Method Consulting

Intelligent engineering, sustainable buildings

Knoll House

Light Spill Mitigation Report

Kingfisher Resorts Studland Ltd

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Document History

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1 Introduction

1.1 Location

The proposed development involves the redevelopment of the existing Knoll House Hotel, on Ferry Road in Studland, Dorset. The redevelopment is to consist of a main hotel building with associated leisure and dining facilities; a spa building including an internal and external pool, and two blocks of apartment/villa accommodation. The development is in a generally rural area with few immediately adjacent properties. The site is bordered to the north and west by woodland; to the south by open countryside and to the east by Ferry Road and the coast. Ferry Road is a relatively low traffic road with currently no street lighting. The development is located within the Dorset Area of Outstanding Natural Beauty (AONB). As such, the lighting scheme for the site has been designed to minimise the impact on adjacent areas.

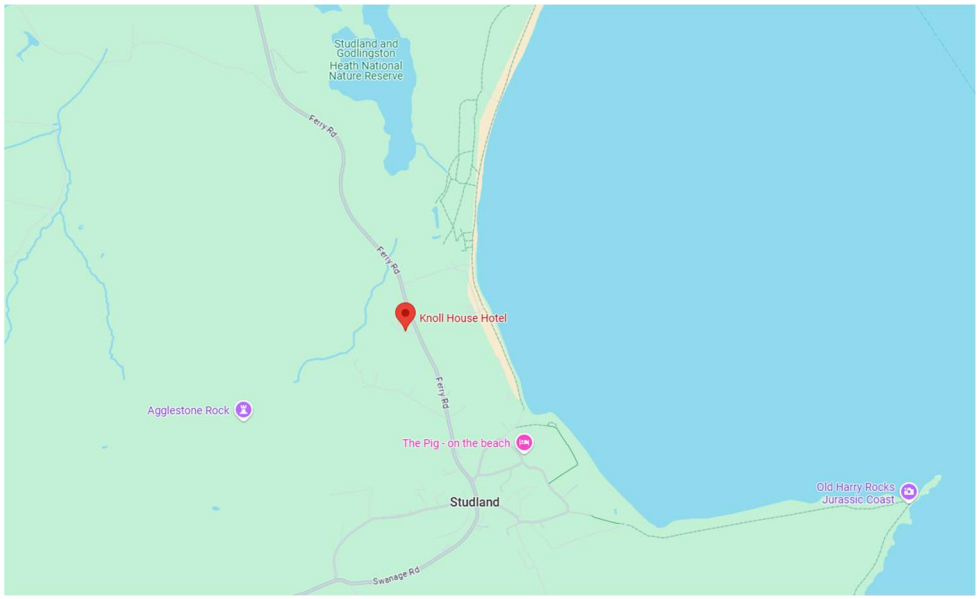

Figure 1 - Extract from Google Maps showing the site location in the surrounding area.

This report reviews the impact of the new lighting introduced to the area as part of the proposed redevelopment of the Knoll House Hotel. It details how the proposed internal and external lighting for the scheme has a limited impact on the surrounding environment and has been designed to reduce the light spill to the surrounding area.

1.2 Environmental Type

As the development is within an AONB, it is deemed as an Environmental Zone E1, described as 'intrinsically dark.' ILP guidance notes for the reduction of obtrusive light and reducing lighting impacts on bats have been carefully followed in the development of the lighting scheme. Luminaires have been selected to reduce light spill to the surrounding areas and have minimal upwards light components as standard.

2 Design Standards and Guidelines

2.1 Local Planning Policy

The proposed development falls within the Purbeck area of Dorset Council. The Purbeck Local Plan Policy E12: Design states that developments must:

- Positively integrate with their surroundings.
- Avoids and mitigates any harmful impacts, including light pollution, on local amenity.
- Supports biodiversity through sensitive landscaping and in-built features.

2.2 Design Standards

The lighting design has been informed by the following relevant guidance:

- BS EN 12464
- CIBSE SLL Code for Lighting
- ILP Guidance Notes for the Reduction of Obtrusive Light
- ILP Guidance Note for Bats and Artificial Lighting at night

The ILP Guidance Notes define environmental zones, as shown in Figure 2 below. As the development is located within the Dorset AONB, it falls within Environmental Zone E1.

