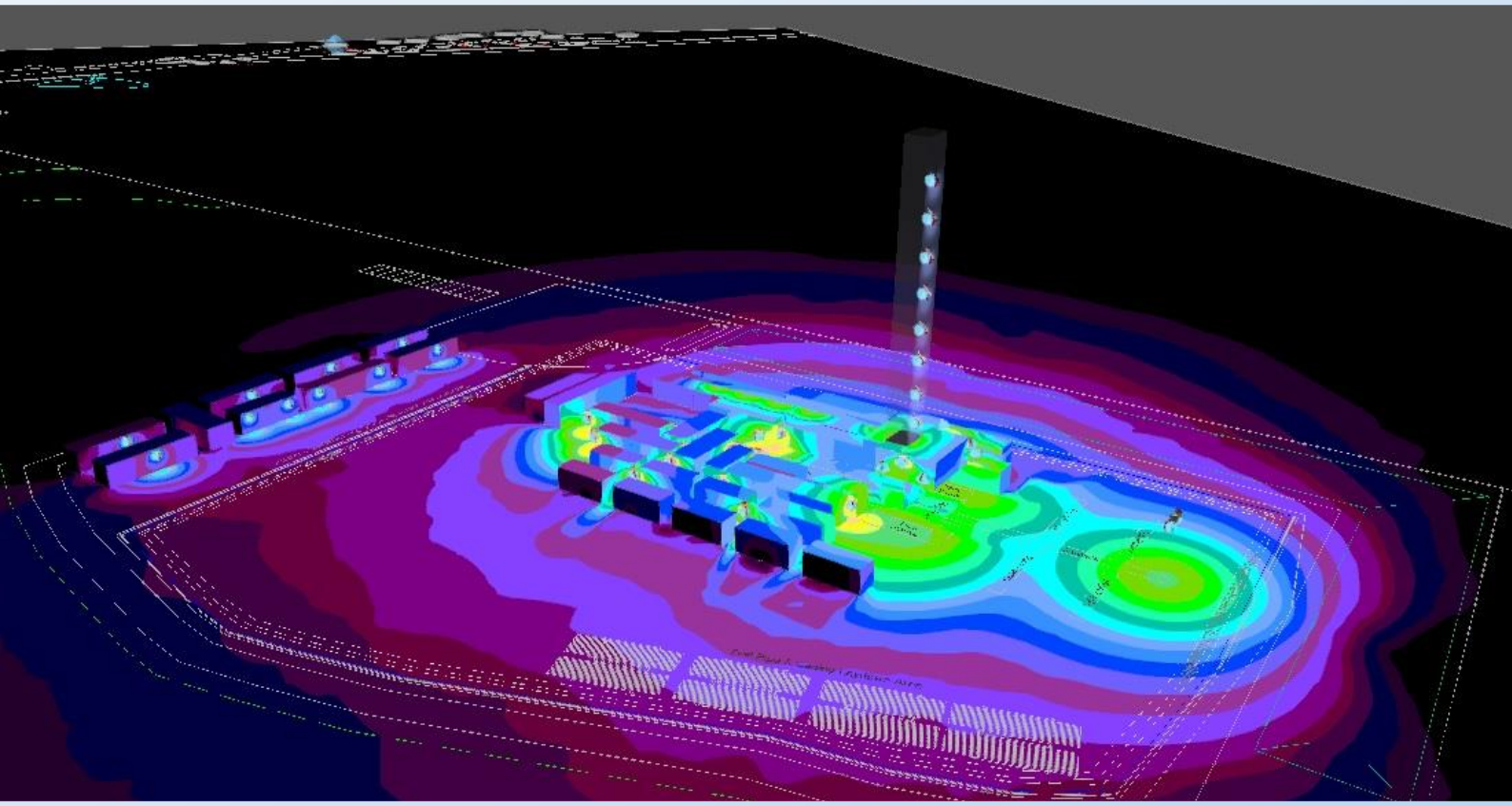
Europa Oil & Gas

LAND EAST OF THE YARD, BURNISTON MILL, COASTAL ROAD, BURNISTON, SCARBOROUGH, CONSTRUCTION AND OPERATION OF AN APPRAISAL WELLSITE

Lighting Impact Assessment



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JANUARY 2025

PUBLIC

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1 INTRODUCTION

1.1 BACKGROUND

1.1.1. WSP have been appointed by Europa Oil & Gas to undertake an assessment of the proposed lighting of an appraisal well site near Burniston, Scarborough. The appraisal well is proposed to test the underlying target reservoir for commercially viable reserves of hydrocarbons.

1.1.2. This document addresses a temporary operational phase lasting approximately eight weeks. The operational phase includes drilling operations and the use of a drilling rig upwards of 38m in height, together with necessary machinery, cabins, tanks and the like across the site. Much of the operational phase equipment will be demobilised and removed from site, with a smaller number of cabins, tanks and associated equipment retained for the follow-on testing phase which is not covered by this document.

1.2 SITE LOCATION AND DESCRIPTION

1.2.1. The site is the product of an assessment process carried out by the client to identify the locations least likely to impact upon the environment and local communities, when balanced against the technical needs of the project.

Figure 1-1 - Site location and boundary

Google Earth (2025)

1.2.2. The site is currently an agricultural field bounded by open agricultural fields to the north, further agricultural fields, the Heritage Coast and coastal path to the east and north east; an area of scrubland to the south with further fields beyond which is intersected by the A165 Coast Road; a solar farm and commercial/industrial buildings to the south west; and the village of Burniston to the west.

1.2.3. The Application Site is located close to the North York Moors National Park, with the nearest boundary being approximately 815m to the north of the site. The National Park was designated as a Dark Sky Reserve in 2020. An International Dark Sky Reserve (IDSR) is a protected area that is considered to have exceptional starry, dark or pristine skies. The International Dark Sky Association (IDA) designates the areas which are then protected for scientific, educational, cultural and general public enjoyment. The provision of lighting, whilst not precluded within and IDSR, is strictly controlled to maintain the dark skies status. Whilst the appraisal well site is not located within the National Park, control of the effects associated with Artificial Light at Night (ALAN) should be implemented to reduce and mitigate the effects where practicable.

1.3 AIM OF THIS DOCUMENT

1.3.1. This document outlines:

- Establishment of the appropriate Environmental Zone in which the site is located, in accordance with current standards, guidance and consultation with the Mineral Planning Authority (MPA) North Yorkshire Council (NYC);
- The methodology for environmental impact assessment of exterior lighting proposed for the drill site; and
- Analysis of the expected impact of the site lighting and the relationship to industry guidance documentation;

2 LIGHT POLLUTION AND NUISANCE

2.1 BENEFITS AND DIS-BENEFITS OF ARTIFICIAL LIGHTING

2.1.1. Suitable levels and quality of illumination are required to enable any workplace to be used safely and effectively. There is a general correlation between the complexity of a task, or how hazardous that task is, and the level of illumination required to safely undertake the task. Employers have a duty of care under health and safety legislation to provide an environment in which it is safe to work. This duty of care extends to others who may be affected by the operations of the workplace, such as nearby residents. Employers with more complex and hazardous places of work will generally provide greater levels of illumination, in-line with national, international and industry standards and guidance.

2.1.2. The recommended lighting levels for different tasks are outlined in national and international standards, as well as industry standards and guidance documents. Typically, the more complex a task, the greater the required level of illumination and the higher the levels of uniformity in lighting levels required.

2.1.3. Levels of lighting must be carefully selected to ensure that they are suitable for the task being undertaken whilst ensuring that they are not excessive. Excessive levels of lighting lead to wasted energy, as well as having the potential to negatively impact local ecological receptors, human amenity receptors, and the safety of the surrounding area. In extreme cases, poor lighting may make the task it is provided for more difficult to accomplish and constitute a statutory nuisance on nearby receptors. In the context of light sensitive species (specifically bats) excessive lighting levels may lead to changes in feeding and commuting behaviour, increased risk of predation, or roost abandonment.

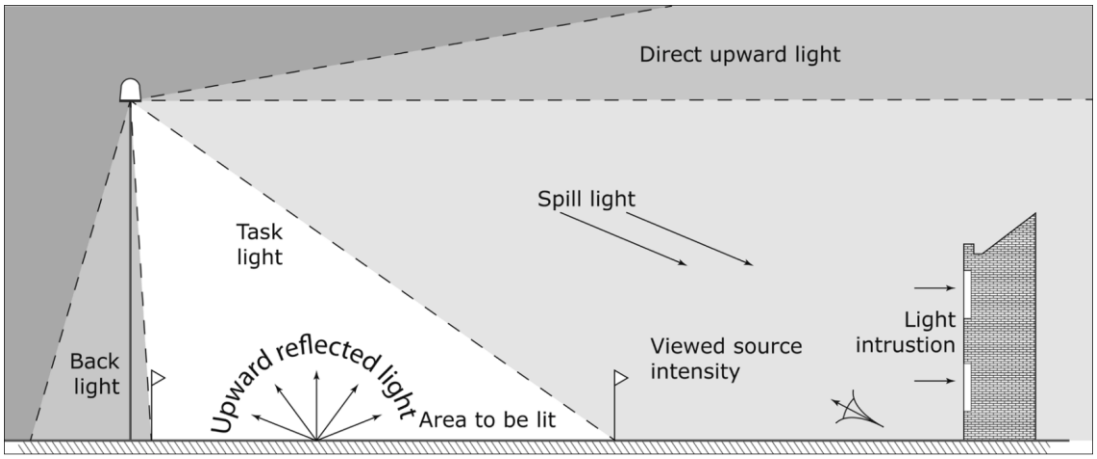
Figure 2-1 - Example of various poorly controlled lighting installations

2.1.4. The incorrect application of lighting can have a negative effect on the local environment, in the form of light pollution and nuisance light. Light pollution is defined as emitted light that is serving no useful purpose as it falls outside of the area required to be illuminated. This can take several forms:

- Light Spill – Light falling outside of the extents of a site, building or event which falls onto areas not intended for illumination.
- Sky Glow – The emission of upward light into the atmosphere that limits the visibility of the night sky. The cumulative effects of sky glow may be noticeable above urban areas, where several poorly controlled sources combine to create a brightening of the horizon and night sky.
- Glare – The uncomfortable brightness of a light source when viewed against a darker background. Poorly oriented lighting units may exhibit glare and, while the disabling effects of glare diminish with distance, lighting may still cause a nuisance over several hundred metres.

