

Havant Thicket Reservoir

Lighting Strategy (Phases 5 – Control House)

Main Reservoir Works Phase

Date: 28/11/25 | Rev: FW01

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Document Control

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P01	12/11/25	LS	JH	
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1. Introduction

1.1 Purpose of Document

In 2021, Hybrid Planning Permission (ref APP/20/00990 and 51680/001) was granted by Havant Borough Council (HBC) and East Hampshire District Council (EHDC) for development of a reservoir for raw water storage, subject to further planning conditions. Subsequently, a Section 73 application proposing a number of amendments to the design of the main embankment and related infrastructure was approved by both authorities in December 2024 (ref APP/24/00312 and 51680/012) and planning conditions are henceforth discharged against this planning permission.

This Lighting Strategy has been prepared for submission to Havant Borough Council (HBC) in order to secure the discharge of Condition 20 for Phase 5 of the approved Detailed Phasing Plan (ref. HTR-FUW-RZ-RE-DP-W-507) for the Havant Thicket Reservoir scheme. Phase 5 relates specifically to the Control House, which includes a building which is predominantly buried within the main embankment and an associated courtyard.

The wording of **Condition 20** is as follows:

“No phase of the development approved under Condition 4 shall commence until a Lighting Strategy for that phase or parcel has been approved by the local planning authority. The Strategy must include:

- Proposed specifications for external lighting of service areas, parking, buildings, signs, open space and access junctions.*
- Measures to prevent obtrusive light to residents and distraction of motorists.*
- Measures to minimise light pollution.*
- Appropriate energy efficiency technology*
- Permanent lighting will comprise hooded luminaires directed away from vegetation, particularly the boundary hedgerows and treelines to avoid any light spill onto retained vegetation.*

Lighting will follow good practice current at the time of detailed design. The new lighting will be task-related, associated with the visitor centre and associated car park and with no lighting on the access roads. The lux level will be as low as possible to meet their purpose safely and effectively. The lighting for each phase or parcel shall be carried out in accordance with the approved Lighting Strategy and shall be retained and maintained as such thereafter.”

1.2 Scope of Document

This document provides the required Lighting Strategy sufficient to enable the discharge of the Condition 20 in relation to Phase 5 of the approved Detailed Phasing Plan.

The Lighting Strategy relates to permanent external lighting for the Control House (building and courtyard) only. A strategy for temporary lighting required during the construction phase of the scheme, and for the Temporary Worker’s Accommodation area, has been discharged separately (doc ref. HTR-FUW-ZZ-ZZ-PL-W-0534), therefore this document does not reference lighting during the construction period.

2. Scheme Considerations

The lighting design for the Control House has been developed with careful consideration of visual receptors and the ecological sensitivity of the area surrounding the reservoir, ensuring that artificial illumination does not disrupt local wildlife habitats or natural ecosystems.

Alongside these considerations, the strategy must also uphold health and safety standards in the workplace, providing adequate illumination for safe operations.

2.1 Ecological Sensitivity

Thirteen bat species have been recorded within the Havant Thicket Reservoir (HTR) site, including Bechstein's bat *Myotis bechsteinii* (one of the UK's rarest species), with a maternity roost recorded on the southeastern Site boundary. Artificial lighting can increase the chances of predation, for example by owls. At roosting sites, illumination can cause disturbance and this may result in the bats delaying their emergence resulting in less foraging time, deserting the roost, or even becoming entombed within it. A map showing bat roost areas and buffer zones is included as Appendix A.

A range of other nocturnal protected species have previously been identified on site including glow worms, dormice, badgers, owls and nightjars. The habitats that support these species (woodland, hedgerows, scrub and grassland) are the habitats which support bats and therefore by ensuring optimal mitigation for light impacts on bats and their habitats on site, suitable mitigation is also provided for all other nocturnal species associated with the site.

Specialist guidance has been sought in relation to appropriate lighting specifications for the Scheme, with the following reflected as part of the lighting design:

- All lighting should lack UV elements when manufactured.
- Metal halide, compact fluorescent sources should not be used.
- LED lighting should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability.
- A warm white light source (3000Kelvin or lower) should be adopted to reduce blue light component.
- Light sources should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Column heights should minimise light spill and glare visibility.
- Only lighting with a negligible or zero Upward Light Ratio, and with good optical control, should be used.
- Lighting should always be mounted horizontally, with no light output above 90° and/or no upward tilt.
- Where appropriate, external security lighting should be set on motion sensors and set to as short a possible a timer as the risk assessment will allow.

- Only if all other options have been explored, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed. However, due to the lensing and fine cut-off control of the beam inherent in modern LED luminaires, the effect of cowls and baffles is often far less than anticipated and so should not be relied upon solely.

The location, orientation and height of newly built structures such as the Control House can have a considerable impact on light spill. Therefore the following mitigation measures to further minimise light spill have also been applied during detailed design of the control house building and during lighting design:

- A reduction of the number of windows that directly face key and buffer habitats will be the most effective way to permanently limit light spill.
- On-site lighting controlled by dimming or switching either diurnally, seasonally, or according to human activity (light on demand) will be of clear benefit to bats.
- Lighting should be set to a low output state by default, to turn up to a predetermined output in response to a trigger and be combined with a timeclock or photocell to further add an element of seasonal or diurnal control. For example, passive infrared, AI enabled cameras, on demand controls, or pressure sensors may be used to trigger lights to come on or dim in response to movements, either by vehicles or pedestrians. Inbuilt timeclocks or photocells can ensure that this response only occurs during a set window of hours after sunset and before sunrise, or during certain months.

2.2 Proximity of Visual Receptors

Sensitive visual receptors for light from the reservoir construction works include occupiers of residential properties and people working or enjoying the adjacent countryside.

A review to identify potentially sensitive receptors that could be affected by external artificial lighting has been undertaken, considering all buildings within 250m of the site. These potential receptors are as follows:

VISUAL RECEPTORS	Distance from Control House
Swanmore Road	600m
Harbridge Court	530m
Well Meadow	450m
Winterslow Drive	380m
Durrants Road	1285m

Fig. 1a - Table of distances from Control House



Fig. 1b - Map of visual receptors

2.3 Health & Safety at Work

Under the Health and Safety at Work etc. Act 1974, Portsmouth Water, as an employer and operator of Havant Thicket Reservoir, has a duty to provide and maintain safe systems of work. This includes responsibilities for the following:

- **Adequate Illumination:** Lighting must be suitable and sufficient to ensure the health, safety, and welfare of employees.
- **Risk Management:** Employers are required to assess and manage risks associated with poor lighting. This includes preventing accidents due to inadequate visibility.
- **Visual Comfort and Health:** Lighting should support visual tasks without causing eyestrain, headaches, or fatigue.
- **Task-Specific Lighting:** Areas where detailed or hazardous work is carried out should have task lighting that meets the specific visual demands of the activity.

Derived from the Health and Safety Executive (HSE) document Health and Safety Guidance 38 (HSG38) 'Lighting at Work' (1997), Figure 2 outlines recommended minimum lighting levels based on work activity and location. It provides suggestions for average illuminance across the work area and the minimum measured illuminance at any specific position within it.

Activity	Typical locations/types of work	Average illuminance measured (lux) 1x	Minimum illuminance measured (lux) 1x
Movement of people, machines and vehicles	Courtyard access and parking, vehicle unloading within courtyard	20	5
Movement of people, machines and vehicles in hazardous areas	Operation of loading bay	50	20
Work requiring limited perception of detail	General courtyard maintenance works	100	50
Work requiring perception of detail	Work within chambers beneath courtyard	200	100
Work requiring perception of fine detail	Work within chambers beneath courtyard	500	200

*Fig. 2 - Recommendations for Minimum Lighting Levels
 (adapted from HSE document HSG38 (Lighting at Work)).*

3. Lighting Scheme Overview

3.1 Lighting Design

The design for the external lighting system at the Control House is included as Appendix B (drawing ref. HTR-BRD-RZ-CB-DR-E-8404). This has been developed with consideration of receptors, requirements detailed in Section 2 and in accordance with the following guidance and standards:

- Institution of Lighting Professionals (ILP), 2020, Guidance Note for the Reduction of Obtrusive Light, (ILP, 2020);
- British Standard BS EN 12464-2:2014 Light and lighting. Lighting of workplaces. Outdoor workplaces;
- British Standard BS 5489-1:2020 Code of practice for the design of road lighting. lighting of roads and public amenity areas;
- Health and Safety and Executive (HSE), Health and Safety Guidance 38 (HSG38) 'Lighting at Work' (HSE, 1997);
- Guidance Note GN08/23 Bats and Artificial Lighting at Night (ILP, 2023), published by the Institution of Lighting Professionals (ILP).

The lighting system includes eight lighting units around the courtyard perimeter and three light switches to power on/off the system. Emergency bulkhead lights are also present, but will only illuminate in the event of a power outage to Control House building, where they are then required to provide safe access/egress into the building.

Once powered on, the system will use a Passive Infrared (PIR) sensors to detect motion and automatically turn the external lighting on or off accordingly. Lighting will cease to be operated by motion sensor when the switch is powered off, or when the pre-set 5 minute "on time" has elapsed and no further motion is detected.

3.2. Operation of Lighting

The lighting system at the Control House will be overseen by Portsmouth Water as operator of the reservoir upon completion of construction. The Control House building is not permanently staffed, although access will occur intermittently by authorised personnel for the purpose of inspecting or maintaining plant and machinery.

External lighting will be managed in correlation with three distinct scenarios for operation which are as follows:

- Regular unoccupied operation
- Intermittent occupied operation
- Emergency maintenance

In the event of a power outage, emergency bulkheads are present on the building façade

3.2.1 Regular unoccupied operation

When the Control House building is unoccupied, no external lighting will be in operation within the Control House courtyard. The lighting system will only be activated when personnel are present, with the system enabled/disabled via keypad protected switches located close to access gates and building access doors.

3.2.2 Intermittent occupied operation

For general operational visits by authorised personnel, lighting must provide them safe access into/from the Control House building. Inspection or planned maintenance visits will only take place during the working day (8am to 5pm) and therefore during much of the year lighting will not be required for this.

At times when artificial illumination is necessary, for example, during some Autumn/Winter months, the lighting system can be powered on/off at either the access gate or building access doors. This will then activate the Passive Infrared (PIR) sensors to detect motion and automatically turn the external lighting on or off accordingly, allowing illumination when required, but without causing significant periods of potential disturbance.

The pre-set “on time” for the lighting units (once activated by the PIR sensors) will be set to 5 minutes, but be adjustable between 0-30 minutes.

3.2.3 Emergency maintenance

In a scenario where emergency maintenance is required to equipment beneath the Control House courtyard, access is via covers within the courtyard surface.

As detailed in Figure 2, to enable such emergency maintenance works, lighting would be required to be robust, responsive, and sufficient to support safe and effective intervention. In this eventuality, the lighting system would remain switched on and the PIR sensor-activated for a prolonged period of time. Additional external lighting units to provide suitable task lighting may also be required to illuminate the central areas of the courtyard to a suitable and safe lux level.

4. Lighting Performance Summary

The suitability assessment for the external lighting system at the Control House is included as Appendix C (ref. HTR-BRD-RZ-CB-CA-E-8414). This details the technical specifications of the lighting units in Appendix B and assesses the resulting illuminance and light spill.

Accordance of the lighting system with the scheme considerations outlined in Section 2 is assessed below:

Ecological sensitivity

Following completion of the design for the lighting system, the detail within Appendices B & C was provided to an Ecologist to undertake a review focused on the impact of the lighting installation and operation on bats. Their assessment, included as Appendix D, concluded the disturbance from the lighting would be temporary and limited in extent.