Zone	Surrounding	Lighting environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

Figure 2 - Extract from ILP Guidance Notes detailing different types of environmental zone

The ILP Guidance also details measures to be taken when bats are known to be in the area. For areas where bats are present, sensitive lighting should aim for 'complete darkness' or 'very low levels of light.' This is equivalent to 0.2 and 0.5 lux respectively on the horizontal plane. Furthermore, all external luminaires should have a colour temperature of 2700K or below, to reduce the blue light component that bats are particularly sensitive to.

3 Lighting Design

3.1 Overview

The lighting scheme has been modelled using DIALux lighting software. The software allows the user to virtually build a ‘model space’ representing the proposed building, and then import light fittings from a range of manufacturers in the form of ‘.ldt’ files. These contain photometric data specific to each fitting, including the light output, colour temperature and distribution.

Upon setting up the model, the user can simulate the effect that the placed luminaires have on internal and external light levels.

The proposed site layout is made up of buildings surrounding a central landscaped area. As this central area is largely enclosed by the surrounding buildings, it will have no impact on the light spill to the surroundings and so will not be modelled. Typically only outwards facing rooms will be modelled in any detail to assess the impact of internal light spill onto the surrounding area.

Bats are known to be present in the forested areas along the north and west site boundaries, so ILP guidance will be followed to reduce the impact on them as a result of the lighting from the development.

The model geometry was constructed using the latest Revit models from the architects, that were submitted to planning as part of the planning application with reference: P/FUL/2022/06840.

The modelled building geometry can be seen in the below images. It is important to note that the model has been constructed for the purpose of measuring external light levels only, and does not accurately reflect the visual appearance of the development.

