

The Lighthouse Green Fuels Order

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Applicant: LGF Projects Limited

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Abbreviations

Abbreviation	In full
BS	British Standard
CCTV	Closed-circuit television
CDM	Construction (Design and Management) Regulations 2015
CHP	Combined Heat and Power
CIBSE	Chartered Institute of Building Services Engineers
CIE	Commission Internationale de L'Eclairage
CLO	Constant Light Output
CRI	Colour Rendering Index
CSU	Continuous Ship Unloaders
DCO	Development Consent Order
EPC	Engineering, Procurement and Construction
ES	Environmental Statement
EZ	Environmental Zone
FEED	Front End Engineering Design
FOAK	First-of-a-Kind
GN	Guidance Note
GR	Glare Rating
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
ILP	Institute of Lighting Professionals
LED	Light-Emitting Diode
LGF	Lighthouse Green Fuels
LWS	Local Wildlife Site
m	Metres
NNR	National Nature Reserve
PLG	Professional Lighting Guide
RCBC	Redcar and Cleveland Borough Council
SAF	Sustainable Aviation Fuel
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STBC	Stockton-on-Tees Borough Council
ULR	Upward Light Ratio

1 Introduction

1.1 Overview

- 1.1.1 **This Framework Lighting Strategy (ES Appendix 13C, ES Volume III, Application Document Ref. 6.3)** has been prepared by Ove Arup & Partners Ltd. on behalf of LGF Projects Limited (the Applicant), to support an application (the Application) seeking development consent for the construction, operation, maintenance and decommissioning of the Lighthouse Green Fuels project (the Proposed Development) on land within the administrative boundaries of Stockton-on-Tees Borough Council (STBC) and Redcar and Cleveland Borough Council (RCBC).
- 1.1.2 The Order limits for the Proposed Development are made up of the Main Site and Wider Site, together ‘the Site’. A more detailed description of the Site is set out at Section 1.4.
- 1.1.3 The Application has been submitted to the Planning Inspectorate (PINS), and the decision whether to grant a Development Consent Order (DCO) will be made by the Secretary of State (SoS) for Energy Security and Net Zero pursuant to the Planning Act 2008 (the PA 2008) [Ref 1].
- 1.1.4 The Proposed Development comprises a commercial-scale second generation Sustainable Aviation Fuel (SAF) production facility and associated infrastructure.

1.2 The Applicant

- 1.2.1 The Applicant is wholly owned by Alfanar Energy Limited (Alfanar). Alfanar is part of a global project development, manufacturing, and engineering group headquartered in Saudi Arabia. Alfanar has developed significant in-house feedstock-to-SAF expertise. This experience will be utilised to construct and operate the Proposed Development.

1.3 Overview of the Proposed Development

- 1.3.1 The Proposed Development is anticipated to be the UK’s first commercial-scale second generation SAF production facility.
- 1.3.2 The Proposed Development includes the construction, operation, maintenance and eventual decommissioning of a commercial-scale facility that will produce approximately 180 million litres of advanced SAF and approximately 30 million litres of renewable naphtha each year.
- 1.3.3 The Proposed Development includes the following elements (the location of each Work No. is shown on the **Works Plans (Application Document Ref. 2.4)**):

Table 2.1 Works description summaries

Work Number:	
Work No. 1	SAF production facility comprising: • 1A - feedstock pre-treatment facility • 1B - SAF processing facility including stack, flue gas treatment, and thermal oxidiser • 1C - up to two flare structures
Work No. 2	Combined heat and power generating station comprising: • 2A - boilers and steam turbine generators • 2B - stack and flue gas treatment
Work No. 3	Feedstock and intermediate and final product handling and storage
Work No. 4	Cooling infrastructure for SAF production facility and CHP plant
Work No. 5	Bridge and culvert crossings of existing infrastructure
Work No. 6	Marine infrastructure comprising: • 6A - construction of permanent quay • 6B - permanent quay • 6C - capital and maintenance dredging
Work No. 7	Electrical connection works comprising: • 7A - underground and overground cable connections to the existing North Bank Switchyard • 7B - electrical connection works
Work No. 8	Modified or new natural gas connection and above ground infrastructure
Work No. 9	Supply of industrial gases: Only one of Work No. 9A or Work No. 9B would be developed. • 9A - industrial gases connection works comprising upgrade of oxygen pipeline connection, new and repurposed nitrogen pipeline connection, and connection to existing low pressure nitrogen supply • 9B - air separation unit facility and connections to Work No. 1
Work No. 10	Replacement and new wastewater pipeline connection works
Works No. 11	Export connection works comprising: • 11A - pipeline(s) for the export of SAF and renewable naphtha • 11B or 11C - a pipeline for the export of carbon dioxide connecting to above ground infrastructure (AGI) by others (being either AGI C1 or C2 of the Northern Endurance Partnership transport and storage pipeline)
Works No. 12	Surface water attenuation, and drainage and discharge works
Works No. 13	Laydown areas comprising: • 13A - temporary construction compounds and laydown areas • 13B - permanent laydown and storage
Work No. 14	Access works and private street improvements

- 1.3.4 In addition, a range of associated development, both specified and unspecified, is proposed in relation to the above.
- 1.3.5 The new quay on the River Tees (**Work No. 6**) will allow delivery of modular plant and construction materials by ship during construction and biomass and waste wood feedstock during operation, reducing reliance on road transport. Feedstock will be stored (**Work No. 3**) then pre-treated at the Main Site and processed into SAF through gasification and gas-to-liquids processes (**Work No.1**).
- 1.3.6 To support operations, the Proposed Development will include a biomass and waste wood-fired CHP plant (**Work No. 2**) with an electrical output capacity of up to approximately 200 megawatts electrical (MWe), providing a low-carbon energy supply for the SAF process. Cooling infrastructure (**Work No. 4**) will be required for the SAF process and the CHP plant. Connections will provide electricity for start-up and to maintain ancillary site supplies (**Work No. 7**), natural gas for start-up and as auxiliary fuel for some processes during operation (**Work No. 8**), and oxygen and nitrogen which will either be delivered to the Site via pipelines or produced by a new Air Separation Unit (ASU) in the Main Site (**Work No. 9A or 9B** respectively). Waste materials, including off-specification materials will be exported from the Main Site by road. Finished products (SAF, and a secondary product of the process, renewable naphtha) will be transferred via pipelines (**Work No. 11A**) for marine export or export via road. Carbon dioxide from the acid gas removal unit in Work No. 1B will be exported via pipeline (**Work No. 11B**) to one of the above ground installations in the Northern Endurance Partnership project.
- 1.3.7 The Proposed Development will also include replacement and new wastewater pipeline connection works (**Work No. 10**), surface water drainage systems (**Work No. 12**) and access and street improvements (**Work No. 14**). Space within the Wider Site is identified for temporary construction and laydown and space within the Main Site identified for permanent laydown and storage areas (**Work No. 13**).
- 1.3.8 The layout of the Proposed Development is shown on **Figure 4.1: Indicative Proposed Development Layout (Environmental Statement (ES) Volume II, Document Ref. 6.2)**.
- 1.4 [The Site](#)
- 1.4.1 The Site location and boundary (which is also known as the 'Order limits') are shown on **Figure 1.1: Site Location (ES Volume II, Document Ref. 6.2)**. The Site is located in Teesside on land to the north and south of the River Tees with connection corridors crossing the Tees.