Visual receptors

At the distances identified in Figure 1a and 1b, light intrusion/nuisance and light spill are not considered to be significant, particularly for Swanmore Road and Harbridge Court where street lighting stands between the properties and the site.

Health & Safety at Work

As detailed in Section 3.2.2, inspection or planned maintenance visits will only take place during the working day (8am to 5pm) and therefore during much of the year lighting will not be required for this.

In the limited scenarios where lighting is required, the Control House courtyard's average illuminance is 28 lx. When compared to Figure 2, the following access and planned maintenance activities are therefore able to take place safely with the proposed lighting system in operation:

- Movement of people, machines and vehicles – courtyard access and parking, vehicle unloading within the courtyard
- Movement of people, machines and vehicles in hazardous areas – operation of the loading bay*

**(internal Control House lighting is beyond the scope of this document, but would be in operation when the loading bay is in use)*

For any works requiring additional lighting provision, a suitable risk assessment will be prepared prior to the works commencing to assess the safety of lighting conditions and required lux levels. This risk assessment will include consideration of ecological and visual receptors, with suitable mitigations applied as control measures where appropriate.

Appendices

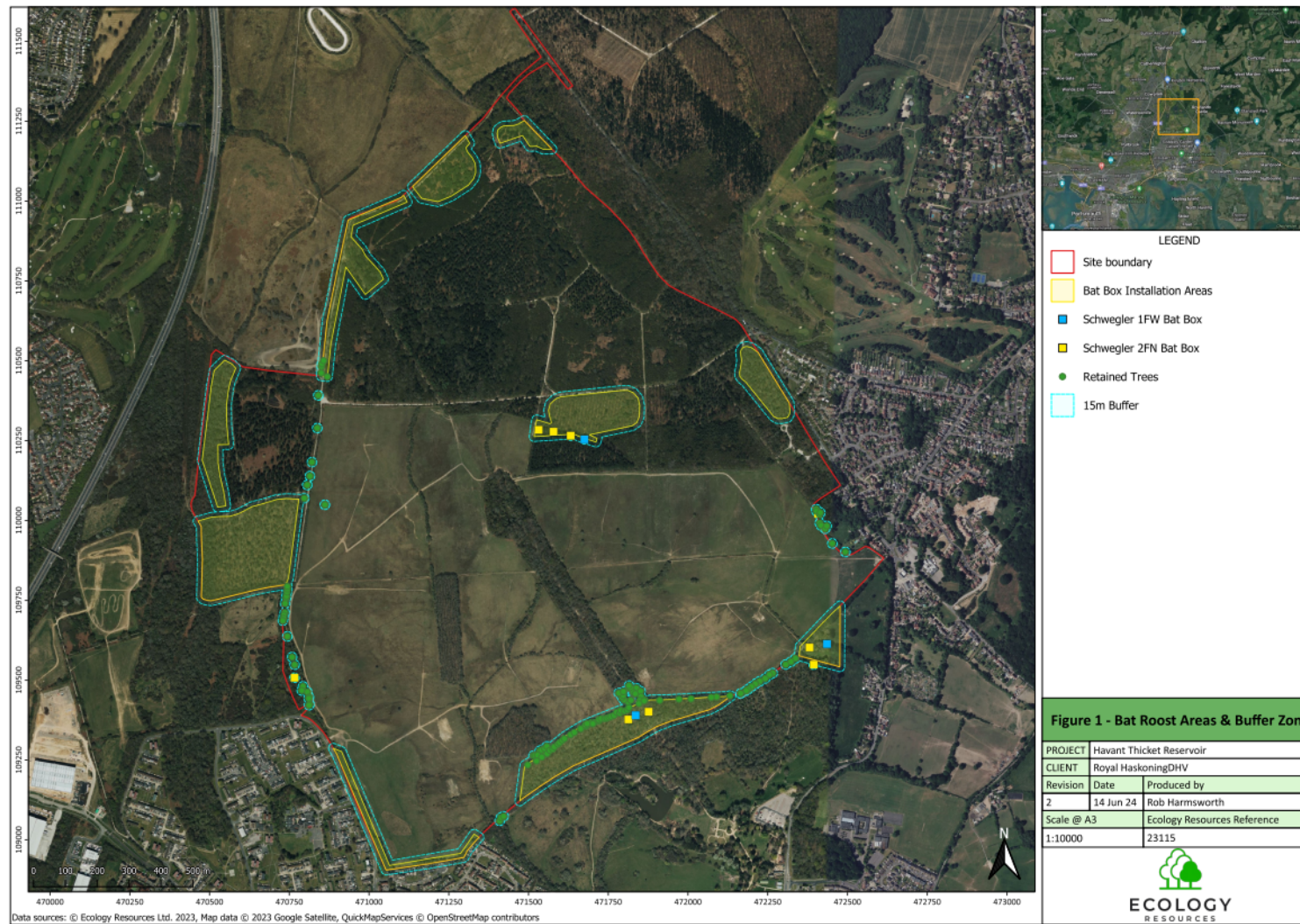
Appendix A – Bat Roost Areas & Buffer Zone

Appendix B – Courtyard Exterior Lighting Design

Appendix C – Courtyard Exterior Lighting Calculations

Appendix D – Ecological Assessment of Lighting Design

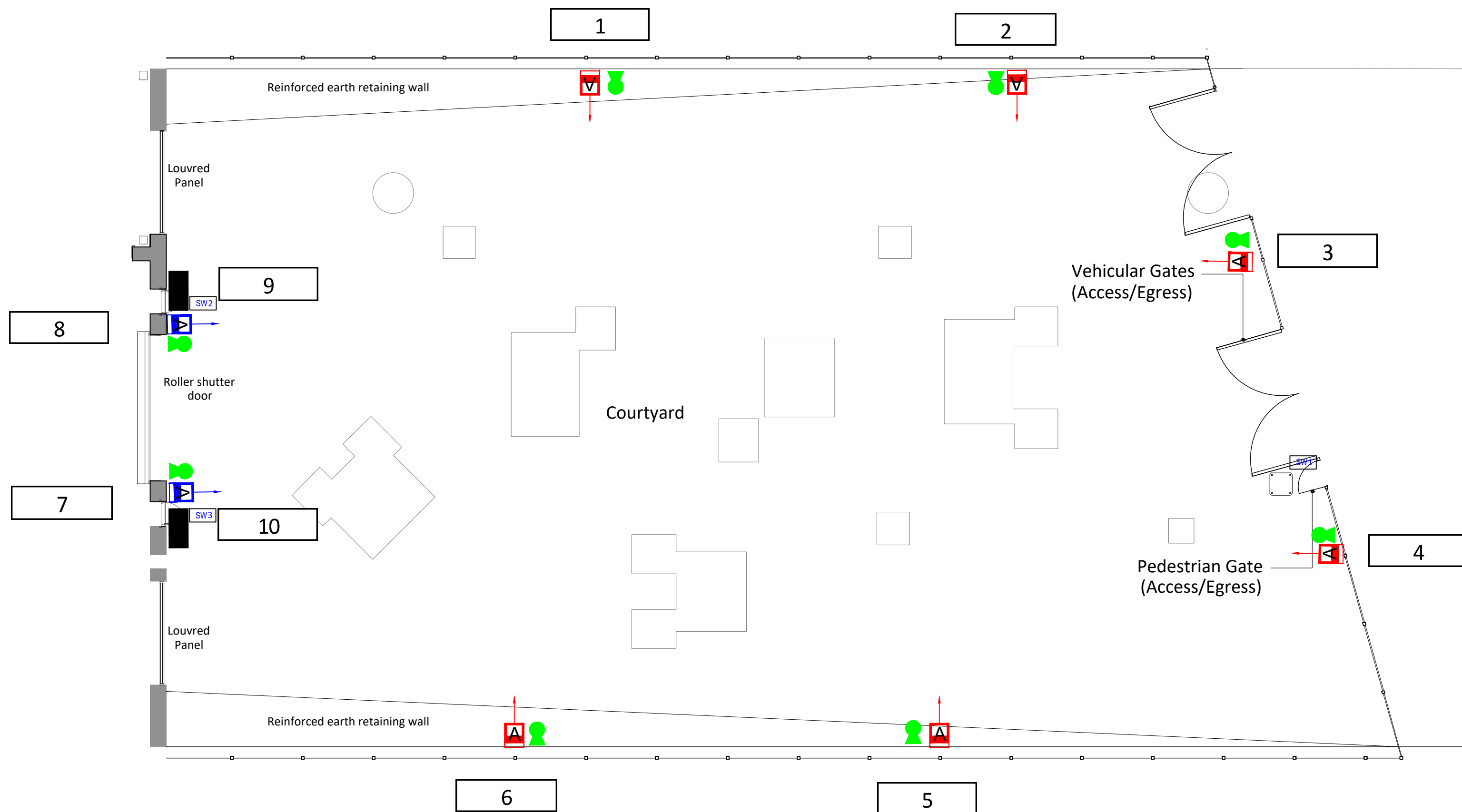
Appendix A – Bat Roost Areas & Buffer Zone



Appendix B – Courtyard Exterior Lighting Design

Drawing reference: HTR-BRD-RZ-CB-DR-E-8404

OUTLET WORKS CONTROL BUILDING COURTYARD



Reservoir External Courtyard Lighting Control

1. The floodlights are normally off.
2. All floodlights operate together via the same switch control.
3. To turn floodlights on –manually operate switch at the main gate or at either entrance door to the inner courtyard.
4. Once activated the floodlights stay on for pre-set “on time” (5 mins but adjustable [0-30min]) before automatically turning off unless motion is detected by the P.I.R sensors. If motion is detected the pre-set “on time” is reset and the floodlights turn off after motion within the courtyard is not detected and the “on time” elapsed.
5. After the floodlights switch off, they will need to be reactivated by manually operating the switch (or pushbutton) at any of the switch locations.
6. The floodlights automatically turn off after a pre-set time unless motion is detected by the P.I.R sensors. Once the floodlight are off the P.I.R. sensors are disabled until the lights are switched back on via the lighting control switch (or pushbutton).
7. A key switch, manual override to the automatic floodlight control shall be provided. The key switch shall be located in the floodlight control panel.