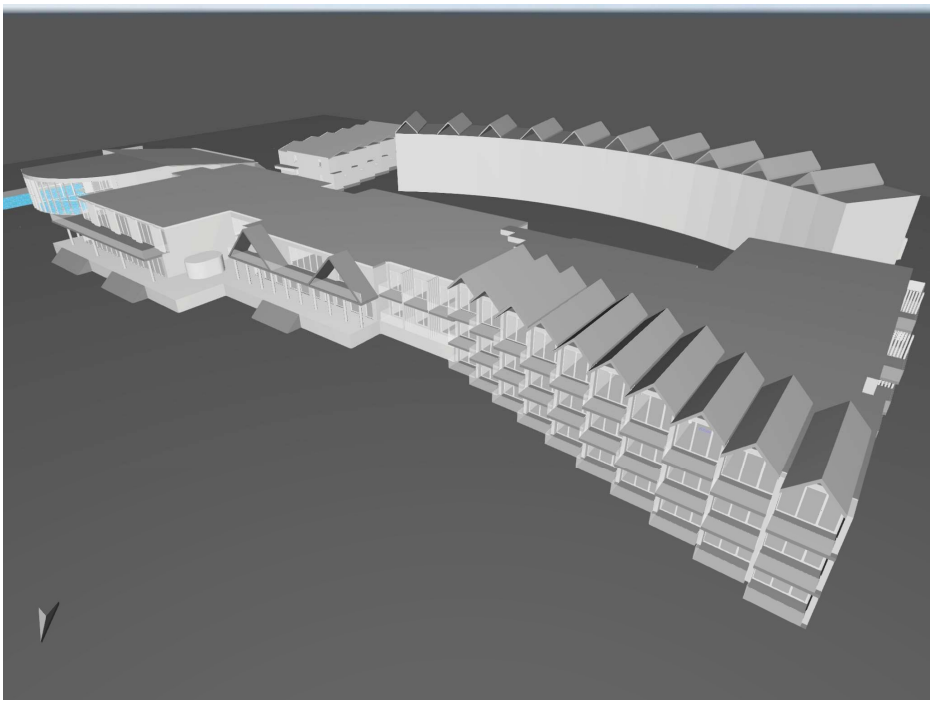

Figure 3 - Model of site geometry in DIALux - view from the north-east

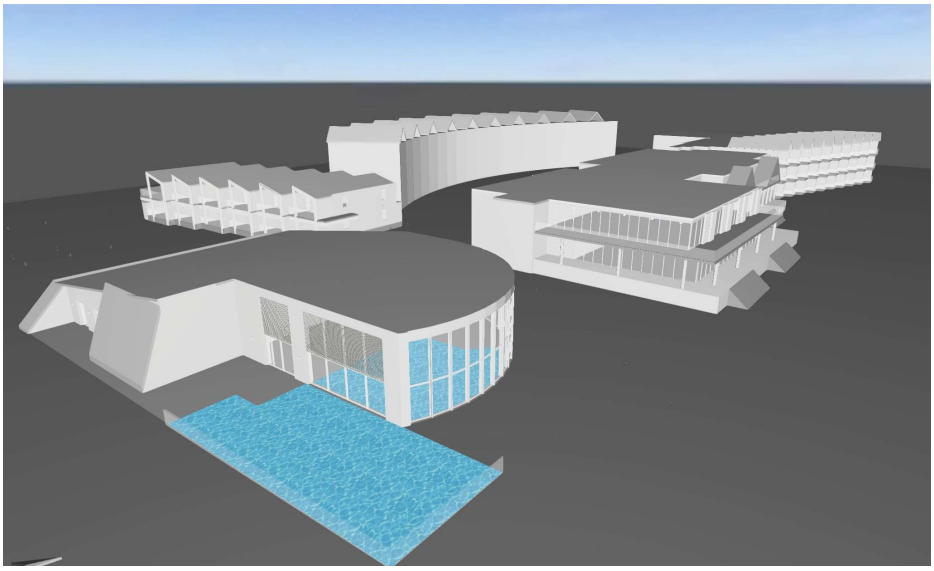

Figure 4 - Model of site geometry in DIALux - view from the south-east

Figure 5 - Model of site geometry in DIALux - view from the north-west

3.2 Selected luminaires

Luminaires have been selected to help provide suitable light levels across the development whilst minimising the overall spill of light to the surrounding areas. The specific luminaires used in the model are indicative of the style/output of the types of fittings, but do not necessarily represent the final installation specification.

3.2.1 Internal Lighting

The internal luminaires used in the model are detailed in Table 1 below:

Luminaire type and location	Manufacturer and luminaire model	Image	Technical data
Wall lights – bedroom headboards	Louis Poulsen Keglen Wall 91805		485lm 3000K 8.5W
Free standing lamps – bedrooms and lounge areas	Zero Bob Pendant Freestanding 19100101		862lm 3000K 10W
Pendant lamps – dining and lounge areas	SLV Magico 133310		1149lm 21W 3000K
Recessed ceiling lights – kitchens, corridors and pool	Glamox D50-R175 1600 840		1602lm 4000K* 12W DALI Dimmable
Pendant lamps – feature lighting	BEGA Pendant 50411K3		5022lm 3000K 52W DALI Dimmable

**3000K available on request*

Table 1 - Internal luminaire types included in the model.

Internal luminaires were selected based on preferences provided by the architects. All lighting will predominantly have a colour temperature of 3000K, which equates to warm white light, to reduce the impact on wildlife. This type of light emits lower quantities of blue wavelength light, therefore minimising potential impacts on ecological receptors. Additionally, all specified light fittings use LED light sources, which emit negligible levels of infrared or ultraviolet light and thus are favourable for ecology.

3.2.2 External Lighting

The external luminaires used in the model are detailed in Table 2 below:

Luminaire type and location	Manufacturer and luminaire model	Image	Technical data	Notes
Bollards – Carpark and pathway wayfinding lighting	Thorn URBA Bollard 4L105		1010lm 2700K 15W	Asymmetric beam distribution
Wall lighting – adjacent to all communal final exit doors	Glamox O21-W		1070lm 2700K 7W	Asymmetric beam distribution

Table 2 - External luminaire types included in the model.

All external light fittings have been selected from a range of 'DarkSky Approved' luminaires, an independent 3rd party certification for luminaires that minimise light spill and light pollution. This includes reducing the upwards light component to less than 1% of the total light output, and avoiding glare. They additionally all have a colour temperature of 2700K to comply with the ILP Guidance surrounding bats and sensitive lighting.

The height of a luminaire can significantly affect light levels and distribution, with taller/higher luminaires typically producing much higher levels of undesirable light

spill. As such, all external lighting has been designed using low-level bollards (<1000mm) or wall mounted fittings on the ground floor with an asymmetric output. Additionally, no column mounted fittings have been used in this scheme.

