Lighting Assessment

Magor Brewery, Monmouthshire

Client: AB InBev UK Ltd

Reference: 4275-2r1

Date: 7th September 2021

Report Issue

Report Title: Lighting Assessment - Magor Brewery, Monmouthshire

Report Reference: 4275-2

Field	Report Version			
	1	2	3	4
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Executive Summary

Redmore Environmental Ltd was commissioned by AB InBev UK Ltd to undertake a Lighting Assessment in support of the development of additional infrastructure on land at Magor Brewery, Monmouthshire.

Artificial lighting associated with the development has the potential to cause impacts at sensitive ecological receptors in the vicinity of the site. As such, a Lighting Assessment was undertaken to consider the likely effects.

The proposed lighting design was used to develop a model of the scheme using lighting engineering software. Ecological features sensitive to potential changes in lighting levels were identified through consultation with the Project Ecologist. Impacts were subsequently quantified at the relevant features and the results compared with the relevant criteria.

Light trespass was predicted at the identified receptor locations. The results indicated predicted values above the relevant criteria at the receptor locations. As such, mitigation measures to be included in the final lighting design were identified to reduce impacts associated with the scheme.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by AB InBev UK Ltd to undertake a Lighting Assessment in support the development of additional infrastructure on land at Magor Brewery, Monmouthshire.

1.1.2 Artificial lighting associated with the development has the potential to cause impacts at sensitive ecological receptors in the vicinity of the site. As such, a Lighting Assessment was undertaken to consider the likely effects.

1.2 Site Location and Context

1.2.1 The site is located on land at Magor Brewery, Monmouthshire, at approximate National Grid Reference (NGR): 341708, 187592. Reference should be made to Figure 1 for a site location plan.

1.2.2 The proposal comprises construction of several new structures, including the Perfect Draught building, exterior storage locations and tanks as well as reconfiguration of an existing trailer park.

1.2.3 The development requires provision of suitable light fixtures on the proposed Perfect Draught building to provide sufficient lighting to future users. Reference should be made to Figure 2 for a map detailing the location of the proposed Perfect Draught building. Reference should be made to Figures 3 and 4 for a preliminary lighting design.

1.2.4 Lighting impacts have been quantified by assessing the lighting design for the development and calculating light trespass at specified receptors. This is detailed in the following report.

2.0 LIGHTING BACKGROUND

2.1 Documents Consulted

2.1.1 The following legislation and guidance was used in this assessment:

- Guidance Notes for the Reduction of Obtrusive Light GN01/20, The Institution of Lighting Practitioners (ILP), 2020;
- Guidance Notes for Bats and Artificial Lighting in the UK, GN08/18, ILP and the Bat Conservation Trust (BCT), 2018;
- Lighting in the Countryside: Towards Good Practice, Department for Communities and Local Government, 1997;
- Clean Neighbourhoods and Environment Act, 2005; and,
- Environmental Protection Act, 1990.

2.2 Legislative Framework

2.2.1 Light pollution was introduced within the Clean Neighbourhoods and Environment Act (2005) as a form of statutory nuisance under the Environmental Protection Act (1990). This was amended to include the following nuisance definition:

> "(fb) artificial light emitted from premises so as to be prejudicial to health or nuisance;"

2.2.2 Although light was described as a statutory nuisance, no prescriptive limits or rules have been set for assessment. Guidance produced by the International Commission on Illumination (CIE), ILP and the Chartered Institute of Building Services Engineers (CIBSE) have been referred to whilst undertaking this assessment.

2.2.3 The Lighting in the Countryside: Towards Good Practice guidance produced by the Department for Communities and Local Government aims to identify good practice in the planning and design of rural areas and advises on how this can be achieved. The document states:

> "Lighting itself is not a problem; it only becomes a problem when it is excessive, poorly designed or badly installed."

2.2.4 The document provides advice on how to reduce impacts associated with development, as well as identifying relevant considerations for environmental assessments. Although it is noted the site is not located in a rural area, the guidance provides useful background to lighting assessment and has therefore been considered throughout this report as necessary.

2.3 National Planning Policy

2.3.1 Planning Policy Wales[1] (PPW) was published in February 2021 and sets out the land use planning policies of the Welsh Government. The PPW, along with Technical Advice Notes, Welsh Government Circulars and policy clarification letters, provide the National Planning Policy Framework for Wales.

2.3.2 Section 6.8 of the PPW document details objectives in relation to lighting. It states that:

> "There is a need to balance the provision of lighting to enhance safety and security to help in the prevention of crime and 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."

2.3.3 The implications of the document have been considered throughout this assessment.

2.4 Local Planning Policy

2.4.1 The proposed site is located within Monmouthshire County Council's (MCC's) area of jurisdiction. The Local Development Plan[2] was adopted by MCC on 27th February 2014. Policy EP3 is of relevance to this assessment.

[1] Planning Policy Wales Edition 11, Welsh Assembly Government, 2021.

[2] Local Development Plan, MCC, 2014.

3.0 METHODOLOGY

3.1 Introduction

3.1.1 The Lighting Assessment included the establishment of baseline ambient light conditions and an evaluation of impacts associated with the proposed development. This included assessment of light trespass at existing ecological receptor locations using computation modelling. The utilised methodology is summarised in the following Sections.

3.2 Baseline

3.2.1 Existing lighting conditions in the vicinity of the development site were identified in order to provide a reference for assessment. The following were considered during the determination of the baseline:

- A review of the area and landscape together with any designations;
- An overview of existing lighting; and,
- Identification of potential receptors.

3.3 Model

3.3.1 Modelling was undertaken using DIALux software in order to quantify light spillage from the proposed lighting design at the identified sensitive ecological features. DIALux is an independent lighting software package capable of calculating daylight and artificial lighting scenes in exterior and interior scenarios. The software is commonly used throughout the UK.

3.3.2 Model inputs included:

- Proposed luminaire specifications and locations;
- Existing and proposed building geometries; and,
- Landscaping and vegetation.

3.4 Assessment Criteria

3.4.1 Predicted light spillage levels were compared with the criteria provided within the Guidance Notes for Bats and Artificial Lighting in the UK[3] document produced by the ILP and BCT. This provides reference lighting levels for various scenarios, as shown in Table 1.

Table 1 Chart of Example Lux Levels

Lighting Conditions	Lighting Level (lux)
British Summer Sunshine	50,000
Overcast Sky	5,000
Well-lit Office	500
Minimum for Easy Reading	300
Passageway or Outside Working Area	50
Good Main Road Lighting	5-20
Sunset	10
Typical Side Road Lighting	5
Minimum Security Lighting	2
Twilight	1
Clear Full Moon	0.25 - <1
Typical Moonlight/Cloudy Sky	0.1
Typical Starlight	0.001
Poor Starlight	0.0001

3.4.2 Correspondence with Tyler Grange indicated that a light spill limit of 0.5lux, representative of lighting levels during a clear full moon, should be applied to sensitive ecological features.

[3] Guidance Notes for Bats and Artificial Lighting in the UK, GN08/18, ILP and the BCT, 2018.

