Waterman Moylan
Engineering Consultants

Public Lighting Calculation Report

Proposed Residential Development at Ballyoulster, Celbridge, Co. Kildare

June 2022

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Client Name:	Kieran Curtin, Receiver over certain assets of Maplewood Developments Unlimited Company (in liquidation and in receivership)
Document Reference:	21-121.r002 Lighting Calculation Report
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Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	26-05-22	N. Coughlan	Niall Coughlan	Draft
2	10-06-22	N. Coughlan	Niall Coughlan	Draft
3	14-06-22	N. Coughlan	Niall Coughlan	N. Coughlan

Comments

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Disclaimer

This report has been prepared by Waterman Moylan, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the Client.

We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report is confidential to the Client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

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1. Introduction

Waterman Moylan have been appointed to conduct an analysis of the external lighting designs for the proposed strategic housing development at lands at Ballyoulster, Celbridge, Co. Kildare. The proposed development comprises a Strategic Housing Development of 344 no. residential units (comprising 54 no. 1 beds, 30 no. 2 beds, 210 no. 3 beds and 50 no. 4 beds), a childcare facility with a GFA of c. 369 sq.m, public and communal open space, landscaping, car and cycle parking spaces, provision of an access road from Dublin Road and Shinkeen Road, associated vehicular accesses, internal roads, pedestrian and cycle paths, bin storage, ESB substations, pumping station and all associated site and infrastructural works.

This report outlines the design intent and considerations to be taken into account with regards to the lighting designs for the proposed development. Particular attention will be given to how the lighting designs have been tailored to minimise obtrusive light spill and to mitigate impacts on bats and other wildlife.

The report considers the lighting design provided by Sabre Electrical which has been developed with the following principal considerations:

- To preserve residential amenity of neighbouring properties and the impact of lighting on the bat's natural habitat.
- Provide adequate illumination to contribute towards the safe use of the green walkway and general public walkways.
- Contain the lighting within the site and minimise light pollution and visual glare.

The complete external lighting installation has been designed in accordance with the regulations for electrical services "National Rules for Electrical Installations I.S. 10101" and Bat Conservation Ireland (BCI) guidelines. These design criteria are outlined in Section 2.0.

Section 3 of the report details the design methodology and the specific mitigation measures that have been implemented in the design and Section 4 describes the specific light fittings proposed and the results that have been achieved by the lighting design

2. Standards & Design Criteria

2.1 Lighting Standards & Design Guides

The lighting design for the Greenway and for the public lighting is based on best practice and more importantly National & International Industry Standards, incorporating the following:

- ETCI National Rules for Electrical Installations ET101:2008 plus amendments
- Bat Conservation Ireland (BCI) guidelines
- Guide to Obtrusive lighting, The ILE guidance Notes on reduction of Obtrusive Light and CIE.
- The Institution of Lighting Professionals (ILP) and the Bat Conservation Trust Guidance note 08/18 - Bats and artificial lighting in the UK. Bats and the Built Environment series.
- The Kildare Development Plan 2017 – 2023 (PL1, PL2, PL3, PL4, PL6, PC4, GI21 and Section 17.7.5 which refers to the KCC Street Lighting Technical Specification) and the Celbridge Local Area Plan 2017-2023

2.2 General Design Criteria

The lighting design parameters proposed for the development are as follows

The Public Lighting (estate roads & car parking) require 5 lux

The Greenway Pedestrian Route will require 3 lux

2.2.1 Design Criteria related to Bats & Other Wildlife

The project Ecologist, Altemar Marine & Environmental Consultancy provided advice and guidance in relation to the lighting design and how it could be designed in order to mitigate any negative impacts on wildlife. The guidance provided is as follows:

- Bat Conservation Ireland Guidelines should be followed
- Ideally only areas that need to be lit should be lit.
- All open spaces/hedgerows treelines etc. should remain unlit i.e. (< 1 Lux),
- Warm lighting should be used (2700^{o}K)

3. Design Response & Mitigation Measures

It is intended to utilise best international practice in controlling obtrusive light in the proposed development.

The brief for the lighting design is to mitigate the impact of lighting wildlife by reducing light spill from the development and to conform to Bat Conservation Ireland (BCI) guidelines.

Sabre Electrical Services have conducted light level calculations for the entire site and the required type, quantity and location of the light fittings was identified. Details of these designs and of the resulting light levels within the target design areas and surrounding areas are presented in Appendix A.

In preparing the design, Sabre have had to consider minimum public lighting requirements, (lighting designed in accordance with ISEN13201-2:2015 Class P4 for residential roads.P3 for Link Road and C3 for Dublin Rd and C4 for Shinkeen Rd junctions) and best practice principles and BCI guidance for minimising the impact of the lighting on wildlife.

3.1 Specific Mitigation Measures

In line with the recommendations of Bat Conservation Ireland and in an attempt to mitigate any negative impacts, the following measures have been included in the design

- The design will seek to provide only the minimum required lux levels, (5 lux on residential roads & pedestrian routes,7.5 lux on the access road) ensuring no excessive lighting levels are provided.

- Column heights, positions and the luminaire photometry have been carefully selected for each area of the site. 6m columns have been selected for general public lighting, 5m columns for pedestrian routes. 8m Columns are required for the main link road through the site and 10m columns are required on the Dublin Road.

- Market leading LED light fittings have been selected to provide the required lux levels in all areas LED light emitters have excellent directional properties and the fittings selected will have provide warm white lighting with a colour temperature of 2700 Kelvin.

- Where lighting is provided in areas that are close to wildlife habitats, rear louvres will be fitted to reduce rearward light spill.

