

PROJECT NAME

EXCELLENCE, LAND AT WIGGS FARM, STATION ROAD, COALVILLE

EXTERNAL LIGHTING STRATEGY DOCUMENT

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13th May 2025
1189/DN/02 Rev P3

Document Control Sheet

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1 Introduction

1.1 Overview

- 1.1.1 D.W Pointer & Partners Ltd have been commissioned by Barberry Bardon Limited ('the Applicant') to prepare a Lighting Strategy in relation to the planning application known as Excellence, Land at Wiggs Farm, Station Road, Coalville.

1.2 Purpose of this Document

- 1.2.1 D.W Pointer & Partners Ltd were appointed on behalf of Barberry Bardon Ltd to review the lighting for of the Environmental Statement (ES) and prepare outline designs for the planning application for the Proposed Scheme.
- 1.2.2 The following elements will be included within the lighting strategy:
- Maximum luminaire mounting height for building and column mounted luminaires;
 - Zero degree tilt angles.
 - Luminaire design (how light will be restricted to ensure glare is minimised and maximum Upwards Light Ratio (ULR) achieved);
 - Maximum Correlated Colour Temperature and how this has been selected;
 - Control system methodology, including adaptive proposals for energy saving adaptive lighting solutions; and
- 1.2.3 As such, this document has been prepared to provide a lighting strategy and details of the above.
- 1.2.4 This document does not cover lighting requirements for the following elements of the Proposed Scheme:
- Lighting along the Station Road

1.3 The Site

- 1.3.1 The Site is approximately 12.4 hectares (ha) in size and includes agricultural land and forest areas.
- 1.3.2 The existing ambient lighting conditions of the Site are considered to be defined as Environmental Zone E2 (Rural) in accordance with the Institution of Lighting Professionals Guide (ILP) (2020) given that the Site is relatively dark, on the outskirts of a built up urban area.

2 Lighting Strategy

2.1 Introduction

- 2.1.1 This section provides an overview of lighting design requirements that for the lighting strategy for the outline elements of the Proposed Scheme and applicable guidance, standards, design information and parameters that will be used to guide future lighting designs.

2.2 Lighting Requirements

- 2.2.1 Operational lighting is required throughout the Proposed Scheme to provide the minimum level of lighting to complete activities safely.

- 2.2.2 Proposed uses within the Development include the following:

- B2 - General Industrial
- B8 – Storage or distribution

- 2.2.3 External artificial lighting is anticipated to be required for the above uses to illuminate:

- vehicle access and internal roads for unit.
- pedestrian routes across the Site;
- walkways around buildings and building entrances;
- loadings bays and services yards;
- car parks, Heavy Goods Vehicle (HGV) parking areas and cycle parking;
- external storage areas and waste management facilities; and
- signage and advertisements
- Amenity area

2.3 Standards and Guidance

- 2.3.1 The following standards and guidance are applicable to the proposed uses and external artificial lighting requirements for the Proposed Scheme. These will be used to inform the future detailed lighting designs for the Development.

- 2.3.2 It should be noted that as the details of the Proposed Scheme are progressed, the below guidance and standards may be updated and/or new guidance or standards implemented. Subsequent designs should take account of the most up to date site plans and appropriate guidance and standards at the time of preparation.

Obtrusive Light

- 2.3.3 *The ILP Guidance Notes for the Reduction of Obtrusive Light (202* This guidance provides advice on lighting including the recommendation to local planning authorities to specify Environmental Zones for exterior lighting based on the existing external ambient lighting levels in the area. These documents also provide design guidance including maximum obtrusive lighting (lighting pollution) level limits for each Environmental Zone.

Ecological

- 2.3.4 *Bat Conservation Trust and ILP Guidance Note 08/18: Bats and Artificial Lighting in the UK (2018)* - Bats and Artificial Lighting in the UK provides guidance on general principles of lighting to mitigate adverse effects on areas where bats are known to be present and / or commuting to feeding areas. The document sets out advice for bat workers/ecologists and lighting professionals to ensure that both parties work together to achieve the most effective solution in delivering an appropriate artificial lighting solution whilst reducing the adverse effects on bats.

Standards

- 2.3.5 *BS EN 5489-1:2020 Design of road lighting. Lighting of roads and public amenity areas* - BS 5489-1 is a revision of the British Standard for road lighting design. It provides guidance and recommendations that are intended to support the BS EN 13201 series. This document provides recommendations on the general principles of road lighting including aesthetic and technical aspects, operation and maintenance, means of minimising energy consumption and limiting the impact on the environment. The guidance provides recommendations for the design of lighting for urban centres, public amenity areas and smart cities.
- 2.3.6 *BS EN 12464-2:2014 Light and lighting - Lighting of work places Part 2: Outdoor work* - This document outlines requirements for lighting outdoor work places, focusing primarily on visual comfort and performance.
- 2.3.7 *CIBSE (2016) Lighting Guide LG6 – The Outdoor Environment* - presents lighting solutions to basic visual problems and individual characteristics of outdoor lighting applications.

2.4 General Lighting Strategy

- 2.4.1 In addition to the guidance outlined in **Section 2.3** above, **Table 2.1** below outlines parameters that will be used to guide the future lighting designs and see that there is a consistent approach to lighting.
- 2.4.2 An illustrative lighting design for the development is provided in **Appendix D** which shows how lighting can be provided within these limitations for the E2 Environmental Zone and within the maximum parameters set out in **Table 2.1**. The illustrative design shows how obtrusive lighting can be well controlled using the selected products and fittings (e.g. back light shields and/or internal optical baffles) to reduce light spill onto surrounding areas.