2.1.5. A graphical representation of the types of lighting nuisance is provided in **Figure 2-2**:

Figure 2-2 - Types of light nuisance (ILP GN01:2021)



ILP GN01:2021

2.2 LEGISLATION

Clean Neighbourhoods and Environment Act (2005)

2.2.1. The Clean Neighbourhoods and Environment Act 2005 (the 'CNEA') gives local authorities powers to deal with artificial lighting by classifying artificial light emitted from defined premises as a statutory nuisance. The CNEA amends Section 79 of the Environmental Protection Act 1990 (the 'EPA') to extend the statutory nuisance regime to include light spill and glare (emitted from certain premises), defined as "*artificial light emitted from premises so as to be prejudicial to health or a nuisance*".

2.2.2. Several defined types of premises are exempt from this provision, including premises where higher levels of lighting are to be expected for the purposes of safety, such as airports and lighthouses.

2.2.3. Guidance produced by the Department of Environment, Food and Rural Affairs (DEFRA) on Sections 101 to 103 of the CNEA extends the duty on local authorities to ensure their areas are checked periodically for existing and potential sources of statutory nuisances, including situations where a nuisance arises from the use of artificial lighting.

2.3 NATIONAL POLICIES

National Planning Policy Framework (2024)

2.3.1. The National Planning Policy Framework (NPPF), prepared by the Ministry of Housing, Communities & Local Government, December 2024 states:

'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: …

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.' (NPPF, Paragraph 198, 2024)

Planning Practice Guidance (2019)

2.3.2. The Ministry of Housing, Communities and Local Government provides guidance on light pollution on the gov.uk website (https://www.gov.uk/guidance/light-pollution) and details the following:

- What light pollution consideration does planning need to address?
- What factors can be considered when assessing whether a development proposal might have implications for light pollution?
- What factors are relevant when considering where light shines?
    - Impacts on sensitive receptors in the form of obtrusive light i.e. light spill, obtrusive light in the form of direct illumination or glare/source intensity from a direct view of the light fitting etc.
- What factors are relevant when considering when light shines?
    - Consideration to working hours of a site and adherence to any curfew or restrictions imposed by the LPA. Switching, dimming, zonal application of lighting to illuminate areas only when in use for task or activities.
- What factors are relevant when considering how much the light shines?
    - What tasks are being undertaken? Are they complex or intricate? What plane are they being performed on and what level of illumination is appropriate to enable that task to be performed safely and without visual impairment?
- What factors are relevant when considering possible ecological impacts of lighting?

2.3.3. A brief commentary on the factors relevant to the appraisal well site has been provided above.

2.4 LOCAL POLICIES

Minerals and Waste Joint Plan 2022

2.4.1. Policy M16(d)(i) states:

"Where proposals for surface hydrocarbon development meet other locational criteria set out in this policy but fall within a National Park or an AONB or the associated 3.5km visual sensitivity zone around this zone, are otherwise considered to have the potential to cause significant harm to a National park and/or AONB, applications should be supported by a detailed assessment of the potential impacts on the designated area/s, unless it can be demonstrated that such an

assessment is not required taking into account the particular locational circumstances of the proposed site relative to the designated area/s. Where detailed assessment is required this should include an assessment of views of and from the designated area/s from significant view points and an assessment of the cumulative impact of development in the area. Permission will not be granted for such proposals where they would result in unacceptable harm to the special qualities of the designated area/s or are incompatible with their statutory purposes in accordance with Policy D04."

2.4.2. Paragraph 5.132 of the MWJP notes that drilling rigs associated with hydrocarbons development in close proximity to National Parks have the potential to cause significant adverse impact on the setting of the designated area. This could include impacts on dark night skies typically associated with the need for site lighting during 24-hour operations. Paragraph 5.133 goes on to say that proposals for surface hydrocarbons development within the visual sensitivity zone of the National Park should be supported by detailed information assessing the impact of the proposed development. For development outside the boundary of the designated area, such a requirement is most likely to apply within a 3.5km zone around the boundary.

2.4.3. Paragraph 5.152 states that the potential for adverse impacts from proposals within 500m of sensitive receptors are generally likely to create higher risks of harmful impacts on amenity. A 500m distance from the well pad boundary is considered to represent a reasonable distance of immediate sensitivity taking into account the potential for cumulative impacts on amenity and public health, including lighting and light pollution.

2.4.4. Policy D02 states that:

"Proposals for minerals and waste development, including ancillary development and minerals and waste transport infrastructure, will be permitted where it can be demonstrated that there will be no unacceptable impacts on the amenity of local communities and residents, local businesses and users of the public rights of way network and public open space as a result of:..

- *Site lighting;"*

2.4.5. Policy D06 (3) states:

"Where proposals may have an adverse impact on landscape, tranquility or dark skies, schemes should provide for a high standard of design and mitigation, having regard to landscape character, the wider landscape context and the setting of the site and any visual impact, as well as the delivery of landscape enhancement where practicable."

North York Moors National Park Authority

2.4.6. North York Moors National Park Authority Local Plan July 2020 – Policy ENV4 Dark Night Skies states:

The darkness of the night skies above the National Park will be maintained and where possible enhanced. All development will be expected to minimise light spillage through good design and lighting management and the following lighting principles will be applied:

1. *No external lighting will be permitted in Remote Areas;*
2. *In Open Countryside proposals that involve external lighting will only be permitted where it can be demonstrated that the lighting is essential for safety or security reasons and the*

lighting details meet or exceed those set out in any lighting guidelines adopted by the Authority;

3. *Within settlements listed in the Authority's settlement hierarchy, proposals that involve external lighting will be permitted where it can be demonstrated that the lighting is essential for safety, security or community reasons and the lighting details meet or exceed those set out in any lighting guidelines adopted by the Authority*

2.4.7. Although the Application Site does not fall within the boundary of the North York Moors National Park, every effort should be made to ensure that the effects associated with ALAN are controlled, minimised and balanced with the immediate surrounds, but without compromising health and safety when undertaking critical tasks during the hours of darkness.

2.5 PRE-APPLICATION ADVICE

2.5.1. Europa sought pre-application planning advice from NYC in March 2024. NYC issued advice on 11th June 2024. The advice stated that supporting information should demonstrate how adverse impacts are to be avoided, especially in regard to noise and light, due to 24 hour working. The Environmental Health Officer for the Scarborough area confirmed that a lighting assessment should be submitted with the planning application.

2.6 SCREENING OPINION

2.6.1. NYC issued a screening opinion on 1st August 2024. The screening opinion stated that impacts arising from the proposed development on the surrounding landscape and the transport network would be likely to be significant. Whilst NYC acknowledged that there is potential for an impact in respect of lighting, it was not considered to be likely to be significant.

2.7 GUIDANCE FOR IMPLEMENTATION

2.7.1. Applicable guidance for lighting designers regarding obtrusive light is predominantly covered by the following international documents:

- CIE 150:2017 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (International Commission on Illumination, 2017)
- CIE 126:1997 Guidelines for Minimizing Sky Glow (International Commission on Illumination 1997)

2.7.2. National guidance for the United Kingdom is produced by the Institution of Lighting Professionals (ILP) in the following documents:

- Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (PLG04) (ILP, 2013)
- Guidance Note 01/21 Guidance Note the Reduction of Obtrusive Light (GN01) (ILP, 2021)
- Bat Guidance Note 08/23 Bats and Artificial Lighting at Night (ILP & The Bat Conservation Trust, 2023)

2.7.3. Further guidance has been produced by the Society for Light & Lighting (SLL), with the following documents outlining good lighting practice that will inform the design:

- SLL Code for lighting (2022)
- SLL Lighting Guide 6: The Exterior Environment (2016)

ILP GN01:2021 Guidance Note 'The reduction of obtrusive light'

2.7.4. Guidance Note outlined in ILP GN01:2021 sets out what constitutes Obtrusive Light, how it can be limited through the implementation of best practice, and what limits should be imposed upon lighting depending upon the Environmental Zone in which the Application Site is located. GN01 is a distillation of CIE150:2017.

2.7.5. ILP GN01:2021 Table 2 (Table 2-1 below) sets out the Environmental Zones against which lighting should be considered.

Table 2-1 - GN01 Table 2: Environmental Zones

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

ILP GN01:2021

2.7.6. ILP GN01:2021 Table 3 (CIE 150 Table 2) (Table 2-2 below) sets out the maximum values for vertical illuminance onto nearby premises, depending upon the Environmental Zone in which the premises is located. This limitation is typically considered at windows and apertures, with a focus on bedroom windows (typically at 3.8m and above).

Table 2-2 - ILP GN01 Table 3 (CIE 150 Table 2): Maximum values of vertical illuminance on premises

Light Technical Parameter	Application conditions	Environmental Zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (Ev)	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

ILP GN01:2021

2.7.7. ILP GN01:2021 Table 4 (CIE 150 Table 3) (Table 2-3 below) sets out the limits on the luminous intensity of luminaires, to control glare.

Table 2-3 - ILP GN01 Table 4 (CIE Table 3): Limits for the luminous intensity of bright luminaires

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m^2)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.5$	$A_p > 0.5$
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 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10 *d*	7,500
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500
	E3						
	Pre-curfew	0.86 *d*	1.9 *d*	3.8 *d*	8.5 *d*	15 *d*	10,000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	1,000
	E4						
	Pre-curfew	1.4 *d*	3.1 *d*	6.3 *d*	13 *d*	26 *d*	25,000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500

2.7.8. ILP GN01:2021 Table 6 (CIE 150 Table 5) (Table 2-4 below) sets out the maximum upward light ratio (ULR) for luminaires depending upon the Environmental Zone in which they are to be used.

Table 2-4 - ILP GN01:2021 Table 6 (CIE 150 Table 5): Maximum values of upward light ratio (ULR) of luminaires

Light Technical Parameter	Environmental Zones				
	E0	E1	E2	E3	E4
Upward light ratio (ULR) / %	0	0	2.5	5	15

ILP GN08:2023 BATS AND ARTIFICIAL LIGHTING IN THE UK

2.7.9. ILP GN08:2023 is a document intended to raise awareness of the impacts of artificial lighting on bats and outline mitigation options for various scenarios. Work on site should always be informed by site-specific ecological information and lighting assessments.

2.7.10. Whilst the document does not set out a prescriptive limit for light spill onto bat commuting routes, feeding grounds and roosts, it states:

"N.B. It is acknowledged that, especially for vertical calculation plans, very low levels of light (<0.5 lux) may occur even at considerable distances from the source if there is little intervening attenuation. It is therefore very difficult to demonstrate 'complete darkness' or a 'complete absence of illumination' on vertical plants where some form of lighting is proposed on site despite efforts to reduce them as far as possible and where horizontal plane illuminance levels are zero. Consequently, where 'complete darkness' on a feature or buffer is required, it may be appropriate to consider this to be where illuminance is below 0.2 lux on the horizontal plane and below 0.4 lux on the vertical plane. These figures are still lower than what may be expected on a moonlit night and are in line with research findings for the illuminance found at hedgerows used by lesser horseshoe bats, a species well known for its light averse behaviour (Stone, 2012)."