- The LED fittings will be positioned with tilt angles of 0 degrees which will reduce backward light spill while still delivering zero upward light spill.

- Luminaires are to automatically dim to 75% 00:00 – 06:00 (U14 profile). If required and with agreement of the local authority additional dimming is available.

4. Proposed Installation

4.1 Light Fitting Selections

The fittings proposed for the development are as follows:

Luminaire A Data

Supplier	C U Phosco
Type	E950-28-P4A-727-C650-17W
Lamp(s)	727N
Lamp Flux (klm)	2.35
File Name	E950-28-P4A-727-C0650-17W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	659.3, 183.1, 0.3
No. in Project	65

Luminaire B Data

Supplier	Urbis Schreder
Type	AXIA 2.2 5166 Integrated lenses Rear louvers 48 OSLON SQUARE
Lamp(s)	48 OSLON SQUARE GIANT@300mA WW 727 230V 00-36-649
LampFlux(klm)/Colour	6.80 WW 2700K/70
File Name	AXIA 2.2 5166 48 OSLON SQUARE GIANT 300mA WW 727 42.5W 491132 Integrated ...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	843.7, 115.7, 0.0
No. in Project	25

Luminaire C Data

Supplier	Urbis Schreder
Type	AXIA 2.2 5167 Integrated lenses Rear louvers 48 OSLON SQUARE
Lamp(s)	48 OSLON SQUARE GIANT@600mA WW 727 230V 00-36-983
LampFlux(klm)/Colour	12.55 WW 2700K/70
File Name	AXIA 2.2 5167 48 OSLON SQUARE GIANT 600mA WW 727 86W 491142 Integrated I...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	877.5, 121.4, 0.0
No. in Project	4

Luminaire D Data

Supplier	C U Phosco
Type	E950-28-P4A-727-C250-8W
Lamp(s)	727N
Lamp Flux (klm)	0.96
File Name	E950-28-P4A-727-C0250-8W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	659.3, 183.1, 0.3
No. in Project	34

Figure 4.1 – Proposed Fittings for General Public Lighting on main link road and on estate roads

Luminaire I Data

Supplier	Urbis Schreder
Type	AXIA 2.1 5165 Integrated lenses Rear louvers 16 OSLON SQUARE
Lamp(s)	16 OSLON SQUARE GIANT@300mA WW 727 230V 00-36-648
LampFlux(klm)/Colour	2.27 WW 2700K/70
File Name	AXIA 2.1 5165 16 OSLON SQUARE GIANT 300mA WW 727 15.9W 434262 Integrated ...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	1250.5, 121.8, 2.3
No. in Project	31

Luminaire J Data

Supplier	Urbis Schreder
Type	AXIA 2.1 5165 Integrated lenses Rear louvers 8 OSLON SQUARE G
Lamp(s)	8 OSLON SQUARE GIANT@300mA WW 727 230V 00-36-648
LampFlux(klm)/Colour	1.13 WW 2700K/70
File Name	AXIA 2.1 5165 8 OSLON SQUARE GIANT 300mA WW 727 9W 434262 Integrated len...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	1250.5, 121.8, 2.3
No. in Project	19

Figure 4.2 – Proposed Fittings with rear louvres for pedestrian routes through parks and for areas in close proximity to hedgerows & river

4.2 Typical Lighting Results

Typical results from the lighting design are provided below. A full report on the design of the lighting is provided in Appendix A.