Table 2.1: Lighting Design Parameters

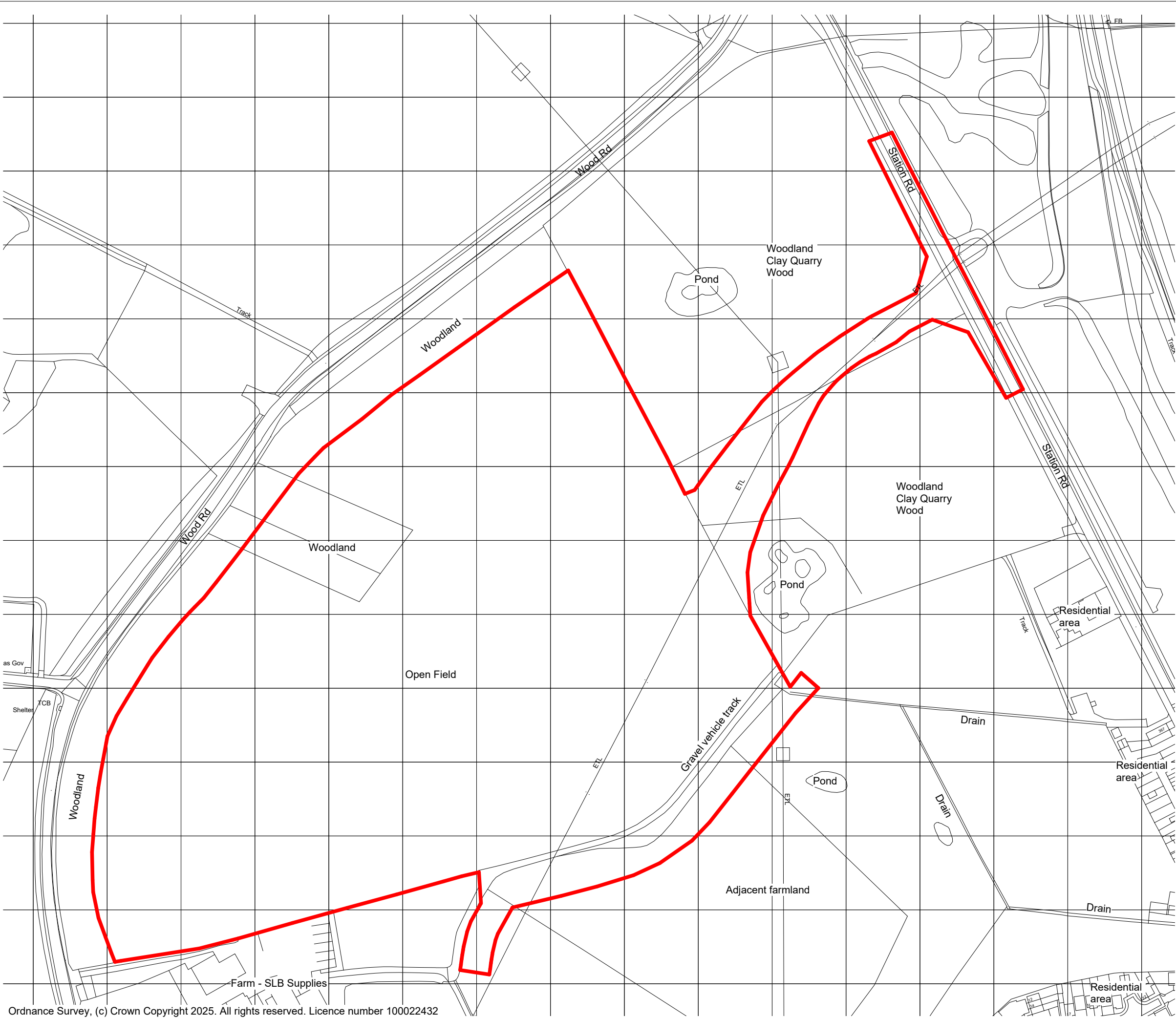
Design Parameter	Design	Notes
ILP environmental zone	As outlined within Section 1.2 , the Site is classified as being within Environmental Zone E2 Lighting provided on Site will be designed to be within the light limitation thresholds of the E2 zone (see Appendix C).	
Average Illuminance	20 lux average for low-risk areas (such as car parks) at 0.25 uniformity. 30 lux average for high-risk areas (lorry yard) at 0.4 uniformity. 50 lux average for loading/canopy areas at 0.4 uniformity.	The levels provided are indicative as future tenant may have differing requirements. These would be agreed during reserved matters applications.
Operating hours	Operational hours of lighting will depend on the use of areas which are not used 24 hours a day lighting will be dimmed or switched off by curfew. In some instance, operations will be undertaken 24 hours a day (e.g. B8 storage and distribution uses). Where safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system will comply with the lower levels of lighting recommended during these hours as outlined in Table 3 of the ILP Guidance 2020	
Luminaire source	LED	
Maximum luminaire mounting height	Columns – 10m Buildings - 10m	Column mounted lighting will typically range from 6m - 10m in height. Heights for building mounted lighting will vary depending on the height of the building however heights will typically range from 4m – 10m. Low level bollard lighting will also be provided along walkways which will be ~1m in height.
Maximum tilt angles	Generally Columns – Zero tilt	Generally, all luminaires will be horizontal and will

Design Parameter	Design	Notes
	(Minimal 5 degree in specific location, due to width of service yard) Buildings – Zero tilt	not be tilted. (unless noted on legend note luminaire L17) generally All luminaires have optics devised to perform tasks without having to tilt them.
Maximum ULR	Maximum ULR - 2.5% (threshold for Environmental Zone E2)	The majority of lighting (such as column mounted lighting) will be horizontal and so will not emit light upward. Upward light emissions will be predominantly associated with low level bollard lighting used for pedestrian walkways. It is anticipated that the ULR associated plot lighting may be much less than the maximum threshold permitted
Maximum Glare	Maximum luminous intensity emitted by luminaire (I in cd) where the projected area (Ap) >0.5 m ² : Pre-curfew = 7,500 Post-curfew = 500 (thresholds for Environmental Zone E2 – see Appendix C Table C for further details and Ap sizes)	Specifically illuminated bollards should contain internal optical controls or external louvres to direct light downwards to protect drivers from discomfort or disability glare.
Maximum Correlated Colour Temperature	3000K	3000K has been selected through consultation with the project ecologist. Using warmer colour temperatures is considered to cause less impact on bats. ILP GN08/18 cites Stone (2012, 2015a, 2015b) who states that “ <i>warm white (more yellow/orange colour) at around 3000°K and as low as 2700°K can now be used with little reduction in lumen output.</i> ”
Control system	Control shall be a centralised time switch/photo-cell controlled via a	

Design Parameter	Design	Notes
	contactor arrangement with a manual override. The controls shall allow independent switching for the car park, lorry yard, pedestrian access. Presence detection will also be used in areas of intermittent pedestrian traffic.	
Maintenance Factor	All lighting design information should present the initial light output of the designed installation (i.e. M.F of 1.0).	

Appendix A

Site Location Plan



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Safety Health and Environmental Information

A3

The following risks are identified as unusual or unfamiliar to a competent contractor

CONSTRUCTION

DEMOLITION RISKS (FUTURE)

It is assumed that all work will be carried out by a competent contractor working, where appropriate, to an approved method statement

North

Graphics Scale 1:2500

01050100

520

Site Boundary

B

Updated to suit latest design

07/03/25

JDK/ST

A

Redline boundary updated to Tier information - JDK

18/02/25

TH/ST

REVDETAILSDATEDRN/CHK

bhb

architects

LICHFIELD

01543 254357

CHELTENHAM

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RIBA Chartered Practice

Coalville, Pall-Ex

Location Plan

Barberry Industrial

DRAWING NO.

4092 - 00

REVDATE

BFEB 25

WORK IN PROGRESS

DRNCHK

JDKST

SCALE

1 : 2500 @ A3

✓

ISO 9001

REGISTERED FIRM

✓

ISO 14001

REGISTERED FIRM

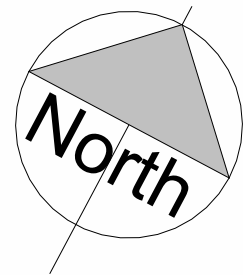
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THE Green REGISTER