Lighting Schedule									
Light Number	Make	Model	Wattage (W)	Mounting	Options	Angle (°)	Tilt (°)	Height (m)	
1	ROBUS	COSMIC	50W	3.0m Fence Post	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	7.2m	
2	ROBUS	COSMIC	50W	3.0m Fence Post	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	4.5m	
3	ROBUS	COSMIC	50W	3.0m Fence Post	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	3.0m	
4	ROBUS	COSMIC	50W	3.0m Fence Post	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	3.0m	
5	ROBUS	COSMIC	50W	3.0m Fence Post	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	5.8m	
6	ROBUS	COSMIC	50W	3.0m Fence Post	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	7.8m	
7	ROBUS	COSMIC	90W	STRUCTURE	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	3.0m	
8	ROBUS	COSMIC	90W	STRUCTURE	WITH SEPARATE PIR SENSOR-ROBUS MOTION SENSOR	0	5	3.0m	
9	ROBUS	BULKHEAD	3W	STRUCTURE	EMERGENCY	0	0	2.2m	
10	ROBUS	BULKHEAD	3W	STRUCTURE	EMERGENCY	0	0	2.2m	
SW1	EXTERNAL LIGHT SWITCH - MAIN ENTRANCE (MOUNTED ON FENCE POST)								
SW2	EXTERNAL LIGHT SWITCH - BUILDING MOUNTED (MOUNTED ON NEAR DOOR)								
SW3	EXTERNAL LIGHT SWITCH - BUILDING MOUNTED (MOUNTED ON NEAR DOOR)								

Bridges Electrical Engineers Limited
Unit 31A, Second Avenue
Westfield Trading Estate
Midsomer Norton, Bath
BA3 4BH

Tel: 01761 419337
Fax: 01761 413521



NOTES :

1. PLEASE SEE DRAWING HTR-BRD-RZ-CB-DR-E-8403 FOR THE SPECIFICATIONS OF THE EMERGENCY LIGHTS MOUNTED ABOVE EACH ENTRANCE/EXIT DOOR.
2. THE FENCE POSTS WILL NEED TO BE ASSESSED BY OTHERS, IF THEY CAN CARRY THE WEIGHT OF THE LIGHTS WHICH ARE 1.6KGs EACH.
3. THE PIR SENSORS ARE LINKED TO ACTIVATE TIMER SWITCH ON ALL FLOODLIGHTS AND KEEP ON FOR AN ADJUSTABLE PRE-SET TIME AFTER DETECTION NOT ACTIVE.
THE FLOODLIGHTS AUTOMATICALLY TURN OFF AFTER A PRE-SET TIME UNLESS MOTION IS DETECTED BY PIR SENSORS. ONCE THE FLOODLIGHTS ARE OFF THE PIR SENSORS ARE DISABLED UNTIL THE LIGHTS ARE SWITCHED BACK ON VIA THE LIGHTING CONTROL SWITCH (OR PUSHBUTTON)
4. THE ROBUS MOTION SENSOR HAS A RANGE OF APPROXIMATELY 17M, AT AN ANGLE.

FITTING DESCRIPTION	PRODUCT CODE	SYMBOL
COSMIC 50W LED ASYMMETRIC FLOODLIGHT	RCM5040AS-04	
COSMIC 90W LED ASYMMETRIC FLOODLIGHT	RCM9040AS-04	
LIGHT SWITCH		
ROBUS MOTION SENSOR	RPIRMW-HIM31S	
3W MAINTAINED EMERGENCY LED BULKHEAD	R8MLED-01	
JUNCTION BOX WITH ADJUSTABLE TIMER		

P04	ACC REVIEW #577 COMMENTS ADDRESSED	SJC	DR	28.10.2025
P03	ACC REVIEW #479 COMMENTS ADDRESSED	SJC	DR	10.10.2025
P02	ACC REVIEW #257 COMMENTS ADDRESSED	SJC	DR	03.09.2025
P01	FOR REVIEW	SJC	DR	22.05.2025

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Client PORTSMOUTH WATER

Project HAVANT THICKET RESERVOIR

Status **S4 - FOR APPROVAL**

Drawing Title EXTERIOR LIGHTING DESIGN
COURTYARD

Size
A1

Drawing No. Rev
HTR-BRD-RZ-CB-DR-E-8404 P04

Appendix C – Courtyard Exterior Lighting Calculation

Document reference: HTR-BRD-RZ-CB-CA-E-8414

Document number: HTR-BRD-RZ-CB-CA-E-8414

Document title: Exterior Lighting Calculation Courtyard

Site: Reservoir/Control Tower

Project number: 61903

Project: Havant Thicket Reservoir

Client: Portsmouth Water

Status	Revision number	Date of revision	Reason for revision	Written by	Checked by	Approved by
S4	P01	23.06.25	First Issue	RD	SJC	MW
S4	P02	01.09.25	ACC REVIEW #257 COMMENTS ADDRESSED	RD	SJC	MW
S4	P03	10.10.25	ACC REVIEW #479 COMMENTS ADDRESSED	RD	SJC	MW
S4	P04	28.10.25	ACC REVIEW #577 COMMENTS ADDRESSED	RD	SJC	MW

PLEASE NOTE

THE GRIDS SHOWING THE LIGHT SPILL BEHIND THE COURTYARD, DOES NOT TAKE INTO ACCOUNT THE FENCE. THIS CALCULATION SHOWS THE FENCE POSTS ONLY, IF THERE WAS A FENCE IN POSITION, THE LIGHT LEVELS WOULD BE CONSIDERABLY LOWER AS THE FENCE WOULD CAUSE A BLOCKING EFFECT.

Object : EXTERIOR LIGHTING CALCULATION COURTYARD
Installation : Havent Thicket Reservoir
Project number : HTR-BRD-RZ-CB-CA-E-8414
Date : 01.09.2025



1 Luminaire data

1.1 ROBUS, Cosmic Asymmetric (RCM5030AS-04)

1.1.1 Data sheet

Manufacturer: ROBUS

ROBUS®

RCM5030AS-04 desk luminaire Cosmic Asymmetric
COSMIC 50W LED Flood Light IP65 Black 3000K Asymmetric

CCT 3000K

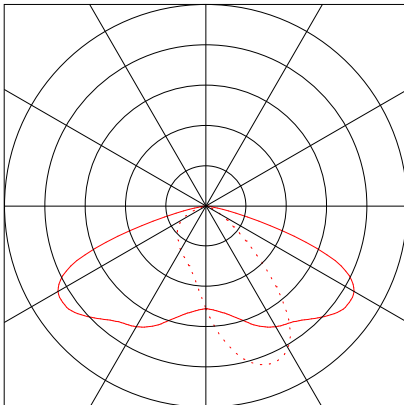
Luminaire data

Absolute Photometry
Luminaire efficacy : 101.63 lm/W
Classification : A40 ↓99.9% ↑0.1%
CIE Flux Codes : 46 82 99 100 100
UGR 4H 8H : 36.0 / 25.8
Control gear : Electronic ballast
Power : 52.05 W
Luminous flux : 5290 lm

Equipped with

Quantity : 1
Designation : LED
Colour : 3000
Socket : -
Colour reproduction : 80

Dimensions : 275 mm x 261 mm x 40 mm



Object : EXTERIOR LIGHTING CALCULATION COURTYARD
Installation : Havent Thicket Reservoir
Project number : HTR-BRD-RZ-CB-CA-E-8414
Date : 01.09.2025



1 Luminaire data

1.2 ROBUS, Cosmic Asymmetric (RCM9030AS-04)

1.2.1 Data sheet

Manufacturer: ROBUS

ROBUS®

RCM9030AS-04 desk luminaire Cosmic Asymmetric
COSMIC 90W LED Flood Light IP65 Black 3000K Asymmetric

CCT 3000K

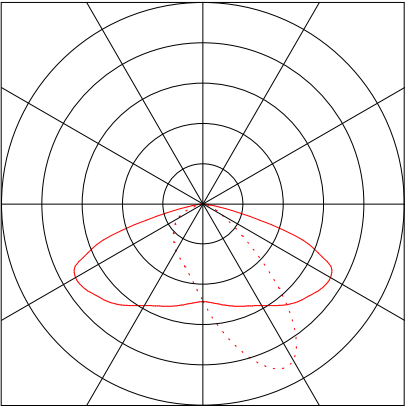
Luminaire data

Absolute Photometry
Luminaire efficacy : 117.66 lm/W
Classification : A40 ↓99.9% ↑0.1%
CIE Flux Codes : 45 81 99 100 100
UGR 4H 8H : 36.4 / 26.8
Control gear : Electronic ballast
Power : 88.56 W
Luminous flux : 10410.3 lm

Equipped with

Quantity : 1
Designation : LED
Colour : 3000
Socket : -
Colour reproduction : 80

Dimensions : 383 mm x 306 mm x 55 mm



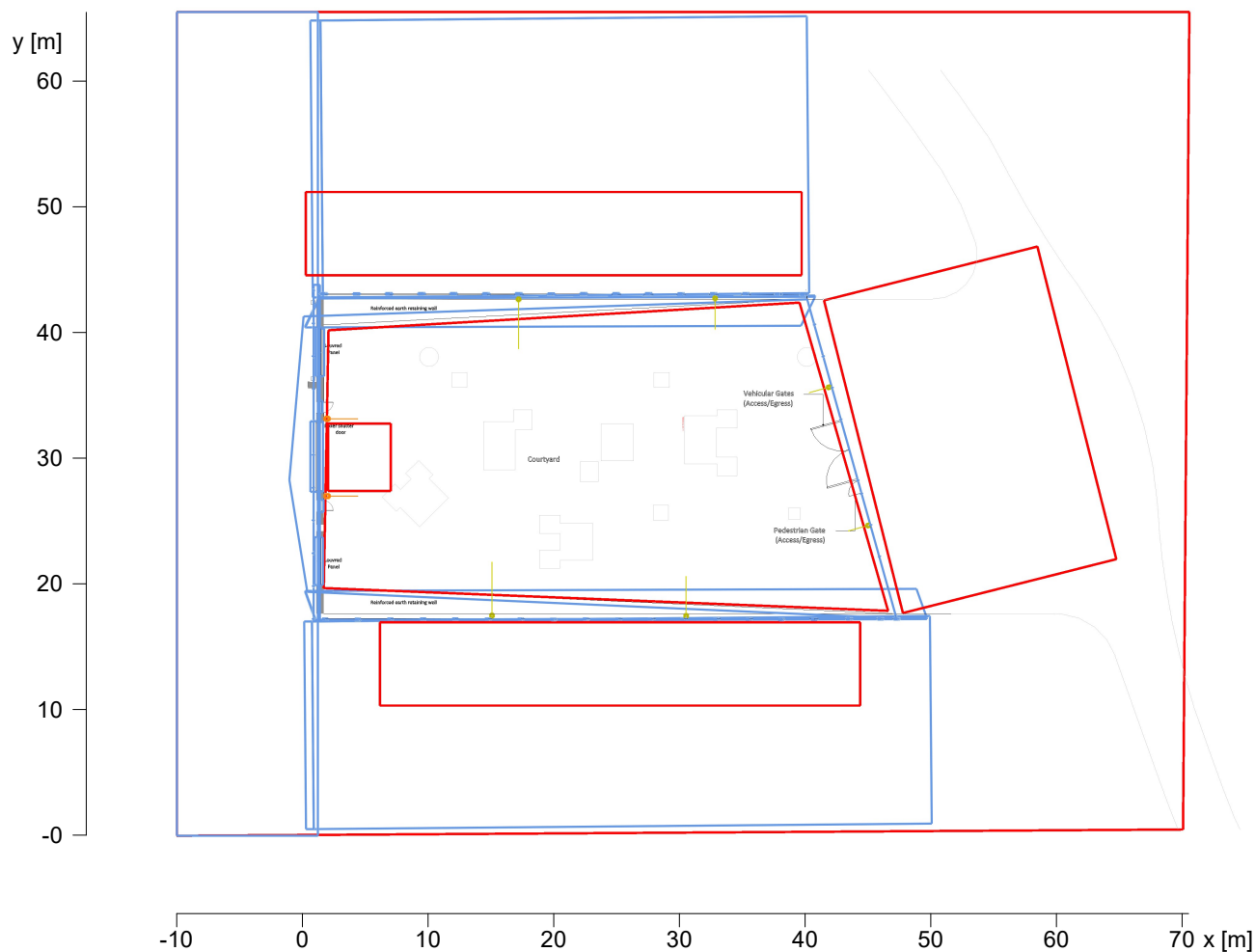
Object : EXTERIOR LIGHTING CALCULATION COURTYARD
Installation : Havent Thicket Reservoir
Project number : HTR-BRD-RZ-CB-CA-E-8414
Date : 01.09.2025