Figure 4.3 – Typical lighting results for estate roads

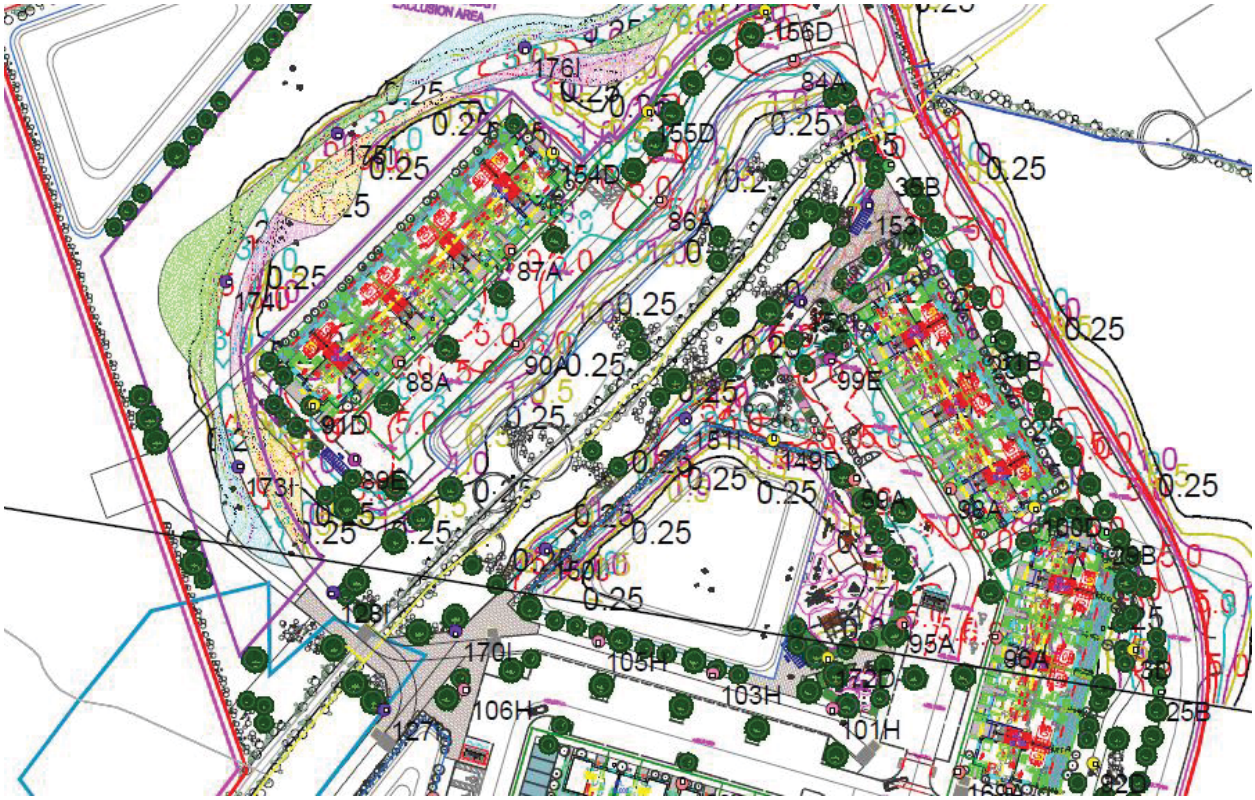

Figure 4.4 – Typical lighting results adjacent to river

Figure 4.5 – Typical lighting results for paths through open space

5. Conclusion.

The proposed lighting layouts for the development have been prepared to meet the requirements for the provision of lighting to public roads and footpaths while also implementing measures to minimise light spill and light pollution that could negatively impact on wildlife habitats within and adjacent to the proposed development.

The recommendations made by the ecologist and the guidelines provided by Bat Conservation Ireland have been taken on board by lighting designers and every effort made to mitigate any impacts that might arise as a result of the lighting for the proposed development.

The key measures implemented to minimise the impact on bats are as follows

- High quality directional LED lights provided throughout
- Zero upward light spill achieved
- Column heights specifically selected to minimise impact on wildlife
- The addition of louvres on fittings in and near to the most sensitive areas of the site
- Advanced lighting controls on lighting in woodland areas to ensure lighting is only provided when required

Appendix A – Lighting Calculations Report

DATE:	**14 June 2022**
DESIGNER:	**Graham Sheehan & AN**
PROJECT No:	**SES 15921 Rev C**
PROJECT NAME:	**Ballyoulster Waterman Moylan**

Designed in accordance with ISEN13201-2:2015 Class P4 for residenrtial roads.P3 for link rd and C3 for Dublin Rd and C4 for Shinkeen Rd junctions.

Rev A: Updated site layout.
Rev B: Updated site layout.
Rev C: Updated site layout

Outdoor Lighting Report

PREPARED BY:

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DATE: 14 June 2022 **DESIGNER:** **Graham Sheehan & AN**

PROJECT No: SES 15921 Rev C PROJECT NAME: Ballyoulster Waterman Moylan

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1	697847.00	732801.47	376.00	150.00	1.50	1.50
2	Grid 2	698203.88	733065.59	345.95	296.21	1.50	1.50
3	Grid 3	698181.33	732843.79	262.45	223.00	1.50	1.50
4	Grid 4	697857.00	732919.00	361.00	49.51	1.50	1.50
5	Grid 5	698208.02	732825.26	230.71	301.00	1.50	1.50
6	Grid 6	698293.00	733292.00	237.00	66.00	1.50	1.50
7	Grid 7	697816.00	732900.00	39.00	105.00	1.50	1.50
8	Grid 8	698282.00	733288.00	114.00	27.00	1.50	1.50

Luminaires

Luminaire A Data

Supplier	C U Phosco
Type	E950-28-P4A-727-C650-17W
Lamp(s)	727N
Lamp Flux (klm)	2.35
File Name	E950-28-P4A-727-C0650-17W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	659.3, 183.1, 0.3
No. in Project	65

Luminaire B Data

Supplier	Urbis Schreder
Type	AXIA 2.2 5166 Integrated lenses Rear louvers 48 OSLON SQUARE
Lamp(s)	48 OSLON SQUARE GIANT@300mA WW 727 230V 00-36-649
LampFlux(klm)/Colour	6.80 WW 2700K/70
File Name	AXIA 2.2 5166 48 OSLON SQUARE GIANT 300mA WW 727 42.5W 491132 Integrated ...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	843.7, 115.7, 0.0
No. in Project	25

Luminaire C Data

Supplier	Urbis Schreder
Type	AXIA 2.2 5167 Integrated lenses Rear louvers 48 OSLON SQUARE
Lamp(s)	48 OSLON SQUARE GIANT@600mA WW 727 230V 00-36-983
LampFlux(klm)/Colour	12.55 WW 2700K/70
File Name	AXIA 2.2 5167 48 OSLON SQUARE GIANT 600mA WW 727 86W 491142 Integrated I...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	877.5, 121.4, 0.0
No. in Project	4

Luminaire D Data

Supplier	C U Phosco
Type	E950-28-P4A-727-C250-8W
Lamp(s)	727N
Lamp Flux (klm)	0.96
File Name	E950-28-P4A-727-C0250-8W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	659.3, 183.1, 0.3
No. in Project	34

Luminaires

Luminaire E Data

Supplier	C U Phosco
Type	E950-28-F2A-727-C600-16W
Lamp(s)	727N
Lamp Flux (klm)	2.23
File Name	E950-28-F2A-727-C0600-16W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	623.6, 113.9, 0.3
No. in Project	5

Luminaire F Data

Supplier	C U Phosco
Type	E951-64-H1-G-727-W5-0450-40W
Lamp(s)	727SS
Lamp Flux (klm)	5.78
File Name	E951-64-H1-G-727-W5-0450-40W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	376.6, 84.9, 0.0
No. in Project	5