3.3 Typical room layouts

Internal lighting was modelled in all rooms facing onto the site boundaries. Lighting layouts were modelled as accurately as possible to best reflect the light spill from these spaces onto the external areas. Generally, lighting was arranged in a way to reduce direct light components shining through windows to the outside.

3.3.1 Bedrooms

Lighting to bedrooms was modelled based on the layout shown in Figure 6. The exact quantity of entrance downlights depended on the size/layout of each specific room. Desk lamps were omitted due to their low brightness and limited hours of operation. Recessed lights to the bathrooms were omitted due to the lack of windows in these spaces.

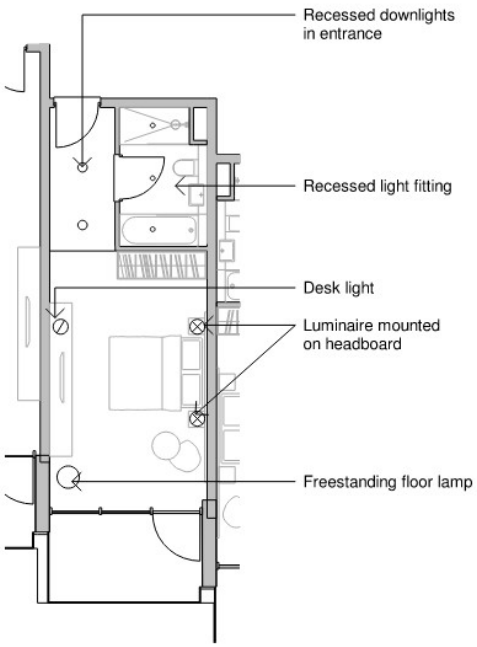

Figure 6 - Typical bedroom lighting layout, provided by the architects.

The bedrooms on the northern side of the hotel are in close proximity to the site boundary, so have the highest impact on the light spill to the ecological areas beyond. As a result, all bedrooms along this elevation had the freestanding lamp omitted to further reduce light spill.

3.3.2 *Apartments/Villas*

Lighting to apartments was modelled based on the layout shown in Figure 7. The exact quantity of entrance and kitchen downlights varied depending on the size/layout of each specific room. Recessed lights to the bathrooms and entrance corridors were omitted due to the lack of windows in these spaces. Beds were located away from windows to reduce the external light spill from the wall mounted headboard lighting.

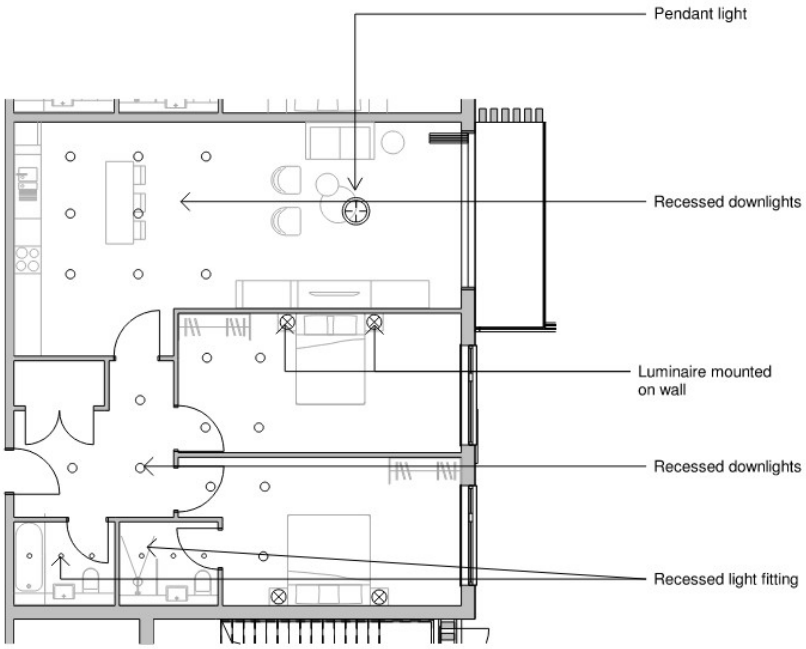

Figure 7 - Typical apartment/villa lighting layout, provided by the architects.

3.3.3 *Communal Spaces*

For the large communal spaces, luminaires of the preferred type were modelled in a regular grid arrangement to meet the desired lux levels within each space.