4.0 BASELINE

4.1 Introduction

4.1.1 Existing conditions in the vicinity of the development site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

4.2 Surrounding Area

4.2.1 The proposed development is located in a rural setting with the existing Magor Brewery infrastructure enclosing the west and south of the site. A tree belt runs along the east and north-eastern site boundary. To the north is a car park and commercial premises.

4.3 Existing Lighting

4.3.1 The baseline review indicated that there is existing street lighting along the following roads:

- A4810, approximately 25m to the east of the site;
- Magor Road, approximately 45m to the east of the site;
- B425, approximately 60m to the north of the site; and,
- M4 Motorway, approximately 300m to the north of the site.

4.3.2 The baseline review also indicated that there is existing lighting at the following locations:

- High level lighting within the storage and loading areas at Wilcrick Depot, approximately 100m to the east of the site;
- Highways lighting along circulatory routes and within car parks at the Wales 1 Business Park, approximately 215m to the north of the site; and,
- Low level security lighting at the residential dwellings situated along Queens Gardens and Blenheim Gardens, approximately 325m to the east of the site.

4.3.3 It should be noted that there is existing lighting installed at the Magor Brewery site. This includes the following:

- Highways lighting along access roads, internal circulatory routes, pedestrian walkways and car parking areas, including those adjacent to the proposed site; and,
- High level lighting within loading and storage areas.

4.4 Sensitive Receptors

4.4.1 Consultation with Tyler Grange[4], the Project Ecologist, indicated that the tree belt enclosing the east and north-east of the site should be considered within the assessment due to the potential for bat activity and the requirement for it to be maintained as a dark corridor. Specific receptor locations for consideration in the assessment were chosen along this tree belt, as outlined in Table 2.

Table 2 Sensitive Receptor Locations

Receptor		NGR (m)	
		X	Y
S1	Eastern Tree Belt	341718	187469
S2	Eastern Tree Belt	341725	187485
S3	Eastern Tree Belt	341732	187498
S4	Eastern Tree Belt	341738	187511
S5	Eastern Tree Belt	341745	187526
S6	Eastern Tree Belt	341752	187542
S7	Eastern Tree Belt	341758	187554
S8	Eastern Tree Belt	341763	187563
S9	Eastern Tree Belt	341768	187574
S10	Eastern Tree Belt	341771	187582
S11	Eastern Tree Belt	341775	187591
S12	Eastern Tree Belt	341783	187607
S13	Eastern Tree Belt	341787	187618

[4] Email correspondence with Tyler Grange, August 2021.

Receptor		NGR (m)	
		X	Y
S14	Eastern Tree Belt	341793	187631
S15	North-eastern Tree Belt	341790	187636
S16	North-eastern Tree Belt	341785	187638
S17	North-eastern Tree Belt	341779	187641
S18	North-eastern Tree Belt	341772	187644
S19	North-eastern Tree Belt	341767	187647

4.4.2 Reference should be made to Figure 5 and Figure 6 for a visual representation of the outlined habitat and receptor locations, respectively.

5.0 ASSESSMENT

5.1 Model

5.1.1 A model of the preliminary lighting design was produced in DIALux in order to assess potential impacts associated with the development. This was provided by Arquid. The luminaire family selected by the architects was the Philips ClearFlood. The specific unit chosen for the purpose of the assessment was:

- Philips ClearFlood BVP650 LED420/740 (265W, 36303lm).

5.1.2 A maintenance factor of 0.8 was utilised in the lighting software. This is routinely utilised to represent 'normal' levels of pollution, dirt depreciation and lamp depreciation and as such was considered suitable for a site of this nature.

5.1.3 Reference should be made to Figure 3 and Figure 4 for the preliminary lighting design and Appendix 1 for the DIALux output report.

5.2 Light Trespass Results

5.2.1 Light trespass at the ecological receptor locations identified in Table 2 was predicted using DIALux. The results are shown in Table 3.

Table 3 Light Trespass Assessment Results

Location		E_v (lux)
S1	Eastern Tree Belt	2.11
S2	Eastern Tree Belt	0.5
S3	Eastern Tree Belt	1.08
S4	Eastern Tree Belt	3.25
S5	Eastern Tree Belt	7.04
S6	Eastern Tree Belt	7.42
S7	Eastern Tree Belt	11
S8	Eastern Tree Belt	7.41

Location		E_v (lux)
S9	Eastern Tree Belt	9.22
S10	Eastern Tree Belt	5.26
S11	Eastern Tree Belt	5.27
S12	Eastern Tree Belt	1.08
S13	Eastern Tree Belt	0.91
S14	Eastern Tree Belt	0.26
S15	North-eastern Tree Belt	0.83
S16	North-eastern Tree Belt	0.65
S17	North-eastern Tree Belt	1.58
S18	North-eastern Tree Belt	4.32
S19	North-eastern Tree Belt	1.6

5.2.2 As indicated in Table 3, the calculated illuminance was above the criteria of 0.5lux recommended by Tyler Grange at all receptor locations. It should be noted that the selected positions are on the edge of the tree belt and light levels would reduce through vegetative screening with distance from the source.

6.0 MITIGATION

6.1.1 In order to reduce light spill and mitigate impacts on the relevant ecological receptors, the final lighting design strategy should include the following measures to ensure a dark corridor is maintained along the east and north-eastern tree belt:

- Luminaires should be directed inwards towards the site where practicable to avoid unnecessary lighting beyond the boundary;
- A luminaire with a cap or hood should be chosen to prevent unnecessary light spill;
- The luminaire mounting height on the building should be reduced as far as practicable to ensure only the required area is illuminated;
- LED luminaires should be used due to their sharp cut off, lower intensity and good colour rendition;
- Avoidance of metal halide and fluorescent luminaires;
- Use of a warm white colour spectrum to reduce blue light content;
- Lighting should be designed to the correct standard for the task and should not over light; and,
- The lighting scheme should meet all relevant British Standards.

6.1.2 The mitigation measures described above are considered appropriate for this development, providing a practicable solution to minimise light spill on ecological features whilst maintaining health and safety standards on site. As such, they should be included within the final lighting design.

7.0 CONCLUSION

7.1.1 Redmore Environmental Ltd was commissioned by AB InBev UK Ltd to undertake a Lighting Assessment in support of the development of additional infrastructure on land at Magor Brewery, Monmouthshire.

7.1.2 Artificial lighting associated with the development has the potential to cause impacts at existing sensitive ecological receptors in the vicinity of the site. As such, a Lighting Assessment was undertaken to consider the likely effects.

