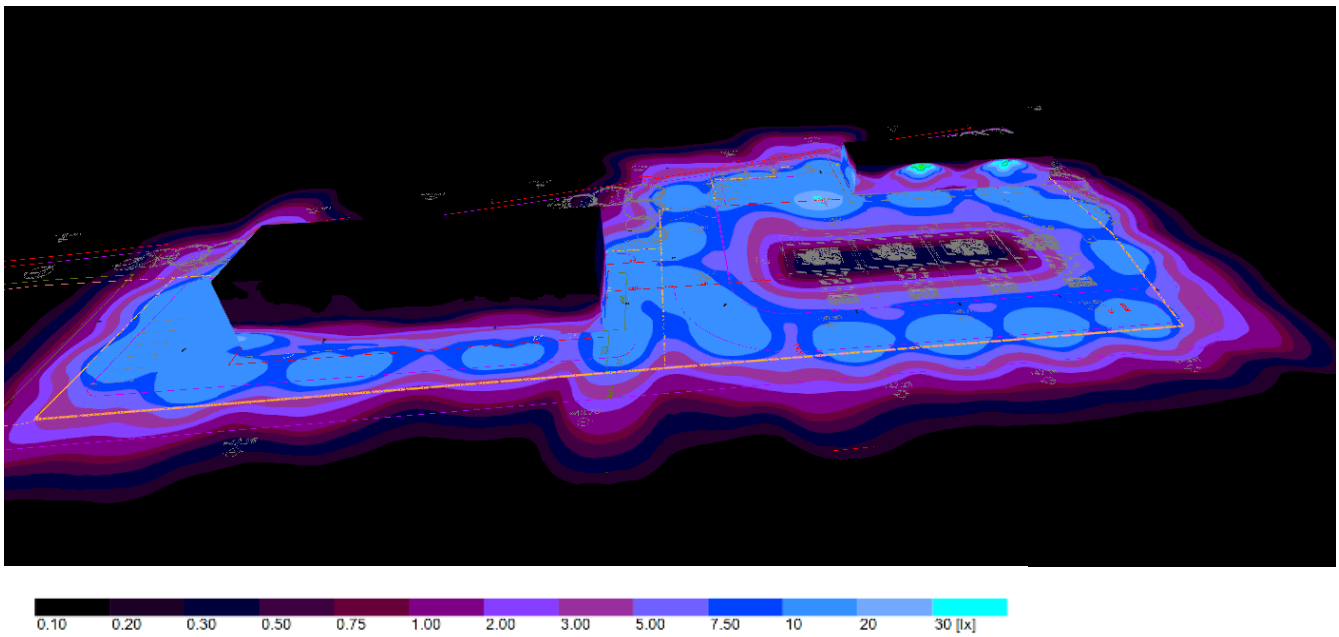


Figure 13 3D Model false colour rendering visualization from ICT Development Ref 20/1088