2 Exterior 1

2.1 Description, Exterior 1

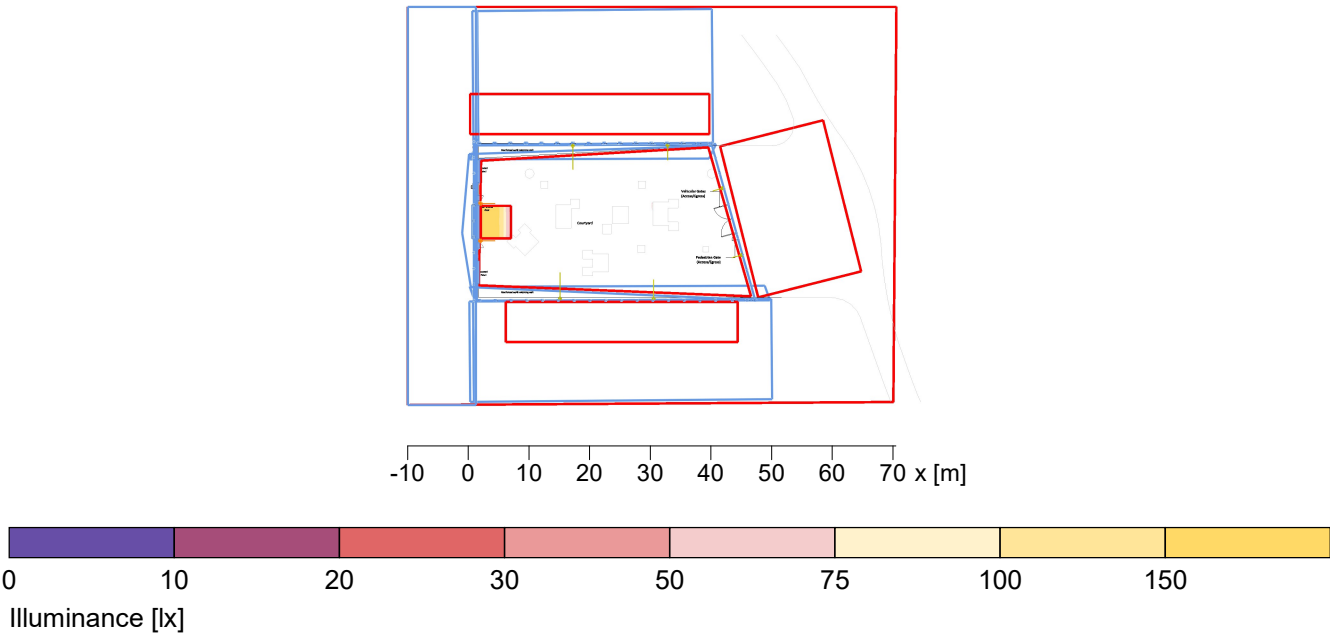
2.1.1 Floor plan



2 Exterior 1

2.2 Summary, Exterior 1

2.2.1 Result overview, Loading Bay



General

Calculation algorithm used	Average indirect fraction
Height of evaluation surface	0.10 m
Maintenance factor	0.80
Total luminous flux	52580 lm
Total power	489.4 W
Total power per area (5236.25 m²)	0.09 W/m²

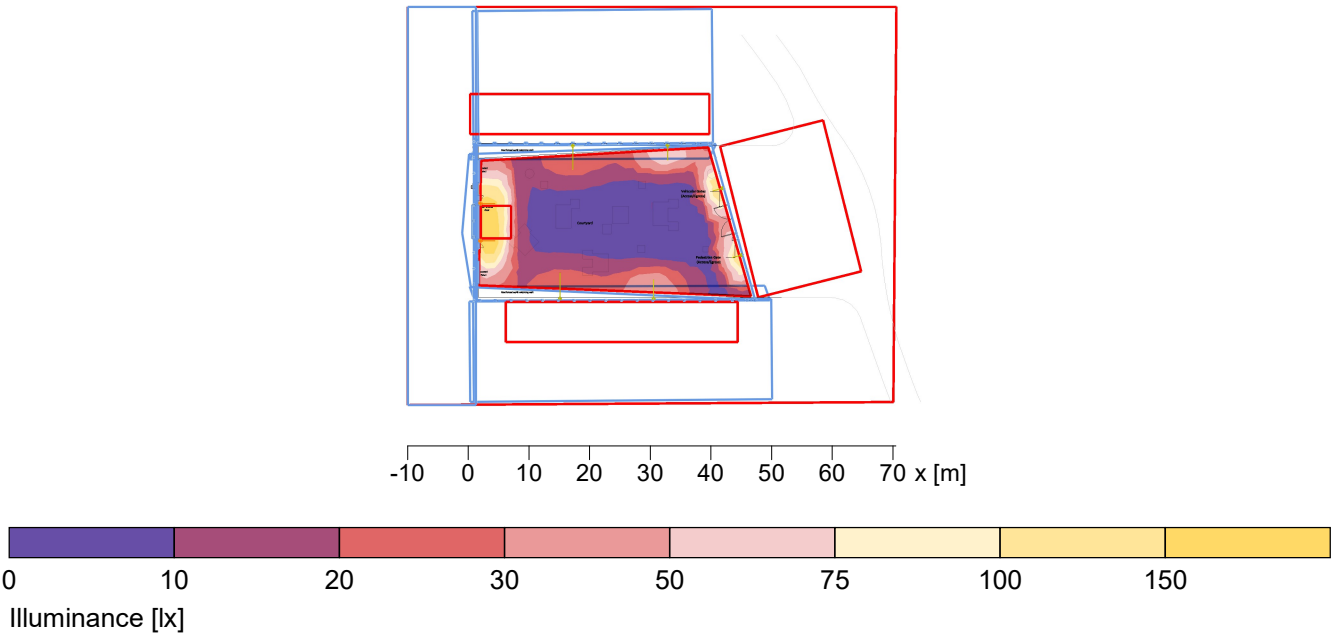
Illuminance

Average illuminance	$\bar{E}_m$	157 lx
Minimum illuminance	E_{min}	49 lx
Maximum illuminance	E_{max}	231 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:3.22 (0.31)
Diversity U_d	E_{min}/E_{max}	1:4.76 (0.21)

Type No.Make

ROBUS	
1 6 x	Order No. : RCM5030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 52.05 W / 5290 lm
2 2 x	Order No. : RCM9030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 88.56 W / 10420 lm

2.2 Summary, Exterior 1
2.2.2 Result overview, Courtyard



General

Calculation algorithm used	Average indirect fraction
Height of evaluation surface	0.10 m
Maintenance factor	0.80
Total luminous flux	52580 lm
Total power	489.4 W
Total power per area (5236.25 m²)	0.09 W/m²

Illuminance

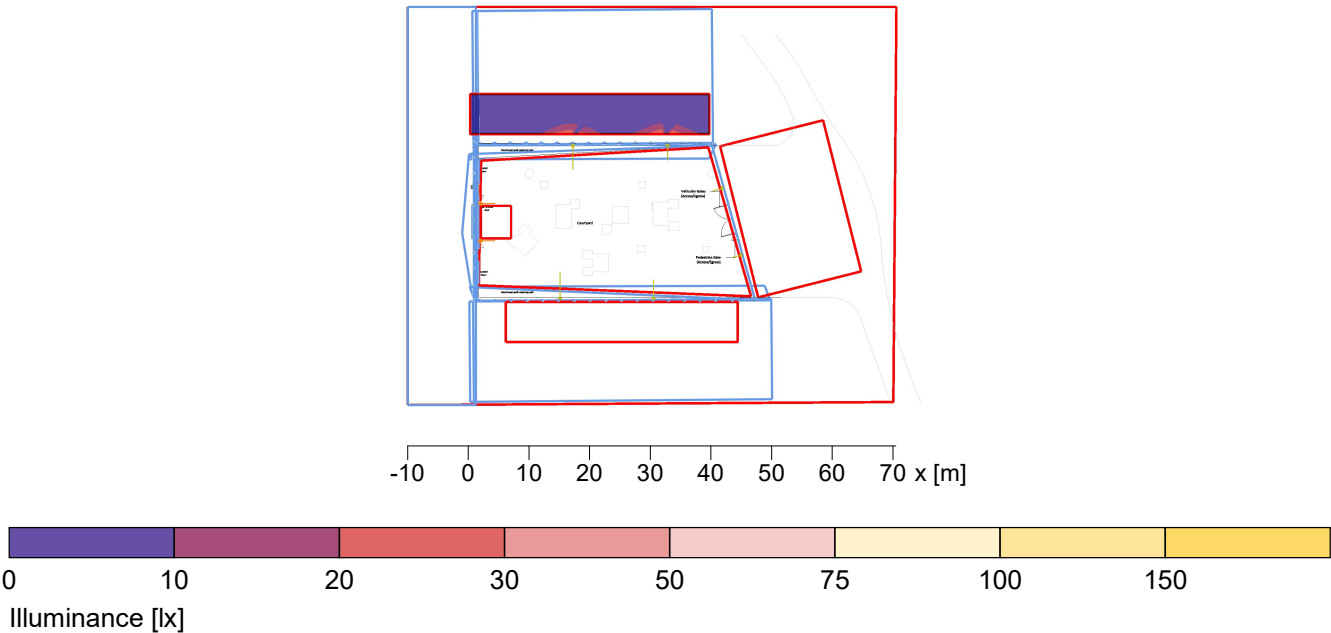
Average illuminance	$\bar{E}_m$	28 lx
Minimum illuminance	E_{min}	1 lx
Maximum illuminance	E_{max}	204 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:21.8 (0.05)
Diversity U_d	E_{min}/E_{max}	1:156 (0.01)

Type No.Make

ROBUS	
1 6 x	Order No. : RCM5030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 52.05 W / 5290 lm
2 2 x	Order No. : RCM9030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 88.56 W / 10420 lm

2.2 Summary, Exterior 1

2.2.3 Result overview, Light Spill RHS



General

Calculation algorithm used	Average indirect fraction
Maintenance factor	0.80
Total luminous flux	52580 lm
Total power	489.4 W
Total power per area (5236.25 m²)	0.09 W/m²

Illuminance

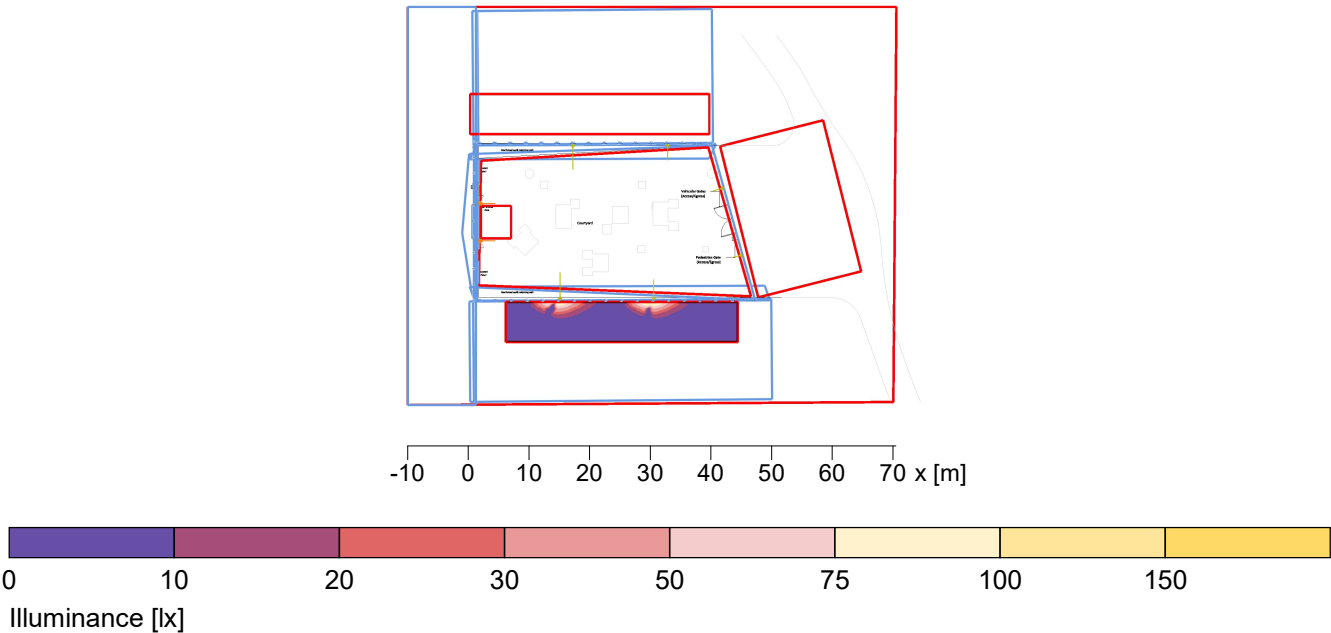
Average illuminance	$\bar{E}_m$	2.7 lx
Minimum illuminance	E_{min}	0 lx
Maximum illuminance	E_{max}	25.1 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:2390 (0)
Diversity U_d	E_{min}/E_{max}	1:22400 (0)