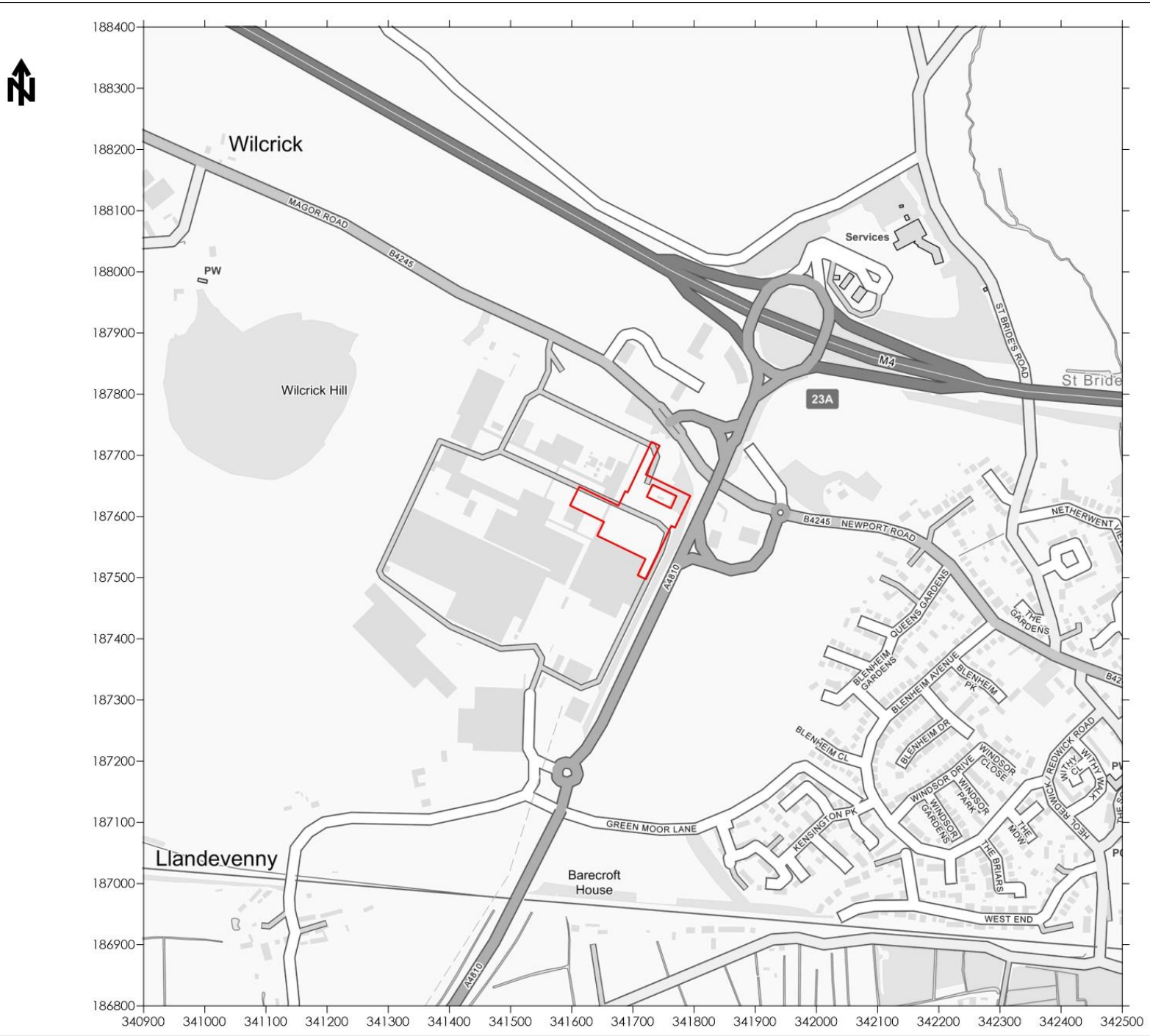
7.1.3 A desk-top study was undertaken to determine baseline conditions in the vicinity of the site. Consultation with the Project Ecologist, Tyler Grange, indicated sensitive ecological receptors to the east and north-east of the proposed development. A preliminary lighting design, provided by Arquid, was used to develop a model of the scheme using DIALux software.

7.1.4 Light trespass was predicted at the identified receptor locations. The calculated illuminance levels at the receptor locations were above the 0.5lux criteria recommended by Tyler Grange. As such, mitigation measures to be included in the final lighting design have been identified to reduce impacts associated with the scheme.

8.0 ABBREVIATIONS

BCT	Bat Conservation Trust
CIBSE	Chartered Institute of Building Services Engineers
CIE	International Commission on Illumination
ILP	Institute of Lighting Practitioners
MCC	Monmouthshire County Council
NGR	National Grid Reference
PPW	Planning Policy Wales

Figures



Legend

Site Boundary

Title
Figure 1 - Site Location Plan

Project
Lighting Assessment
Magor Brewery, Monmouthshire

Project Reference
4275-2

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Legend

Site Boundary

Perfect Draught Building

Title
Figure 2 - Proposed Location of Perfect Draught Building

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Lighting Assessment
Magor Brewery, Monmouthshire

Project Reference
4275-2

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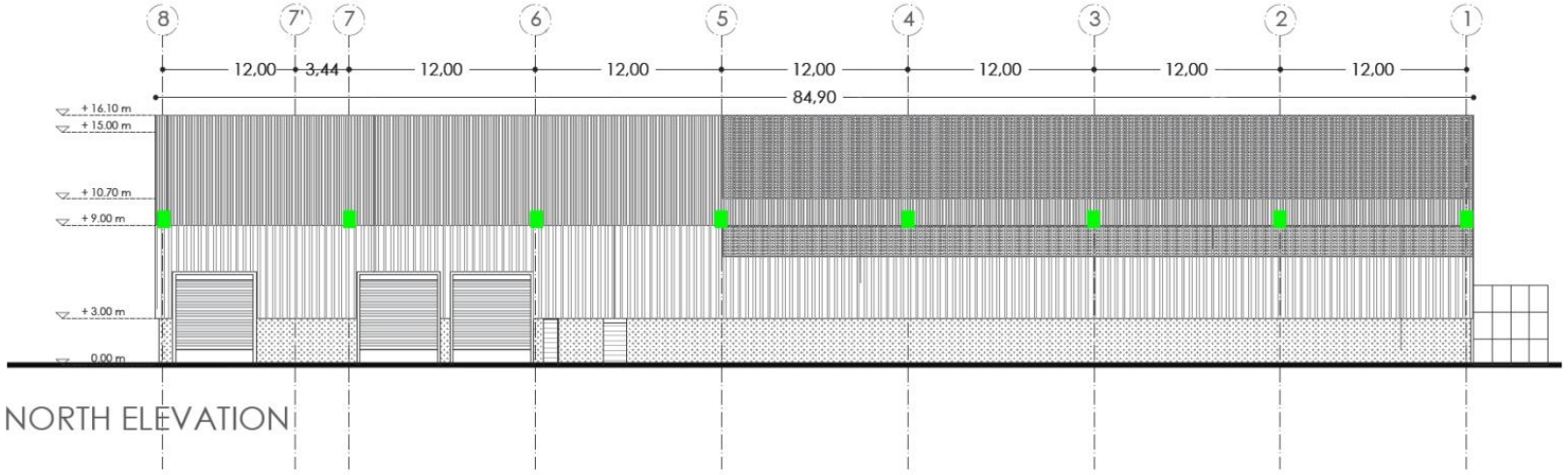
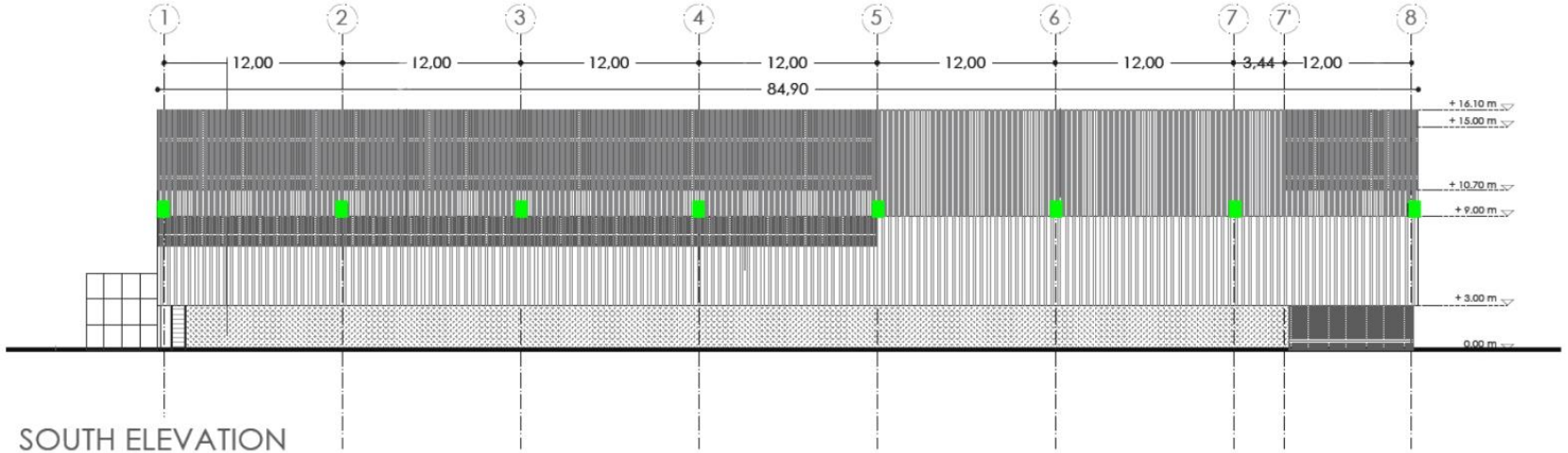