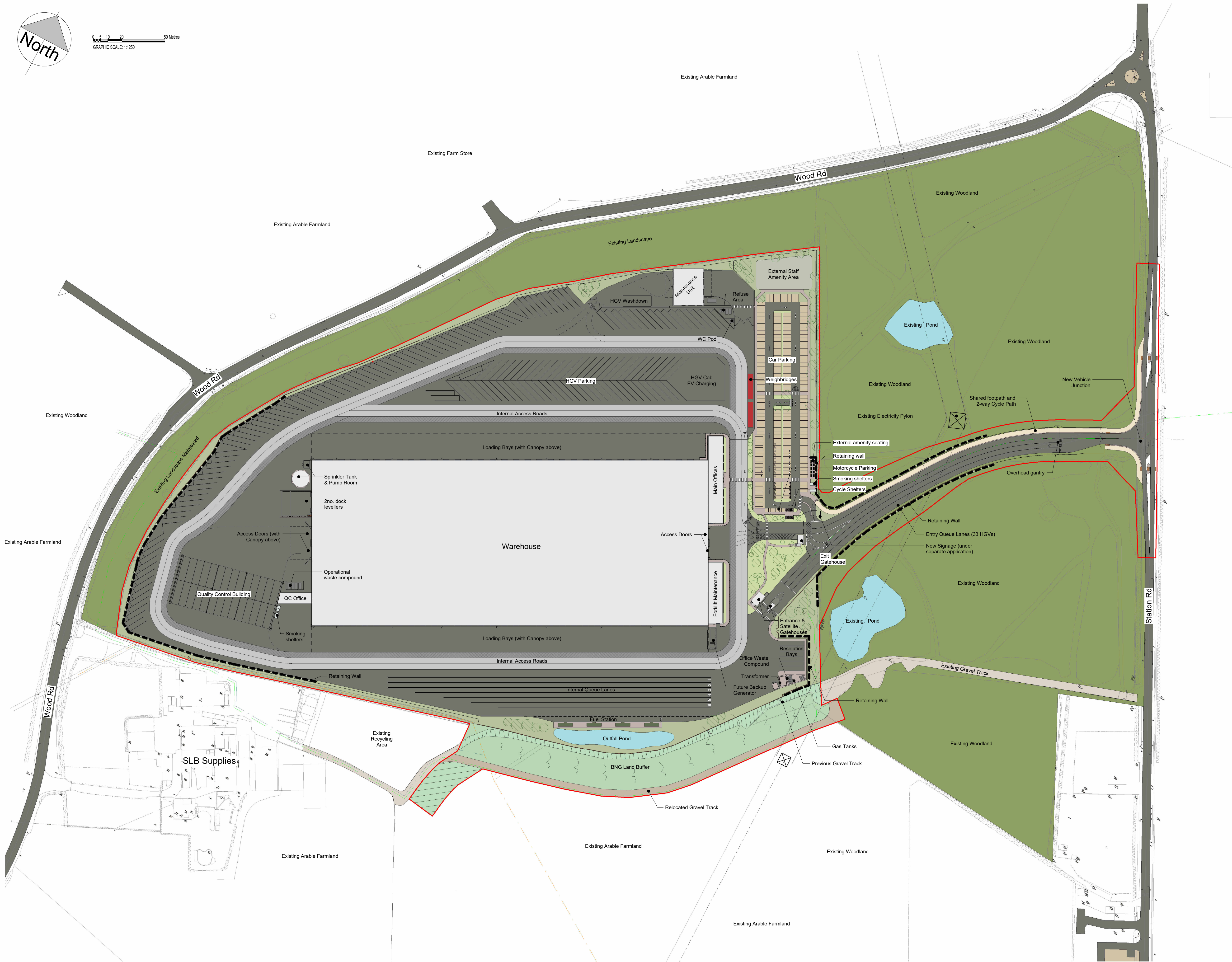
OF CONSTRUCTION PROFESSIONALS

Appendix B

Site Plan



0 5 10 20 50 Metres
GRAPHIC SCALE 1:1250



Safety Health and Environmental Information A1

The following risks are identified as unusual or unfamiliar to a competent contractor

CONSTRUCTION

DEMOLITION RISKS (FUTURE)

It is assumed that all work will be carried out by a competent contractor working, where appropriate, to an approved method statement

Area Schedule - GIA		
Name	Area (m2)	Area (ft2)
Forklift Maintenance - GIA	408 m ²	4,396 ft ²
In Gatehouse - GIA	35 m ²	374 ft ²
Office - Ground - GIA	608 m ²	6,545 ft ²
Office - First - GIA	625 m ²	6,725 ft ²
Office - Second - GIA	645 m ²	6,945 ft ²
Office - Third - GIA	645 m ²	6,945 ft ²
Out Gatehouse - GIA	16 m ²	169 ft ²
Quality Control Office - GIA	170 m ²	1,828 ft ²
Satellite Gatehouse - GIA	4 m ²	47 ft ²
Maintenance Unit - Ground - GIA	519 m ²	5,585 ft ²
Maintenance Unit - First - GIA	103 m ²	1,107 ft ²
Warehouse - GIA	31,726 m ²	341,497 ft ²
Total GIA - All Floors*	35,504 m ²	382,161 ft ²

* Excludes Quality Control Building. Includes Quality Control Office.

Key:

Boundary

Area Schedule - Site		
Name	Hectares	Acres
Planning Site Boundary	14.64	36.18

Underside of Haunch Heights (AFFL)

- Warehouse: 15.25m
- Forklift: 5m
- Main Offices: 15m
- VMU: 7.25m
- QC: 5.5m

Parking Quantities

Car Parking spaces - 201
including: 13 Disabled spaces / 10 Car Share / 20 EV Spaces
(whole car park to be passively ducted)

HGV External Parking Spaces - 156
(not including Loading Bays, Dock Levellers, Resolution Bays,
HGV Cab Charging, Quality Control Building, Fuel Station,
Weighbridge or Queue Lanes)

Canopy Dock Doors - 67

Level Access Doors - 2

Motorcycle Spaces - 6

Cycle Spaces - 48

Refer to DTA Transport assessment
for vehicle parking quantities rationale
associated with this bespoke scheme.

bhb
architects

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RIBA Chartered Practice

Project Excellence

Proposed Site Plan - Orientated

Barberry Barton Ltd

PLANNING

DRAWING NO.

4092 - 06

REV DATE

B FEB 25

SCALE

1 : 1250 @ A1

DRN

CHK

ST

JDK

ST

ISO 9001

REGISTERED

ISO 14001

REGISTERED

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Appendix C

ILP Environmental Zone Thresholds

**Table A - Obtrusive Light Limitations for Exterior Lighting Installations –
General Observers**

Environmental Zone	Sky Glow Maximum values of upward light ratio (ULR) [URL/%] (1)	Maximum values of vertical illuminance on properties Illuminance in the vertical plane (Ev) [Lux]		Maximum permitted values of average surface Luminance(cd/m ²) (2)	
		Pre Curfew	Post Curfew	Building façade luminance	Sign luminance
E0	0	n/a	n/a	<0.1	<0.1
E1	0	2	<0.1*	<0.1	50
E2	2.5	5	1	5	400
E3	5.0	10	2	10	800
E4	15	25	5	25	1,000
Definitions ULR = Upward Light Ratio of the Installation is the maximum permitted percentage of luminaire flux for that goes directly into the sky. Ev = Vertical Illuminance in Lux and is measured flat on the glazing at the centre of the window L = Luminance in Candelas per Square Metre Cd/m² Curfew = The time after which stricter requirements (for the control of obtrusive light) will apply; often a condition of use of lighting applied by the local planning authority. (1) This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow. This is the traditional method to limit sky glow and is suitable to compare different single luminaires. (2) The values apply to both pre- and post-curfew, except that in zones 0 and 1 the values shall be zero post curfew. The values for signs do not apply to signs for traffic control purposes * If the installation is for public (road) lighting then this may be up to 1 lx.					