3 RECEPTOR AND BASELINE ASSESSMENT

3.1 METHODOLOGY

3.1.1. A desktop assessment of the Application Site has been prepared to examine the existing baseline lighting conditions both within the Application Site boundary and in the immediate surrounds. This assessment involved the review of publicly available mapping data, sky glow information, environmental sensitivities, and consultation with relevant disciplines to build up a picture of the area.

3.1.2. An on-site baseline survey of the Application Site has not been carried out as part of this lighting strategy. Sufficient information can be gathered from publicly available sources to build up a picture of the baseline conditions.

3.2 POTENTIALLY SENSITIVE HUMAN RECEPTORS

3.2.1. Potentially sensitive human receptors to changes in lighting can be split into two categories:

- Human Amenity – Receptors that are sensitive to changes in lighting that can affect the amenity of spaces. E.g. Residential receptors
- Human Safety – Receptors that are sensitive to changes in lighting that can affect the safety of users. E.g. Public highways, Railway lines.

3.2.2. Table 3-1 and Figure 3-1 highlight the human and residential receptors that have the potential to be affected by the presence of artificial light planned at the Application Site.

Table 3-1 - Potentially Sensitive Human Receptors

Receptor No.	Receptor Name	Description	Distance from Site/Well Pad (m)	Receptor Type	Receptor Sensitivity
SR1	Glennifer	Residential properties adjacent in the vicinity of the Application Site	456	Human Amenity	Medium
SR2	Meadowside	Residential properties adjacent in the vicinity of the Application Site	461	Human Amenity	Medium
SR3	Belmont	Residential properties adjacent in the vicinity of the Application Site	471	Human Amenity	Medium
SR4	Meadowburn	Residential properties adjacent in the vicinity of the Application Site	479	Human Amenity	Medium
SR5	Beckside	Residential properties adjacent in the vicinity of the Application Site	483	Human Amenity	Medium
SR6	Janian	Residential properties adjacent in the vicinity of the Application Site	487	Human Amenity	Medium
SR7	Riskato	Residential properties adjacent in the vicinity of the Application Site	495	Human Amenity	Medium

Receptor No.	Receptor Name	Description	Distance from Site/Well Pad (m)	Receptor Type	Receptor Sensitivity
SR8	Magpie	Residential properties adjacent in the vicinity of the Application Site	462	Human Amenity	Medium
SR9	Kingfisher	Residential properties adjacent in the vicinity of the Application Site	468	Human Amenity	Medium
SR10	Flats Farm	Residential properties adjacent in the vicinity of the Application Site	432	Human Amenity	Medium
SR11	Wayside Farm	Residential properties adjacent in the vicinity of the Application Site	374	Human Amenity	Medium

3.2.3. Refer to Section 4, Figure 4-1 and Appendix B for full lighting calculation results and summary.

Figure 3-1 - Human sensitive receptor locations

Google Earth (2025)

3.3 POTENTIALLY SENSITIVE ECOLOGICAL RECEPTORS

3.3.1. Potentially sensitive ecological receptors to changes in lighting consist of flora and fauna which may be affected by changes in lighting levels, periods of illumination, sky glow or glare. For example,

certain species of bats are known to change their commuting behaviour or the times at which they emerge in the evening depending upon levels of artificial lighting. It should be noted that light emitted from within a building also has the potential to contribute unwanted obtrusive and spill light to the surrounding environment, but this assessment concentrates on light associated with exterior lighting only.

3.3.2. Table 3-2 and Figure 3-2 highlight the ecological receptors that have the potential to be affected by the presence of artificial light.

Table 3-2 - Potentially Sensitive Ecological Receptors

Receptor No.	Receptor Name	Description	Receptor Type	Receptor Sensitivity
ER1	Scrub/tree belt	Existing scrub/tree belt located adjacent to site	Ecology	High

Figure 3-2 - Ecological sensitive receptor locations

Google Earth (2025)

3.3.3. Lighting should be implemented in such a way as to limit the potential impacts upon ecology within and in the vicinity of the Application Site.

3.3.4. Refer to Section 4, Figure 4-1 and Appendix B for full lighting calculation results and summary.

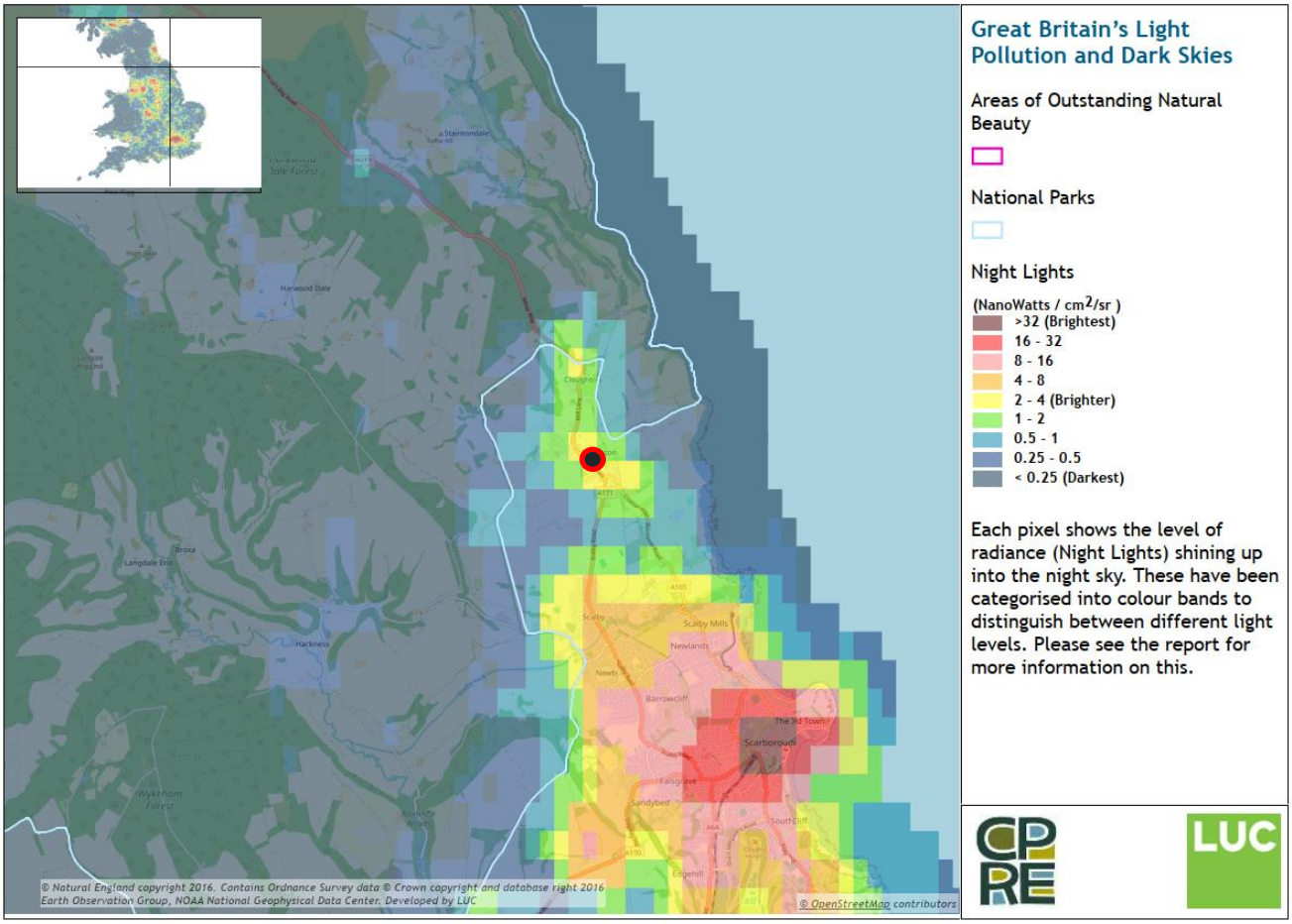
3.4 SITE CLASSIFICATION & BASELINE ASSESSMENT

3.4.1. The classification of the Environmental Zone is made in accordance with the criteria set out in Table 2-1**,** taken from ILP GN01:2021.

3.4.2. The character of the area surrounding the Application Site is predominantly rural as described in Section 1.

3.4.3. Sky glow mapping prepared by the CPRE in 2016 indicates that the skies above the Application Site are currently relatively dark but with bright areas associated with some light pollution from Burniston Village and the Towns of Scalby and Scarborough further south being the main contributor. A screenshot from the CPRE Night Blight Map is shown in Figure 3-2.

Figure 3-3 - CPRE Light Pollution Mapping (Application Site shown by Red/Black mark)



CPRE (2016)

3.4.4. Existing sources of lighting are typically those associated with highway lighting and consist of a mix of LED and High Pressure Sodium (SON).

Figure 3-4 - Typical LED (Left) and HID (SON) lighting (Right)

Google Maps (2025)

3.4.5. Other sources of lighting are associated with commercial properties such as area lighting mounted on building facades and residential property security lighting.

3.4.6. The character of the Application Site and its immediate surrounds is considered to be mixed 'Rural' area of a 'Low District Brightness as outlined within ILP GN01:2021 (Table 2-1 within this document).

3.4.7. As such the Application Site is classified as being within an E2 Environmental Zone. It is therefore recommended that the lighting for the proposed development be assessed to the parameters of an E2.

3.4.8. Early consultation was undertaken with NYC Environmental Health Officer, who advised that the site and immediate surrounding area, should be classified as an E2 environmental zone. It should be noted that there is potential for observers located in the National Park (designated an E1 zone) to see the site, however, given the temporary nature and short duration of the drilling phase, the impacts are negligible.

3.5 SITE LIMITATIONS

3.5.1. The limitations imposed upon the exterior lighting within an E2 Environmental Zone are provided in the tables below, extracted from ILP GN01:2021. Further guidance on limitations and how these are calculated is provided in CIE 150:2017.

3.5.2. The following tables are extractions of parameters which are applicable to the lighting for the Application Site, with every effort to implement best design practice being taken in order to ensure a design that is compliant with the outlined parameters as far as is reasonably practicable.

3.5.3. It is assumed that a curfew will not be applied to the operational phase as the drilling rig is required to operate on a 24/7 basis once it has commenced the drilling phase. Therefore post-curfew requirements for an E2 zone have not been considered as part of the assessment. The operational lighting is required to be on during the hours of darkness to ensure the safety of the workforce on site.

3.5.4. The 2 main parameters applicable to lighting on the Application Site are Luminous Intensity and Upward Light Ratio, outlined in Tables 3-3 and 3-4.