NORTH ELEVATION



SOUTH ELEVATION

Legend

Philips ClearFlood
BVP650 LED420/740

Title
Figure 3 - Proposed Perfect Draught Building North and South Elevation

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Lighting Assessment
Magor Brewery, Monmouthshire

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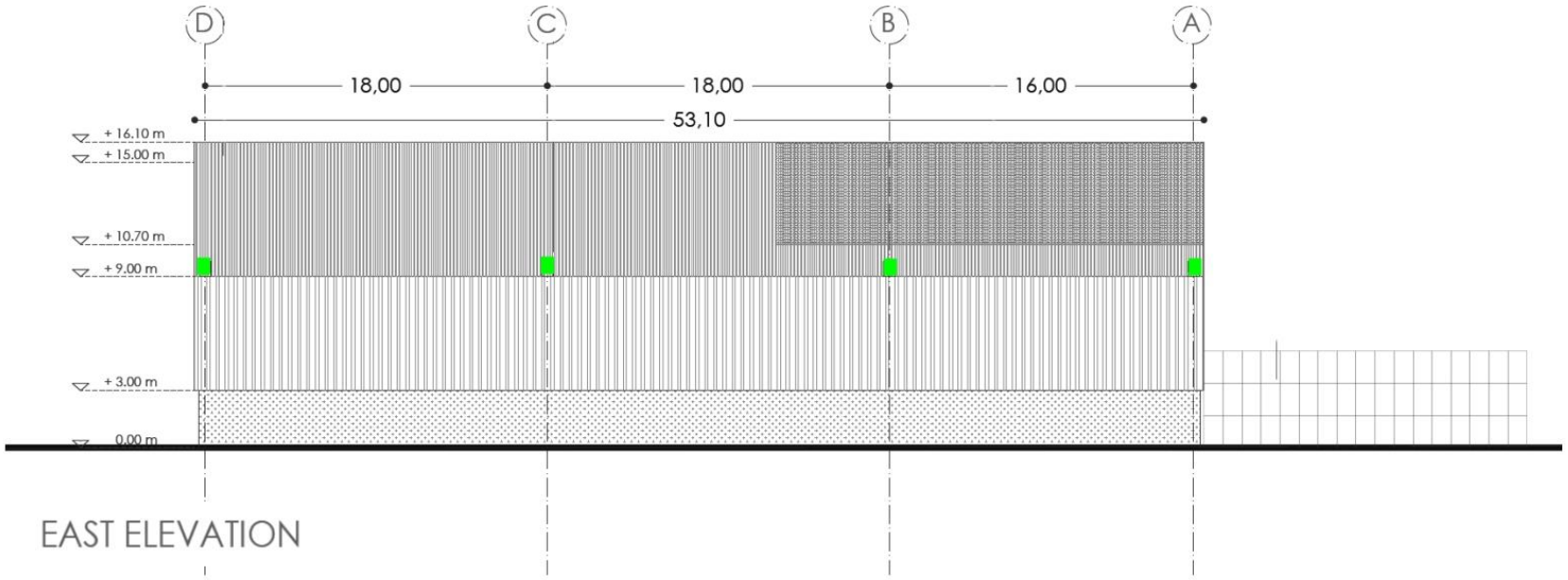
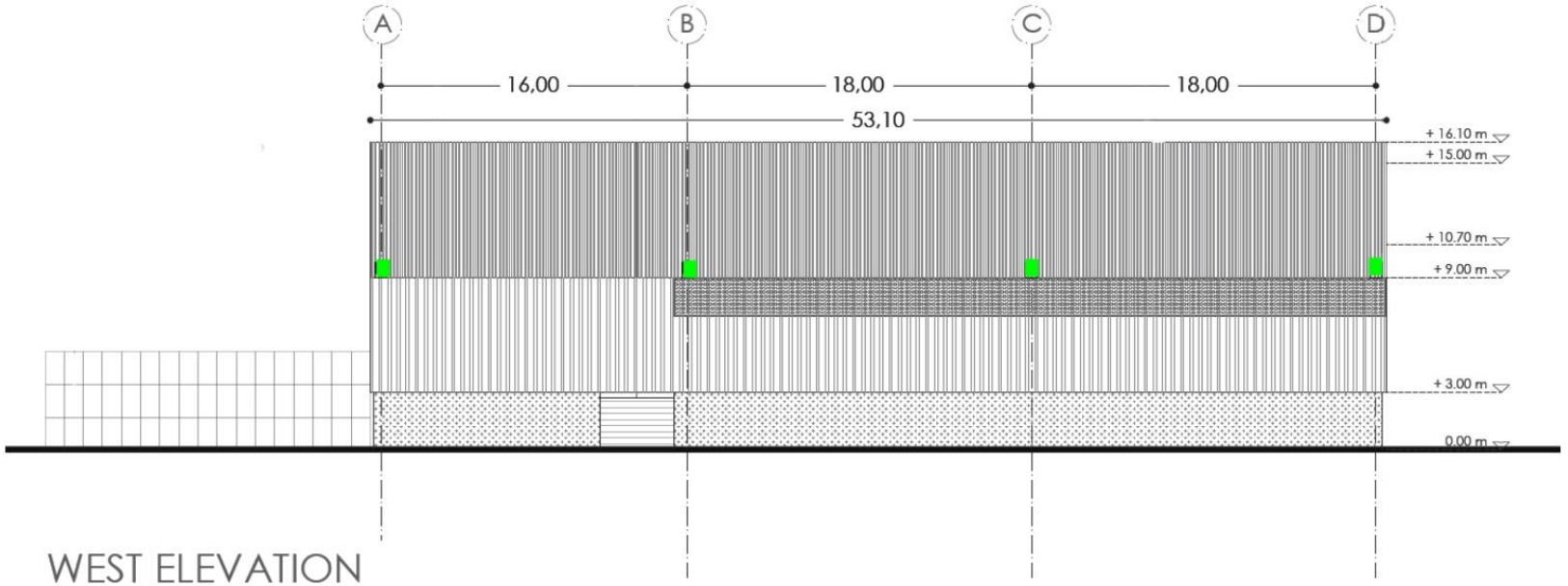