- 1.4.2 The Main Site is located in the industrial area of Seal Sands approximately 5km east of Billingham town centre and 4km north-east of Middlesbrough town centre, on the north bank of the River Tees in the borough of Stockton-on-Tees (see **Figure 1.1: Site Location (ES Volume II, Document Ref. 6.2)**). The majority of the Main Site lies south of Seal Sands Road and largely comprises previously developed land formerly used as a chemical plant from the early 1970s. It was last operated by INEOS Nitriles.
- 1.4.3 The Main Site comprises the main SAF facility development area of the Site, lying to the south and north sides of Seal Sands Road and bounded by the proposed quay in the River Tees, with the River Tees to the east.
- 1.4.4 The eastern boundary of the Main Site is formed by the River Tees, where existing jetties will be demolished and a new quay developed.
- 1.4.5 The Wider Site comprises the connection corridors, including land required for road access, pipelines (including under the River Tees), dredging near to the Main Site, and utility connections and construction laydown in both North Tees and (in the borough of Redcar and Cleveland) South Tees.

1.5 The DCO process

- 1.5.1 Part 3 of the Planning Act 2008 ('the PA 2008') defines which projects constitute a nationally significant infrastructure project (NSIP). Once classed as an NSIP, development consent (in the form of a Development Consent Order) is required under Part 4 of the PA 2008.
- 1.5.2 In legislative terms the Proposed Development comprises both a SAF production facility and a CHP generating station together with development associated with the SAF production facility and the CHP generating station.
- 1.5.3 The construction and operation of the main SAF production facility does not automatically fall within the definition of an NSIP. Therefore, on 12 August 2025, the Applicant formally requested a direction by the SoS for Energy Security and Net Zero ('SoS'), pursuant to section 35(1) of the PA 2008, that the following elements be treated as one for which development consent is required. The Section 35 direction request was made in respect of: a main gasification facility to process sustainably sourced biomass; feedstock pre-treatment, syngas clean-up apparatus; Fischer-Tropsch process units; refining units; feedstock, intermediates and finished product storage; quayside with ship loading/ offloading infrastructure; supporting infrastructure and utility connections (hereafter called the 'Specified Elements').
- 1.5.4 The SoS for Energy Security and Net Zero issued a direction under Section 35 of the PA 2008 [Ref 1] on 08 September 2025 to confirm that the Specified Elements of the Proposed Development, together with any

matters/ development associated with them, should be treated as development for which development consent under the PA 2008 is required.

- 1.5.5 The CHP plant (**Work No. 2**) surpasses the 50 Megawatt (MW) threshold for generating stations defined in Section 15 of the PA 2008 and is therefore a Nationally Significant Infrastructure Project (NSIP) in its own right.
- 1.5.6 An application for development consent for the Proposed Development has been submitted to PINS acting on behalf of the SoS. Subject to the Application being accepted, PINS will then examine it and make a recommendation to the SoS who will then decide whether to grant a DCO.
- 1.5.7 The application for development consent for the Proposed Development supersedes a previous application that was being progressed by Lighthouse Green Fuels Limited centred on a site off Huntsman Drive in Seal Sands, TS2 1TT (PINS ref. EN010150). Statutory consultation on that application took place between 16 May 2024 and 20 June 2024. As shown on the PINS websiteⁱ, that application is discontinued.

1.6 The purpose and structure of this document

- 1.6.1 This Framework Lighting Strategy sets out the approach to the design and management of lighting during the construction and operation of the Main Site. It aims to balance safety, functionality and environmental considerations while mitigating potential impacts on the surrounding environment. Appropriate reference has been made to the Institute of Lighting Professionals Guidance Note for the Reduction of Obtrusive Light [Ref 3] to minimise potential adverse impacts on sensitive receptors, including local residents and biodiversity in nationally and internationally designated sites.
- 1.6.2 At the time of preparation of the Framework Lighting Strategy, a number of the design aspects and features of the Proposed Development cannot be confirmed until the detailed design of the Proposed Development has been completed (anticipated to be post-consent). As such, the building sizes and orientation may vary, depending on the Applicant's Engineering, Procurement and Construction (EPC) Contractor(s) (the 'EPC Contractor(s)') selected and their specific configuration and selection of plant and equipment. Therefore, it is important that the consent retains some flexibility to allow for changing economic conditions and the advancement of SAF production technology in the period between preparing the application and starting construction. As such this Framework Lighting Strategy provides design principles and indicative lighting

ⁱ <https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010150>

proposals for construction and operation, which will be further refined by the EPC Contractor(s) during detailed design.

- 1.6.3 A detailed Lighting Strategy will be developed by the EPC Contractor(s) prior to the commencement of the construction and operational phases of the Proposed Development. The detailed Lighting Strategy will be substantially in accordance with the principles set out in this Framework Lighting Strategy and will be secured by a Requirement in Schedule 2 of the **draft DCO (Application Document Ref. 3.1)**.
- 1.6.4 The purpose of this Framework Lighting Strategy are to:
- identify the requirements of relevant guidance and standards (Section 1.7);
 - identify design principles that will guide the detailed design and construction phase of the Proposed Development (Section 2);
 - provide an overview of the existing baseline conditions within the Order Limits (Section 3);
 - identify relevant light sensitive receptors with recommendations provided from the project ecologist (Section 3); and
 - provide technical and environmental recommendations for lighting during construction and operation of the Proposed Development (Section 4 and Section 5).

1.7 [Legislative framework, policy and guidance](#)

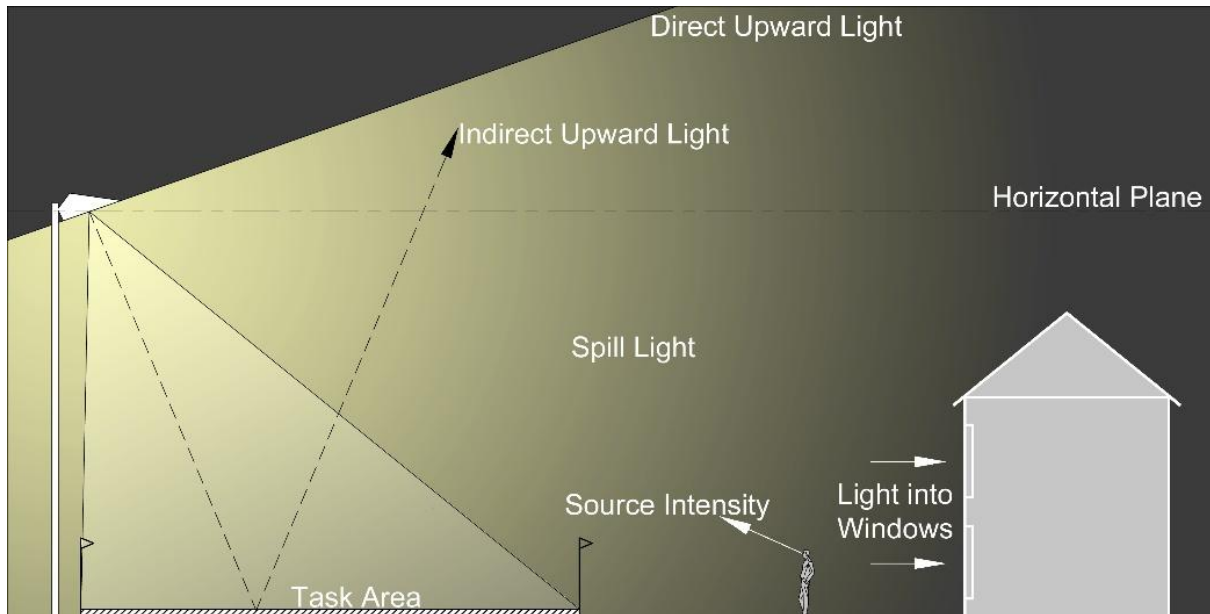
- 1.7.1 The following legislation has informed the assessment of effects within this report:
- The Environmental Protection Act 1990 (Part III Statutory Nuisances and Clean Air, Section 79 of statutory nuisances and inspections), gives local authorities the power to consider obtrusive artificial light as a statutory nuisance [Ref 2].
- 1.7.2 The following guidance has informed the assessment of effects within this report:
- Institute of Lighting Professionals (ILP) Guidance Note GN01 (2021): The Reduction of Obtrusive Light [Ref 3];
 - ILP Guidance Note GN08 (2023): Bats and artificial lighting in the UK; Bats and the Built Environment series [Ref 4];
 - ILP Professional Lighting Guide PLG04 (2013): Guidance on Undertaking Environmental Lighting Impact Assessments [Ref 5];