Table 3-3 - Limitation on Luminous Intensity (E2 Environmental Zone)

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m^2)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.5$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E2						
	Pre-curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10 *d*	7,500
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500

ILP GN01:2021

Table 3-4 - Limitation on Upward Light (E2 Environmental Zone)

Light Technical Parameter	E2
Upward light ratio (ULR) / %	2.5

ILP GN01:2021

3.5.5. Vertical illumination on to surfaces i.e. property windows, has not been considered as part of this assessment due to the nature of the site being in a slight dip and distance of properties from the site, levels of illumination on to properties will be negligible.

3.5.6. The above outlined criteria are desirable guidance which should be considered as the basis of any good practice design to minimise the effects of artificial lighting to the immediate surrounding environment. There may be instances where this is not fully achievable for Health and Safety operational reasons relating to activities within the site.

4 ASSESSMENT

4.1 CALCULATIONS

4.1.1. Calculations have been performed using DiaLUX EVO lighting simulation software. A 3D model of the installation has been developed based on Client provided data to model a best representation of the site and the plant being utilised, in the absence of a Client provided confederated model.

4.2 TOPOGRAPHY AND SOLID STRUCTURES

4.2.1. The site is located in a gently sloping valley running north-south. While the slight changes in topography may shield a number of receptors from the site in part, calculations within this assessment do not take account of topographic variations, trees or other natural or artificial structures outside of the site compound. In this regard, the calculations may therefore be considered worst-case.

4.2.2. Indicative structures and solid objects within the site compound that will provide some obstruction to light have been modelled in the 3D calculation. Larger elements, such as tanks, generators and pumps are included. Smaller elements such as pipes are not. The drilling rig used during the operational phase has been marked with an indicative envelope for reference, but because it is likely to be a lattice structure it has been calculated as transparent.

4.3 ENVIRONMENTAL ZONE

4.3.1. It is considered that the site and wider area of interest sit within a rural area with a low district brightness and would therefore be considered as Environmental Zone E2. There is public lighting in the area surrounding the site, private dwellings and commercial/industrial buildings. Some security lighting is present on the private properties in the area, as well as limited industrial units, but this does little to raise the general ambient level. Limited public road lighting is present in the village of Burniston.

4.4 OPERATIONAL PHASE

4.4.1. The operational drilling phase will require 24 hour working of the site for approximately six of the eight weeks of operations. The activities taking place are likely to be hazardous to the workforce and tasks being undertaken likely to be complex. The appropriate number of lighting units and level of illumination is expected to enable the employer to satisfy their obligations under health and safety legislation. Due to the risk of explosive gases on site, much of the lighting equipment must be suitable for hazardous areas and bespoke to the oil and gas industry.

4.5 TECHNICAL DATA AND SOURCES

Information Received

4.5.1. Proposed luminaire types and locations have been applied based on client-provided drawings to create a worst-case picture of how the proposed lighting scheme is expected to be installed. The drawings used are as follows:

- ZG-EOG-CLTN-PA-07 Site Layout Plan – Indicative Drilling Phase (Appendix A)
- ZG-EOG-CLTN-PA-08 Indicative Section Plan - Drilling Phase

4.5.2. The height and dimensions of structures and buildings are informed by drawing *Indicative Section Plan – Drilling Phase* and stated unit mounting heights were given on other documents.

Luminaires and Light Sources

4.5.3. The lighting proposals developed to-date assume the use of the following equipment based on information and data sheets provided by the Client. A commentary is provided below on what has been calculated in this assessment.

Table 4-1 – Luminaires utilised in assessment

	Proposed Unit and Location	Calculated Unit
	Appleton Emerson ATX FELED Linear Located on the rig	73W (5,879lm) 4000k
	Thorn Lighting Escort Above door luminaire for offices and welfare facilities	8W (1,000lm) 4000k
	Brackenheath REX Slim Floodlight Mounted for visual tasks in non-hazardous areas	300w (27,286lm) 3000k
	SafeSite Highbay LEDs Located on and around rig structure	212w (23,861lm) 3000k

4.6 ASSUMPTIONS

4.6.1. The following assumptions have been made:

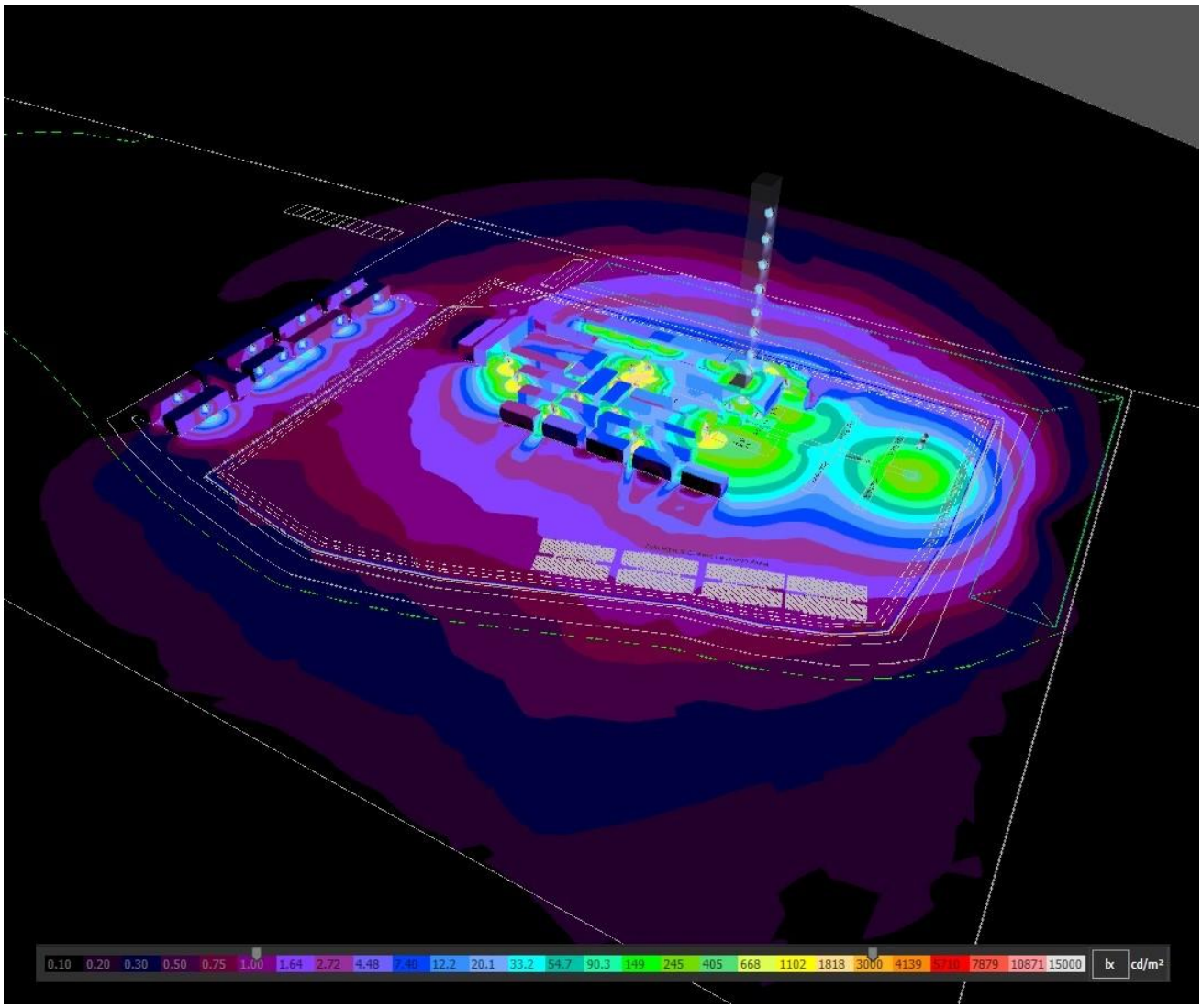
- As required for environmental lighting assessments a maintenance factor of 1 has been used to model the worst-case, day-one output of the installation;
- Where selected luminaires have a number of distribution options or accessories, the worst-case option has generally been selected (with regard obtrusive light). This may be using the widest, least controlled distribution, for example, or selecting a luminaire without physical controllers such as external reflectors. This mitigates against incorrect installation, damage to equipment during installation or service and other unforeseen factors;
- Luminaires are generally calculated directed outwards from their mounting structure along the horizontal plane, unless it is obvious that the luminaire will face the interior of an open structure, such as those luminaires on the drilling rig which are mounted with an angle of 45°;
- Floodlight-type units are mounted in initial calculations at 10° inclination, an expected sensible value that replicates equipment being installed by eye on site.;
- Observer points at receptor sites have been calculated at a height of 1.8m to model the average height of a person looking directly at the proposed site; and
- Technical parameters have been applied to calculations based on professional knowledge and the expected conditions and installation practices of the site. Any calculation variations applied to explore the impact of obtrusive light do not necessarily take account of any impact on the functional lighting levels of the site, the design of which is outside the scope of this assessment.

4.7 RESULTS

Upward Light Ratio (ULR or Rul)

4.7.1. The operational phase scheme exhibits a ULR of 1.7%.

Figure 4-1 - 3D model of drilling phase of site layout (pseudo colour)



Luminous Intensity

4.7.2. The following table, organised by receptor, details the maximum intensities to the observer. The thresholds are taken from the requirements for Environmental Zone E2, as recommended by GN01.

Table 4-2 – Luminous Intensity calculation summary table.

Receptor	GN01 Luminous Intensity (I in cd) E2 Zone Limitation	Greatest intensity calculated (I in cd)	Pass/Fail (✓/×)
SR1	2500	1307	✓
SR2	2500	1339	✓
SR3	2500	1353	✓
SR4	2500	1365	✓
SR5	2500	1381	✓
SR6	2500	1404	✓
SR7	2500	1379	✓
SR8	2500	1429	✓
SR9	2500	1453	✓
SR10	2500	1435	✓
SR11	2500	40.6	✓

Light Spill

4.7.3. Sites of this type involving complex tasks would be expected to be lit to high levels of illumination to aid safe working of complex activities, which can sometimes lead to unwanted, spill or obtrusive light being emitted beyond the boundaries.

4.7.4. As can be seen from the pseudo colours presented in Figure 4-1 there is minimal spill of light to the immediate surrounding area, despite the required high levels of illumination for safe working. It should be noted that the levels being emitted beyond the boundaries are controlled due to the angle of fittings and the shielding of light offered by the structures that make up the site. Crucially levels of illumination being emitted towards the scrubland/tree belt (ER1) are between 0.20 and 0.75 lux which are deemed to be low and acceptable on a short-term basis.