EAST ELEVATION



WEST ELEVATION

Legend

Philips ClearFlood
BVP650 LED420/740

Title
Figure 4 - Proposed Perfect Draught Building East and West Elevation

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Legend

Site Boundary

Perfect Draught Building

Tree Belt

Title
Figure 5 - Tree Belt Location

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Legend

Site Boundary

Perfect Draught Building

Tree Belt

Receptor Location

Title
Figure 6 - Receptor Locations

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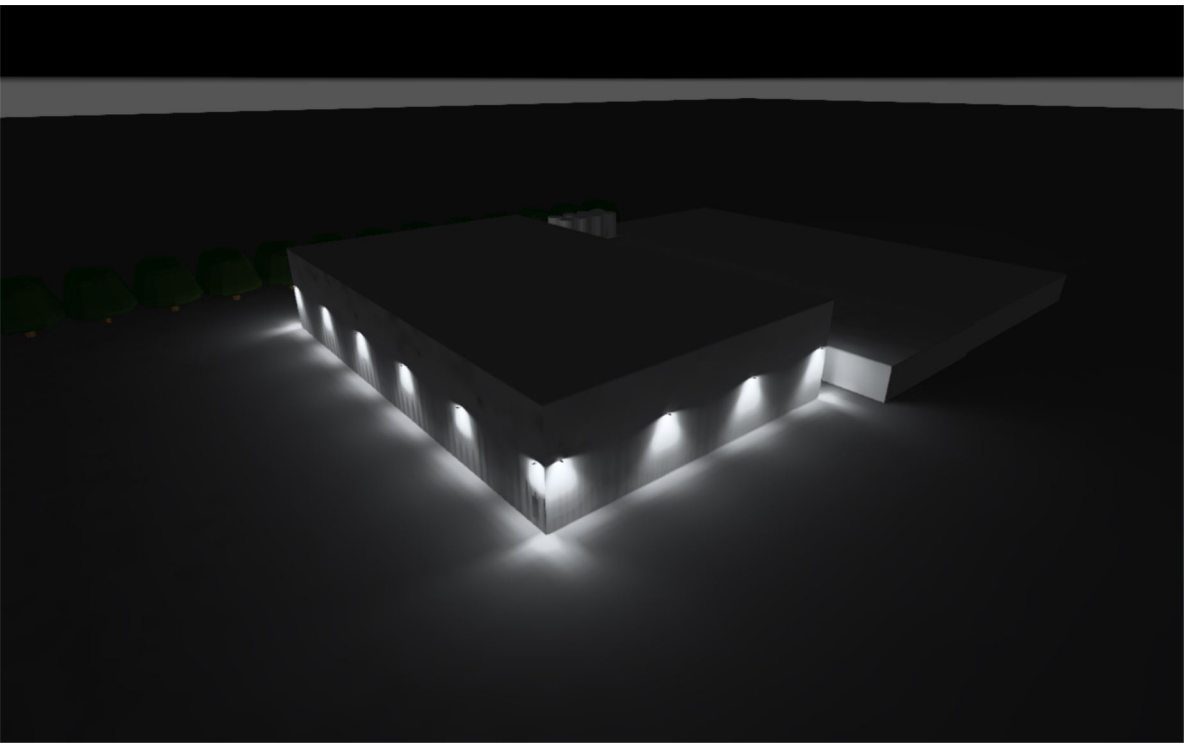
Appendix 1 - DIALux Output

Date 07/09/2021

DIALux



Magor Brewery, Monmouthshire

Content

Product data sheets

Magor Brewery

Luminaire list

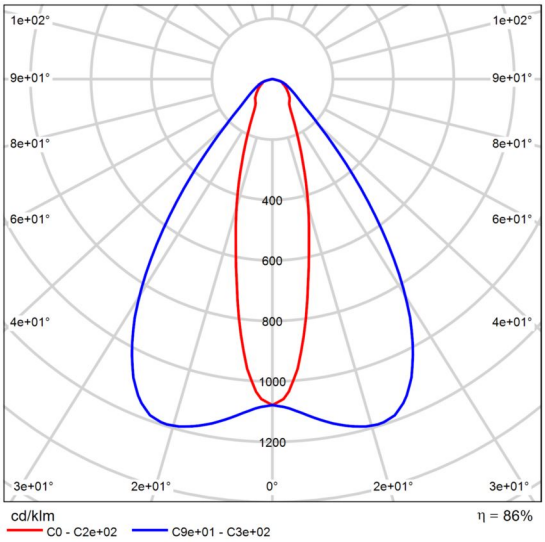
Φ_{total}	P_{total}	Luminous efficacy
726060 lm	5300.0 W	137.0 lm/W

pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy
20	PHILIPS		BVP650 T25 S LED420/740 NO	265.0 W	36303 lm	137.0 lm/W

Product data sheet

PHILIPS BVP650 T25 S LED420/740 NO

P	265.0 W
Φ_{Lamp}	42000 lm
$\Phi_{Luminaire}$	36303 lm
η	86.43 %
Luminous efficacy	137.0 lm/W
CCT	4000 K
CRI	100