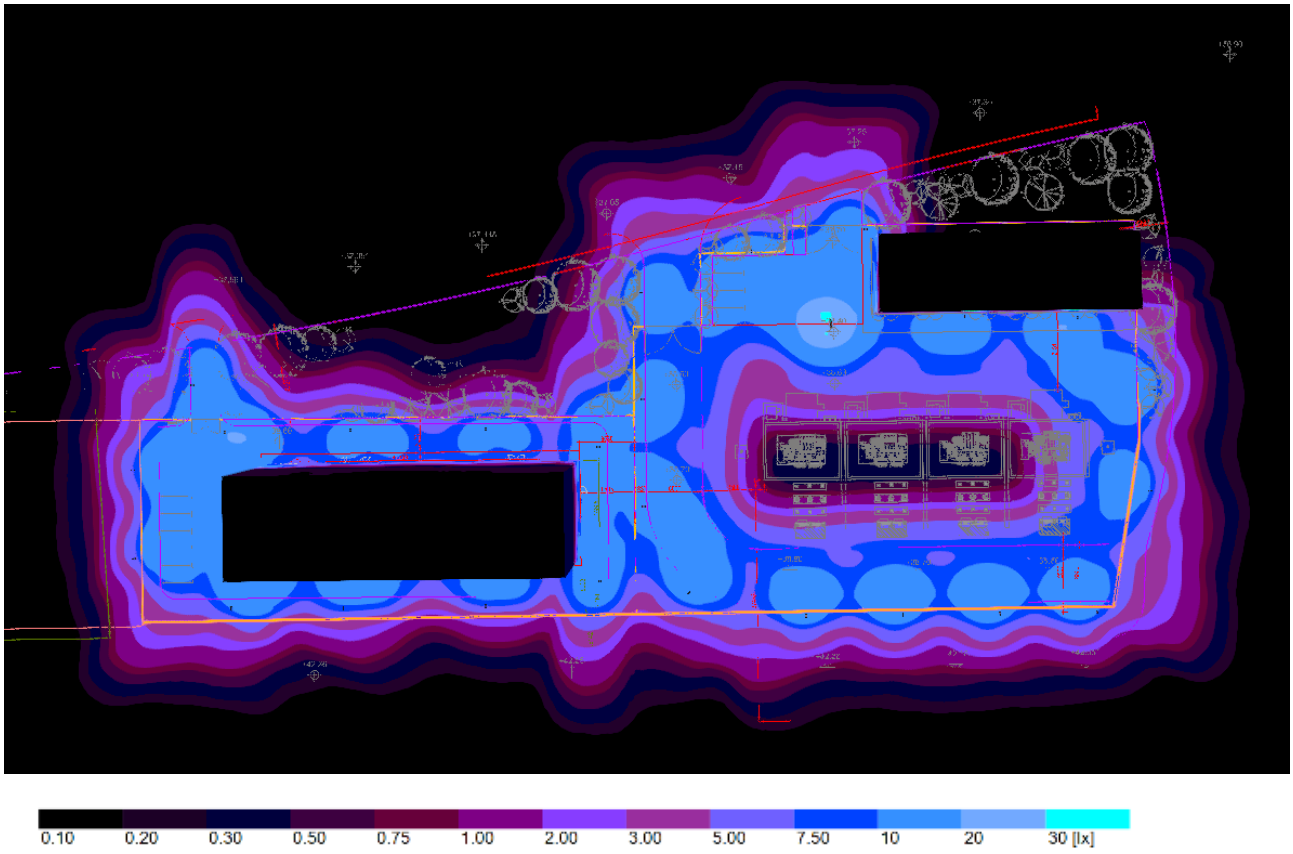


Figure 14 3D Model false colour rendering visualization – Birds eye.

7 Conclusion

The calculations confirm that the design as presented complies with the design criteria of an E3 environment.

The design includes for mitigation to bat foraging which are light sensitive 3000k lighting is being used throughout.