5 ANALYSIS AND CONCLUSIONS

5.1 RESULTS ANALYSIS

5.1.1. The operational phase exhibits a ULR of 1.7%, meets the values of the guidance values of GN01, which recommends 2.5% for Environmental Zone E2. None of the sensitive receptor sites receive luminous intensity values in excess of the guidance of GN01 (Refer to Table 4-2)

5.2 CONCLUSIONS AND RECOMMENDATIONS

5.2.1. As has been found by the 3D modelling based on the data provided by the Client, the lighting associated with the drilling rig, working areas and compounds etc. is compliant with the requirements of ILP GN01 and CIE150:2017.

5.2.2. The site is well shielded from view to sensitive receptors, so direct views of the lighting across the site will be limited or negligible. However, due to the height of the rig and provision of lighting along the length of the mast section, it is likely that the mast section may be visible in some instances due to the luminaires lighting the structure of the rig rather than any direct view of the luminaires but given the short duration of the drilling phase the effect will be temporary and negligible.

5.2.3. It should also be noted that the presence of the site may be apparent from some views due to reflected light from building surfaces within the operational area. This can be minimised through the application of dark surface treatments to plant and equipment where practicable.

5.2.4. Whilst any work site must be lit to allow safe operation, the application of appropriate design guidance and modern, efficient equipment can ensure, where practicable, that any lighting produces minimal impact and is acceptable to its local environment.

5.3 ANALYSIS OF MITIGATING FACTORS

5.3.1. In conjunction with the likely technical improvements that can be made to the lighting design, there are a number of expected factors that will help mitigate the environmental impact of the scheme:

- The operational phase, which is expected to use the largest amount of lighting due to the nature of the complex tasks to be undertaken and to ensure the health and safety of site personnel, is temporary (relatively short period of approximately six to eight weeks); and
- This assessment does not take account of the variations in local topography, nor the presence of natural screening features such as trees, which together may have a cumulative shielding effect on a number of receptor sites.

5.4 RECOMMENDATIONS FOR FUTURE STAGES OF THE SITE

5.4.1. The following items are recommended to reduce the environmental impact of the proposed lighting:

- Explore the use of more controllable light sources, including full cut-off luminaires installed at 0°;
- Ensure the correct level of lighting is being provided to each task area and that no area is being over-lit unnecessarily. Refer to national, international and industry standards and guidance;
- Investigate whether areas of the site could make use of switching, whether manual or via detection, to only provide lighting when it is required;

- Explore the use of physical mitigation measures at equipment (such as shields) and site boundaries (such as planting) to screen receptor sites from installed lighting;
- Ensure the installation is installed as per design and assessed by a suitably qualified lighting engineer.

6 GLOSSARY OF TERMS AND ABBREVIATIONS

6.1 GLOSSARY OF TERMS

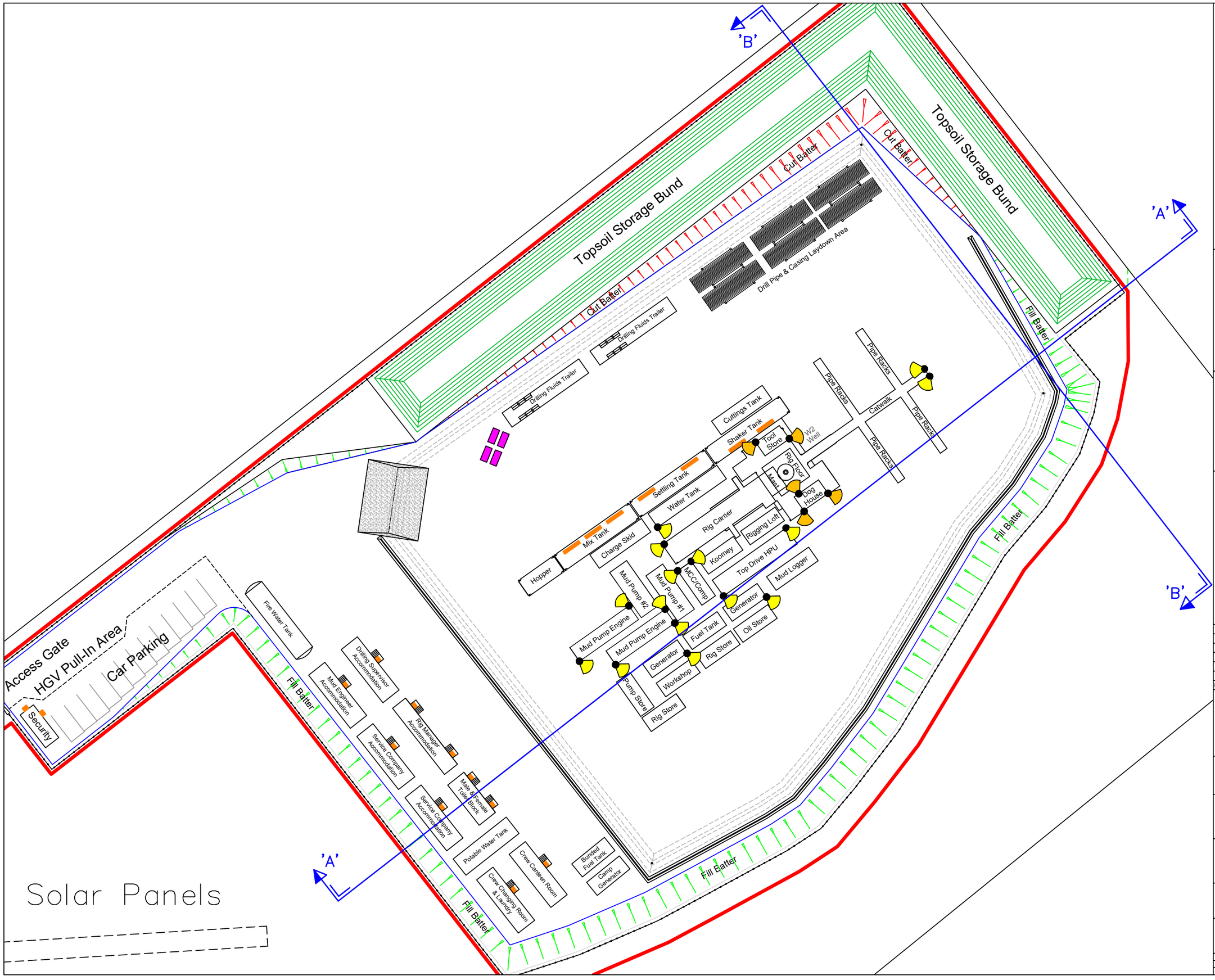
Term	Definition
Colour rendering	Colour rendering (as per BS EN 12665:2002) - Effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant.
LED	Light Emitting Diode
Illuminance	Quotient of the luminous flux (dϕ) incident on an element of the surface containing the point, by the area (dA) of that element. Equivalent definition: Integral, taken over the hemisphere visible from the given point, of the expression Unit: L x cos ᵉ x dΩ. Where L is the luminance at the given point in the various directions of the incident elementary beams of solid angle dΩ; and ᵉ is the angle between any of these beams and the normal to the surface at the given point. Unit Lx (lux) or lumens per metre2 (lm/m2)
Illuminance Uniformity (Uo)	Ratio of minimum illuminance to average illuminance on a surface. Note: Use is also made of the ratio of minimum illuminance to maximum illuminance, in which case, this should be specified explicitly.
Lamp	Source made in order to produce optical radiation, usually visible. Note: This term is also sometimes incorrectly used for certain types of luminaires.
Light Pollution	The spillage of light into areas where it is not desired.
Luminaire	Apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply. Note: The term 'light fitting' is deprecated.
Maintained illuminance (Em or Eav)	Value below which the average illuminance on the specified area should not fall. It is the average illuminance at the time during which maintenance should be carried out. Unit: Lx (Lux) or lm/m2
Luminous Intensity (I in cd)	A measure of how bright a light source is in a specific direction.
Obtrusive / Nuisance Light	Light, outside the area to be lit, which, because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information, e.g. at signal lights.

6.2 ABBREVIATIONS

Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
CIBSE	Chartered Institution of Building Services Engineers
CIHT	Chartered Institute of Highways and Transportation
CMS	Central Management System
CRI	Colour Rendering Index
CSS	County Surveyor's Society
NYC	North Yorkshire Council
IDA	International Dark Skies Association
IDSR	International Dark Skies Reserve
ILP	Institution of Lighting Professionals
LED	Light Emitting Diode
PIR	Passive Infrared
PECU	Photo Electronic Cell Unit

Appendix A

DRAWING ZG-EOG-CLTN-PA-07



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KEY:

PLANNING APPLICATION BOUNDARY

CUT BATTER

FILL BATTER

PERIMETER CONTAINMENT DITCH

SECURITY FENCING

LIGHTING DETAILS:

LXFL20WBV2 (1 X 20W / 1613 ml)

DRILLING RIG 300W LED FLOODLIGHT

DRILLING RIG 212W HIGH BAY FLOODLIGHT

DRILLING RIG 75W LINEAR LED

MOBILE LIGHTING TOWER 4 X 300W LED (OR SIMILAR SPECIFICATION)

ABBREVIATIONS:

HPU: HYDRAULIC POWER UNIT
V-DOOR: RAMP FROM CATWALK TO RIG FLOOR

NOTES:

CROSS-SECTION VIEW DETAILS INDICATED BY THE DIRECTION THE ARROWS ARE FACING, FROM POINT 'A' TO POINT 'A', AS SHOWN BELOW:

'A' 'A'

FOR SECTION DETAILS, REFER TO PLAN NO: ZG-EOG-CLTN-PA-08

REVISION HISTORY				
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
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0	OCT24	JF	FIRST ISSUE	JF
REV	DATE	BY	DETAILS	APR

ZETLAND GROUP
FROM CONCEPTION TO COMPLETION

ZETLAND GROUP LIMITED
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SITE: CLOUGHTON WELLSITE, BURNISTON, NORTH YORKSHIRE