Polar LDC

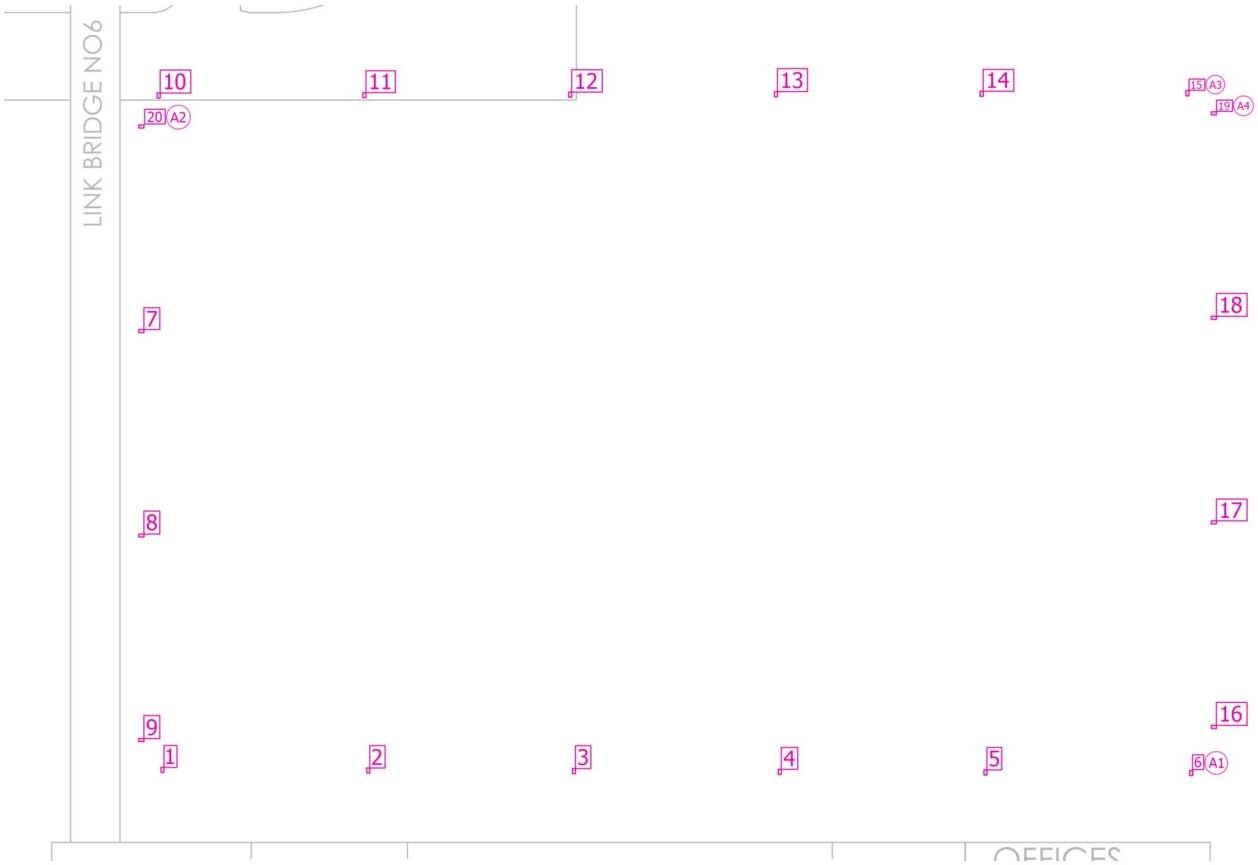
Glare evaluation according to UGR

ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	22.6	23.6	22.8	23.8	24.0	26.8	27.8	27.1	28.0	28.2
	3H	24.4	25.3	24.7	25.5	25.8	27.5	28.4	27.8	28.7	28.9
	4H	25.3	26.1	25.6	26.4	26.7	27.9	28.7	28.2	29.0	29.3
	6H	25.4	26.2	25.8	26.5	26.8	28.0	28.8	28.4	29.1	29.4
	8H	25.4	26.2	25.8	26.5	26.8	28.0	28.8	28.4	29.1	29.4
	12H	25.4	26.1	25.7	26.4	26.8	28.0	28.7	28.3	29.0	29.4
4H	2H	23.3	24.2	23.6	24.5	24.7	26.9	27.7	27.2	28.0	28.3
	3H	25.2	26.0	25.6	26.3	26.6	27.8	28.5	28.1	28.8	29.1
	4H	26.2	26.9	26.6	27.2	27.6	28.2	28.9	28.6	29.2	29.6
	6H	26.4	27.0	26.9	27.4	27.8	28.5	29.1	28.9	29.5	29.9
	8H	26.4	27.0	26.9	27.4	27.8	28.6	29.1	29.0	29.5	29.9
	12H	26.4	26.9	26.8	27.3	27.7	28.5	29.0	29.0	29.4	29.8
8H	4H	26.4	26.9	26.8	27.3	27.7	28.3	28.8	28.7	29.2	29.6
	6H	26.7	27.1	27.1	27.5	28.0	28.7	29.1	29.1	29.5	30.0
	8H	26.7	27.1	27.2	27.5	28.0	28.7	29.1	29.2	29.5	30.0
	12H	26.7	27.0	27.2	27.5	28.0	28.7	29.0	29.2	29.5	30.0
12H	4H	26.4	26.9	26.8	27.3	27.7	28.3	28.8	28.7	29.2	29.6
	6H	26.7	27.1	27.2	27.5	28.0	28.6	29.0	29.1	29.5	29.9
	8H	26.7	27.0	27.2	27.5	28.0	28.7	29.0	29.2	29.5	30.0
Variation of the observer position for the luminaire distances S											
S = 1.0H		+0.2 / -0.2					+2.2 / -0.9				
S = 1.5H		+0.4 / -0.5					+4.1 / -1.4				
S = 2.0H		+0.7 / -1.3					+5.7 / -1.8				
Standard table		BK05					BK03				
Correction Summand		8.9					10.4				
Corrected glare indices referring to 42000lm Total luminous flux											

UGR diagram (SHR: 0.25)

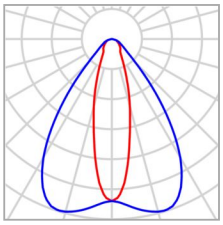
Magor Brewery

Luminaire layout plan



Magor Brewery

Luminaire layout plan



Manufacturer	PHILIPS
Article name	BVP650 T25 S LED420/740 NO

6 x Philips BVP650 T25 S LED420/740 NO

Type	Line arrangement
1st luminaire (X/Y/Z)	8.846 m / 5.795 m / 9.000 m
X-direction	6 pcs., Center - center, Distances not equal
Arrangement	A1

X	Y	Mounting height	Luminaire
8.846 m	5.795 m	9.000 m	1
25.283 m	5.743 m	9.000 m	2
41.719 m	5.692 m	9.000 m	3
58.156 m	5.640 m	9.000 m	4
74.592 m	5.589 m	9.000 m	5
91.029 m	5.537 m	9.000 m	6

4 x Philips BVP650 T25 S LED420/740 NO

Type	Line arrangement
1st luminaire (X/Y/Z)	7.157 m / 40.865 m / 9.000 m
X-direction	4 pcs., Center - center, Distances not equal
Arrangement	A2

X	Y	Mounting height	Luminaire
7.157 m	40.865 m	9.000 m	7
7.157 m	24.520 m	9.000 m	8
7.157 m	8.176 m	9.000 m	9
7.157 m	57.209 m	9.000 m	20