Luminaire G Data

Supplier	C U Phosco
Type	E951-64-H1-G-727-W5-1025-90W
Lamp(s)	727SS
Lamp Flux (klm)	12.26
File Name	E951-64-H1-G-727-W5-1025-90W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	376.6, 84.9, 0.0
No. in Project	4

Luminaire H Data

Supplier	C U Phosco
Type	E950-28-F2A-727-C600-16W
Lamp(s)	727N
Lamp Flux (klm)	2.23
File Name	E950-28-F2A-727-C0600-16W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	623.6, 113.9, 0.3
No. in Project	4

Luminaire I Data

Supplier	Urbis Schreder
Type	AXIA 2.1 5165 Integrated lenses Rear louvers 16 OSLON SQUARE
Lamp(s)	16 OSLON SQUARE GIANT@300mA WW 727 230V 00-36-648
LampFlux(klm)/Colour	2.27 WW 2700K/70
File Name	AXIA 2.1 5165 16 OSLON SQUARE GIANT 300mA WW 727 15.9W 434262 Integrated ...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	1250.5, 121.8, 2.3
No. in Project	31

Luminaire J Data

Supplier	Urbis Schreder
Type	AXIA 2.1 5165 Integrated lenses Rear louvers 8 OSLON SQUARE G
Lamp(s)	8 OSLON SQUARE GIANT@300mA WW 727 230V 00-36-648
LampFlux(klm)/Colour	1.13 WW 2700K/70
File Name	AXIA 2.1 5165 8 OSLON SQUARE GIANT 300mA WW 727 9W 434262 Integrated len...
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	1250.5, 121.8, 2.3
No. in Project	19

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
2	B	697905.32	732936.96	8.00	70.00	0.00	0.00	0.50			
3	B	697934.20	732923.93	8.00	73.00	0.00	0.00	0.50			
3	D	698441.28	733035.11	5.00	0.00	0.00	0.00	0.40			
5	I	697974.98	732928.73	5.00	249.00	0.00	0.00	0.50			
7	I	698029.79	732910.19	5.00	272.00	0.00	0.00	0.50			
8	I	698108.07	732907.55	5.00	257.00	0.00	0.00	0.50			
9	I	698138.78	732894.36	5.00	250.00	0.00	0.00	0.50			
13	I	698169.71	732885.10	5.00	263.00	0.00	0.00	0.50			
14	I	698203.58	732879.65	5.00	264.00	0.00	0.00	0.50			
14	D	698020.60	732822.36	5.00	263.00	0.00	0.00	0.40			
16	I	698238.45	732872.51	5.00	253.00	0.00	0.00	0.50			
17	A	698124.81	732872.85	6.00	331.00	0.00	0.00	0.50			
18	B	698283.24	732838.38	8.00	65.00	0.00	0.00	0.50			
19	B	698321.40	732828.78	8.00	77.00	0.00	0.00	0.50			
21	B	698443.48	732984.97	8.00	165.00	0.00	0.00	0.50			
22	B	698366.98	732822.69	8.00	83.00	0.00	0.00	0.50			
23	B	698402.84	732842.76	8.00	153.00	0.00	0.00	0.50			
24	B	698412.33	732875.54	8.00	165.00	0.00	0.00	0.50			
25	B	698446.29	733026.98	8.00	349.00	0.00	0.00	0.50			
26	B	698421.38	732907.48	8.00	159.00	0.00	0.00	0.50			
27	B	698433.13	732948.47	8.00	161.00	0.00	0.00	0.50			
29	B	698435.69	733057.57	8.00	25.00	0.00	0.00	0.50			
31	B	698413.56	733094.97	8.00	25.00	0.00	0.00	0.50			
32	B	697865.26	732944.78	8.00	76.00	0.00	0.00	0.50			
33	A	698308.45	733276.38	6.00	288.00	0.00	0.00	0.40			
35	B	698393.81	733128.85	8.00	26.00	0.00	0.00	0.50			
37	B	698378.10	733171.70	8.00	12.00	0.00	0.00	0.50			
38	C	698362.57	733202.22	8.00	16.00	0.00	0.00	0.50			
29	C	698338.43	733268.51	8.00	16.00	0.00	0.00	0.50			
40	C	698349.23	733238.12	8.00	16.00	0.00	0.00	0.50			
41	C	698337.77	733306.32	8.00	200.00	0.00	0.00	0.50			
41	E	697901.84	732922.72	6.00	348.00	0.00	0.00	0.40			
109	F	697840.53	732954.51	8.00	347.00	0.00	0.00	0.50			
110	F	697854.16	732976.63	8.00	177.00	0.00	0.00	0.50			
111	F	697849.90	732931.37	8.00	159.00	5.00	0.00	0.50			
112	F	697844.58	732904.39	8.00	169.00	0.00	0.00	0.50			