PROJECT: APPLICATION FOR PLANNING PERMISSION

TITLE: SITE LAYOUT PLAN - INDICATIVE DRILLING PHASE

CLIENT: EUROPA OIL & GAS LIMITED

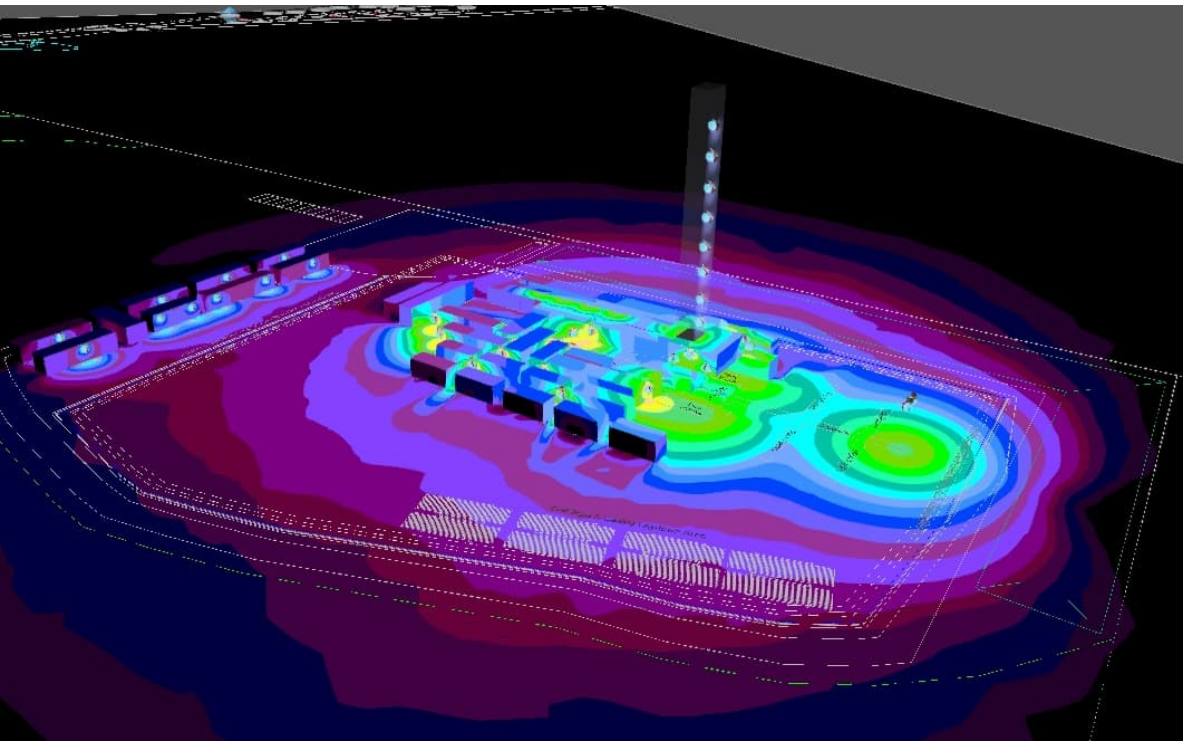
Scale:	1:500
Size:	A3
Sheet:	1 of 1

DWG. No: ZG-EOG-CLTN-PA-07

Appendix B

DIALUX LIGHTING SIMULATION MODEL

Date 21/01/2025



Burniston Mill - Drilling Phase Obtrusive Light Calculation

Luminous Intensity calculations to identified sensitive receptors

Preface

Notes on planning:

The energy consumption quantities do not take into account light scenes and their dimming levels.

Table of Contents

Product data sheets

Burniston Mill

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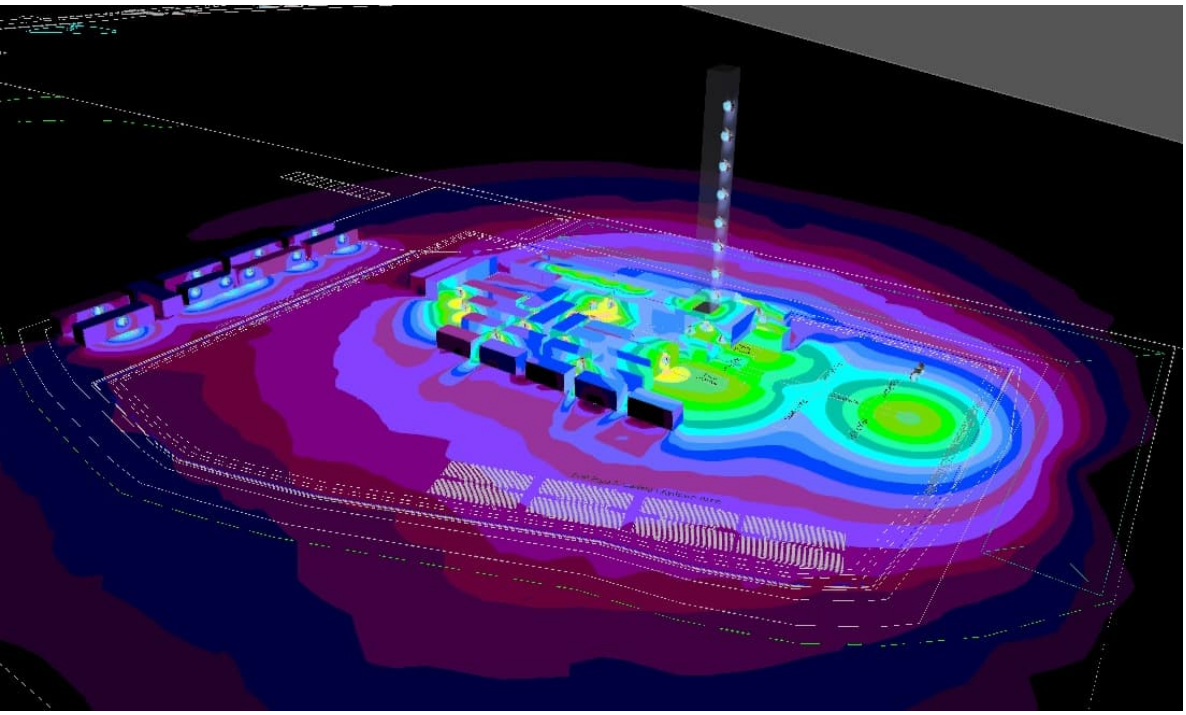

Description

Calculations performed to determione compliance with ILP GN01/21 (CIE150:2017) Environmental Zone E2.

Identified Parameters for an E2 Zone applicable to teh site and immediate surrounidng area have been identified as Table 4 - Luminous Intensity (I in cd) and Table 6 - Maximum values of Upward Light Ratio (ULR%)

Target Values

Luminous Intensity = 7,500 precurfew
500 post curfew

Upward Light Ratio = 2.5%

Refer ot contents of this report for full results

Associate
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Luminaire list

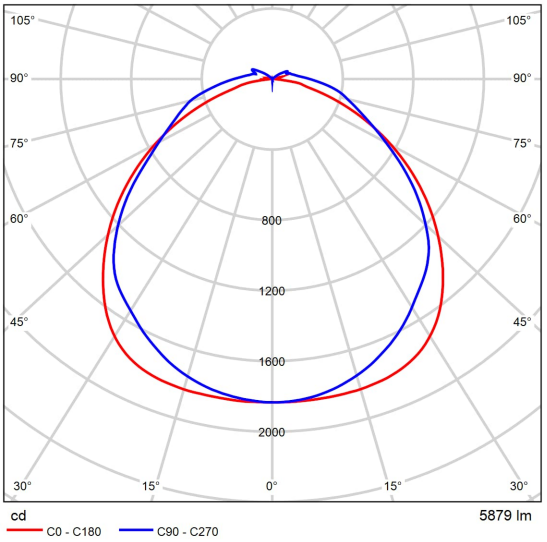
Φ_{total}	P_{total}	Luminous efficacy
626780 lm	6617.5 W	94.7 lm/W

pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy
15	Appleton	FELED7NB USAD	ATX FELED LINEAR 7k LUMEN NEMA TYPE V 4000 K CCT	73.1 W	5879 lm	80.4 lm/W
5	Dialight	HEA9RC4P NKCG	Safesite LED High Bay 23000 Lumens, Wide Distribution, Tempered Glass Lens	212.5 W	23861 lm	112.3 lm/W
15	Deta Electrical			291.9 W	27286 lm	93.5 lm/W
10	Thorn Lighting	96636107	ESCORT 1000-840 HF [STD]	8.0 W	1000 lm	125.0 lm/W

Product data sheet

Appleton - ATX FELED LINEAR 7k LUMEN NEMA TYPE V 4000 K CCT

Article No.	FELED7NBUSAD
P	73.1 W
Φ_{Lamp}	–
$\Phi_{Luminaire}$	5879 lm
η	–
Luminous efficacy	80.4 lm/W
CCT	3783 K
CRI	80



Polar LDC

ATX FELED Series Nonmetallic LED Explosionproof Luminaires
Ceiling/ Pendant Mount

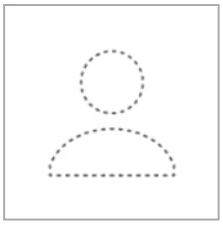
4000 K CCT/ 80 CRI
Pendant/Ceiling Mount
BU:-120-277 Vac, 50/60Hz, 170-300 Vdc,
BD:-100-240 Vac 50/60 Hz
3/4" NPT Hub
Clear polycarbonate cover

Zone 1 and 2
Zone 21 & 22
Ex. II 2 GD
IP 66 IK 10

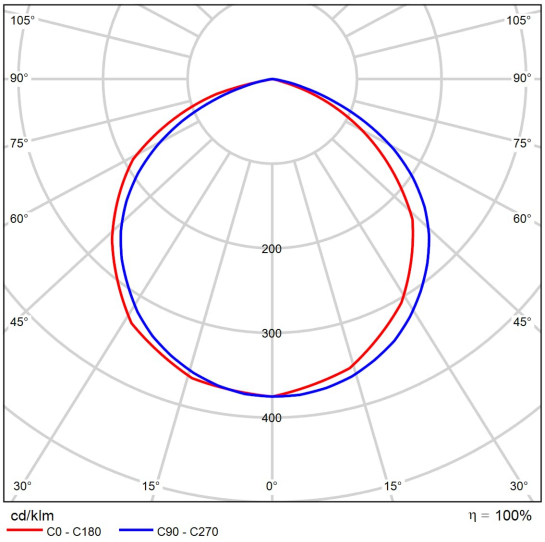
Refer to catalog for additional options

Product data sheet

Deta Electrical -



P	291.9 W
Φ_{Lamp}	27259 lm
$\Phi_{Luminaire}$	27286 lm
η	100.10 %
Luminous efficacy	93.5 lm/W
CCT	3000 K
CRI	100

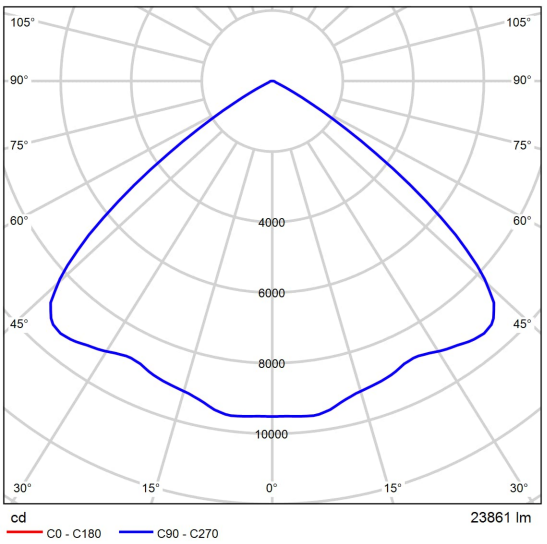


Polar LDC

Product data sheet

Dialight - Safesite LED High Bay 23000 Lumens, Wide Distribution, Tempered Glass Lens