DIALux

Magor Brewery

Luminaire layout plan

6 x Philips BVP650 T25 S LED420/740 NO

Type	Line arrangement
1st luminaire (X/Y/Z)	8.542 m / 59.680 m / 9.000 m
X-direction	6 pcs., Center - center, Distances not equal
Arrangement	A3

X	Y	Mounting height	Luminaire
8.542 m	59.680 m	9.000 m	10
24.978 m	59.717 m	9.000 m	11
41.415 m	59.754 m	9.000 m	12
57.851 m	59.791 m	9.000 m	13
74.288 m	59.828 m	9.000 m	14
90.724 m	59.865 m	9.000 m	15

4 x Philips BVP650 T25 S LED420/740 NO

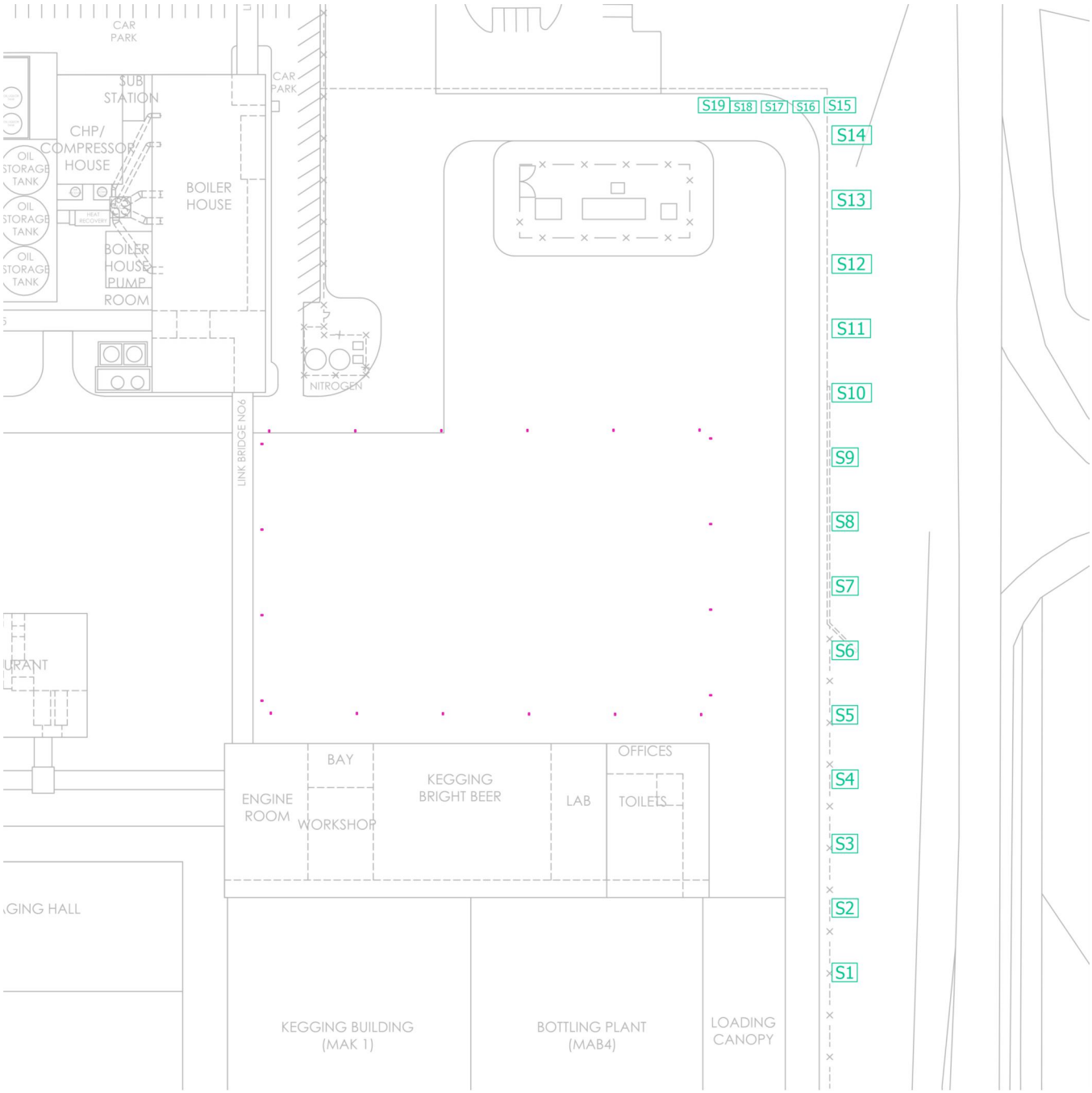
Type	Line arrangement
1st luminaire (X/Y/Z)	92.840 m / 9.227 m / 9.000 m
X-direction	4 pcs., Center - center, Distances not equal
Arrangement	A4

X	Y	Mounting height	Luminaire
92.840 m	9.227 m	9.000 m	16
92.840 m	25.572 m	9.000 m	17
92.840 m	41.917 m	9.000 m	18
92.840 m	58.261 m	9.000 m	19

DIALux

Magor Brewery

Calculation objects



Magor Brewery

Calculation objects

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Calculation objects

Calculation points

Properties	Calculated	Index
Calculation point 41 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	2.11 lx	S1
Calculation point 42 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	0.50 lx	S2
Calculation point 43 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	1.08 lx	S3
Calculation point 44 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	3.25 lx	S4
Calculation point 45 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	7.04 lx	S5
Calculation point 46 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	7.42 lx	S6
Calculation point 47 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	11.0 lx	S7
Calculation point 48 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	7.41 lx	S8
Calculation point 49 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	9.22 lx	S9
Calculation point 50 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	5.26 lx	S10
Calculation point 51 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	5.27 lx	S11
Calculation point 52	1.08 lx	S12

DIALux

Magor Brewery

Calculation objects

Properties	Calculated	Index
Vertical illuminance Rotation: 180.1°, Height: 3.000 m		
Calculation point 53 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	0.91 lx	S13
Calculation point 54 Vertical illuminance Rotation: 180.1°, Height: 3.000 m	0.26 lx	S14
Calculation point 55 Vertical illuminance Rotation: 270.0°, Height: 3.000 m	0.83 lx	S15
Calculation point 56 Vertical illuminance Rotation: 270.0°, Height: 3.000 m	0.65 lx	S16
Calculation point 57 Vertical illuminance Rotation: 270.0°, Height: 3.000 m	1.58 lx	S17
Calculation point 58 Vertical illuminance Rotation: 270.0°, Height: 3.000 m	4.32 lx	S18
Calculation point 59 Vertical illuminance Rotation: 270.0°, Height: 3.000 m	1.60 lx	S19

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Glossary

A

A	Formula symbol for a surface in the geometry

B

Background area	The background area borders the direct ambient area according to DIN EN 12464-1 and reaches up to the borders of the room. In larger rooms, the background area is at least 3 m wide. It is located horizontally at floor level.