Type No.Make

ROBUS	
1	6 x
	Order No. : RCM5030AS-04/CCT 3000K Luminaire name : Cosmic Asymmetric Equipment : 1 x LED 52.05 W / 5290 lm
2	2 x
	Order No. : RCM9030AS-04/CCT 3000K Luminaire name : Cosmic Asymmetric Equipment : 1 x LED 88.56 W / 10420 lm

2.2 Summary, Exterior 1

2.2.4 Result overview, Light Spill LHS



General

Calculation algorithm used	Average indirect fraction
Maintenance factor	0.80
Total luminous flux	52580 lm
Total power	489.4 W
Total power per area (5236.25 m²)	0.09 W/m²

Illuminance

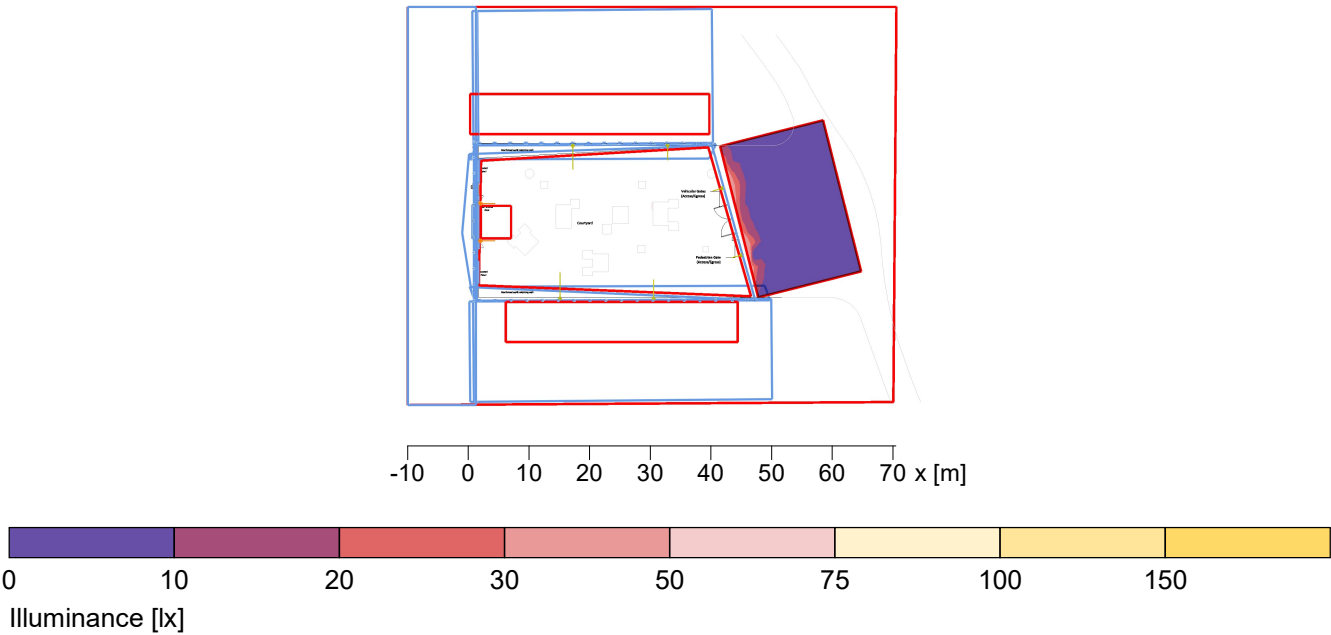
Average illuminance	$\bar{E}_m$	6 lx
Minimum illuminance	E_{min}	0 lx
Maximum illuminance	E_{max}	106 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:5040 (0)
Diversity U_d	E_{min}/E_{max}	1:88700 (0)

Type No.Make

ROBUS	
1 6 x	Order No. : RCM5030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 52.05 W / 5290 lm
2 2 x	Order No. : RCM9030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 88.56 W / 10420 lm

2.2 Summary, Exterior 1

2.2.5 Result overview, Light Spill Gate



General

Calculation algorithm used	Average indirect fraction
Height of evaluation surface	0.00 m
Maintenance factor	0.80
Total luminous flux	52580 lm
Total power	489.4 W
Total power per area (5236.25 m²)	0.09 W/m²

Illuminance

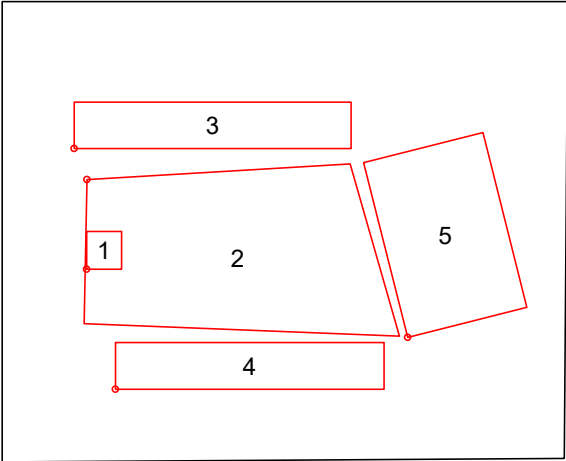
Average illuminance	$\bar{E}_m$	2.7 lx
Minimum illuminance	E_{min}	0 lx
Maximum illuminance	E_{max}	28.2 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:131 (0.01)
Diversity U_d	E_{min}/E_{max}	1:1380 (0)

Type No.Make

ROBUS	
1 6 x	Order No. : RCM5030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 52.05 W / 5290 lm
2 2 x	Order No. : RCM9030AS-04/CCT 3000K
	Luminaire name : Cosmic Asymmetric
	Equipment : 1 x LED 88.56 W / 10420 lm

2.2 Summary, Exterior 1

2.2.6 Result overview, Grids (3)



Illuminance

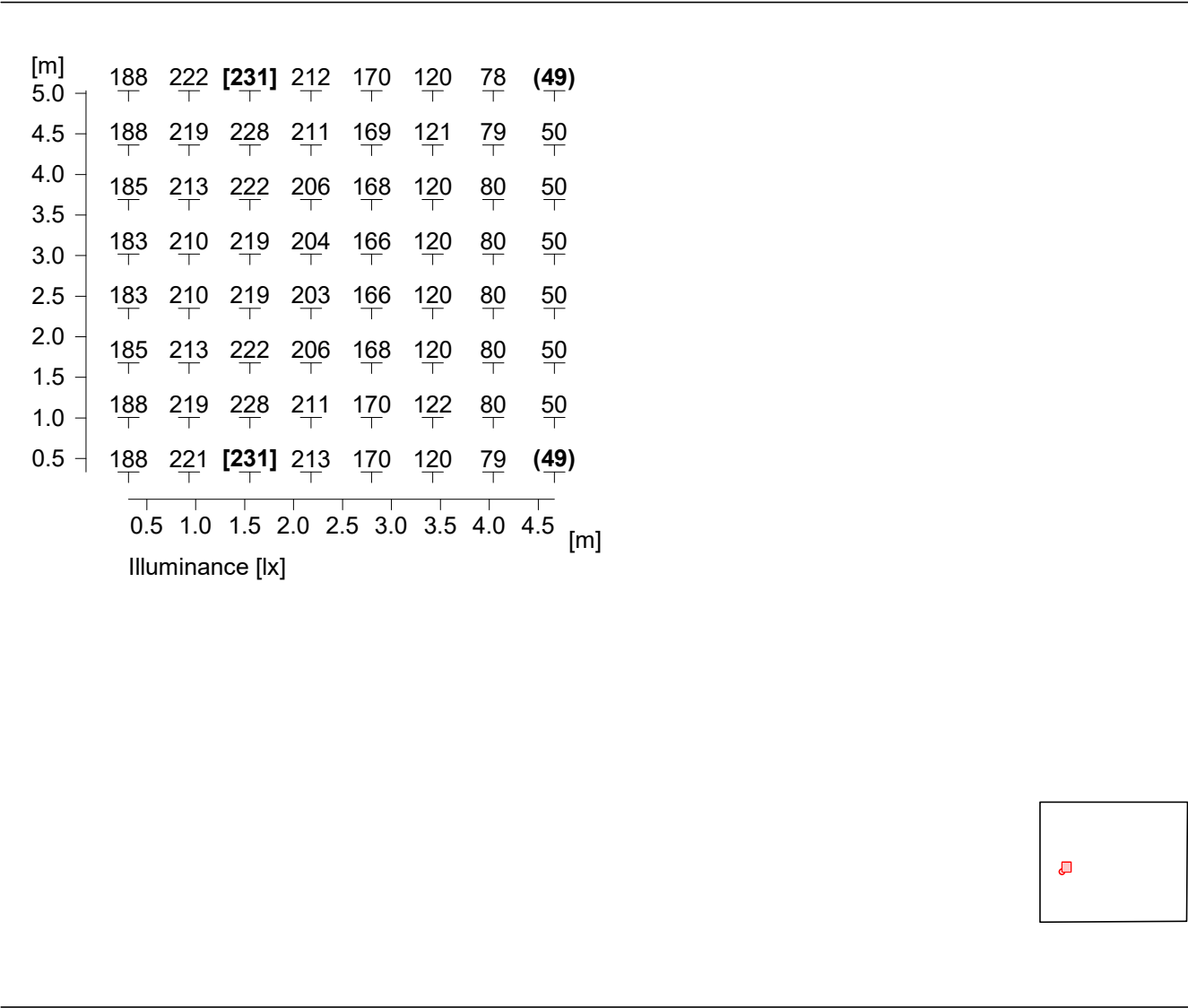
No.	Measuring surface	Grid	$\bar{E}_m$	E_{min}	E_{max}	U_o	U_d
3.1	Loading Bay	8 x 8	157 lx	49 lx	231 lx	0.31	0.21
3.2	Courtyard	16 x 9	28 lx	1 lx	204 lx	0.05	0.01
3.3	Light Spill RHS	53 x 9	3 lx	0 lx	25 lx	0.00	0.00
3.4	Light Spill LHS	51 x 9	6 lx	0 lx	106 lx	0.00	0.00
3.5	Light Spill Gate	9 x 13	3 lx	0 lx	28 lx	0.01	0.00
Summary			18 lx	0 lx	231 lx	0.00	0.00