- ILP Technical Report 12 (TR12): Lighting of Pedestrian Crossings (2007) [Ref 6];
- Commission Internationale de L'Eclairage (CIE) 150: Guide on the limitation of the effects of light obtrusion from Outdoor Lighting Installations (2017) [Ref 7];
- CIE 126: Guidelines for Minimising Sky Glow (1997) [Ref 8];
- CIE 136: Guide to the Lighting of Urban Areas (2000) [Ref 9];
- Chartered Institute of Building Services Engineers (CIBSE) LG6: The Exterior Environment (2016) [Ref 10];
- Chartered Institute of Building Services Engineers (CIBSE) LG21: Protecting the night-time environment (2021) [Ref 11];
- BS EN 12464 Part 2: Outdoor Lighting (2024) [Ref 12]; and
- BS 5489-1 (2020), Design of road lighting Part 1: Lighting of roads and public amenity areas [Ref 13].

2 Design principles and impact avoidance measures

2.1 Obtrusive light

- 2.1.1 Obtrusive light, often called light pollution, is unwanted artificial light that spills beyond the intended area, causing annoyance, ecological disruption and / or safety hazards. It includes sky glow, light trespass and glare [Ref 14].
- 2.1.2 Obtrusive light effects can be mitigated through lighting design principles and adherence to current best practice design guidance from national and international professional lighting institutions (as outlined Section 1.7).
- 2.1.3 Inset 2.1 illustrates the characteristics of obtrusive light which require assessment and potential mitigation. The characteristics of obtrusive light are described as follows:
- **Light Intrusion:** stray light beyond the task area onto neighbouring dwellings or sensitive receptors. Units: illuminance (Ev), measured in lux;
 - **Source Intensity:** how bright the light source appears to an observer. Units, Intensity (I), measured in candelas (cd);
 - **Sky Glow:** a combination of Direct Upward Light and Indirect Upward Light. This effect is often seen as an artificial glow above towns/cities in the night sky. The sky glow is quantified in the guidance notes by the percentage of the luminaire output emitted above the horizontal plane;
 - **Building or Signage Luminance:** how bright an illuminated façade or sign/advert appears to the observer. Units: Luminance (L) measured in cd/m^2 ; and
 - **Threshold Increment:** this is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation experienced by road users. Expressed as a percentage.



Inset 2.1 Characteristics of obtrusive light

2.1.4 Consequences often associated with light obtrusion are the loss of dark night skies and views of the stars, perception of an unsatisfactory nocturnal environment and the harming of wildlife habitats and ecosystems. Light obtrusion has also been shown to have detrimental effects on human health and can present serious physiological and ecological problems. Light obtrusion manifests itself as unnecessary energy waste and therefore a contributor to climate change.

2.1.5 Appropriate threshold limits for lighting are defined in ILP GN01 [Ref 3], termed environmental zones. These define the typical nocturnal character of the external environment in five categories, from intrinsically dark (such as dark sky reserves) to national parks, villages, suburbia, and city centres. Given the variation of existing activity across the Proposed Development, it is considered that two environmental zones can be observed. Further detail is provided in Section 3.6.

2.2 Construction lighting criteria

2.2.1 Table 2.1 outlines the construction lighting recommendations for exterior building compounds for various areas, tasks and activities during the construction phase. These will need to be considered as part of the design of the construction phase lighting.

Table 2.1 General lighting requirements for construction lighting (BS EN 12464 Part 2:2024 – Table 13 [Ref 12])

Type of area, task or activity	Illuminance Em (lux)	Uniformity Uo	Glare GR	CRI Ra
Walkways for pedestrians	5	0.20	50	70
Slow moving vehicle routes (max, 10km/h) such as trucks and excavators	10	0.40	50	70
Vehicle parking areas	10	0.25	50	70
Short-term handling of raw materials, large units, loading and unloading of solid bulk goods	20-30	0.25	55	70
Short-term handling of large units in wharf/dock areas	20-30	0.25	55	40
General lighting of quayside area, storage for prefabricated goods	20-30	0.25	55	40
Vehicle turning, loading and unloading points	50	0.40	50	70
Clearance, excavation and loading	20	0.25	55	70
Construction areas, drainage mounting, transport, auxiliary and storage tasks	50 -75	0.40	50	70
Framework element mounting, light reinforcement work, wooden mould and framework mounting, electric piping and cabling	100-150	0.40	45	70
Element jointing, demanding electrical, machine and pipe mounting	200-300	0.50	45	70

2.3 Operational lighting criteria

2.3.1 Table 2.2 outlines the operational lighting criteria to be considered as part of the Detailed Lighting Strategy.

Table 2.2 Operational lighting criteria

Type of area, task or activity	Illuminance Em (lux)	Uniformity Uo	Glare GR	CRI Ra	Standard
Walkways for pedestrians	5	0.20	50	70	BS EN 12464-2:2014 General Requirements (Table 7)
Traffic areas for slowly moving vehicles (max. 10km/h) such as bicycles and trucks	10	0.40	50	70	BS EN 12464-2:2014 General Requirements (Table 7)
Regular vehicle traffic (max. 40km/h)	20	0.20	45	70	BS EN 12464-2:2024 General Requirements (Table 7)
Loading/Unloading points and vehicle turning	50	0.40	50	70	BS EN 12464-2:2024 General Requirements (Table 7)
Cleaning and servicing	50	0.25	50	70	BS EN 12464-2:2024 General Requirements (Table 7)
Gangways for pedestrians	10	0.20	50	70	BS EN 12464-2:2024 Canals, locks and harbours (Table 14)
Cargo handling, loading and unloading	30-50	0.25	55	70	BS EN 12464-2:2024 Canals, locks and harbours (Table 14)
Coupling of hoses, pipes and ropes	50 -75	0.40	50	70	BS EN 12464-2:2024 Canals, locks and harbours (Table 14)
General lighting of quayside area	20 -30	0.25	55	40	BS EN 12464:2-2024