- The hotel reception was modelled with recessed downlights, with additional free-standing lamps to lounge areas. Feature lighting was added above the reception desk.
- The hotel bar/lounge was modelled with pendant lighting.
- The hotel stairwell was modelled with recessed downlights, with additional feature lighting above the meet and greet area and within the stairway.
- The pool room in the spa building was modelled with recessed downlights.
- The café in the spa building was modelled with pendant lighting.

3.3.4 Glazing

Given the sensitive nature of the site, all glazing in residential areas is proposed to include a 'light reducing film' that reduces the visible light transmission (VLT) of the window and thus reduces any light spill to the surroundings. All glazing in bedrooms, villas and apartments in the model was modelled with a maximum of 70% VLT, with any glazing facing onto the ecologically sensitive north and west site boundaries reduced further to 54% VLT.

3.4 External lighting levels

A simulation was run for a 'worst case' lighting scenario, representing the following conditions:

- All internal and external lighting in the measured areas is switched on at full brightness.
- All window blinds are open.
- None of the proposed trees have been included, owing to variability in foliage cover etc.

The results of this modelling are shown in the following false colour lux plots produced in DIALux. Lux plots show the extent of the light spill to the surrounding environment, with each colour representing a certain threshold illumination measured at ground level. It is worth noting that areas shown without colour have been excluded from the calculation to aid in simulation time.

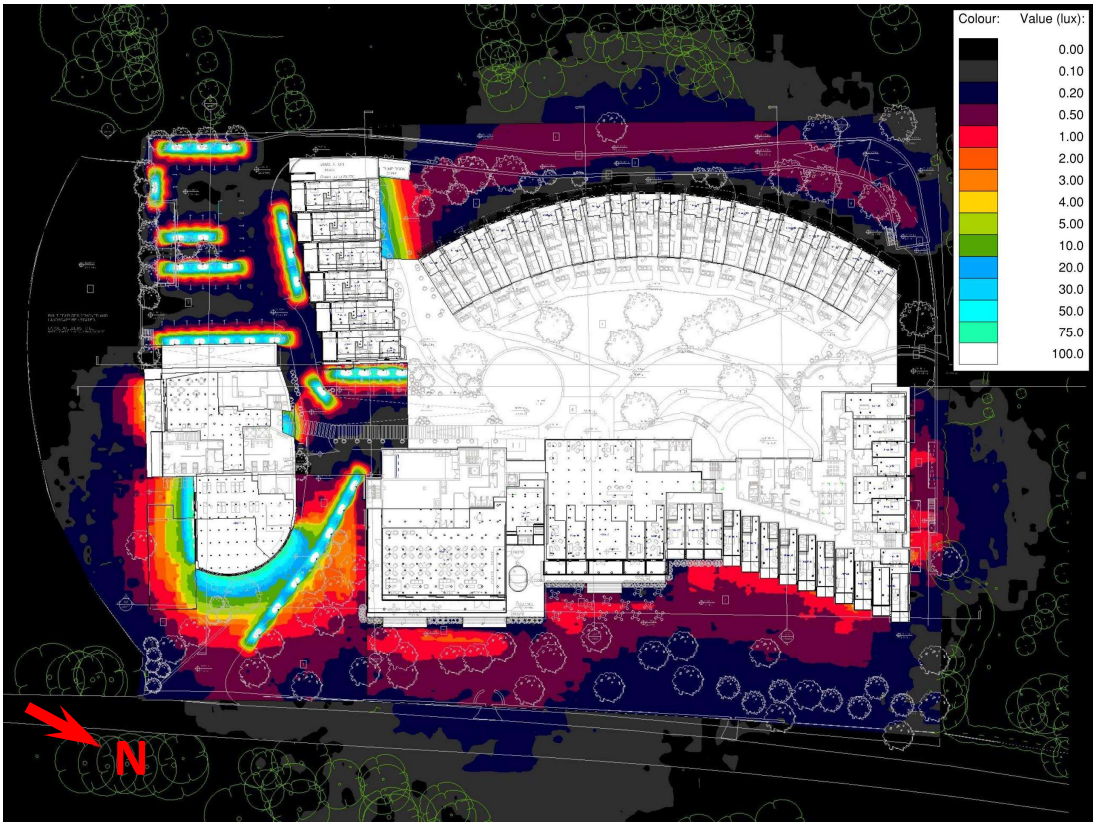

Figure 8 - False colour lux plot, site plan view.