2 Exterior 1

2.3 Calculation results, Exterior 1

2.3.1 Table, Loading Bay (E)

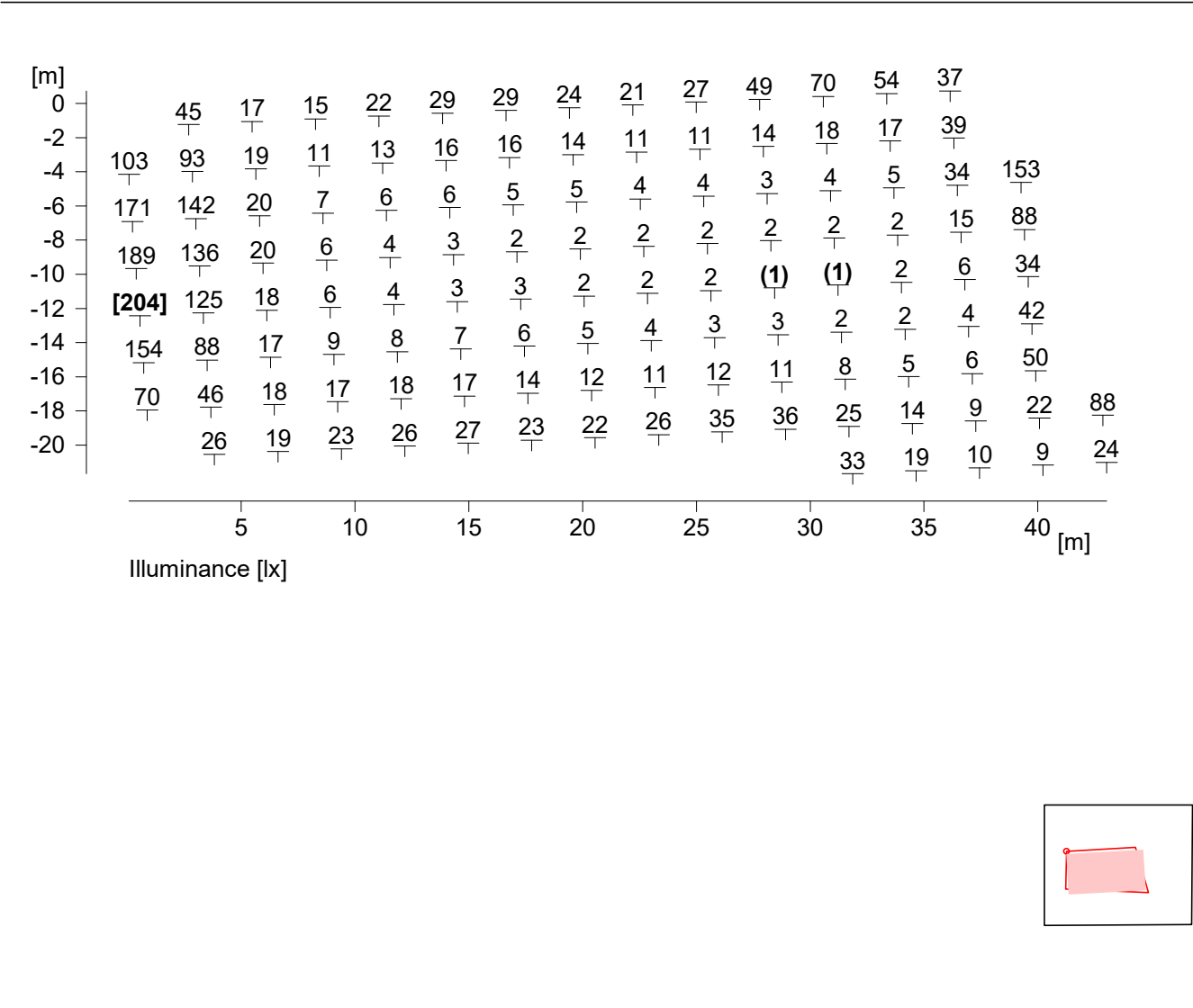


Height reference plane		: 0.10 m
Average illuminance	$\bar{E}_m$	: 157 lx
Minimum illuminance	E_{min}	: 49 lx
Maximum illuminance	E_{max}	: 231 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	: 1 : 3.22 (0.31)



2.3 Calculation results, Exterior 1

2.3.2 Table, Courtyard (E)



Height reference plane		: 0.10 m
Average illuminance	$\bar{E}_m$	: 28 lx
Minimum illuminance	E_{min}	: 1 lx
Maximum illuminance	E_{max}	: 204 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	: 1 : 21.80 (0.05)

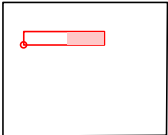




2.3 Calculation results, Exterior 1

2.3.3 Table, Light Spill RHS (E)

(0)	(0)	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.5	0.5	0.5	0.5	0.4	0.4
(0)	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.2	0.2	0.2	0.2	0.8	0.8	0.7	0.6	0.6	0.5
(0)	0.9	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.9	0.2	0.2	0.2	1.2	1.2	1.1	1.1	1	0.8	0.8
1.5	1.4	1.3	1.1	1	0.9	0.9	0.8	0.8	0.9	1	1.2	1.5	1.7	1.8	0.3	0.3	0.3	1.9	1.8	1.7	1.6	1.6	1.5	1.2
2.3	2	1.7	1.5	1.4	1.2	1.1	1.1	1.3	1.5	1.7	2.1	2.4	2.8	2.9	0.4	0.3	0.4	3.4	3.1	2.8	2.5	2.2	2	1.8
3.2	2.8	2.4	2.1	1.9	1.7	1.7	1.7	2	2.3	2.8	3.5	4.3	5.2	5.8	0.4	0.5	5.6	5.1	4.6	4	3.6	3.1	2.5	2.2
4.6	3.9	3.4	2.9	2.6	2.5	2.4	2.8	3.3	4.1	5.2	6.7	7.9	9	9.5	0.5	0.7	8.8	7.8	6.8	5.8	5	4.4	3.7	3.3
6.6	5.5	4.7	4.1	3.7	3.5	3.7	4.4	5.4	6.9	8.8	10.8	13	14.9	15.7	0.6	0.9	13.7	11.5	9.7	8.1	7	5.9	5.2	4.6
9.5	8	6.7	5.7	5	4.9	5.2	6.6	8.6	11.4	14.4	18.1	20.4	23.8	[25.1]	0.7	23.8	20.9	17.9	14.8	12.4	10.4	8.9	7.8	6.8
				25									30											35 [m]

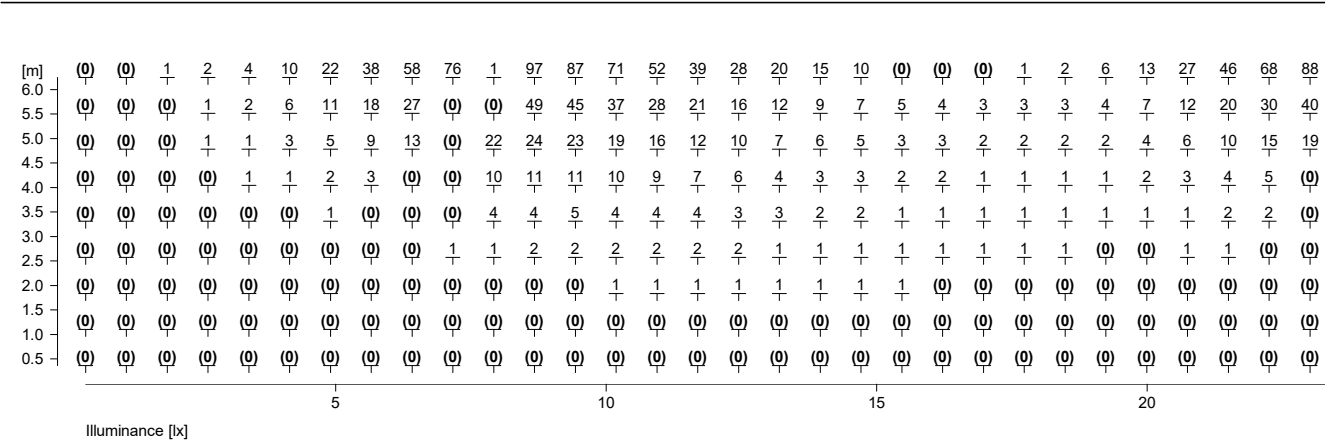
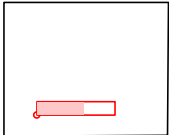


Part2



2.3 Calculation results, Exterior 1

2.3.4 Table, Light Spill LHS (E)



Part1

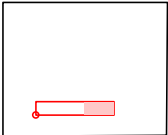
Average illuminance	$\bar{E}_m$	: 6 lx
Minimum illuminance	E_{min}	: 0 lx
Maximum illuminance	E_{max}	: 106 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	: 1 : 5039.79 (0.00)



2.3 Calculation results, Exterior 1

2.3.4 Table, Light Spill LHS (E)

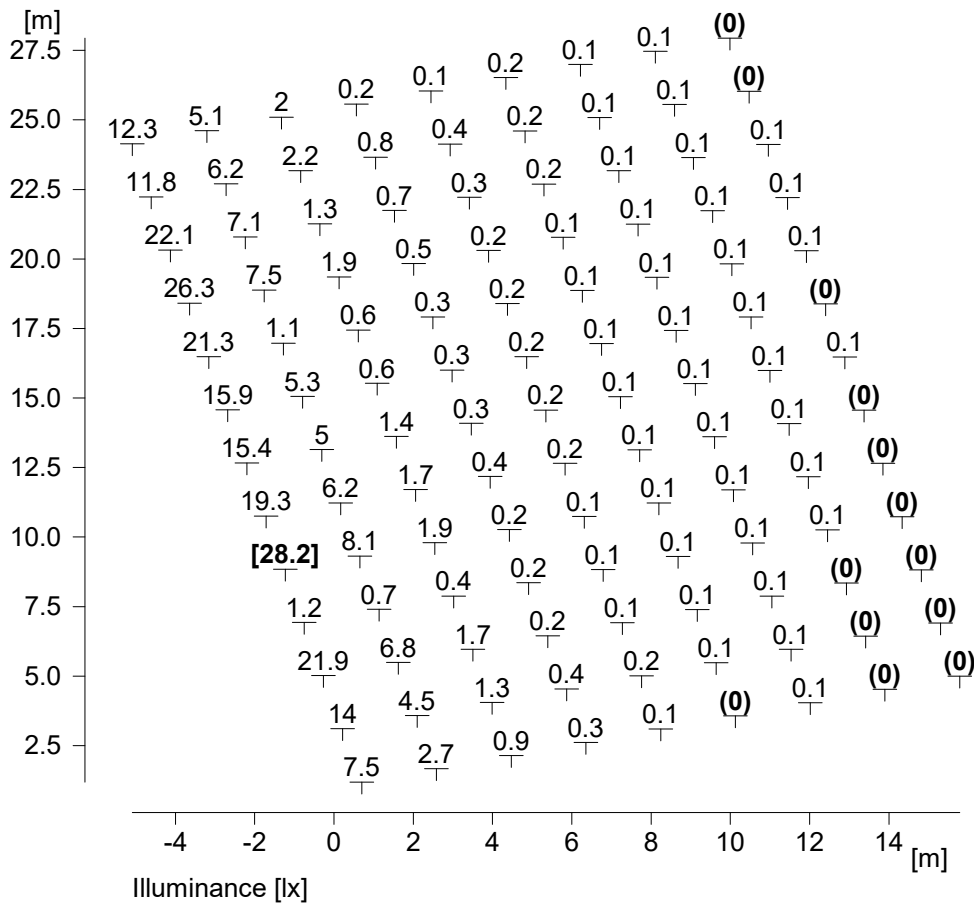
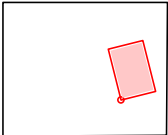
[106]	103	88	67	48	35	25	18	12	9	6	(0)	(0)	(0)	(0)	(0)	1	1	(0)	(0)
1	51	44	34	26	20	15	11	8	6	4	3	2	2	1	1	1	1	(0)	(0)
1	24	22	18	14	11	8	6	5	4	3	2	2	1	1	1	1	1	(0)	(0)
(0)	11	11	9	8	6	5	4	3	2	2	2	1	1	1	1	(0)	(0)	(0)	(0)
(0)	4	4	4	4	3	3	2	2	2	1	1	1	1	1	(0)	(0)	(0)	(0)	(0)
(0)	1	2	2	2	2	1	1	1	1	1	1	1	1	1	(0)	(0)	(0)	(0)	(0)
(0)	(0)	(0)	1	1	1	1	1	1	1	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
25					30					35 [m]									