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Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
113	F	697853.61	733001.75	8.00	196.00	0.00	0.00	0.50			
114	G	698328.11	733325.78	10.00	300.00	0.00	0.00	0.50			
115	G	698363.33	733324.98	10.00	112.00	0.00	0.00	0.50			
116	G	698309.66	733305.28	10.00	111.00	0.00	0.00	0.50			
117	G	698283.40	733295.53	10.00	111.00	5.00	0.00	0.50			
51	A	697929.07	732903.34	6.00	172.00	0.00	0.00	0.40			
52	A	697920.02	732924.29	6.00	342.00	0.00	0.00	0.40			
53	A	697904.67	732884.73	6.00	349.00	0.00	0.00	0.40			
54	A	697918.79	732864.69	6.00	163.00	0.00	0.00	0.40			
55	A	697897.82	732846.74	6.00	344.00	0.00	0.00	0.40			
56	A	697913.74	732832.73	6.00	76.00	0.00	0.00	0.40			
57	A	697936.71	732843.77	6.00	252.00	0.00	0.00	0.40			
58	A	697950.08	732824.32	6.00	76.00	0.00	0.00	0.40			
59	A	697975.53	732835.41	6.00	262.00	0.00	0.00	0.40			
60	A	697979.85	732819.01	6.00	76.00	0.00	0.00	0.40			
61	A	697980.14	732858.91	6.00	341.00	0.00	0.00	0.40			
62	A	697992.90	732846.52	6.00	173.00	0.00	0.00	0.40			
63	A	697986.73	732897.31	6.00	346.00	0.00	0.00	0.40			
64	A	697999.04	732881.01	6.00	163.00	0.00	0.00	0.40			
65	A	698057.67	732803.99	6.00	75.00	0.00	0.00	0.40			
66	A	698102.27	732796.50	6.00	81.00	0.00	0.00	0.40			
67	A	698079.94	732812.74	6.00	265.00	0.00	0.00	0.40			
59	A	698387.19	733068.10	6.00	29.00	0.00	0.00	0.40			
69	A	698128.20	732828.91	6.00	170.00	0.00	0.00	0.40			
70	A	698047.82	732825.22	6.00	344.00	0.00	0.00	0.40			
71	A	698053.63	732856.95	6.00	343.00	0.00	0.00	0.40			
72	E	698064.00	732885.28	6.00	262.00	0.00	0.00	0.40			
73	D	698082.38	732782.78	5.00	353.00	0.00	0.00	0.40			
74	D	698330.61	733284.09	5.00	20.00	0.00	0.00	0.40			
75	A	698327.26	733264.74	6.00	114.00	0.00	0.00	0.40			
76	A	698281.69	733266.15	6.00	285.00	0.00	0.00	0.40			
77	A	698286.48	733251.35	6.00	108.00	0.00	0.00	0.40			
78	A	698311.42	733240.79	6.00	19.00	0.00	0.00	0.40			
79	A	698322.64	733254.74	6.00	199.00	0.00	0.00	0.40			
80	A	698320.11	733218.59	6.00	12.00	0.00	0.00	0.40			
81	A	698332.31	733228.66	6.00	205.00	0.00	0.00	0.40			

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
82	A	698342.35	733202.83	6.00	103.00	0.00	0.00	0.40			
83	A	698349.10	733225.28	6.00	290.00	0.00	0.00	0.40			
84	A	698375.49	733149.18	6.00	113.00	0.00	0.00	0.40			
85	E	698307.15	733198.97	6.00	21.00	0.00	0.00	0.40			
86	A	698349.75	733122.05	6.00	140.00	0.00	0.00	0.40			
87	A	698320.49	733112.61	6.00	318.00	0.00	0.00	0.40			
88	A	698298.95	733090.88	6.00	318.00	0.00	0.00	0.40			
89	E	698290.27	733071.85	6.00	47.00	0.00	0.00	0.40			
90	A	698321.93	733094.14	6.00	137.00	0.00	0.00	0.40			
91	D	698282.52	733082.59	5.00	224.00	0.00	0.00	0.40			
92	D	698433.54	733013.02	5.00	347.00	0.00	0.00	0.40			
93	A	698417.26	733007.98	6.00	251.00	0.00	0.00	0.40			
94	A	698430.03	732987.68	6.00	82.00	0.00	0.00	0.40			
95	A	698396.54	733040.05	6.00	339.00	0.00	0.00	0.40			
96	A	698414.72	733037.38	6.00	163.00	0.00	0.00	0.40			
97	A	698393.72	732997.73	6.00	79.00	0.00	0.00	0.40			
98	A	698405.82	733066.26	6.00	213.00	0.00	0.00	0.40			
99	E	698382.54	733091.35	6.00	294.00	0.00	0.00	0.40			
100	D	698422.17	733062.65	5.00	299.00	0.00	0.00	0.40			
101	H	698383.01	733023.59	5.00	259.00	0.00	0.00	0.40			
102	A	698353.86	733009.06	6.00	70.00	0.00	0.00	0.40			
103	H	698359.85	733030.40	5.00	252.00	0.00	0.00	0.40			
104	A	698282.40	732924.11	6.00	334.00	0.00	0.00	0.40			
105	H	698337.61	733036.70	5.00	253.00	0.00	0.00	0.40			
106	H	698311.51	733027.31	5.00	345.00	0.00	0.00	0.40			
107	A	698305.52	733006.25	6.00	338.00	0.00	0.00	0.40			
108	A	698328.81	733005.53	6.00	161.00	0.00	0.00	0.40			
109	A	698314.11	732978.37	6.00	166.00	0.00	0.00	0.40			
110	A	698295.73	732969.06	6.00	339.00	0.00	0.00	0.40			
111	A	698302.63	732939.46	6.00	163.00	0.00	0.00	0.40			
112	A	698293.73	732907.39	6.00	156.00	0.00	0.00	0.40			
113	A	698273.19	732893.69	6.00	333.00	0.00	0.00	0.40			
114	A	698300.57	732867.69	6.00	79.00	0.00	0.00	0.40			
115	A	698292.99	732887.73	6.00	253.00	0.00	0.00	0.40			
116	A	698323.89	732879.14	6.00	254.00	0.00	0.00	0.40			
117	A	698336.76	732856.23	6.00	76.00	0.00	0.00	0.40			