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020

**Table B - Obtrusive Light Limitations for Exterior Lighting Installations
(Upward Flux Ratio) – General Observer**

Environmental Zone	Type of Installation		
	Road	Amenity	Sport
E0	n/a	n/a	n/a
E1	2	n/a	n/a
E2	5	6	2
E3	8	12	6
E4	12	35	15
This table allows the effect of both direct and reflected upward components of a whole installation to be taken into account. The factor being the upward flux ratio (UFR) and CIE 150 suggests that table 7 is used for all installations consisting of four or more luminaires. Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULP and UFR. Light emitted just above the horizontal in a zone between 90° and 110° is extra critical for sky glow in large open areas around observatories. An additional measure in these areas limits the luminous intensities ($I_{90} - I_{110}$) as follows: • between 90° and 100° < 0.5 cd/1000lm; • between 100° and 110° 0 cd.			

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020

Table C – Obtrusive Light Limitation for Exterior Lighting Installations – Limits for the Luminous Intensity of Bright Luminaires - General Observer

Light technical parameter	Application Conditions	Luminaire group (projected area A_p in m ²)					
		$0 < A_p \leq 0.002$	$0.002 < A_p \leq 0.01$	$0.01 < A_p \leq 0.03$	$0.03 < A_p \leq 0.13$	$0.13 < A_p \leq 0.50$	$A_p \geq 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E0						
	Pre-Curfew	0	0	0	0	0	0
	Post Curfew	0	0	0	0	0	0
	E1						
	Pre-Curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.3 <i>d</i>	2.5 <i>d</i>	5.1 <i>d</i>	2,500
	Post Curfew	0	0	0	0	0	0
	E2						
	Pre-Curfew	0.57 <i>d</i>	1.3 <i>d</i>	2.5 <i>d</i>	5.0 <i>d</i>	10.0 <i>d</i>	7,500
	Post Curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.3 <i>d</i>	2.5 <i>d</i>	5.1 <i>d</i>	500
	E3						
	Pre-Curfew	0.86 <i>d</i>	1.9 <i>d</i>	3.8 <i>d</i>	7.5 <i>d</i>	15 <i>d</i>	10,000
	Post Curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.3 <i>d</i>	2.5 <i>d</i>	5.1 <i>d</i>	1,000
	E4						
	Pre-Curfew	1.4 <i>d</i>	3.1 <i>d</i>	6.3 <i>d</i>	13 <i>d</i>	26 <i>d</i>	25,000
	Post Curfew	0.29 <i>d</i>	0.63 <i>d</i>	1.3 <i>d</i>	2.5 <i>d</i>	5.1 <i>d</i>	2,500
Aid to gauging A_p		2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m ²)		0.0008	0.004	0.016	0.063	0.251	>0.5
Notes: 1. <i>d</i> is the distance between the observer and the glare source in metres; 2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cutoff in the designated directions; 3. A_p is the apparent surface of the light source seen from the observer position 4. For further information refer to Annex C of CIE 150 5. Upper limits for each zone shall be taken as those with column $A_p > 0.5$							

Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – IL GN01:2020

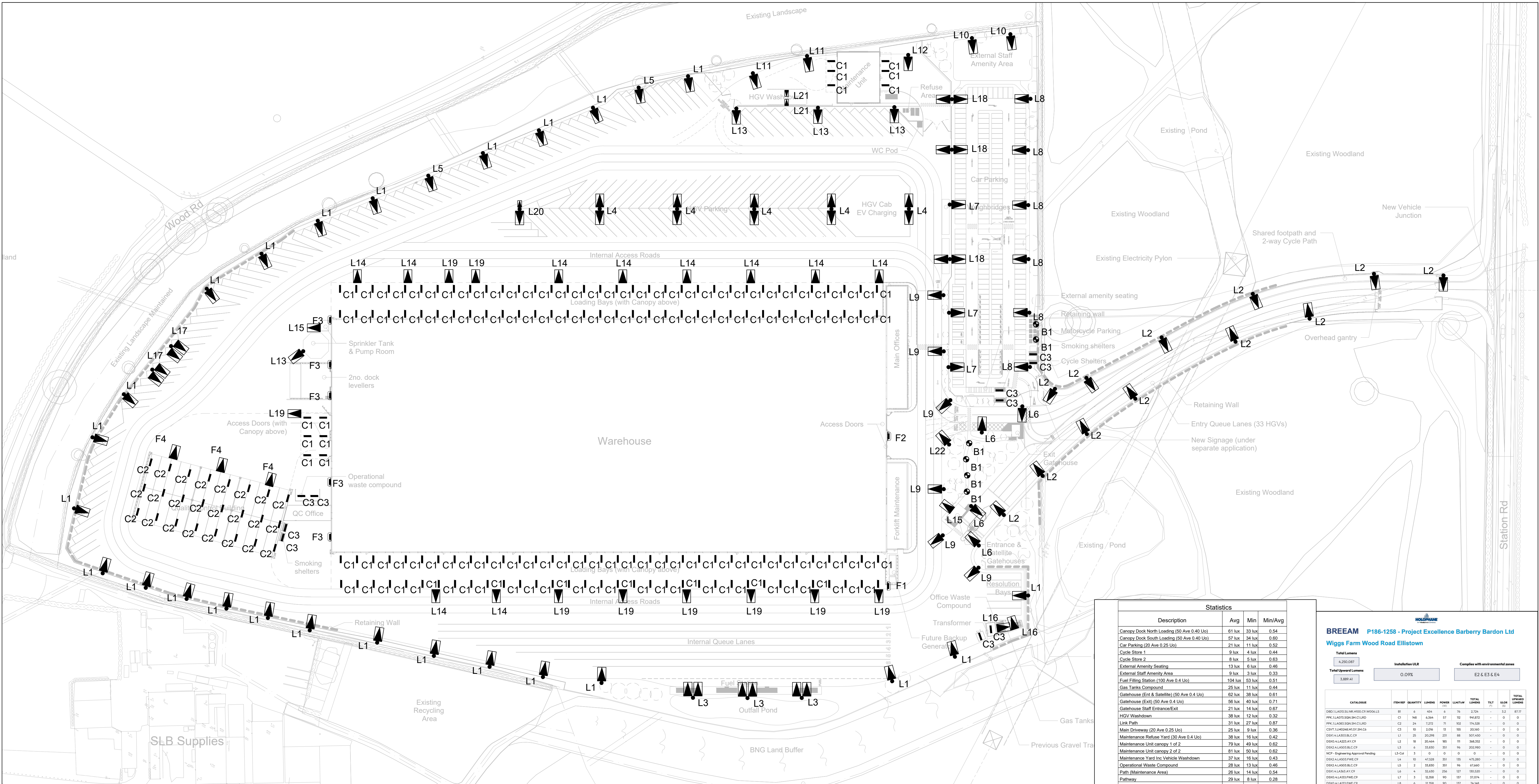
Table D – Obtrusive Light Limitation for Exterior Lighting Installations – Road Users