C

CCT	(Engl. correlated color temperature) Body temperature of a thermal radiator that serves to describe its light color. Unit: Kelvin [K]. The lesser the numerical value the redder; the greater the numerical value the bluer the light color. The color temperature of gas-discharge lamps and semi-conductors are termed "correlated color temperature" in contrast to the color temperature of thermal radiators. Allocation of the light colors to the color temperature ranges acc. to EN 12464-1: Light color - color temperature [K] warm white (ww) < 3,300 K neutral white (nw) ≥ 3,300 – 5,300 K daylight white (dw) > 5.300 K
Clearance height	The designation for the distance between upper edge of the floor and bottom edge of the ceiling (in the completely furnished status of room).
CRI	(Engl. color rendering index) Designation for the color rendering index of a luminaire or a lamp acc. to DIN 6169: 1976 or CIE 13.3: 1995. The general color rendering index Ra (or CRI) is a dimensionless figure that describes the quality of a white light source in regards to its similarity with the remission spectra of defined 8 test colors (see DIN 6169 or CIE 1974) to a reference light source.

D

Daylight factor	Ratio of the illuminance achieved solely by daylight incidence at a point in the inside to the horizontal illuminance in the outer area under an unobstructed sky. Formula symbol: D (Engl. daylight factor) Unit: %

Glossary

Daylight quotient effective area	A calculation surface within which the daylight quotient is calculated.

E

Eta (η)	(light output ratio) The light output ratio describes what percentage of the luminous flux of a free radiating lamp (or LED module) is emitted by the luminaire when installed. Unit: %

G

g1	Often also Uo (Engl. overall uniformity) Designates the overall uniformity of the illuminance on a surface. It is the quotient from Emin to Ē and is required, for instance, in standards for illumination of workstations.
g2	Actually it designates the "non-uniformity" of the illuminance on a surface. It is the quotient of Emin to Emax and is generally only relevant for certifying the emergency lighting acc. to EN 1838.

I

Illuminance	Describes the ratio of the luminous flux that strikes a certain surface to the size of this surface ($lm/m^2 = lx$). The illuminance is not tied to an object surface. It can be determined anywhere in space (inside or outside). The illuminance is not a product feature because it is a recipient value. Luxometers are used for measuring. Unit: Lux Abbreviation: lx Formula symbol: E
Illuminance, adaptive	For the determining of the middle adaptive illuminance on a surface, this is rastered "adaptively". In the area of large illuminance differences within the surface, the raster is subdivided finer; within lesser differences, a rougher classification is made.
Illuminance, horizontal	Illuminance that is calculated or measured on a horizontal (level) surface (this can be for example a table top or the floor). The horizontal illuminance is usually identified by the formula letter Eh.
Illuminance, perpendicular	Illuminance that is calculated or measured plumb-vertical to a surface. This needs to be taken into account for tilted surfaces. If the surface is horizontal or vertical, then there is no difference between the perpendicular and the horizontal or vertical illuminance.

Glossary

Illuminance, vertical	Illuminance that is calculated or measured on a vertical surface (this can be for example the front of some shelves). The vertical illuminance is usually identified by the formula letter Ev.

L

LENI	(Engl. lighting energy numeric indicator) Lighting energy numeric indicator acc. to EN 15193 Unit: kWh/m² year
Light loss factor	See MF
LLMF	(Engl. lamp lumen maintenance factor)/acc. to CIE 97: 2005 Lamp flux maintenance factor that takes the luminous flux reduction into account of a luminaire or an LED module in the course of the operating time. The lamp flux maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no luminous flux reduction existing).
LMF	(Engl. luminaire maintenance factor)/acc. to CIE 97: 2005 Luminaire maintenance factor that takes the soiling into account of the luminaire in the course of the operating time. The luminaire maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).
LSF	(Engl. lamp survival factor)/acc. to CIE 97: 2005 Lamp survival factor that takes the total failure into account of a luminaire in the course of the operating time. The lamp survival factor is specified as a decimal digit and can have a maximum value of 1 (no failures existing within the time concerned or prompt replacement after the failure).
Luminance	Dimension for the "brightness impression" that the human eye has of a surface. The surface itself can emit light thereby or light striking it can be reflected (emitter value). It is the only photometric value that the human eye can perceive. Unit: Candela per square meter Abbreviation: cd/m² Formula symbol: L
Luminous efficacy	Ratio of the emitted luminous flux Φ [lm] to the absorbed electrical power P [W] Unit: lm/W. This ratio can be formed for the lamp or LED module (lamp or module light output), the lamp or module with control gear (system light output) and the complete luminaire (luminaire light output).

Glossary

Luminous flux	Dimension for the total light output that is emitted from one light source in all directions. It is thus an "emitter value" that specifies the entire emitting output. The luminous flux of a light source can only be determined in a laboratory. A difference is made between the lamp or LED module luminous flux and the luminaire luminous flux. Unit: Lumen Abbreviation: lm Formula symbol: Φ
Luminous intensity	Describes the intensity of the light in a certain direction (emitter value). The luminous intensity is a matter of the luminous flux Φ that is emitted in a certain spherical angle Ω. The radiation characteristics of a light source are presented graphically in a light distribution curve (LDC). The luminous intensity is an SI base unit. Unit: Candela Abbreviation: cd Formula symbol: I

M

MF	(Engl. maintenance factor)/acc. to CIE 97: 2005 Maintenance factor as decimal number between 0 and 1 that describes the ratio of the new value of a photometric planning parameter (e.g. of the illuminance) to a maintenance value after a certain time. The maintenance factor takes into account the soiling of luminaires and rooms as well as the luminous flux reduction and the failure of light sources. The maintenance factor is taken into account either overall or determined in detail acc. to CIE 97: 2005 by the formula RMF x LMF x LLMF x LSF.

P

P	(Engl. power) Electric power consumption Unit: watt Abbreviation: W

R

Reflection factor	The reflection factor of a surface describes how much of the striking light is reflected back. The reflection factor is defined by the color of the surface.

Glossary

RMF	(Engl. room maintenance factor)/acc. to CIE 97: 2005 Room maintenance factor that takes the soiling into account of the space encompassing surfaces in the course of the operating time. The room maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).

S

Surrounding area	The ambient area directly borders the area of the visual task and should be planned with a width of at least 0.5 m according to DIN EN 12464-1. It is at the same height as the area of the visual task.

U

UGR (max)	(unified glare rating) Measure for the psychological glare effect in interiors. In addition to luminaire luminance, the UGR value also depends on the position of the observer, the viewing direction and the ambient luminance. Among other things, EN 12464-1 specifies maximum permissible UGR values for various indoor workplaces.
UGR observer	Calculation point in the room, for the DIALux the UGR value is determined. The location and height of the calculation point should correspond to the typical observer position (position and eye level of the user).

V

Visual task area	The area that is needed for carrying out the visual task in accordance with DIN EN 12464-1. The height corresponds with the height at which the visual task is executed.

W

Wall zone	Circumferential area between working plane and walls that is not taken into account for the calculation.
Workplane	Virtual measuring or calculation surface at the height of the visual task that generally follows the room geometry. The working plane may also feature a wall zone.