Type of area, task or activity	Illuminance Em (lux)	Uniformity Uo	Glare GR	CRI Ra	Standard
					Shipyards and Docks (Table 24)
Continuous handling of large units and raw materials, loading and unloading, lifting and descending cranes, open loading platforms	50	0.40	50	70	BS EN 12464-2:2024 Industrial sites (Table 17)
Demanding electrical, machine and piping installations, inspection	200	0.50	45	70	BS EN 12464-2:2024 Industrial sites (Table 17)
Medium traffic parking areas	10	0.25	50	70	BS EN 12464-2:2014 Parking areas (Table 8)
Handling of servicing tools	20-30	0.25	55	70	BS EN 12464-2:2024 Power, electricity, gas and heat plants (Table 21)
Overall inspection	50 - 75	0.40	50	70	BS EN 12464-2:2024 Power, electricity, gas and heat plants (Table 21)
General servicing work and reading of instruments	100 - 150	0.40	45	70	BS EN 12464-2:2024 Power, electricity, gas and heat plants (Table 21)
Repair of electrical devices	200 - 300 (use local lighting)	0.50	45	70	BS EN 12464-2:2024 Power, electricity, gas and heat plants (Table 21)

Type of area, task or activity	Illuminance Em (lux)	Uniformity Uo	Glare GR	CRI Ra	Standard
Walkways in railway areas, open footbridges	10	0.25	50	40	BS EN 12464-2:2014 Railways (Table 22)

3 Baseline lighting conditions

3.1 Overview

3.1.1 To understand the existing baseline lighting conditions across the Main Site (including the locations of existing installed lighting infrastructure), a desktop study was undertaken to inform the construction and operational lighting strategy. An understanding of the baseline conditions ensures that the proposed lighting strategy provides a negligible effect on the sensitive receptors and will not significantly increase existing light pollution.

3.1.2 Due to the assessment being a desktop study, it was not possible to identify all of the lighting infrastructure within some areas of the Site boundary. However, it is expected that all lighting, apart from road lighting, will be replaced during the construction and operational phase across the Proposed Development.

3.2 Local context

3.2.1 The land use surrounding the Proposed Development is described in detail in **Chapter 3: Site and Surrounding Area (ES Volume I, Application Document Ref. 6.1)**, with the key elements summarised below:

- the River Tees lies to the east and south east of the Main Site;
- to the east, north and south of the Site, there are existing operational industrial facilities and businesses in Seal Sands;
- Port Clarence is the nearest residential area, located 2.4km to the south/south west of the Main Site;
- Seal Sands Road runs along the north of the Main Site to connect to the A1185 at Seal Sands roundabout. The A1185 connects the Site to the trunk road network (A19/A689). The A178 is to the west of the Main Site and runs north and south from Seal Sands roundabout.
- to the west/south west of the Site are water bodies and water courses which form part of RSPB Saltholme; and
- the King Charles III England Coast Path runs along the A178 to the west of the Main Site.

3.3 Sensitive receptors

3.3.1.1 The sensitive receptors surrounding the Proposed Development are described in detail in **Chapter 3: Description of the Site and Surrounding Area, Chapter 10: Terrestrial Ecology and Chapter 11: Freshwater and Marine Ecology (ES Volume I, Application Document Ref. 6.1)**.

3.3.1.2 The key sensitive receptors located within the surrounding area are outlined in Table 3.1 and shown on Inset 3.1.

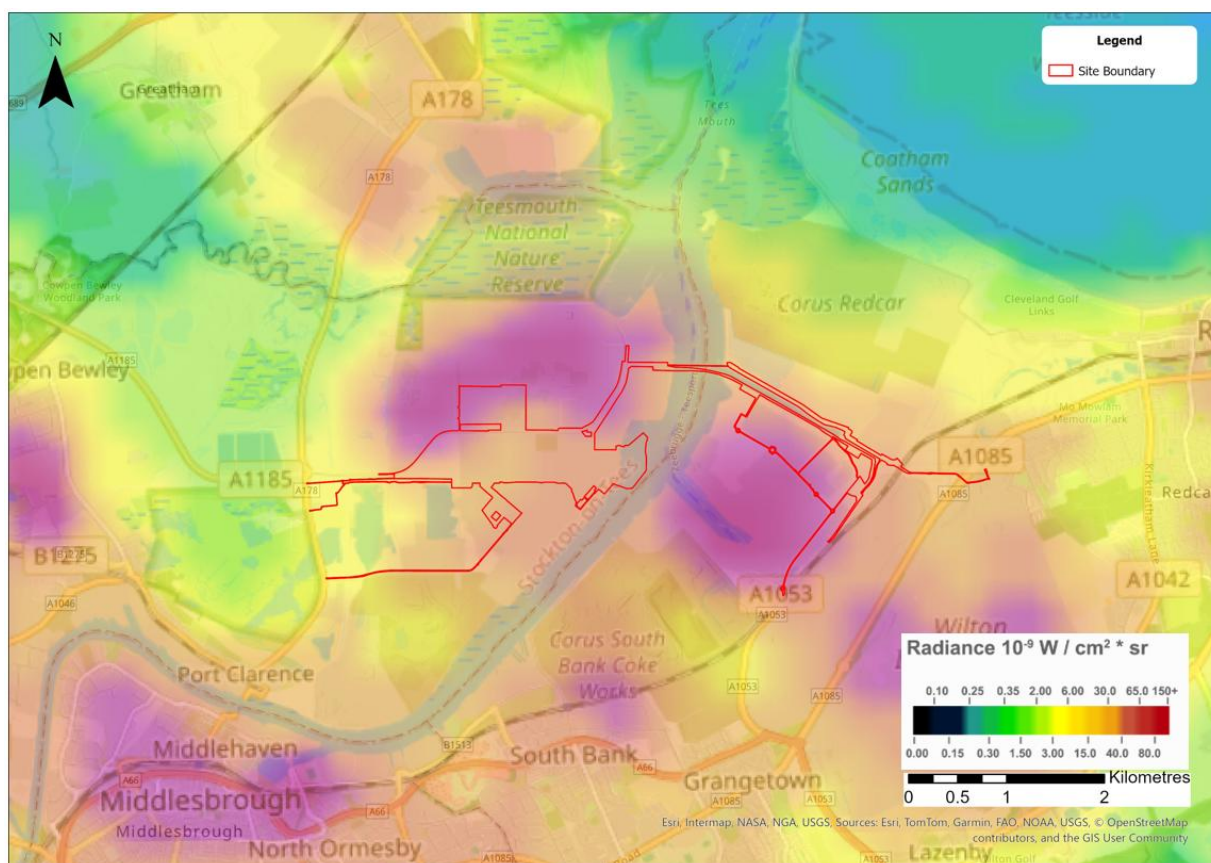
Table 3.1 Sensitive receptors within 2km of the Proposed Development

Sensitive receptor	Distance from Proposed Development (Main Site) (approximate distances)
Statutory nature conservation sites	
Teessmouth and Cleveland Coast Ramsar (including parts of the River Tees)	300m north
Teessmouth and Cleveland Coast SPA (including the River Tees)	0m (Main Site is directly adjacent, but the proposed new quay lies within the designation)
Teessmouth and Cleveland Coast SSSI (including the River Tees)	0m (Main Site is directly adjacent, but the proposed new quay lies within the designation)
Teessmouth National Nature Reserve (NNR)	600m north east
Saltholme Nature Reserve, also known as RSPB Saltholme (multiple water bodies and wetlands)	1.1km west/south west
Non-statutory nature conservation sites	
Teessaurus Park LWS	2km west
Greatham Creek North Bank Saltmarsh LWS	1.2km north
Greenabella Marsh LWS	1.4km north
Coatham Marsh LWS	0.8km east
Saltern Saltmarsh LWS	1.7km north west
Zinc Works Bird Field LWS	1.8km north
Heritage assets	
Grade II listed Tees Transporter Bridge	2.8km south west
Residential	
Port Clarence	2.4km south/south west



3.4 Existing light pollution

- 3.4.1 Inset 3.2 demonstrates existing light pollution (dated 2025) around the Proposed Development. This image provides a visual reference, against which future lighting design proposals can be objectively compared. The areas coloured red have the highest levels of ambient light, whereas the green areas have the lowest levels of ambient light.