Road Classification (1)	Threshold Increment (TI)	Veiling Luminance (L_v) (2)
No road lighting	15% based on adaptation luminance of 0.1 cd/m^2	0.037 cd/m^2
M6/M5	15% based on adaptation luminance of 1.0 cd/m^2	0.23 cd/m^2
M4/M3	15% based on adaptation luminance of 2.0 cd/m^2	0.40 cd/m^2
M2/M1	15% based on adaptation luminance of $.05 \text{ cd/m}^2$	0.84 cd/m^2
TI = The measure of disability glare (the reduction in visibility caused by intense light sources in the field of view) expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare L_v = The luminance that would need to be superimposed on a scene in object space to reduce the scene's contrast by an amount equal to the added retinal illuminance from scattered light on the scene's retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view. (1) Road classifications as given in CIE 115:2010 (2) The veiling luminance values specified in this table are based upon on a permissible TI value of 15% Reproduced from the ILP Publication: Guidance Notes for the Reduction of Obtrusive Light – ILP, GN01:2020		



Appendix D

External Lighting Strategy - Lighting Drawing



EXTERNAL LIGHTING LEGEND

		B1	6W Denver iD Bollard 1m high, c/w root kit. 3000K.		L1	231W D-Series 1 on 10m Column, no tilt. 3000K. Extreme Cut Off.		L8	90W D-Series 0 on 6m Column, no tilt. With External Glare Shield. 3000K.
		C1	57W Parkpack Luminaire mounted to the soffit canopies over loading docks, etc. 3000K.		L2	185W D-Series 0 on 8m Column, no tilt. With External Glare Shield. 3000K.		L9	90W D-Series 0 on 8m Column, no tilt. 3000K.
		C2	71W Parkpack Luminaire mounted to the soffit canopies over loading docks, etc. 3000K.		L3	702W D-Series 2 - Twin Bull Horn Array on 10m column, no tilt. Extreme Cut Off.		L10	27W D-Series 0 on 6m Column, no tilt. light cut off optics. 3000K.
		C3	13W CSV2 IP65 LED Batten Luminaire mounted to the underside of smoking shelter ceilings.		L4	702W D-Series 2 Twin Set on 10m Column, no tilt. 3000K.		L11	185W D-Series 0 on 8m Column, no tilt. Extreme Cut Off. 3000K.
		F1	145W D-Series 2 on Wall @ 7m, no tilt. 3000K.		L5	351W D-Series 2 on 10m Column, no tilt. 300K. Extreme Cut Off.		L12	231W D-Series 0 on 8m Column, no tilt. Extreme Cut Off. 3000K
		F2	145W D-Series 1 on Wall @ 8m, no tilt. 3000K.		L6	256W D-Series 1 on 8m Column, no tilt. 3000K.		L13	351W D-Series 2 on 10m Column, no tilt. 3000K.
		F3	239W D-Series 2 on Wall @ 10m, no tilt. 3000K.		L7	90W D-Series 0 on 6m Column, no tilt. 3000K.		L14	114W D-Series 0 on end of canopy at 7m approx, no tilt. 3000K.
		F4	90w D-Series 0 on 8m Column, no tilt. 3000K.						

	L15	10.3 Denver iD Wall on wall @ 2m, no tilt. 3000K..
	L16	10.3W Denver iD Wall on wall at 4m, no tilt. 3000K.
	L17	702W D-Series 2 Twin Bull Horn Array on 10m Column, minimal 5 degree tilt. With Inner Back Light Shield Optics. 3000K.
	L18	180W D-Series 0 Twin set on 6m Column, no tilt. 3000K.
	L19	145W D-Series 0 on end of canopy @ 7m approx, no tilt. 3000K.
	L20	D-Series 0 (79W) on 10m Column shared with D-Series 2 (351W), back to back, no tilt, 3000K.
	L21	25W Denver iD Wall on screen of Washdown, 4m height, 3000K.
	L22	90W D-Series 0 on 8m Column, no tilt. 3000K.

Note: Feature lighting to be developed with architect to enhance building features.

Statistics				
Description	Avg	Min	Min/Avg	
Canopy Dock North Loading (50 Ave 0.40 Uo)	61 lux	33 lux	0.54	
Canopy Dock South Loading (50 Ave 0.40 Uo)	57 lux	34 lux	0.60	
Car Parking (20 Ave 0.25 Uo)	21 lux	11 lux	0.52	
Cycle Store 1	9 lux	4 lux	0.44	
Cycle Store 2	8 lux	5 lux	0.63	
External Amenity Seating	13 lux	6 lux	0.46	
External Staff Amenity Area	9 lux	3 lux	0.33	
Fuel Filling Station (100 Ave 0.4 Uo)	104 lux	53 lux	0.51	
Gas Tanks Compound	25 lux	11 lux	0.44	
Gatehouse (Ent & Satellite) (50 Ave 0.4 Uo)	62 lux	38 lux	0.61	
Gatehouse Staff Entrance/Exit	21 lux	14 lux	0.67	
HGV Washdown	38 lux	12 lux	0.32	
Link Path	31 lux	27 lux	0.87	
Main Driveway (20 Ave 0.25 Uo)	25 lux	9 lux	0.36	
Maintenance Refuse Yard (30 Ave 0.4 Uo)	38 lux	16 lux	0.42	
Maintenance Unit canopy 1 of 2	79 lux	49 lux	0.62	
Maintenance Unit canopy 2 of 2	81 lux	50 lux	0.62	
Maintenance Yard Inc Vehicle Washdown	37 lux	16 lux	0.43	
Operational Waste Compound	29 lux	13 lux	0.46	
Path (Maintenance Area)	26 lux	14 lux	0.54	
Pathway	29 lux	8 lux	0.28	
Rear Entrance Canopy (50 Ave 0.4 Uo)	79 lux	43 lux	0.54	
Refuse Area	37 lux	29 lux	0.78	
Road Driveway (20 Ave 0.25 Uo)	23 lux	8 lux	0.26	
Service Yard Area North (30 Ave 0.4 Uo)	38 lux	16 lux	0.42	
Service Yard Areas North West (30 Ave 0.4 Uo)	41 lux	16.5 lux	0.40	
Service Yard Areas South (30 Ave 0.4 Uo)	32 lux	13 lux	0.41	
Service Yard Areas South West (30 Ave 0.4 Uo)	32 lux	13 lux	0.41	
Smoking Shelter 1	55 lux	44 lux	0.80	
Smoking Shelter 2	52 lux	41 lux	0.79	
Smoking Shelter 3	52 lux	28 lux	0.54	
Still Light	0 lux	0 lux	N/A	
Store 1	36 lux	24 lux	0.67	
Store 2	26 lux	11 lux	0.42	
Typical Prep Buildings Under Canopy (50 Ave 0.4 Uo)	55 lux	33 lux	0.60	
2 No Dock Levellers (50 Ave 0.40 Uo)	58 lux	48 lux	0.83	

P4	Planning Issue	May25
P3	Lighting Layout Updated	Apr25
P2	Road Lighting Omitted	Apr25
P1	Initial layout	Apr25
REV	DESCRIPTION	DATE