Article No.	HEA9RC4PNKCG
P	212.5 W
Φ_{Lamp}	–
$\Phi_{Luminaire}$	23861 lm
η	–
Luminous efficacy	112.3 lm/W
CCT	3000 K
CRI	100



Polar LDC

Product data sheet

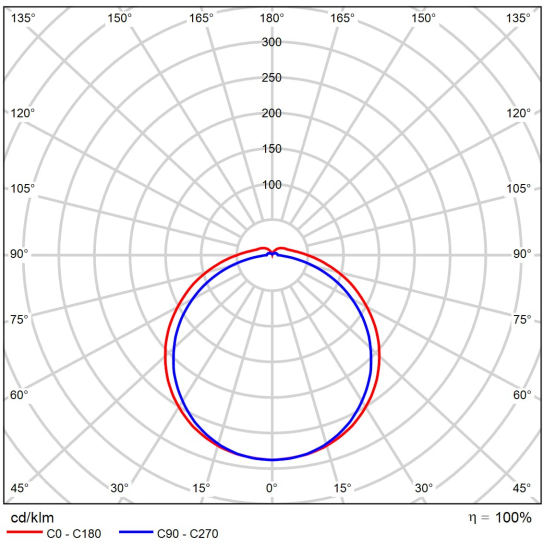
Thorn Lighting - ESCORT 1000-840 HF [STD]

Article No.	96636107
P	8.0 W
Φ_{Lamp}	1000 lm
$\Phi_{Luminaire}$	1000 lm
η	100.00 %
Luminous efficacy	125.0 lm/W
CCT	4000 K
CRI	80

A self-contained, IP65, weatherproof bulkhead luminaire. Electronic, fixed output control gear. Durable, white, stove enamelled die-cast aluminium body and opal polycarbonate diffuser with vandal resistant screw fixings (Type T25 TORX screwdriver required). Suitable for interior and exterior industrial or public amenity usage.
Complete with 4000K LED

ambient temperature: 0°C to +25°C

Dimensions: 352 x 102 x 79 mm
Luminaire input power: 7.8 W
Luminaire luminous flux: 1000 lm
Luminaire efficacy: 128 lm/W
Weight: 1 kg



Polar LDC

Glare evaluation according to RUG

ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	18.1	19.4	18.5	19.8	20.2	17.9	19.3	18.3	19.6	20.0
	3H	19.8	21.0	20.3	21.4	21.9	19.4	20.6	19.8	21.0	21.4
	4H	20.6	21.7	21.1	22.2	22.6	19.9	21.0	20.4	21.5	21.9
	6H	21.3	22.3	21.8	22.8	23.3	20.2	21.3	20.7	21.8	22.2
	8H	21.6	22.6	22.1	23.1	23.6	20.3	21.3	20.8	21.8	22.3
	12H	21.9	22.9	22.4	23.3	23.8	20.4	21.3	20.9	21.8	22.3
4H	2H	18.7	19.8	19.2	20.3	20.7	18.6	19.7	19.0	20.1	20.6
	3H	20.6	21.6	21.1	22.0	22.6	20.2	21.2	20.7	21.6	22.1
	4H	21.5	22.4	22.0	22.9	23.4	20.8	21.7	21.4	22.2	22.8
	6H	22.4	23.2	22.9	23.7	24.3	21.3	22.1	21.8	22.6	23.2
	8H	22.8	23.5	23.3	24.0	24.6	21.4	22.1	22.0	22.7	23.3
	12H	23.1	23.8	23.7	24.4	25.0	21.5	22.2	22.1	22.7	23.3
8H	4H	21.8	22.5	22.3	23.0	23.6	21.2	21.9	21.7	22.4	23.0
	6H	22.8	23.4	23.4	24.0	24.6	21.8	22.4	22.4	23.0	23.6
	8H	23.4	23.9	24.0	24.5	25.1	22.0	22.5	22.6	23.1	23.8
	12H	23.9	24.3	24.5	24.9	25.6	22.2	22.6	22.8	23.2	23.9
12H	4H	21.8	22.5	22.4	23.0	23.6	21.2	21.9	21.8	22.4	23.1
	6H	22.9	23.4	23.5	24.0	24.7	21.9	22.4	22.5	23.0	23.7
	8H	23.5	23.9	24.1	24.5	25.2	22.2	22.6	22.8	23.3	23.9
Variation of the observer position for the luminaire distances S											
S = 1.0H S = 1.5H S = 2.0H		+0.1 / -0.1 +0.2 / -0.3 +0.4 / -0.5					+0.1 / -0.1 +0.2 / -0.3 +0.4 / -0.6				
Standard table		BK07					BK05				
Correction summand		6.8					4.8				
Corrected glare indices referring to 1000lm Total luminous flux											

RUG diagram (SHR: 0.25)

Burniston Mill (Obtrusive light scene)

Summary

Burniston Mill (Obtrusive light scene)

Summary

General obtrusive light scene results

R_{UL}	1.7 %
R_{DLO}	98.4 %
R_{ULO}	1.7 %

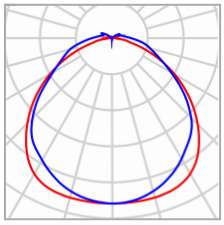
For the calculation of the flux ratios, only the luminaires in the obtrusive light scene are taken into account.

Burniston Mill

Luminaire layout plan

Burniston Mill

Luminaire layout plan



Manufacturer	Appleton	P	73.1 W
Article No.	FELED7NBUSAD	$\Phi_{Luminaire}$	5879 lm
Article name	ATX FELED LINEAR 7k LUMEN NEMA TYPE V 4000 K CCT		
Fitting	1x LED		

Individual luminaires

X	Y	Mounting height	Luminaire
510.000 m	519.300 m	4.645 m	3
504.700 m	515.200 m	4.645 m	6
499.200 m	513.700 m	4.645 m	7
512.200 m	511.517 m	9.703 m	8
512.300 m	511.517 m	12.703 m	9
512.400 m	511.517 m	16.303 m	10
512.500 m	511.517 m	19.503 m	11
512.800 m	511.517 m	23.203 m	12
513.000 m	511.517 m	26.803 m	13
513.100 m	511.517 m	30.503 m	14
513.300 m	511.517 m	34.103 m	15
491.800 m	507.900 m	4.645 m	18
488.200 m	505.000 m	4.645 m	20

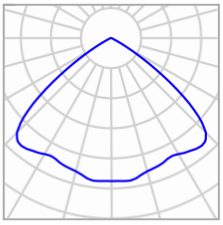
Burniston Mill

Luminaire layout plan

X	Y	Mounting height	Luminaire
484.606 m	502.144 m	4.645 m	23
481.199 m	499.550 m	4.645 m	25

Burniston Mill

Luminaire layout plan



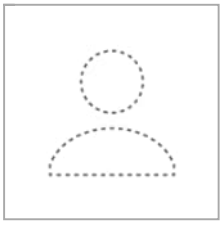
Manufacturer	Dialight	P	212.5 W
Article No.	HEA9RC4PNKCG	$\Phi_{Luminaire}$	23861 lm
Article name	Safesite LED High Bay 23000 Lumens, Wide Distribution, Tempered Glass Lens		
Fitting	1x HEA9RC4PNKCG_Safesite LED High Bay 212.5W 23860.29lm		

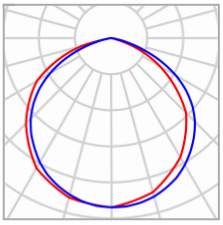
Individual luminaires

X	Y	Mounting height	Luminaire
512.628 m	517.052 m	7.200 m	4
507.698 m	516.376 m	7.200 m	5
518.642 m	509.433 m	7.200 m	16
514.498 m	508.972 m	7.200 m	17
515.218 m	506.763 m	7.200 m	19

Burniston Mill

Luminaire layout plan





Manufacturer	Deta Electrical	P	291.9 W
Fitting	1x 300w	$\Phi_{Luminaire}$	27286 lm

Individual luminaires

X	Y	Mounting height	Luminaire
531.674 m	528.143 m	6.800 m	1
532.494 m	527.095 m	6.800 m	2
512.767 m	504.360 m	2.600 m	21
494.619 m	503.113 m	2.600 m	22
494.616 m	500.515 m	2.600 m	24
499.691 m	498.883 m	2.600 m	26
497.088 m	497.132 m	2.600 m	27
510.828 m	493.977 m	2.600 m	28
504.200 m	493.600 m	2.600 m	29
490.586 m	491.942 m	2.600 m	30
495.738 m	491.815 m	2.600 m	31
497.800 m	489.500 m	2.600 m	32
499.748 m	485.195 m	2.600 m	33

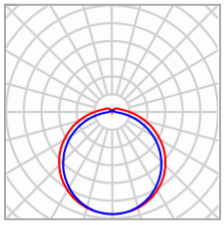
Burniston Mill

Luminaire layout plan

X	Y	Mounting height	Luminaire
483.797 m	483.028 m	2.600 m	34
489.103 m	482.814 m	2.600 m	35

Burniston Mill

Luminaire layout plan



Manufacturer	Thorn Lighting	P	8.0 W
Article No.	96636107	$\Phi_{Luminaire}$	1000 lm
Article name	ESCORT 1000-840 HF [STD]		
Fitting	1x LED 8 W		

Individual luminaires

X	Y	Mounting height	Luminaire
455.265 m	467.561 m	2.400 m	36
451.097 m	463.156 m	2.400 m	37
461.120 m	460.120 m	2.400 m	38
458.128 m	454.207 m	2.400 m	39
466.657 m	453.078 m	2.400 m	40
469.306 m	449.709 m	2.400 m	41
472.452 m	445.724 m	2.400 m	42
465.122 m	445.323 m	2.400 m	43
480.264 m	437.074 m	2.400 m	44
475.541 m	433.376 m	2.400 m	45

Burniston Mill

Luminaire list

Φ_{total}	P_{total}	Luminous efficacy
626780 lm	6617.5 W	94.7 lm/W

pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy
15	Appleton	FELED7NB USAD	ATX FELED LINEAR 7k LUMEN NEMA TYPE V 4000 K CCT	73.1 W	5879 lm	80.4 lm/W
5	Dialight	HEA9RC4P NKCG	Safesite LED High Bay 23000 Lumens, Wide Distribution, Tempered Glass Lens	212.5 W	23861 lm	112.3 lm/W
15	Deta Electrical			291.9 W	27286 lm	93.5 lm/W
10	Thorn Lighting	96636107	ESCORT 1000-840 HF [STD]	8.0 W	1000 lm	125.0 lm/W

Burniston Mill (Obtrusive light scene)