Inset 3.2 Light Pollution map (dated 2025) (Proposed Development outlined in red)
[Ref 15]

- 3.4.2 Within the Site boundary, most of the area has a lower ambient lighting scene than neighbouring sites to the north and east. These brighter locations include Teesport and the Seal Sands industrial area(s). RSPB Saltholme to the west of the site has a lower ambient light scene. On the other side of the River Tees bank, Riverside Park Industrial Estate provides a higher level of ambient light.

3.5 Existing lighting infrastructure

- 3.5.1 The existing lighting infrastructure identified within the Main Site boundary comprises road lighting, access route lighting from floodlights on columns and buildings and mast mounted floodlighting within adjacent industrial sites. Previous site clearance has removed lighting infrastructure from within the Main Site.

- 3.5.2 To the north of the Main Site, at Navigator Terminals, the main access road has single-headed highway lighting columns approximately 8m tall. Columns appear to have been upgraded to LED lantern with minimal upward light spill due to 0° tilt.
- 3.5.3 In the Seal Sands Storage facility there are existing industrial floodlights mounted in groups of 10m high columns providing lighting to the main road and parking areas within the site. These luminaires are asymmetric, and some are aimed at approximately 80° tilt which will contribute to obtrusive light (refer to Inset 3.3).



Inset 3.3 Existing industrial plant lighting at existing Seal Sands Storage facility
(image source: Googlemaps Street View)

- 3.5.4 Existing low rise industrial areas within the Lianhetech site have 10m single-headed lanterns with sodium lamps facing into the site but also have additional floodlights tilted up facing out from the site, which generates light pollution. There was no obvious photocell control and one lantern was energised during daylight hours (refer to Inset 3.4).



Inset 3.4 Car park areas illuminated from 8M column with angled floodlights on existing site for KD Pharma UK within the new proposed area (image source: Googlemaps Street View)

- 3.5.5 Lighting columns of varying height and lantern type. All lanterns that are tilted above 15° will be a source of light pollution to the Site.
- 3.5.6 The existing lighting equipment identified around the Site boundary includes lighting from the Navigator Terminals. This includes single-headed highway lighting columns approximately 10m tall. Columns are flat panel with an outward tilt which contribute direct upward light spill and contribute to obtrusive light effects.



Inset 3.5 Road and access road lighting (image source: Googlemaps Street View)

3.5.7 Seal Sands Road has single-headed highway lighting columns varying in height and lantern type. All lanterns are LED and horizontal mounting which will limit light pollution around the Site (refer to Inset 3.5).

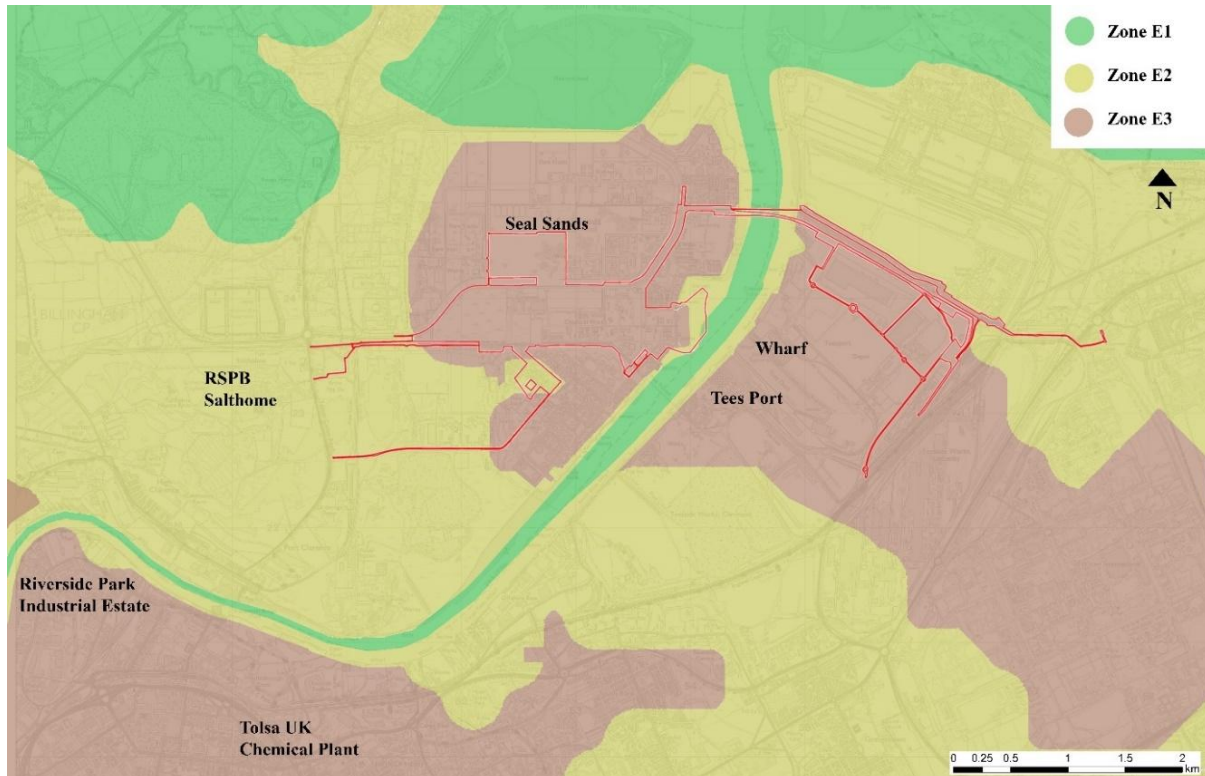
3.6 [Environmental zone](#)

3.6.1 It is recognised that the Proposed Development occupies a large surface area and, for operational reasons, lighting requirements will vary across the Site. For example, the baseline conditions for the proposed pipeline and cable connection(s) located along the north and west of the Main Site is relatively dark compared to the Main Site, and as such will be subject to differing lighting requirements.

3.6.2 To support development of the lighting design in a sustainable manner across the Proposed Development, the Site is defined in terms of the Environmental Zones (as per ILP GN01, Annex A.1.5 [Ref 3]). For each Environmental Zone, the lighting design must uphold the threshold limits attributed to that zone.