PROJECT		Project Excellence	
DRAWING TITLE		External Lighting Layout	

BREEAM P186-1258 - Project Excellence Barberray Barton Ltd

Wiggs Farm Wood Road Ellistown

Total Lumens
4,250,087

Installation VLR
0.00%

Complies with environmental zones
E2 & E3 & E4

CATALOGUE	ITEM REF	QUANTITY	LUMENS	POWER	LUM/WT	TOTAL LUMENS	TILT	SLICK	TOTAL UPWARD LUMENS
D80.LA003.NR.WOOD.CY.WOODS	B1	6	454	6	76	2,724	-	3.2	87.17
FW.LA003.NR.WOOD.CY.WOODS	C1	148	6,564	57	102	94,872	-	0	0
FW.LA003.NR.WOOD.CY.WOODS	C2	26	2,252	71	302	174,526	-	0	0
C2V.LA003.NR.WOOD.CY.WOODS	C3	10	2,076	15	138	20,760	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L1	25	20,296	251	88	507,450	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L2	18	20,444	185	111	368,002	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L3	6	13,800	101	132	82,800	-	0	0
HCP - Engineering Approval Pending	L3-Cul	3	0	0	0	0	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L4	10	47,528	351	135	475,280	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L5	2	13,800	101	132	27,600	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L6	4	32,650	256	127	130,600	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L7	3	12,558	90	157	37,674	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L8	6	12,558	90	157	75,348	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L9	4	12,558	90	157	50,232	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L10	2	2,704	27	130	5,408	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L11	2	1,885	85	80	37,700	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L12	4	47,528	351	135	190,112	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L13	1	20,915	165	126	20,915	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L14	1	20,444	162	126	20,444	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L15	10	32,099	146	133	320,990	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L16	5	34,221	239	143	171,105	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L17	2	1,398	102	132	2,796	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L18	2	1,398	102	132	2,796	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L19	2	1,449	105	138	2,898	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L20	1	9,302	79	118	9,302	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L21	1	47,528	351	135	47,528	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L22	6	12,558	90	157	75,348	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L23	1	20,915	165	126	20,915	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L24	2	5,645	25	146	11,290	-	0	0
D80.LA003.NR.WOOD.CY.WOODS	L25	3	9,302	68	140	27,906	-	0	0

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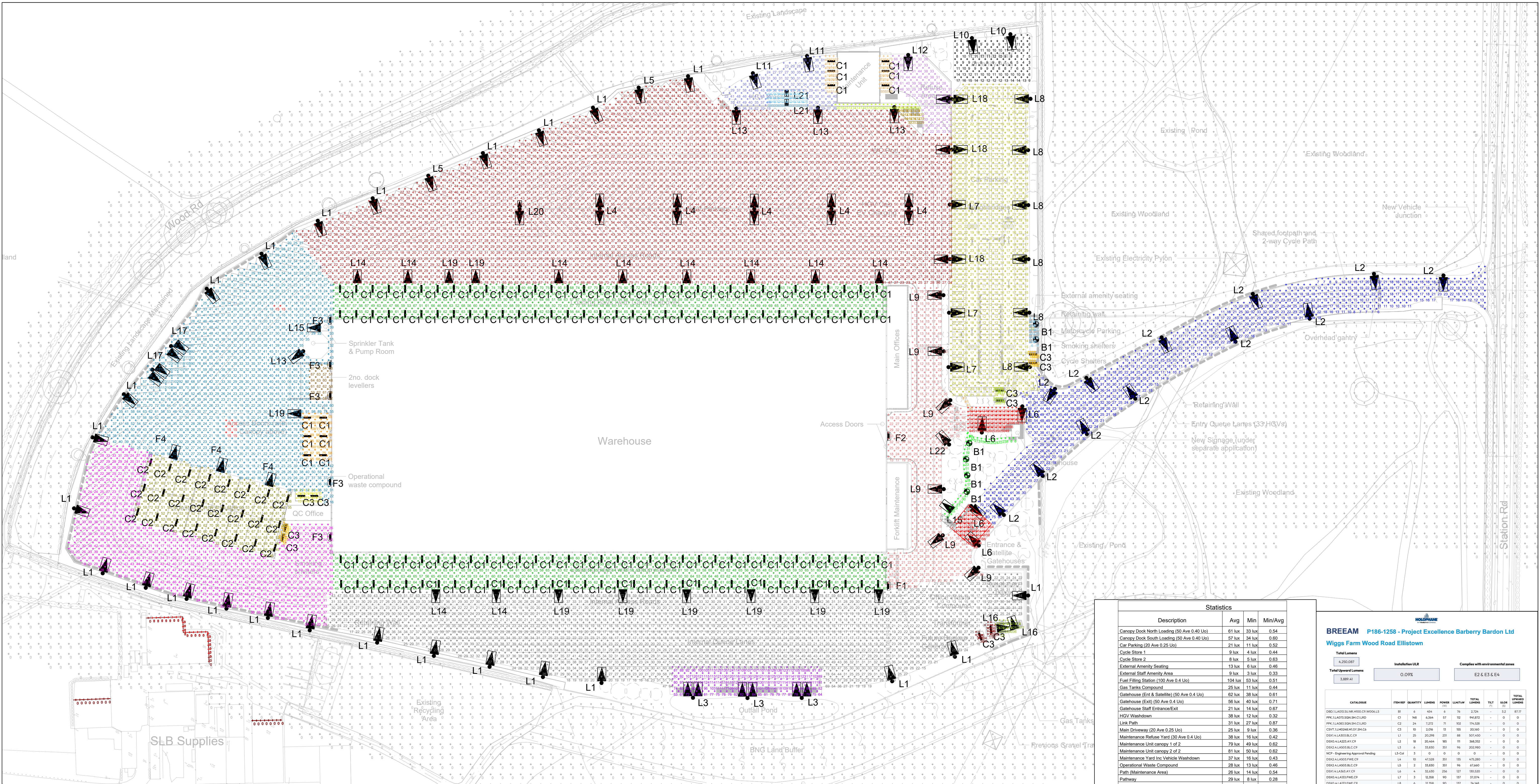
CARBON LOW ENERGY ASSESSORS

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SERVICES ENGINEERS

SCALE	1:1000@A1	DRAWING No.	REV
DATE	13/05/25	E/1189/01	P4
DRAWN	KH		



EXTERNAL LIGHTING LEGEND

	B1	6W Denver iD Bollard 1m high, c/w root kit. 3000K.		L1	231W D-Series 1 on 10m Column, no tilt. 3000K. Extreme Cut Off.		L8	90W D-Series 0 on 6m Column, no tilt. With External Glare Shield. 3000K.
	C1	57W Parkpack Luminaire mounted to the soffit canopies over loading docks, etc. 3000K.		L2	185W D-Series 0 on 8m Column, no tilt. With External Glare Shield. 3000K.		L9	90W D-Series 0 on 8m Column, no tilt. 3000K.
	C2	71W Parkpack Luminaire mounted to the soffit canopies over loading docks, etc. 3000K.		L3	702W D-Series 2 - Twin Bull Horn Array on 10m column, no tilt. Extreme Cut Off.		L10	27W D-Series 0 on 6m Column, no tilt. light cut off optics. 3000K.
	C3	13W CSVPT IP65 LED Batten Luminaire mounted to the underside of smoking shelter ceilings.		L4	702W D-Series 2 Twin Set on 10m Column, no tilt. 3000K.		L11	185W D-Series 0 on 8m Column, no tilt. Extreme Cut Off. 3000K.
	F1	145W D-Series 2 on Wall @ 7m, no tilt. 3000K.		L5	351W D-Series 2 on 10m Column, no tilt. 300K. Extreme Cut Off.		L12	231W D-Series 0 on 8m Column, no tilt. Extreme Cut Off. 3000K.
	F2	145W D-Series 1 on Wall @ 8m, no tilt. 3000K.		L6	256W D-Series 1 on 8m Column, no tilt. 3000K.		L13	351W D-Series 2 on 10m Column, no tilt. 3000K.
	F3	239W D-Series 2 on Wall @ 10m, no tilt. 3000K.		L7	90W D-Series 0 on 6m Column, no tilt. 3000K.		L14	114W D-Series 0 on end of canopy at 7m approx, no tilt. 3000K.
	F4	90W D-Series 0 on 8m Column, no tilt. 3000K.						