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Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
118	A	698345.56	732880.27	6.00	340.00	0.00	0.00	0.40			
119	A	698336.49	732847.56	6.00	346.00	0.00	0.00	0.40			
120	A	698356.39	732917.62	6.00	341.00	0.00	0.00	0.40			
121	A	698365.19	732948.13	6.00	345.00	0.00	0.00	0.40			
122	A	698374.29	732979.65	6.00	344.00	0.00	0.00	0.40			
123	I	698257.86	732874.65	5.00	12.00	0.00	0.00	0.40			
124	I	698238.30	732921.72	5.00	20.00	0.00	0.00	0.40			
125	I	698240.60	732951.97	5.00	322.00	0.00	0.00	0.40			
126	I	698280.75	733003.16	5.00	322.00	0.00	0.00	0.40			
127	I	698296.08	733023.50	5.00	326.00	0.00	0.00	0.40			
128	I	698286.11	733046.18	5.00	227.00	0.00	0.00	0.40			
120	I	697879.78	732958.03	5.00	260.00	0.00	0.00	0.40			
121	I	697912.79	732949.69	5.00	246.00	0.00	0.00	0.40			
122	I	697940.00	732937.04	5.00	253.00	0.00	0.00	0.40			
123	B	697963.32	732918.90	8.00	74.00	0.00	0.00	0.40			
124	B	697992.35	732905.95	8.00	61.00	0.00	0.00	0.40			
125	I	698004.09	732916.69	5.00	255.00	0.00	0.00	0.40			
126	B	698025.89	732893.98	8.00	76.00	0.00	0.00	0.40			
127	I	698064.34	732910.85	5.00	272.00	0.00	0.00	0.40			
128	B	698063.56	732897.24	8.00	91.00	0.00	0.00	0.40			
129	B	698096.36	732897.13	8.00	80.00	0.00	0.00	0.40			
130	B	698128.83	732882.96	8.00	61.00	0.00	0.00	0.40			
131	B	698173.99	732867.68	8.00	82.00	0.00	0.00	0.40			
132	B	698212.63	732861.84	8.00	82.00	0.00	0.00	0.40			
133	B	698260.85	732847.13	8.00	66.00	0.00	0.00	0.40			
134	I	698269.77	732859.21	5.00	252.00	0.00	0.00	0.40			
135	D	697931.01	732892.38	5.00	255.00	0.00	0.00	0.40			
136	D	697955.38	732887.99	5.00	255.00	0.00	0.00	0.40			
137	D	697975.16	732882.72	5.00	82.00	0.00	0.00	0.40			
138	D	697939.75	732880.47	5.00	347.00	0.00	0.00	0.40			
139	D	697936.49	732861.76	5.00	347.00	0.00	0.00	0.40			
140	D	697960.03	732850.88	5.00	172.00	0.00	0.00	0.40			
141	D	697964.55	732877.04	5.00	172.00	0.00	0.00	0.40			
142	D	697887.54	732847.43	5.00	261.00	0.00	0.00	0.40			
143	D	697899.34	732898.51	5.00	84.00	0.00	0.00	0.40			
144	D	698081.67	732883.04	5.00	78.00	0.00	0.00	0.40			

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Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
145	D	698109.73	732878.06	5.00	78.00	0.00	0.00	0.40			
146	A	698133.57	732858.46	5.00	162.00	0.00	0.00	0.40			
147	A	698113.63	732807.94	5.00	346.00	0.00	0.00	0.40			
148	A	698017.66	732811.09	6.00	76.00	0.00	0.00	0.40			
149	D	698371.52	733075.66	5.00	75.00	0.00	0.00	0.40			
150	I	698327.35	733054.56	5.00	313.00	0.00	0.00	0.40			
151	I	698354.40	733079.81	5.00	313.00	0.00	0.00	0.40			
152	I	698376.70	733102.66	5.00	313.00	0.00	0.00	0.40			
153	I	698389.81	733121.46	5.00	324.00	0.00	0.00	0.40			
154	D	698328.63	733131.37	5.00	50.00	0.00	0.00	0.40			
155	D	698347.21	733139.45	5.00	318.00	0.00	0.00	0.40			
156	D	698369.90	733159.00	5.00	290.00	0.00	0.00	0.40			
157	I	698246.64	732901.11	5.00	20.00	0.00	0.00	0.40			
158	D	698279.50	732946.29	5.00	67.00	0.00	0.00	0.40			
159	D	698284.21	732954.58	5.00	245.00	0.00	0.00	0.40			
160	D	698289.98	732990.45	5.00	73.00	0.00	0.00	0.40			
161	D	698269.01	732961.48	5.00	237.00	0.00	0.00	0.40			
162	D	698280.50	732975.29	5.00	163.00	0.00	0.00	0.40			
163	D	698268.43	732935.65	5.00	166.00	0.00	0.00	0.40			
164	D	698262.82	732915.29	5.00	166.00	0.00	0.00	0.40			
165	D	698264.54	732902.00	5.00	254.00	0.00	0.00	0.40			
166	D	698280.34	732866.05	5.00	166.00	0.00	0.00	0.40			
167	D	698320.16	732941.34	5.00	73.00	0.00	0.00	0.40			
168	D	698343.84	732934.93	5.00	78.00	0.00	0.00	0.40			
169	A	698407.51	733011.36	6.00	163.00	0.00	0.00	0.40			
170	I	698309.90	733038.60	5.00	279.00	0.00	0.00	0.40			
171	I	698262.09	732978.80	5.00	315.00	0.00	0.00	0.40			
172	D	698382.05	733033.55	5.00	278.00	0.00	0.00	0.40			
173	I	698267.79	733070.56	5.00	21.00	0.00	0.00	0.40			
174	I	698265.48	733106.43	5.00	345.00	0.00	0.00	0.40			
175	I	698287.05	733135.12	5.00	306.00	0.00	0.00	0.40			
176	I	698323.34	733151.75	5.00	284.00	0.00	0.00	0.40			
177	I	698356.52	733164.84	5.00	135.00	0.00	0.00	0.40			
178	J	698133.16	732790.86	5.00	83.00	0.00	0.00	0.40			
179	J	698143.19	732810.12	5.00	327.00	0.00	0.00	0.40			
180	J	698167.23	732829.42	5.00	290.00	0.00	0.00	0.40			