Calculation objects

Burniston Mill (Obtrusive light scene)

Calculation objects

Surface result objects

Properties	Ø	min	max	U_o (g_1)	g_2	Index
Surface result object 1 Perpendicular illuminance (adaptive) Height: 37.948 m	0.00 lx	0.00 lx	0.00 lx	-	-	RS1
Surface result object 1 Luminance Height: 37.948 m	0.00 cd/m²	0.00 cd/m²	0.00 cd/m²	-	-	RS1

Burniston Mill (Obtrusive light scene)

Calculation objects

Calculation points

Properties	Calculated	Index
SR1 - Gleniffer Luminous intensity Height: 1.800 m	1307 cd	OP1
SR2 - Meadowside Luminous intensity Height: 1.800 m	1339 cd	OP2
SR3 - Belmont Luminous intensity Height: 1.800 m	1353 cd	OP3
SR4 - Meadowburn Luminous intensity Height: 1.800 m	1365 cd	OP4
SR5 - Beckside Luminous intensity Height: 1.800 m	1381 cd	OP5
SR6 - Janian Luminous intensity Height: 1.800 m	1404 cd	OP6
SR8 - Magpie Luminous intensity Height: 1.800 m	1429 cd	OP7
SR7 - Riskato Luminous intensity Height: 3.500 m	1379 cd	OP8
SR9 - Kingfisher Luminous intensity Height: 1.800 m	1453 cd	OP9
SR10 - Flats Farm Luminous intensity Height: 1.800 m	1435 cd	OP10
SR11 - Wayside Farm Luminous intensity Height: 1.800 m	40.6 cd	OP11

Burniston Mill (Obtrusive light scene)

Calculation objects

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Notes on planning:
All values take the initial flux (MF = 1) into account. The k_S value was calculated without any special treatment of small spatial angles.

Glossary

A

A	Formula symbol for a surface in the geometry

B

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

C

CCT	(Engl. correlated colour temperature) Body temperature of a thermal radiator which serves to describe its light colour. Unit: Kelvin [K]. The lesser the numerical value the redder; the greater the numerical value the bluer the light colour. The colour temperature of gas-discharge lamps and semi-conductors are termed "correlated colour temperature" in contrast to the colour temperature of thermal radiators. Allocation of the light colours to the colour temperature ranges acc. to EN 12464-1: Light colour - colour temperature [K] warm white (ww) < 3,300 K neutral white (nw) ≥ 3,300 – 5,300 K daylight white (dw) > 5,300 K
Clearance height	The designation for the distance between upper edge of the floor and bottom edge of the ceiling (in the completely furnished status of room).
Control group	A group of luminaires that are dimmed and controlled together. For each lighting scene, a control group provides its own dimming value. All luminaires within a control group share this dimming value. The control groups with their luminaires are automatically determined by DIALux on the basis of the created light scenes and their luminaire groups.
CRI	(Engl. colour rendering index) Designation for the colour rendering index of a luminaire or a lamp acc. to DIN 6169: 1976 or CIE 13.3: 1995. The general colour rendering index Ra (or CRI) is a dimensionless figure that describes the quality of a white light source in regards to its similarity with the remission spectra of defined 8 test colours (see DIN 6169 or CIE 1974) to a reference light source.

Glossary

D

Daylight autonomy	Describes what percentage of the daily working time the required illuminance is met by daylight. The nominal illuminance is used from the room profile, unlike described in EN 17037. The calculation is not done in the centre of the room but at the placed sensor measuring point. A room is considered sufficiently supplied with daylight if it achieves at least 50% daylight autonomy.
Daylight factor	Ratio of the illuminance achieved solely by daylight incidence at a point in the inside to the horizontal illuminance in the outer area under an unobstructed sky. Formula symbol: D (Engl. daylight factor) Unit: %
Daylight quotient effective area	A calculation surface within which the daylight quotient is calculated.

E

Energy evaluation	Based on an hourly calculation procedure for daylight in indoor spaces, considering the project geometry and any existing daylight control systems. Orientation and location of the project are also considered. The calculation uses the specified system power of the luminaires to determine the energy demand. A linear relationship between power and luminous flux in the dimmed state is assumed for daylight-controlled luminaires. Times of use and nominal illuminance are determined from the usage profiles of the spaces. Switched-on luminaires that are explicitly excluded from control also consider the specified times-of-use. The daylight control systems use a simplified control logic that closes them at an outdoor horizontal illuminance of 27,500lx. The calendar year 2022 is used as a reference only. It is not a simulation of this year. The reference year is only used to assign the days of the week to the calculated results. The changeover to summer time is not considered. The reference sky type used is the average sky described in CIE 110 without direct sunlight. The method was developed together with the Fraunhofer Institute for Building Physics and is available for review by the Joint Working Group 1 ISO TC 274 as an extension of the previous annual regression-based method.
Environmental zones	The assessment of intrusive light and light immission depends on the environment of the lighting installation. Depending on the standard, 4-6 different zones are defined, ranging from highly protected areas in natural settings to urban areas, commercial zones, and industrial zones.
Eta (η)	(light output ratio) The light output ratio describes what percentage of the luminous flux of a free radiating lamp (or LED module) is emitted by the luminaire when installed. Unit: %

Glossary

G

g_1	Often also U_o (Engl. overall uniformity) Designates the overall uniformity of the illuminance on a surface. It is the quotient from E_{min} to $\bar{E}$ and is required, for instance, in standards for illumination of workstations.
g_2	Actually it designates the "non-uniformity" of the illuminance on a surface. It is the quotient of E_{min} to E_{max} and is generally only relevant for certifying the emergency lighting acc. to EN 1838.

I

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

K

k_S	The glare effect of a light source can be described by the glare metric k_S. It relates the solid angle of the glaring light source as seen from the point of immission, the ambient luminance, and the maximum allowable luminance.

Glossary

L

LENI	(Engl. lighting energy numeric indicator) Lighting energy numeric indicator acc. to EN 15193 Unit: kWh/(m^2 * a)
LLMF	(Engl. lamp lumen maintenance factor)/acc. to CIE 97: 2005 Lamp flux maintenance factor that takes the luminous flux reduction into account of a luminaire or an LED module in the course of the operating time. The lamp flux maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no luminous flux reduction existing).
LMF	(Engl. luminaire maintenance factor)/acc. to CIE 97: 2005 Luminaire maintenance factor that takes the soiling into account of the luminaire in the course of the operating time. The luminaire maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).
LSF	(Engl. lamp survival factor)/acc. to CIE 97: 2005 Lamp survival factor that takes the total failure into account of a luminaire in the course of the operating time. The lamp survival factor is specified as a decimal digit and can have a maximum value of 1 (no failures existing within the time concerned or prompt replacement after the failure).
Luminance	Dimension for the "brightness impression" that the human eye has of a surface. The surface itself can emit light thereby or light striking it can be reflected (emitter value). It is the only photometric value that the human eye can perceive. Unit: Candela per square metre Abbreviation: cd/m^2 Formula symbol: L
Luminous efficacy	Ratio of the emitted luminous flux Φ [lm] to the absorbed electrical power P [W] Unit: lm/W. This ratio can be formed for the lamp or LED module (lamp or module light output), the lamp or module with control gear (system light output) and the complete luminaire (luminaire light output).
Luminous flux	Dimension for the total light output that is emitted from one light source in all directions. It is thus an "emitter value" that specifies the entire emitting output. The luminous flux of a light source can only be determined in a laboratory. A difference is made between the lamp or LED module luminous flux and the luminaire luminous flux. Unit: Lumen Abbreviation: lm Formula symbol: Φ

Glossary

Luminous intensity	Describes the intensity of the light in a certain direction (emitter value). The luminous intensity is a matter of the luminous flux Φ that is emitted in a certain spherical angle Ω. The radiation characteristics of a light source are presented graphically in a light distribution curve (LDC). The luminous intensity is an SI base unit. Unit: Candela Abbreviation: cd Formula symbol: I

M

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

O

Obtrusive light/Light immission	To protect the nocturnal environment and minimize problems for humans, flora, and fauna, it is necessary to limit obtrusive light (also known as light pollution), which can cause serious physiological and ecological issues for individuals and the environment. Light immission refers to the disturbing influence of emitted light from artificial light sources.
Operating times	The assessment of obtrusive light and light immission depends on the operating times of the lighting installation. Depending on the standard, 1-3 different operating times are specified. In the absence of specific details, an operating time between 06:00 and 22:00 can be assumed.

P

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

Glossary

R

$R_{(UG)}$ max	Measure of the psychological glare in indoor spaces. In addition to the luminance of luminaires, the level of the $R_{(UG)}$ value also depends on the observer position, the viewing direction and the ambient luminance. The calculation is made according to the table method, see CIE 117. Among other things, EN 12464-1:2021 specifies maximum permissible $R_{(UG)}$- values $R_{(UGL)}$ for various indoor workplaces.
R_{DLO}	The ratio of the luminous flux emitted below the horizontal plane to the total lamp luminous flux of a luminaire or lighting installation in its operational position.
R_G	The glare directly caused by luminaires of an outdoor lighting installation is determined using the CIE Glare Rating (RG) method. To calculate this, the equivalent veiling luminance of the surroundings is needed. There are four options for determining this: • An exact calculation according to CIE 112, based on the scene area. • A simplified method according to EN 12464-2, based on the scene area. • Using a custom calculation area to determine the equivalent veiling luminance. • Specifying a fixed value for easy comparability.
R_{UF}	upward flux ratio The ratio of the luminous flux emitted directly or reflected above the horizontal plane to the luminous flux that cannot be avoided under ideal conditions to achieve the illuminance level on a deliberately illuminated area.
R_{UL}	upward light ratio The ratio of the luminous flux emitted above the horizontal plane to the luminous flux of a luminaire or lighting installation in its operational position. The luminaire efficiency is considered in this calculation.
R_{ULO}	upward light output ratio The ratio of the luminous flux emitted above the horizontal plane to the total lamp luminous flux of a luminaire or lighting installation in its operational position.
Reflection factor	The reflection factor of a surface describes how much of the striking light is reflected back. The reflection factor is defined by the colour of the surface.
RMF	(Engl. room maintenance factor)/acc. to CIE 97: 2005 Room maintenance factor that takes the soiling into account of the space encompassing surfaces in the course of the operating time. The room maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).
RUG (max)	(unified glare rating) Measure for the psychological glare effect in interiors. In addition to luminaire luminance, the RUG value also depends on the position of the observer, the viewing direction and the ambient luminance. Among other things, EN 12464-1 specifies maximum permissible RUG values for various indoor workplaces.

Glossary

RUG observer	Calculation point in the room, for the DIALux the RUG value is determined. The location and height of the calculation point should correspond to the typical observer position (position and eye level of the user).

S

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

V

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

W

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

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