	L15	10.3 Denver iD Wall on wall @ 2m, no tilt. 3000K.
	L16	10.3W Denver iD Wall on wall at 4m, no tilt. 3000K.
	L17	702W D-Series 2 Twin Bull Horn Array on 10m Column, minimal 5 degree tilt. With Inner Back Light Shield Optics. 3000K.
	L18	180W D-Series 0 Twin set on 6m Column, no tilt. 3000K.
	L19	145W D-Series 0 on end of canopy @ 7m approx, no tilt. 3000K.
	L20	D-Series 0 (79W) on 10m Column shared with D-Series 2 (351W), back to back, no tilt, 3000K.
	L21	25W Denver iD Wall on screen of Washdown, 4m height, 3000K.
	L22	90W D-Series 0 on 8m Column, no tilt. 3000K.

Note: Feature lighting to be developed with architect to enhance building features.

Statistics			
Description	Avg	Min	Min/Avg
Canopy Dock North Loading (50 Ave 0.40 Uo)	61 lux	33 lux	0.54
Canopy Dock South Loading (50 Ave 0.40 Uo)	57 lux	34 lux	0.60
Car Parking (20 Ave 0.25 Uo)	21 lux	11 lux	0.52
Cycle Store 1	9 lux	4 lux	0.44
Cycle Store 2	8 lux	5 lux	0.63
External Amenity Seating	13 lux	6 lux	0.46
External Staff Amenity Area	9 lux	3 lux	0.33
Fuel Filling Station (100 Ave 0.4 Uo)	104 lux	53 lux	0.51
Gas Tanks Compound	25 lux	11 lux	0.44
Gatehouse (Ent & Satellite) (50 Ave 0.4 Uo)	62 lux	38 lux	0.61
Gatehouse Staff Entrance/Exit	56 lux	40 lux	0.71
HGV Washdown	21 lux	14 lux	0.67
Link Path	38 lux	12 lux	0.32
Main Driveway (20 Ave 0.25 Uo)	31 lux	27 lux	0.87
Maintenance Refuse Yard (30 Ave 0.4 Uo)	25 lux	9 lux	0.36
Maintenance Unit canopy 1 of 2	38 lux	16 lux	0.42
Maintenance Unit canopy 2 of 2	79 lux	49 lux	0.62
Maintenance Yard Inc Vehicle Washdown	81 lux	50 lux	0.62
Operational Waste Compound	37 lux	16 lux	0.43
Path (Maintenance Area)	29 lux	13 lux	0.46
Pathway	26 lux	14 lux	0.54
Rear Entrance Canopy (50 Ave 0.4 Uo)	29 lux	8 lux	0.28
Refuse Area	79 lux	43 lux	0.54
Road Driveway (20 Ave 0.25 Uo)	37 lux	29 lux	0.78
Service Yard Area North (30 Ave 0.4 Uo)	23 lux	8 lux	0.36
Service Yard Areas North West (30 Ave 0.4 Uo)	38 lux	16 lux	0.42
Service Yard Areas South (30 Ave 0.4 Uo)	41 lux	16.5 lux	0.40
Service Yard Areas South West (30 Ave 0.4 Uo)	32 lux	13 lux	0.41
Smoking Shelter 1	32 lux	13 lux	0.41
Smoking Shelter 2	55 lux	44 lux	0.80
Smoking Shelter 3	52 lux	41 lux	0.78
Still Light	52 lux	28 lux	0.54
Store 1	54 lux	38 lux	0.70
Store 2	0 lux	0 lux	N/A
Tyre and Pong Buildings Under Canopy (50 Ave 0.4 Uo)	36 lux	24 lux	0.67
2 No Dock Levellers (50 Ave 0.40 Uo)	26 lux	11 lux	0.42
	55 lux	33 lux	0.60
	58 lux	48 lux	0.83

Item Ref	Quantity	Lumens	Power	Lux/foot	Total Lumens	Tilt	Total Upward Lumens	
DD0-LA030-SR-NR-000-CV-WOODS	81	6	454	6	75	2.754	3.2	87.17
FW-LA070-SR-NR-000-CV-WOODS	C1	148	4.544	57	152	14.872	-	0
FW-LA030-SR-NR-000-CV-WOODS	C2	26	2.722	71	152	174.528	-	0
CYV-LA030-SR-NR-000-CV-WOODS	C3	10	2.076	15	100	20.540	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L1	25	20.295	251	68	507.450	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L2	18	20.444	185	15	568.352	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L3	6	15.800	351	50	202.860	-	0
HCP - Engineering Approval Pending	L3-Cut	3	0	0	0	0	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L4	10	47.528	351	155	475.280	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L5	1	15.800	351	16	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L6	4	32.650	256	127	100.320	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L7	1	15.800	351	157	37.074	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L8	6	15.800	351	157	74.748	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L9	4	15.800	351	157	74.748	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L10	2	2.705	79	100	5.432	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L11	2	1.885	185	80	29.770	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L12	4	47.528	351	155	190.712	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L13	1	20.915	145	145	25.915	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L14	1	20.444	145	145	25.444	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L15	10	9.209	145	153	52.090	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L16	5	34.221	239	143	171.905	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L17	4	47.528	351	155	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L18	2	1.588	10	152	2.716	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L19	1	1.449	10	158	2.838	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L20	1	9.302	79	148	5.302	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L21	1	47.528	351	155	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L22	4	47.528	351	155	190.712	-	0
HCP - Engineering Approval Pending	L23-Cut	2	0	0	0	0	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L23	2	5.445	25	146	3.290	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L24	1	9.506	68	140	28.518	-	0

Item Ref	Quantity	Lumens	Power	Lux/foot	Total Lumens	Tilt	Total Upward Lumens	
DD0-LA030-SR-NR-000-CV-WOODS	81	6	454	6	75	2.754	3.2	87.17
FW-LA070-SR-NR-000-CV-WOODS	C1	148	4.544	57	152	14.872	-	0
FW-LA030-SR-NR-000-CV-WOODS	C2	26	2.722	71	152	174.528	-	0
CYV-LA030-SR-NR-000-CV-WOODS	C3	10	2.076	15	100	20.540	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L1	25	20.295	251	68	507.450	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L2	18	20.444	185	15	568.352	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L3	6	15.800	351	50	202.860	-	0
HCP - Engineering Approval Pending	L3-Cut	3	0	0	0	0	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L4	10	47.528	351	155	475.280	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L5	1	15.800	351	16	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L6	4	32.650	256	127	100.320	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L7	1	15.800	351	157	37.074	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L8	6	15.800	351	157	74.748	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L9	4	15.800	351	157	74.748	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L10	2	2.705	79	100	5.432	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L11	2	1.885	185	80	29.770	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L12	4	47.528	351	155	190.712	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L13	1	20.915	145	145	25.915	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L14	1	20.444	145	145	25.444	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L15	10	9.209	145	153	52.090	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L16	5	34.221	239	143	171.905	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L17	4	47.528	351	155	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L18	2	1.588	10	152	2.716	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L19	1	1.449	10	158	2.838	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L20	1	9.302	79	148	5.302	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L21	1	47.528	351	155	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L22	4	47.528	351	155	190.712	-	0
HCP - Engineering Approval Pending	L23-Cut	2	0	0	0	0	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L23	2	5.445	25	146	3.290	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L24	1	9.506	68	140	28.518	-	0