3.6.3 Environmental Zones are categorised in ILP GN01 as follows:

- E0: Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places;
 - E1: Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc;
 - E2: Sparsely inhabited rural areas, village or relatively dark outer suburban locations;
 - E3: Well inhabited rural and urban settlements, small town centres of suburban locations; and
 - E4: Town/city centres with high levels of night-time activity.
- 3.6.4 Environmental Zones have been proposed based on the baseline ambient lighting conditions (refer to Section 3.2) and these are presented in Inset 3.6. These zones will be considered when developing the Detailed Lighting Strategy for the Proposed Development (to be developed by the EPC Contractor(s)) and when considering the impact on neighbouring properties and habitats. This categorisation represents current best practice and aims to ensure that the ambient lighting conditions of the Proposed Development, with respect to its environmental context, is appropriate.
- 3.6.5 Subject to detailed design and compliance with prevailing regulatory and technical standards it is proposed that the external lighting design within the areas of highest night-time activity (for example within the Main Site) will not exceed the recommended Zone E3 thresholds.
- 3.6.6 Lighting design to other areas (for example access roads and associated car parks) will broadly not exceed the relevant zone, E2 or E3, as identified in Inset 3.6. Direct transitions between non-consecutive zones will not be permitted, for example Zone E1 cannot border Zone E3, Zone E2 must be located between.



Inset 3.6 **Proposed environmental zones**

3.7 [Baseline conditions summary](#)

- 3.7.1 The existing lighting conditions across the Proposed Development site are typical of an industrial location comprising functional lighting to the highways and open area floodlighting. The floodlights are typically asymmetric and aimed above their optimal tilt, contributing to direct upward light and sky glow.
- 3.7.2 Existing highway lighting within the Site boundary typically has fittings in a horizontal orientation, directing light to the roadways.
- 3.7.3 As a number of areas have been decommissioned and cleared, there are currently several areas with next to no lighting as a baseline condition. This will change with the Proposed Development, depending on where lighting is needed.
- 3.7.4 It is assumed that lighting within the existing industrial sites within the Site boundary will be removed and upgraded in line with the principles outlined within this Framework Lighting Strategy.
- 3.7.5 Residential receptors facing the Site are a significant distance away from the Proposed Development and are therefore not likely to be exposed to light obtrusion effects from the Site in the current baseline conditions.

4 Proposed construction phase lighting strategy

4.1 Introduction

- 4.1.1 The construction areas within the Site boundary will, as far as possible, be arranged so that natural light is available for people to see in order to do their work and move about the Site safely. Where natural light is inadequate or not available, artificial lighting will be required for the construction of the Proposed Development.
- 4.1.2 The construction phase lighting will provide illumination for security and for working at night.
- 4.1.3 It is anticipated the construction and commissioning phase will be approximately four years. Construction vehicles will be on-site and will include excavators, cranes, piling rigs and transportation vehicles (refer to **Chapter 5: Construction Programme and Management (ES Volume I, Application Document Ref. 6.1)**). It is expected that up to 2,200 staff will be on-site during the peak construction period.

4.2 Construction working hours

- 4.2.1 Standard daytime working hours will be 07:00 to 19:00 hours Monday to Friday (except bank holidays), 07:00 to 16:00 hours on Saturday and 08:00 to 17:00 on Sunday. However, it is likely that some construction activities may need to be undertaken outside of these core working hours (such as concrete pouring). Where works are required outside of core working hours, these would comply with any restrictions agreed with the local planning authority.

4.3 General lighting requirements

- 4.3.1 Site lighting and signage will be to the appropriate illumination levels to enable a safe and secure Site. If necessary, lighting to the Site boundary will be provided and illumination will be sufficient to provide a safe route for the construction workforce and passing pedestrians/vehicles.
- 4.3.2 Measures will be considered to enhance the public sense of safety and security within and around the Site. Precautionary measures will be considered to avoid shadows cast from the Site onto surrounding footpaths, walkways, roads and amenity areas. Further measures may include lighting combined with smart-technology where appropriate, such as lighting activated with motion sensors to avoid unnecessary usage and to act as a security method.
- 4.3.3 Where necessary, task-based lighting will be provided for specific high-risk tasks. Task-based lighting will be switched off after use and at the end of the working shift.

- 4.3.4 It is recommended that lighting will be designed, positioned and directed to account for functional and environmental requirements using horizontal cut-off optics and zero floodlight tilt angles.
- 4.3.5 Where possible, lighting will seek to avoid intrusion on sensitive ecological and residential receptors to prevent unnecessary disturbance.
- 4.3.6 Effects such as sky glow and light intrusion beyond the Site will be considered. Lighting will be visually checked after installation during night-time from the perspective of sensitive receptors (such as nearby residential properties and ecological receptors) and any necessary adjustments promptly made.
- 4.3.7 Complaints from nearby residents will be considered and responded to with measures taken to mitigate light obtrusion where safe and practicable to do so. Further detail will be provided in the Detailed Lighting Strategy prepared by the EPC Contractor(s).
- 4.3.8 It is recommended that Site lighting is located and directed so that it will not cause undue interference with nearby highways.

4.4 Technical recommendations

- 4.4.1 Where work will continue outside daylight hours or the building or structure is enclosed, artificial lighting will be required.
- 4.4.2 The artificial lighting will not change the apparent colour or visibility of any safety signs or other safety-related items such as fire extinguishers.
- 4.4.3 In daylight and artificial lighting conditions, shadows can obscure hazards both in the workplace (for example making it difficult to see the blade of a cutting disc or a drill bit) and on the Site generally (such as at stairwells). If shadows are present on the Site, additional lighting will be provided to illuminate shadow areas.
- 4.4.4 Emergency lighting will be provided where failure of the primary artificial lighting would be a risk to the health and safety of anyone (such as descending a tower scaffold). Where it is not possible to have lighting that energises automatically when the primary lighting fails, portable battery powered lighting may be suitable, subject to a risk assessment.
- 4.4.5 In addition, emergency routes (such as the corridors and passageways that people follow in an emergency to escape from danger) should be illuminated by emergency lighting when there are workers on the Site.
- 4.4.6 Where daylight provides adequate lighting, no further action is required. Where emergency routes need artificial light, emergency lighting will be

provided that energises if the primary lighting fails (such as self-contained battery or emergency generator-powered central battery system lighting).

- 4.4.7 Construction lighting will provide the required illuminance levels to support the surveillance systems to assist with protecting the Site's security and health and safety.
- 4.4.8 Lighting considerations will include measures to minimise light obtrusion, through focusing of lighting downwards and inwards into the Site or Proposed Development.
- 4.4.9 Use of photo-electric activation, which allows lighting to remain inactive when ambient light levels are at an acceptable level, will be considered.
- 4.4.10 In addition, attention is drawn to specific activities where particular attention will be paid to mitigating against light obtrusion effects to sensitive receptors (refer to Table 4.1).

Table 4.1 Light obtrusion mitigation focus areas

Focus area	Mitigation consideration during construction phase
Teesmouth and Cleveland Coast (including River Tees) (SPA and SSSI)	Avoid spill light over water and riverbanks when decommissioning the existing and constructing the new Marine Transport Infrastructure, constructing the pipeline connectors and the bulk liquid storage.
Saltholme Nature Reserve (Ramsar site, SSSI and SPA)	Avoid spill light during the construction of the pipeline connectors, SAF plant, conveying corridors and the heavy haul road which are all surrounding the nature reserve.
Existing roads – Access Road	Avoid light obtrusion effects, in particular glare/intensity characteristics, which could impact on the safe use of existing roads.