Part2

2.3 Calculation results, Exterior 1

2.3.5 Table, Light Spill Gate (E)



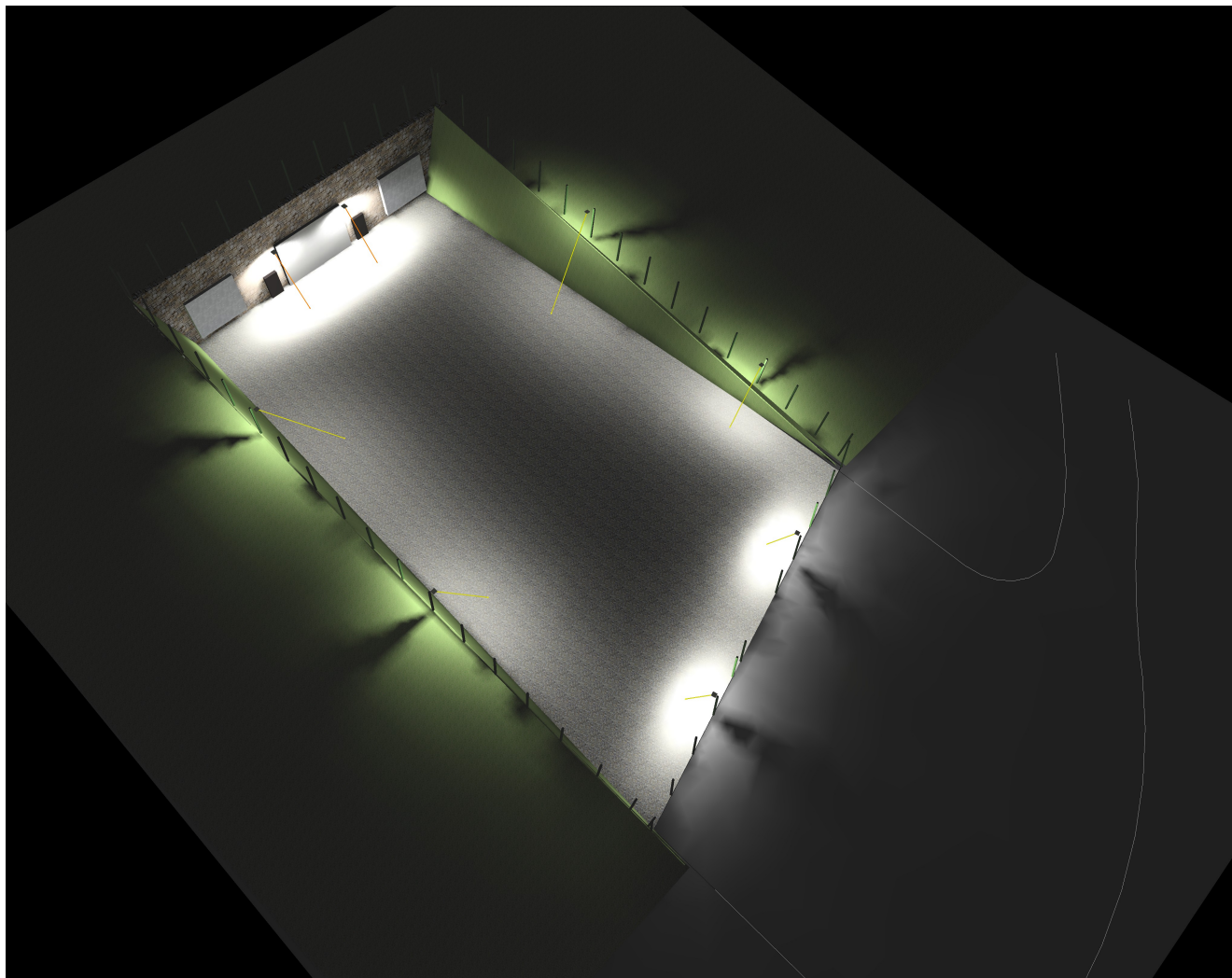
Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 2.7 lx
Minimum illuminance	E_{min} : 0 lx
Maximum illuminance	E_{max} : 28.2 lx
Uniformity U_o	$E_{min}/\bar{E}_m$: 1 : 130.90 (0.01)

Object : EXTERIOR LIGHTING CALCULATION COURTYARD
Installation : Havent Thicket Reservoir
Project number : HTR-BRD-RZ-CB-CA-E-8414
Date : 01.09.2025



2.3 Calculation results, Exterior 1

2.3.6 3D luminance, View 1



Luminance in the scene

Minimum: : 0 cd/m²
Maximum: : 267 cd/m²

Appendix D – Ecological Assessment of Lighting Design

Document reference: HTR-RHD-CB-CB-RP-Z-0001

Technical Note

Haskoning UK Ltd.
Industry & Buildings

To: Future Water MJJV Ltd
From: Andrew Hepworth
Date: 12 November 2025
Copy: JC
Our reference: HTR-RHD-CB-CB-RP-Z-0001
Classification: Project related
Checked by: AH
Revision: P02
Subject: **Havant Thicket Reservoir - Artificial Lighting: Installation, Use, and Impacts on Bats at the Control House**

Artificial Lighting: Installation, Use, and Impacts on Bats at the Control House, Havant Thicket Reservoir

Background

A proposed lighting design at the Control House within the main southern embankment of Havant Thicket Reservoir is being developed in consideration of impacts to bats. The woodlands to the south of the Control House are known to contain bat roosts, including those of Bechstein's bat *Myotis bechsteinii*, a rare UK species.

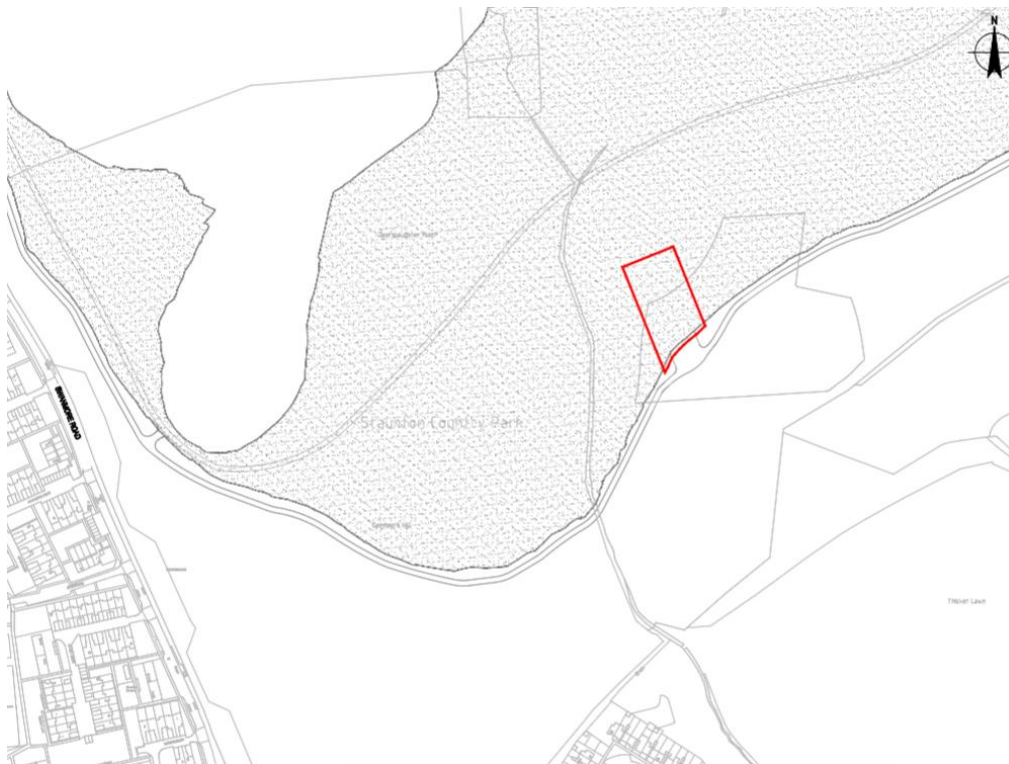


Figure 1: Control House location

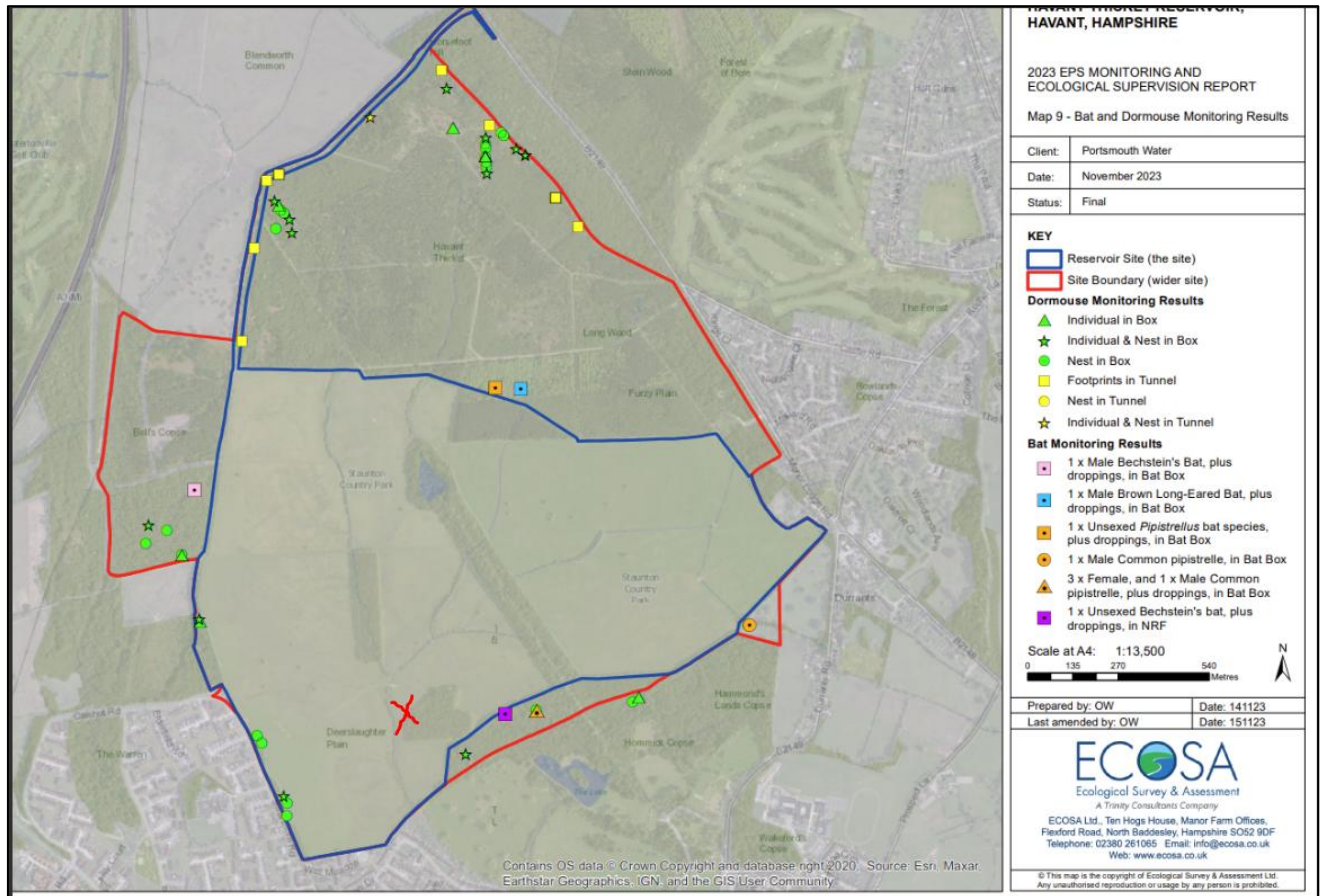


Figure 2: Locations of bats recorded by ECOSA in 2023. The approximate Control House location is marked with a red cross.