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Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
181	J	698195.26	732830.52	5.00	250.00	0.00	0.00	0.40			
182	J	698217.53	732824.47	5.00	250.00	0.00	0.00	0.40			
183	J	698199.81	732813.74	5.00	14.00	0.00	0.00	0.40			
184	J	698236.55	732845.66	5.00	168.00	0.00	0.00	0.40			
185	J	698228.10	732814.25	5.00	165.00	0.00	0.00	0.40			
186	J	698211.23	732798.97	5.00	93.00	0.00	0.00	0.40			
187	J	698182.62	732797.62	5.00	92.00	0.00	0.00	0.40			
188	J	698164.16	732787.79	5.00	100.00	0.00	0.00	0.40			
189	J	698147.76	732773.59	5.00	36.00	0.00	0.00	0.40			
190	J	698174.53	732759.10	5.00	77.00	0.00	0.00	0.40			
191	J	698190.67	732766.89	5.00	116.00	0.00	0.00	0.40			
192	J	698203.31	732785.24	5.00	164.00	0.00	0.00	0.40			
193	J	698203.87	732838.90	5.00	123.00	0.00	0.00	0.40			
194	J	698221.16	732843.93	5.00	87.00	0.00	0.00	0.40			
195	J	698178.63	732751.67	5.00	164.00	0.00	0.00	0.40			
196	J	698150.78	732795.65	5.00	246.00	0.00	0.00	0.40			

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Horizontal Illuminance (lux)

Grid 1

Results

Eav	5.30
Emin	1.05
Emax	22.11
Emin/Emax	0.05
Emin/Eav	0.20

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Horizontal Illuminance (lux)

Grid 2

Results

Eav	6.46
Emin	1.27
Emax	19.98
Emin/Emax	0.06
Emin/Eav	0.20

Horizontal Illuminance (lux)

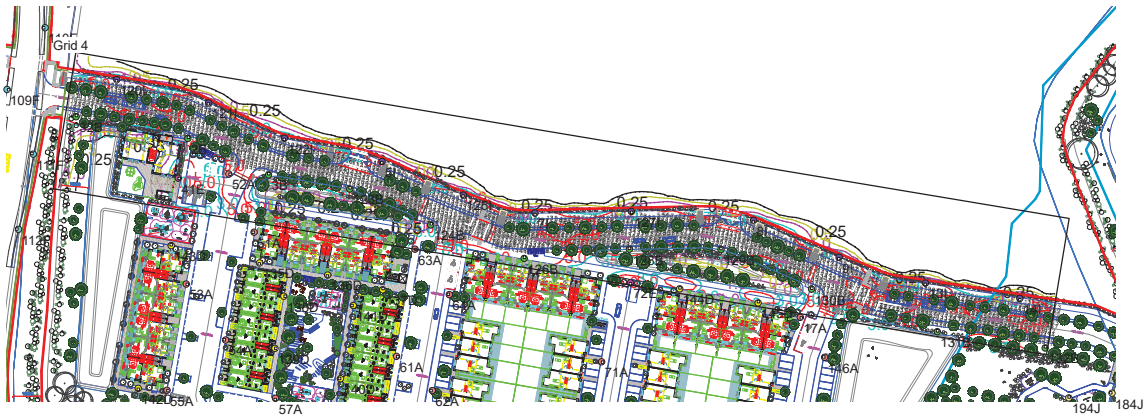
Grid 3

Results

Eav	5.36
Emin	1.05
Emax	20.69
Emin/Emax	0.05
Emin/Eav	0.20

Horizontal Illuminance (lux)

Grid 4



Results

Eav	9.00
Emin	2.19
Emax	23.07
Emin/Emax	0.09
Emin/Eav	0.24

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Horizontal Illuminance (lux)

Grid 5

Results

Eav	7.73
Emin	1.62
Emax	20.60
Emin/Emax	0.08
Emin/Eav	0.21

Horizontal Illuminance (lux)