4.5 Typical construction site lighting arrangements

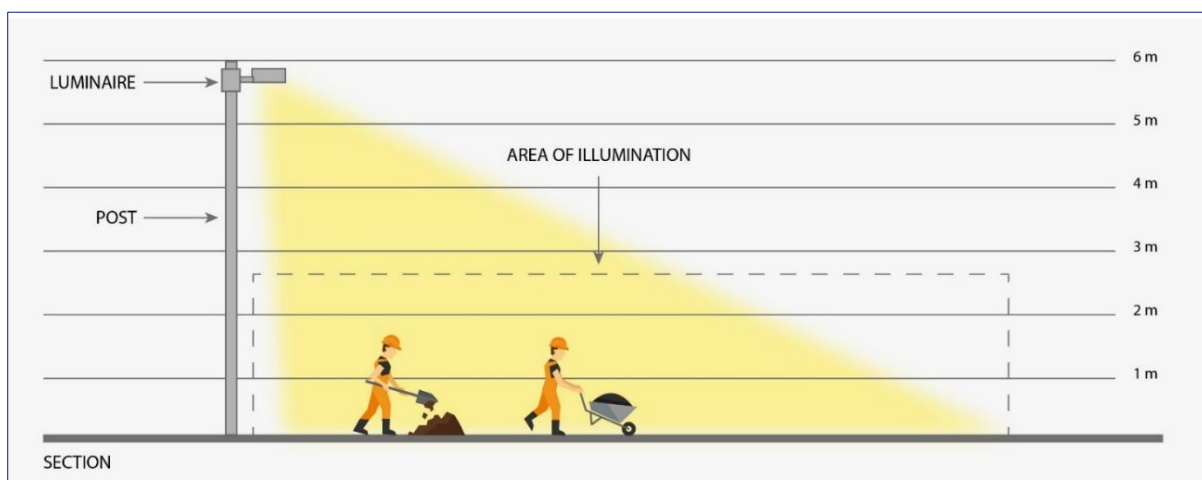
Construction compounds and construction laydown areas

- 4.5.1 Construction compound and laydown area lighting will incorporate the recommendations described in this section.

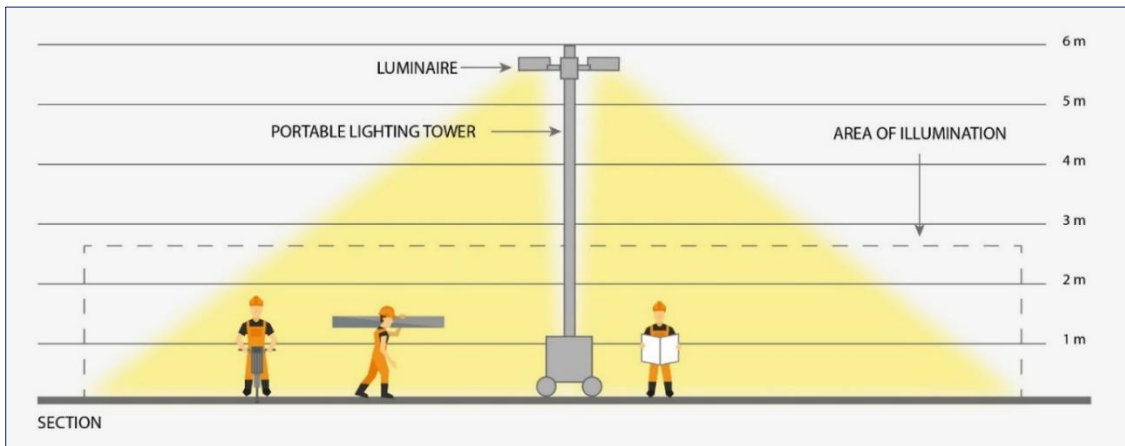
Open area lighting

- 4.5.2 Site lighting arrangements vary and are dependent on the area of illumination and the activity undertaken. The following section describes typical lighting arrangements for construction compounds that will be considered for the Proposed Development. Lighting will be switched off when daylight levels permit.

- 4.5.3 Inset 4.1 shows a typical post-mounted lighting arrangement for the construction compound while Inset 4.2 shows a typical portable site light arrangement.
- 4.5.4 In principle, the following will be provided in the Detailed Lighting Strategy:
- luminaires installed on posts or mast supports to provide lighting to the area of illumination from either one side or both sides (as necessary);
 - the lighting will be limited within the intended task area and will not stray beyond the Site boundary;
 - the lighting arrangement will allow for vehicle movement whilst minimising disruption;
 - lighting equipment will have no upward light spill to minimise light obtrusion effects; and
 - lighting will provide the required illumination levels for the defined task and will not exceed the requirements (refer to Table 2.1).



Inset 4.1 Post-mounted site lighting arrangement



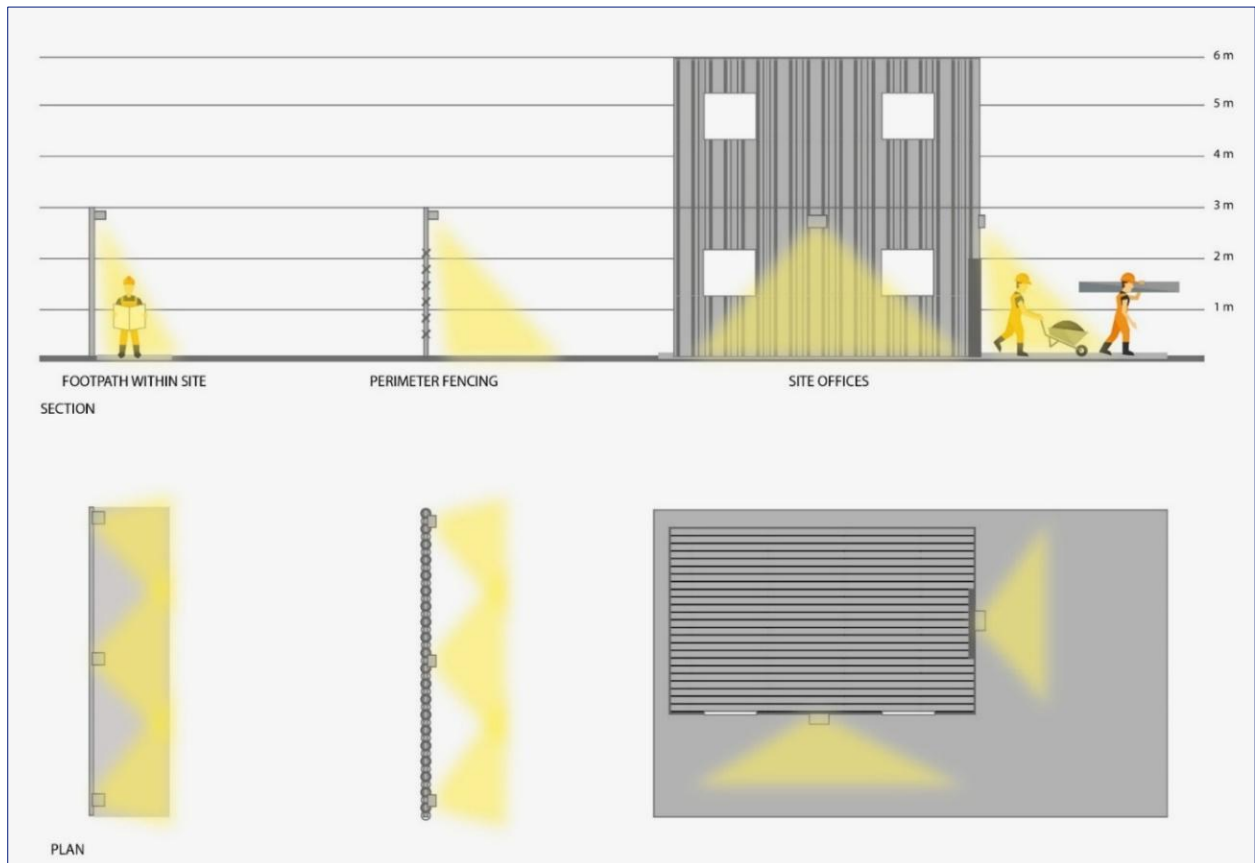
Inset 4.2 Portable lighting arrangement

Perimeter fencing, footpaths and compound lighting

4.5.5 Inset 4.3 shows the recommended lighting arrangements for perimeter fencing, footpaths and compounds within the Site.