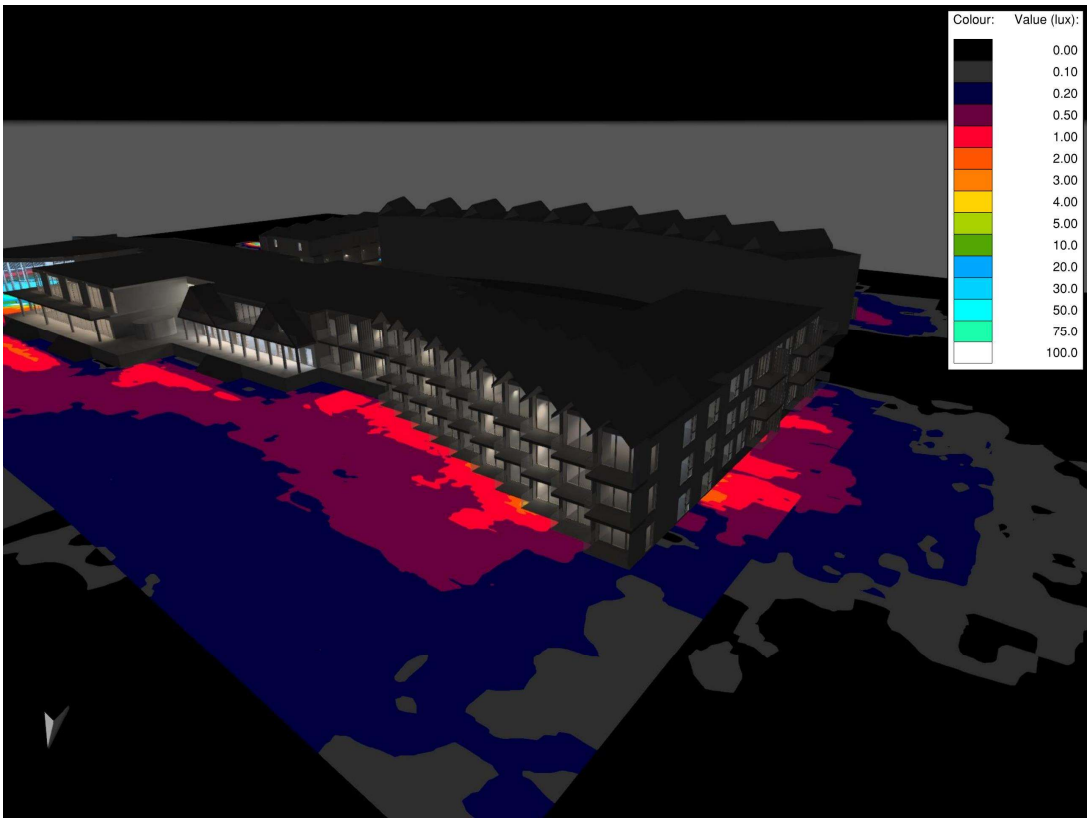

Figure 9 - False colour lux plot, view from the north-east.