Lighting operation

The lighting system at the Control House will be overseen by Portsmouth Water as operator of the reservoir upon completion of construction. The Control House building will not be permanently staffed; access will occur intermittently by authorised personnel to inspect or maintain plant and machinery. External lighting will be managed in correlation with three distinct scenarios for operation which are as follows:

- Regular unoccupied operation
- Intermittent occupied operation
- Emergency maintenance

Regular unoccupied operation

When the Control House building is unoccupied, no external lighting will be in operation within the Control House courtyard. The lighting system will only be activated when personnel are present, with the system enabled/disabled via keypad protected switches located close to access gates and building access doors.

Intermittent occupied operation

For general operational visits by authorised personnel, lighting must provide them safe access into/from the Control House building. Inspection or planned maintenance visits will only take place during the working day (8am to 5pm) and therefore during much of the year lighting will not be required for this.

At times when artificial illumination is necessary, for example, during some Autumn/Winter months, the lighting system can be enabled at either the access gate or building access doors. This will then activate the Passive Infrared (PIR) sensor to detect motion and automatically turn the external lighting on or off accordingly, allowing illumination when required, but without causing significant periods of potential disturbance.

Emergency maintenance

In a scenario where emergency maintenance is required to equipment beneath the Control House courtyard, access is via covers within the courtyard surface.

To enable such emergency maintenance works, lighting would be required to be robust, responsive, and sufficient to support safe and effective intervention. Therefore the lighting system would remain switched on and the PIR sensor-activated for a prolonged period of time. Additional external lighting units to provide suitable task lighting may also be required to illuminate the central areas of the courtyard to a suitable and safe lux level.

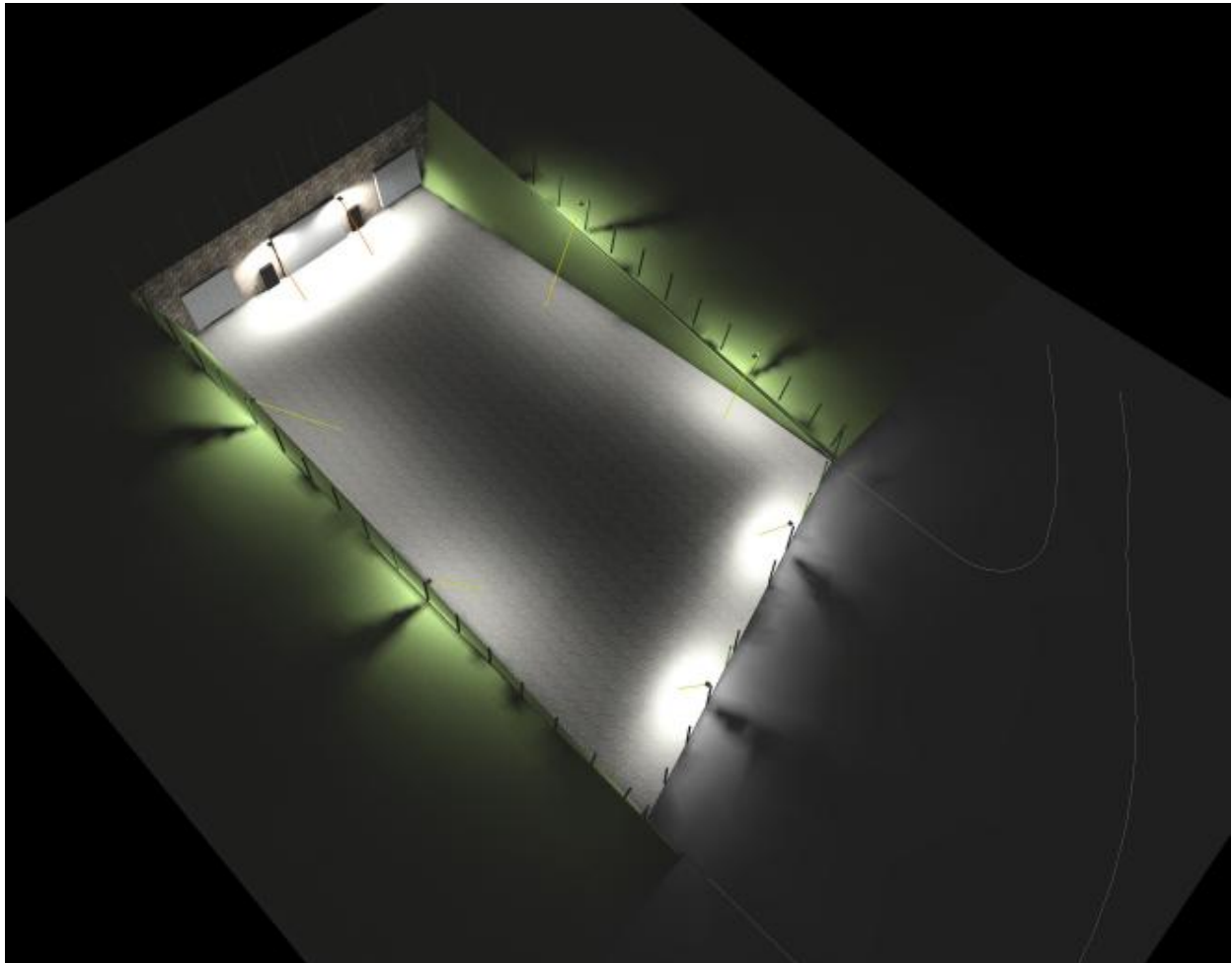


Figure 3: Indicative schematic of lighting at the Control House

Bats are sensitive to artificial lighting, particularly at night, which can affect their foraging habits, for example by altering the movement or abundance of their prey - flying insects. Artificial lighting can also delay or prevent bats from emerging from their roosts, reducing their foraging time.

A solution has been sought to allow artificial lighting at the Control House to be fit for purpose in a safe and effective manner whilst minimising impacts to the local bat populations.

Protection and legislation

All species of bat and their roost sites (whether bats are present at the time or not) are fully protected under international and domestic legislation.

The international protection (the EC Habitats Directive) has been transposed into national laws by means of the Conservation of Habitats and Species Regulations 2017 in England. The Regulations make it illegal to kill, injure, capture, or cause disturbance that affects

populations of bats, obstruct access to bat roosts, or damage or destroy bat roosts. Individual bats are protected from ‘intentional’ or ‘reckless’ disturbance under the Wildlife and Countryside Act 1981 (as amended).

Lighting in the vicinity of a bat roost causing disturbance and potential abandonment of the roost could potentially constitute an offence both to a population and to individuals. It is therefore important that the use of an area by bats is thoroughly assessed before artificial lighting is changed or added in the vicinity of a roost or where bats may commute or forage.

Impacts of artificial lighting

Artificial lighting can disrupt natural bat roosting, foraging and commuting behaviour in various ways:

- Roosting: Light near roosts can delay emergence, reducing feeding time.
- Foraging: Some bats are attracted to insects around lights, while others avoid lit areas, creating competition.
- Commuting: Lighting along flight paths (e.g., hedgerows) can act as barriers.

There are various types of lights used in exterior lighting applications. The most ‘bat friendly’ is Light Emitting Diode (LED) lighting. LED emitted light is more directional, normally controlled by lenses or reflectors, produced in a narrow beam and is available in a number of colour temperatures. Older installations tend to use ‘cool white’ (blueish colour) at >5700° Kelvin. More recently, 4000°K has become more commonly used. ‘Warm white’ (more yellow/orange colour) at around 3000°K can be used with little reduction in lumen output. LED typically features no UV component and research indicates that while lower UV components attract fewer invertebrates, warmer colour temperatures with peak wavelengths greater than 550nm (~3000°K) cause less impacts on bats (Stone, 2012, 2015a, 2015b).

Evaluation of the lighting design/operational strategy

The Control House will be located within reservoir embankment grassland and, crucially, outside of woodland known to be used by Bechstein’s bat, a species which typically relies on mature broadleaved woodland for roosting, foraging and hibernation.

Some use of artificial lighting is unavoidable but such occasions by their nature are expected to be infrequent and proportional to requirements. For example, most planned maintenance at the Control House will occur during daylight (working) hours when no

external lighting is required. Artificial lighting will only be needed during unplanned or emergency procedures.

Lighting will only be required during hours of darkness, and it is not unreasonable to expect this to be more frequent in winter when daylight length is shorter and bat activity is reduced, compared with summer.

As such, disturbance from artificial lighting would be temporary and limited in extent.

Notwithstanding the above, the approved Control House design will include the following elements:

- Lighting will only be in use when required by personnel attending the building with a backup motion sensor in the event that lights stay on for longer than is required.
- Artificial lighting should be sensor-triggered to limit the duration of illumination.
- Motion sensors should be set to the shortest time possible (typically one to two minutes), unless continuous work in the area requires longer lighting.
- The trigger range of motion sensors should also be reduced to minimise activation by wildlife or other non-essential movements.
- To reduce impacts on bats, external compound lighting at the Control House. should be LED, downwardly directional, low UV and have a 'warm white' correlated colour temperature (CCT) that should not exceed 3000°K.

Additional measures such as shielding and avoidance of illumination beyond the Control House compound. i.e. woodland edges which may be important bat foraging and commuting habitats, should be employed in future Reserved Matters applications wherever possible.

References

Bats and Artificial Lighting in the UK (Guidance Note 08/18). Institution of Lighting Professionals and the Bat Conservation Trust, © 2018.

Stone, E.L., Jones, G., Harris, S. (2012). Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. *Glob. Change Biol.* 18, 2458–2465.

Stone, E.L., Harris, S., Jones, G. (2015a). Impacts of artificial lighting on bats: A review of challenges and solutions. *Mammal. Biol.* 80, 213-219.

Stone, E.L., Wakefield, A., Harris, S., Jones, G. (2015b). The impacts of new street light technologies: experimentally testing the effects on bats of changing from low-pressure sodium to white metal halide. *Philos. T. R. Soc. B.* 370, 20140127.