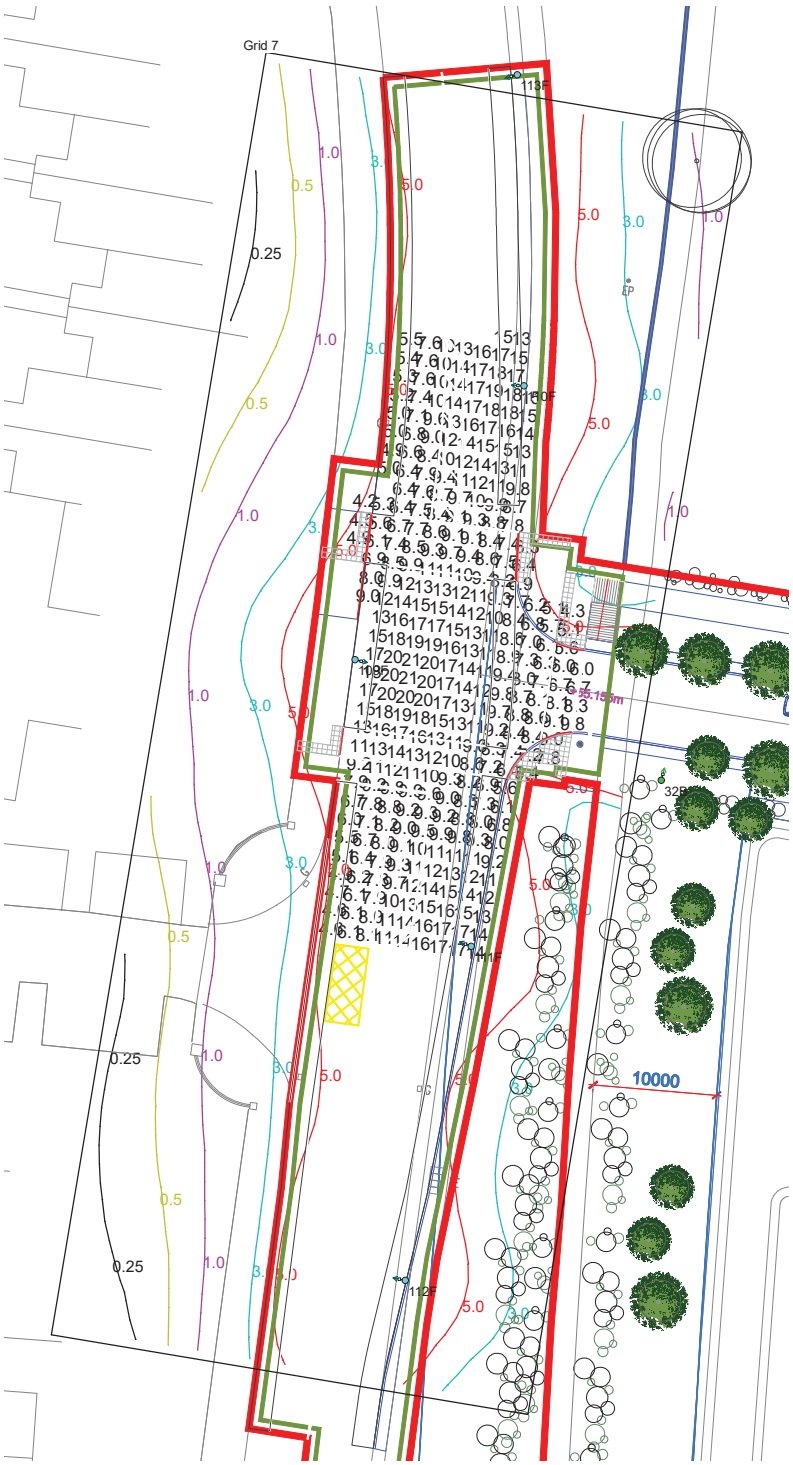
Grid 6

Results

Eav	9.02
Emin	2.94
Emax	21.20
Emin/Emax	0.14
Emin/Eav	0.33

Horizontal Illuminance (lux)

Grid 7

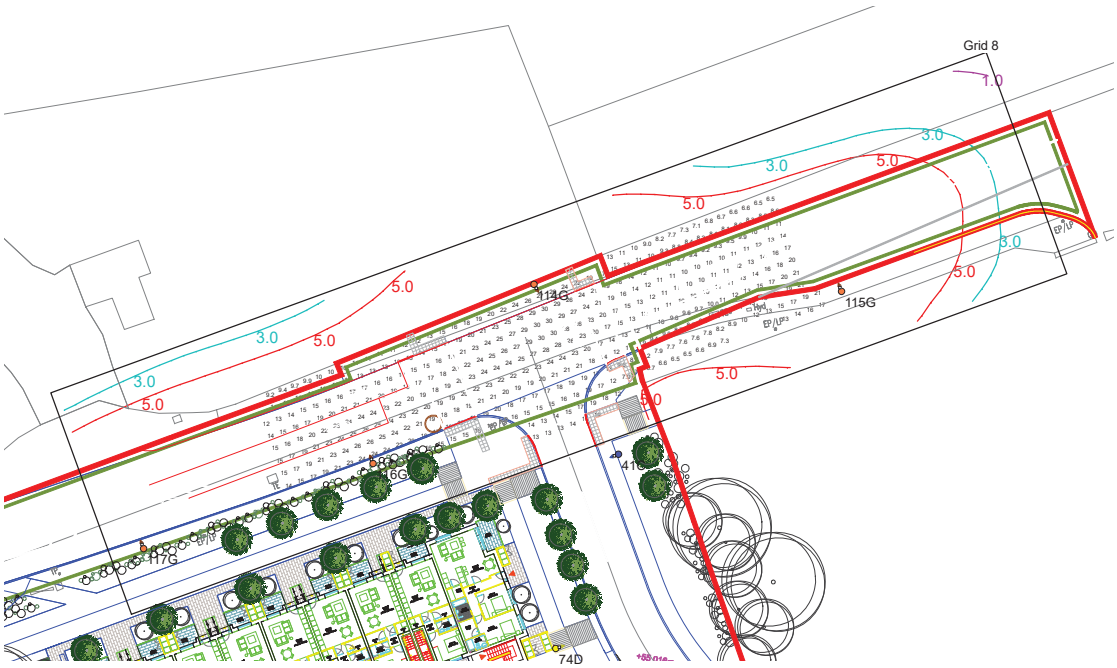


Results

Eav	10.75
Emin	4.19
Emax	21.00
Emin/Emax	0.20
Emin/Eav	0.39

Horizontal Illuminance (lux)

Grid 8



Results

Eav	16.31
Emin	6.47
Emax	30.27
Emin/Emax	0.21
Emin/Eav	0.40

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UK and Ireland Office Locations