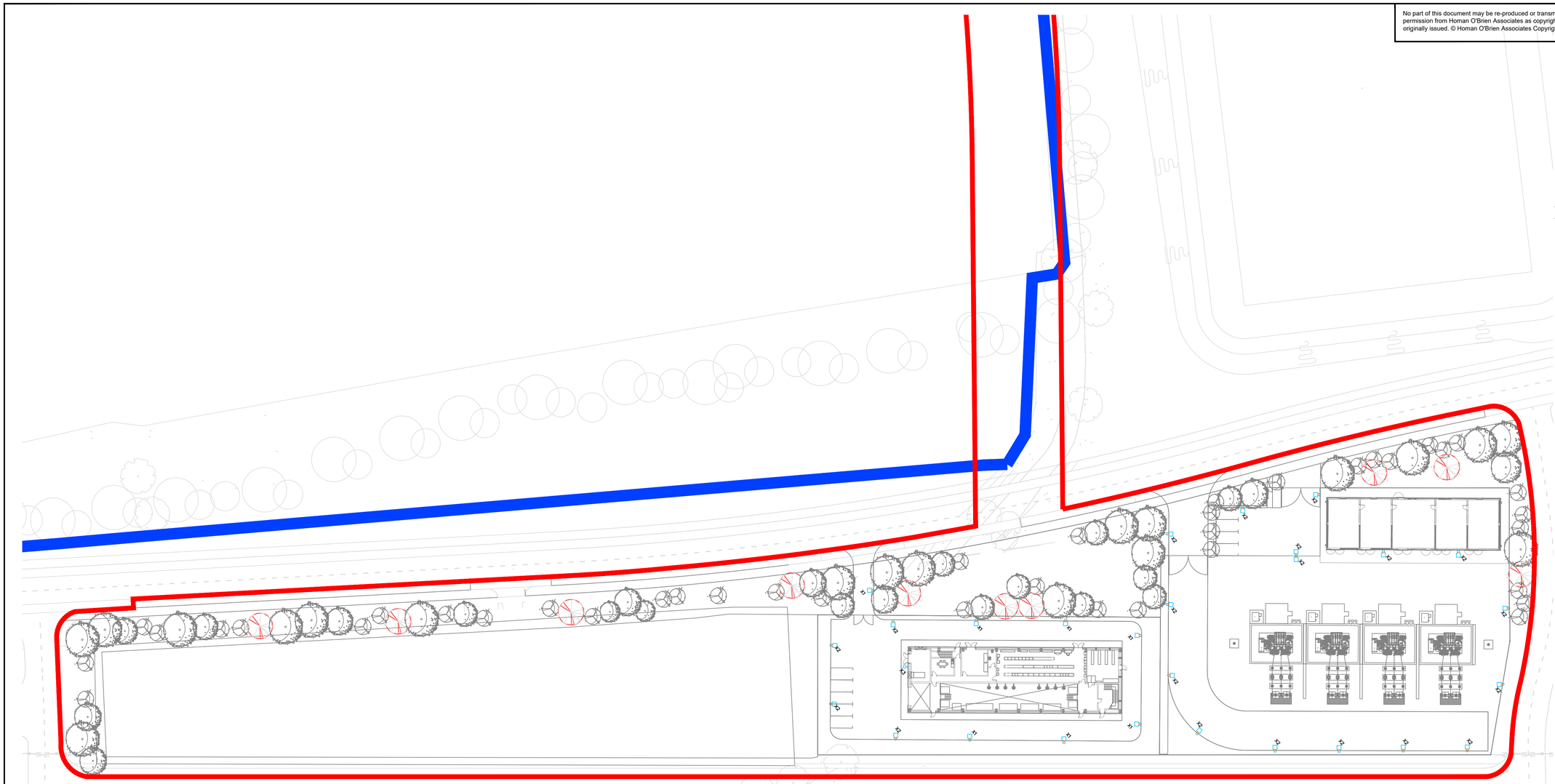
6m poles will be used throughout with lights being used with no upward light output.

Good optical control will be used with an upward light ratio of 15% for the fittings.

The proposed layout offers a design aesthetically pleasing for occupants and for the site as a whole. Homan O' Brien believe the proposed layout will blend seamlessly into the surrounding environment.

8 Appendix 1;

8.1 Lighting Layout Drawing



Symbols Reference:

X1 — Pole Mounted Luminaire – 6m High – Narrow Road Distribution

X2 — Pole Mounted Luminaire – 6m High – Wide Road Distribution

X3 — Wall Mounted Luminaire

Lighting Type X1
Thorn Isoro Pro

Lighting Type X2
Thorn Isaro Pro

Lighting Type X3
Thorn Piazza II

ISSUED FOR PLANNING

0 10 20 30 40 50
METRES

Revision	Issue: P–Preliminary T–Tender CN–Construction A–Approval I–Information	Date	Checked
	Issued for Planning	20-10-2022	P01 C.M.

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Proposed 110kV GIS Substation and Transmision Line Connections

Crag Wicklow Limited

Electrical Services Installation

Site Plan
Site Lighting Layout

Reddy Architecture + Urbanism
41 Dean Street,
Kilkenny

Drawing Number	Date	Scale	Drawn	Checked	Issue
2211.3–E1000		Refer to Scalebar	CM	SOB	01