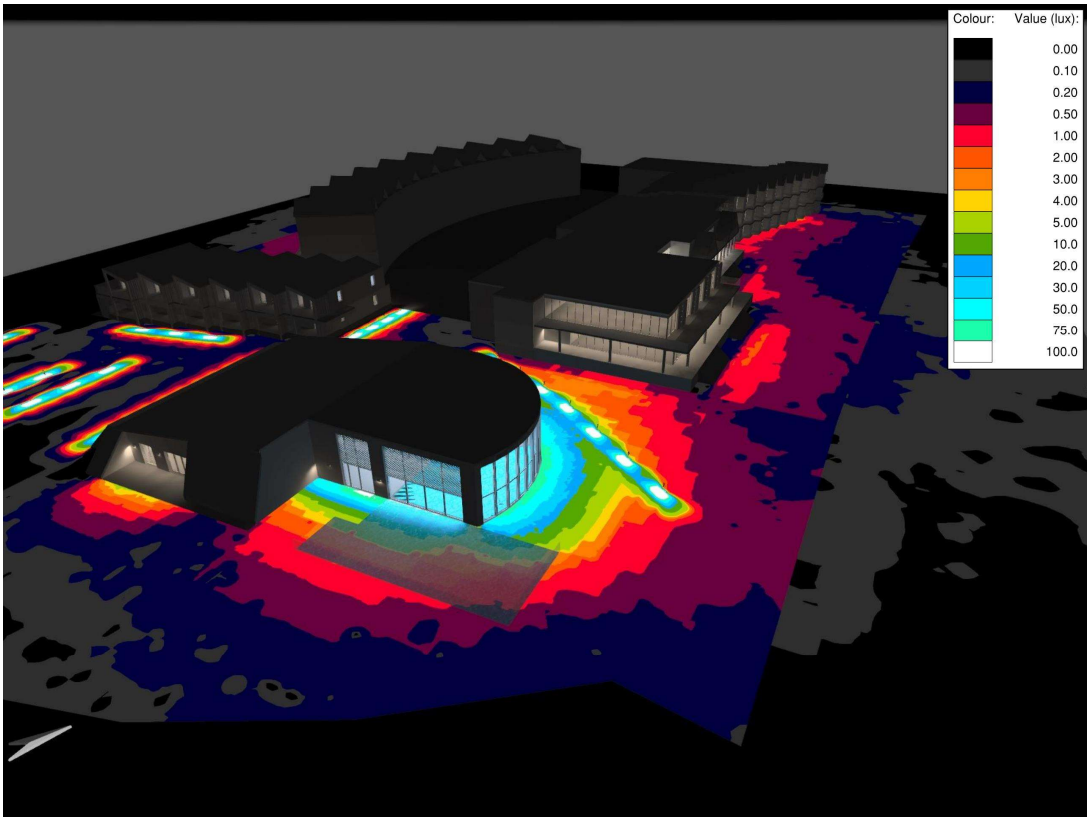

Figure 10 - False colour lux plot, view from the south-east.

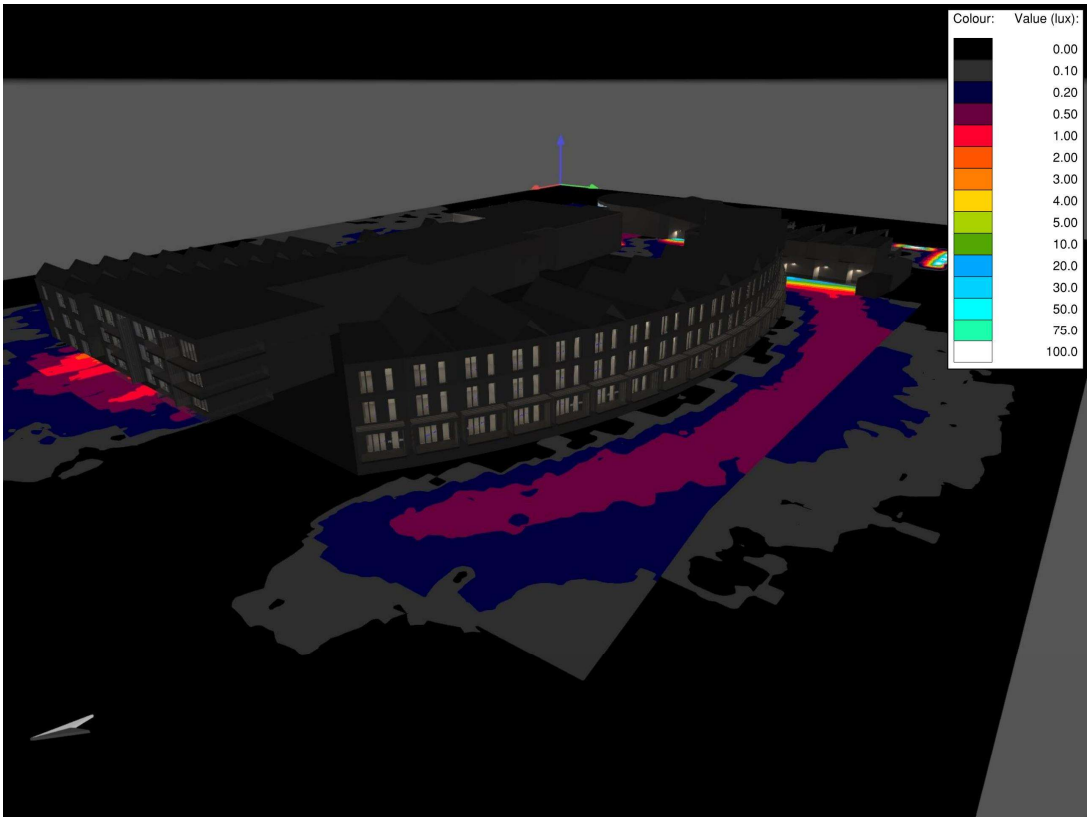

Figure 11 - False colour lux plot, view from the north-west.