Item Ref	Quantity	Lumens	Power	Lux/foot	Total Lumens	Tilt	Total Upward Lumens	
DD0-LA030-SR-NR-000-CV-WOODS	81	6	454	6	75	2.754	3.2	87.17
FW-LA070-SR-NR-000-CV-WOODS	C1	148	4.544	57	152	14.872	-	0
FW-LA030-SR-NR-000-CV-WOODS	C2	26	2.722	71	152	174.528	-	0
CYV-LA030-SR-NR-000-CV-WOODS	C3	10	2.076	15	100	20.540	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L1	25	20.295	251	68	507.450	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L2	18	20.444	185	15	568.352	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L3	6	15.800	351	50	202.860	-	0
HCP - Engineering Approval Pending	L3-Cut	3	0	0	0	0	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L4	10	47.528	351	155	475.280	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L5	1	15.800	351	16	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L6	4	32.650	256	127	100.320	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L7	1	15.800	351	157	37.074	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L8	6	15.800	351	157	74.748	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L9	4	15.800	351	157	74.748	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L10	2	2.705	79	100	5.432	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L11	2	1.885	185	80	29.770	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L12	4	47.528	351	155	190.712	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L13	1	20.915	145	145	25.915	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L14	1	20.444	145	145	25.444	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L15	10	9.209	145	153	52.090	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L16	5	34.221	239	143	171.905	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L17	4	47.528	351	155	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L18	2	1.588	10	152	2.716	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L19	1	1.449	10	158	2.838	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L20	1	9.302	79	148	5.302	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L21	1	47.528	351	155	47.528	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L22	4	47.528	351	155	190.712	-	0
HCP - Engineering Approval Pending	L23-Cut	2	0	0	0	0	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L23	2	5.445	25	146	3.290	-	0
DD0-LA030-SR-NR-000-CV-WOODS	L24	1	9.506	68	140	28.518	-	0

Item Ref	Quantity	Lumens	Power	Lux/foot	Total Lumens	Tilt	Total Upward Lumens	
DD0-LA030-SR-NR-000-CV-WOODS	81	6	454	6	75	2.754	3.2	87.17
FW-LA070-SR-NR-000-CV-WOODS	C1							



**Appendix E BREEAM 29018 Certificate
(Confirming Environmental Zone 2 Compliance)**

BREEAM P186-1258 - Project Excellence Barberry Bardon Ltd

Wiggs Farm Wood Road Ellistown

Total Lumens

4,250,087

Installation ULR

0.09%

Complies with environmental zones

E2 & E3 & E4

Total Upward Lumens

3,889.41

CATALOGUE	ITEM REF	QUANTITY	LUMENS	POWER (W)	LLM/TcW	TOTAL LUMENS	TILT (°)	ULOR (%)	TOTAL UPWARD LUMENS
DBD.1.LA013.SU.NR.H100.C9.W006.LS	B1	6	454	6	76	2,724	-	3.2	87.17
PPK.1.LA073.SQN.SM.C1.LRD	C1	148	6,364	57	112	941,872	-	0	0
PPK.1.LA083.SQN.SM.C1.LRD	C2	24	7,272	71	102	174,528	-	0	0
CSVT.1.LM0248.M1.SY.SM.C6	C3	10	2,016	13	155	20,160	-	0	0
DSX1.4.LA303.BLC.C9	L1	25	20,298	231	88	507,450	-	0	0
DSX0.4.LA223.AY.C9	L2	18	20,464	185	111	368,352	-	0	0
DSX2.4.LA503.BLC.C9	L3	6	33,830	351	96	202,980	-	0	0
NCP - Engineering Approval Pending	L3-Col	3	0	0	0	0	-	0	0
DSX2.4.LA503.FWE.C9	L4	10	47,528	351	135	475,280	-	0	0
DSX2.4.LA503.BLC.C9	L5	2	33,830	351	96	67,660	-	0	0
DSX1.4.LA363.AY.C9	L6	4	32,630	256	127	130,520	-	0	0
DSX0.4.LA133.FWE.C9	L7	3	12,358	90	137	37,074	-	0	0
DSX0.4.LA133.FWE.C9	L8	6	12,358	90	137	74,148	-	0	0
DSX0.4.LA133.FWE.C9	L9	6	12,358	90	137	74,148	-	0	0
DSX0.4.LA043.BLC.C9	L10	2	2,706	27	100	5,412	-	0	0
DSX0.4.LA223.BLC.C9	L11	2	14,885	185	80	29,770	-	0	0
DSX1.4.LA303.BLC.C9	L12	1	20,298	231	88	20,298	-	0	0
DSX2.4.LA503.FWE.C9	L13	4	47,528	351	135	190,112	-	0	0
DSX1.4.LA223.FWE.C9	L14	1	20,913	145	144	20,913	-	0	0
DSX1.4.LA223.AY.C9	L15	1	20,464	145	141	20,464	-	0	0
DSX0.4.LA163.FWE.C9	L16	10	15,209	114	133	152,090	-	0	0
DSX2.4.LA363.FWE.C9	L17	5	34,221	239	143	171,105	-	0	0
DWL.1.LA023.AY.C9.W011	L18	2	1,358	10	132	2,716	-	0	0
DWL.1.LA023.FW.C9.W011	L19	2	1,419	10	138	2,838	-	0	0
DSX0.4.LA103.AY.C9	L20	1	9,302	79	118	9,302	-	0	0
DSX2.4.LA503.FWE.C9	L20	1	47,528	351	135	47,528	-	0	0
DSX2.4.LA503.FWE.C9	L21	4	47,528	351	135	190,112	-	2	3,802.24
NCP - Engineering Approval Pending	L21-Col	2	0	0	0	0	-	0	0
DSX0.4.LA133.FWE.C9	L22	6	12,358	90	137	74,148	-	0	0
DSX1.4.LA223.FWE.C9	L23	9	20,913	145	144	188,217	-	0	0
DWL.1.LA043.NR.C9.W025	L24	2	3,645	25	146	7,290	-	0	0
DSX0.4.LA103.FWE.C9	L25	3	9,506	68	140	28,518	-	0	0

DSX0.4.LA133.FWE.C9	L26	1	12,358	90	137	12,358	-	0	0
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Required LLM/TcW: 70
 Permissible ULR %: E0: 0% E1: 0% E2: up to 2.5% E3: up to 5% E4: up to 15%

Environmental zone level is based solely on the ULR.
 The information provided is based on the latest the Institute of Lighting Professionals (ILP) Guidance notes for the reduction of obtrusive light and the latest BREEAM UK New construction V6.1. This assumes that all external lighting (except safety and security lighting) can automatically be switched off between 23:00 and 07:00. If safety or security lighting is required to be on during these hours, then it should comply with the levels recommended in the ILP guidance notes.
 All values shown are the result of calculations derived from product specific photometry of luminaires positioned in a fixed relationship to each other and the statistical zone. In practice the values may vary due to tolerances in column installation, luminaire orientation, and surface reflectance, the substitution of alternative luminaires will not produce comparable results.