The outputs from the lighting model show that light spill from the development does not have a serious impact on the surrounding areas, with spill from internal lighting in most cases dropping below 1 lux within 10m of the building. The most high-impact building on site is the pool and spa building, located in the south-east corner of the site. However, even in this case the internal light spill drops below 1 lux within 15m of the building. Additionally, this building will only be lit when it is occupied, with all lighting switched off outside of the hours of occupation. The light spill onto the main road to the east and the open field to the south is never above 0.5 lux, even for the 'worst case' scenario.

The ILP Guidance Notes advise on certain maximum illuminance values from a site onto the surrounding premises, depending on the Environmental Zone. These are shown in Figure 12.

Application conditions	Environmental zone				
	E0	E1	E2	E3	E4
Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

Figure 12 - Extract from ILP Guidance Notes detailing maximum illuminance values on building surroundings.

As seen in the lux plots above, the key areas to the south and east of the site are well below the pre-curfew target for Zone E1 of 2 lux. As the light levels were calculated for a 'worst case' scenario where all the building lights were switched on and all blinds were open, this represents a pre-curfew situation. The alternative, post-curfew, represents the time when stricter lighting requirements will apply and people will generally be in bed (with lights off and blinds closed).

The lux plots also show that very low light levels, equivalent to a maximum of 0.5 lux, can be achieved to the west, south and much of the east, and within a distance of 20m of the northern building façade. This demonstrates that significant lighting impacts on bats will not arise, even in this worst-case scenario which does not take account of the presence of lighting from the existing hotel building on site.

4 Mitigation of Light Spill

A number of mitigation measures beyond those mentioned above shall be included in the final design, both to reduce the overall spill of light to the surrounding environment, and to improve the visual comfort of the luminaires. These support the Purbeck local plan requirement to mitigate the impacts from light pollution on local areas.

4.1 Architectural elements

Several architectural elements have been included in the design to reduce the light spill from internal luminaires:

- Glazing will be specified with an appropriate visible light transmittance (VLT).
- Roof eaves have been extended to prevent upwards spill from rooms.
- External slatted screens have been included over several windows.
- Internal blackout blinds will be included on all windows in residential areas.

4.2 Landscaping

For the purposes of lighting calculations, landscaping has been excluded. However, landscaping can often have a measurable reduction on the effects of light spill. Site levels, trees and other forms of foliage will all reduce the light spill. This will be particularly significant along the eastern site boundary, where new trees are proposed as part of the development.

4.3 Lighting Controls

Appropriate controls of both internal and external lighting can help to further reduce the impact of lighting on the surrounding environment.

External lighting shall be zoned onsite such that smaller groups of luminaires can be controlled independently. All external lighting shall be controlled via a photocell and timeclock arrangement such that lighting is switched off during daylight hours and only switches on and off at predetermined times vias the programmable clock.

Internal lighting to the spa shall be switched off outside the hours of operation to prevent excessive light spill over night. Other communal spaces such as the bar and lounges will also have their lights dimmed or switched off outside of hours of operation.

5 Summary

The proposed design for the redevelopment of the Knoll House Hotel has been designed in a way to reduce the levels of light spill to the surroundings. Light spill beyond the site boundary has been minimised to be below 0.5 lux everywhere, and therefore is not deemed obtrusive to the surrounding environment, including bats.

External luminaires have been selected to minimise upward light components in line with dark sky guidance, and with a colour temperature of 2700K to minimise their impact on local bat populations.

Internal luminaires have generally been placed away from windows to minimise light spill to the outside, and in most cases have been selected with a colour temperature of 3000K, to minimise impact on wildlife.

Further mitigation measures will be included to comply with the Purbeck Local Plan These include switching off lighting to communal spaces outside of hours of operation, curtains/blinds in residential areas, light reducing films on all glazing and introducing new trees and foliage along the eastern site boundary.

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