4.5.6 In principle, the following will be provided within the Detailed Lighting Strategy:

- luminaires will provide lighting to the area of illumination by directing the light downwards, avoiding tilting;
- lighting equipment will be selected with no upward light spill to minimise light obtrusion effects;
- the lighting will be limited within the intended task area and not stray beyond the Site boundary; and
- lighting will provide the required illumination levels for the defined task and will not exceed the requirements.



Inset 4.3 Surface-mounted site lighting arrangement

Mitigation measures

4.5.7 The following mitigation measures will be implemented during the construction phase to minimise the obtrusive effects of light on sensitive receptors, as identified in:

- installation of temporary fencing screens to shield any light spill beyond the task area when required i.e. to screen plant, equipment and site operatives from wintering birds;
- lights will be aimed to prevent any upward light spill, with horizontal cut-off luminaires and zero tilt;
- lights will be energised only when required;
- lighting calculations will be completed prior to installation of the construction phase lighting to ensure that the task areas are illuminated to the lighting criteria defined in Table 2.1;
- presence of artificial lighting on-site will be minimised wherever possible;

- LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability;
- where practicable external security lighting should be set on motion sensors and set to as short a possible a timer as the risk assessment will allow. For most purposes, a 1- or 2-minute timer is likely to be appropriate;
- column mounted luminaires should be located so that the rear shields are adjacent to habitats, or narrow optics selected that direct light into the task area where needed; and
- only if all other options have been explored, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed.

5 Proposed operational phase lighting strategy

Introduction

- 5.1.1 The operational phase lighting will provide illumination for security, for working at night and ongoing maintenance. It is anticipated that design life of the Proposed Development will be at least 25 years.
- 5.1.2 The operational phase will comprise the following activities:
- unloading of feedstock via Continuous Ship Unloaders (CSU) and Harbour Cranes at the new quay areas;
 - production of SAF/naphtha;
 - export of products by road; and
 - parking.

Operational hours

- 5.1.3 The Main Site will be operational for 24 hours per day.

Basis of Design

- 5.1.4 The exterior lighting design aims to define the functional, safety and environmental requirements for staff and visitors to the Site, as they arrive, work and depart.
- 5.1.5 Safety is of critical importance. All lighting schemes proposed or developed will need to satisfy the task lighting requirements and design code compliance. Aesthetic considerations will be proportional and not at the expense of the safe operation of the Proposed Development.

Design objectives

- 5.1.6 This Framework Lighting Strategy proposes five operational design objectives. These will be developed further as part of the Detailed Lighting Strategy, by the EPC Contractor(s). These include:
- to create a safe, inclusive and comfortable working environment;
 - to aid the orientation and safe passage of vehicles and pedestrians through the Site;
 - to conserve energy and avoid waste;
 - to minimise obtrusive light and its impact on neighbouring sensitive receptors; and
 - to support the safety and security of the Site, in terms of operational task lighting and staff personal safety.

- 5.1.7 A primary function of the operational phase lighting will be to provide appropriate levels of illumination to enable people to see in the absence of natural light. The extent to which people need to see after dark will vary from area to area, with some requiring high levels of visual acuity whilst others may require an understanding of scale and the ability to identify a safe passage through a space.

Legibility and wayfinding

- 5.1.8 The most visible elements in a nocturnal landscape form the dominant elements for legibility and wayfinding. The most visually prominent elements are those that are perceived as being the brightest, although other factors such as colour, scale, animation and personal association also play important roles.
- 5.1.9 By developing a considered and consistent lighting approach to the key routes such as roads and pedestrian paths, light will play a crucial role in supporting legibility and accessibility and in reinforcing specific visual and physical connections across the Site.

Accessibility

- 5.1.10 The design of artificial light should consider the various needs of the staff, tasks/operations and safety after dark. Considerations to support a highly accessible and safe nocturnal environment include: maintaining uniform lighting, minimising sources of glare, avoiding shiny, mirror-like surfaces at pedestrian level (especially in wet weather), controlling shadow and limiting upward light.

Energy and costs

- 5.1.11 The following will be considered when developing the operational lighting design:
- minimising the impact of obtrusive light;
 - energy efficiency in design and operation (such as LED lighting and circularity); and
 - efficiency of energy supply (such as smart lighting controls).
- 5.1.12 Energy is a key consideration in the operation and maintenance of the Proposed Development. Equipment and the control of lighting levels and therefore the energy consumption will be incorporated in the design. Where practicable, lighting will respond to the presence or absence of people, reducing the light output when a space is empty.
- 5.1.13 The choice of whether to provide lighting will be a key decision in the design process to limit unnecessary energy use without affecting the safety of site

personnel. For example, rarely accessed roofs of buildings may not require lighting as preventative maintenance can be planned for daytime, with temporary lighting provided to carry out emergency repairs. This could avoid lighting being accidentally left energised.

- 5.1.14 Whole life-cycle costs will be considered in relation to project life, energy costs, hours of use, labour rates and light source and control gear replacement periods.

Safety and security

- 5.1.15 The Detailed Lighting Strategy will provide the required lighting for a safe environment for all users at all times. This will include the illumination of potential hazards such as steps and ramps and areas where pedestrians encounter moving vehicles i.e. pedestrian crossings.
- 5.1.16 The lighting will consider the provision of an overall sense of security across the Site, including supporting active surveillance (such as CCTV), if required. Where the CCTV surveillance is supported by infra-red technology, the requirement for additional light in the visible spectrum may not always be necessary.

Maintenance

- 5.1.17 The Detailed Lighting Strategy will consider the types of lighting equipment and light sources selected as well as their mounting locations, materials and the longevity of their finishes. This will ensure minimal disruption to day- and night-time activities when the installation needs maintenance or replacement.
- 5.1.18 A reduced portfolio of luminaires and light sources will simplify maintenance regimes. The ease of maintenance (such as tool free servicing) and ease of cleaning (no special product or tools) will also be considered when selecting equipment as both are key factors in extending the lifetime of a product.
- 5.1.19 Equipment will be selected using the principles identified by the Construction (Design and Management) Regulations 2015 (CDM) to reduce the risks inherent in maintenance activities. For example, base hinged lighting columns and high masts will be considered to enable ground level luminaire maintenance. Where possible, LED drivers will be remote mounted in an accessible location to minimise the need for high level access (for example in the base of the column).
- 5.1.20 Site-wide lighting control systems are recommended to provide remote monitoring of individual luminaires to report lamp-life and lamp failure to further assist maintenance regimes.

Luminaire specification

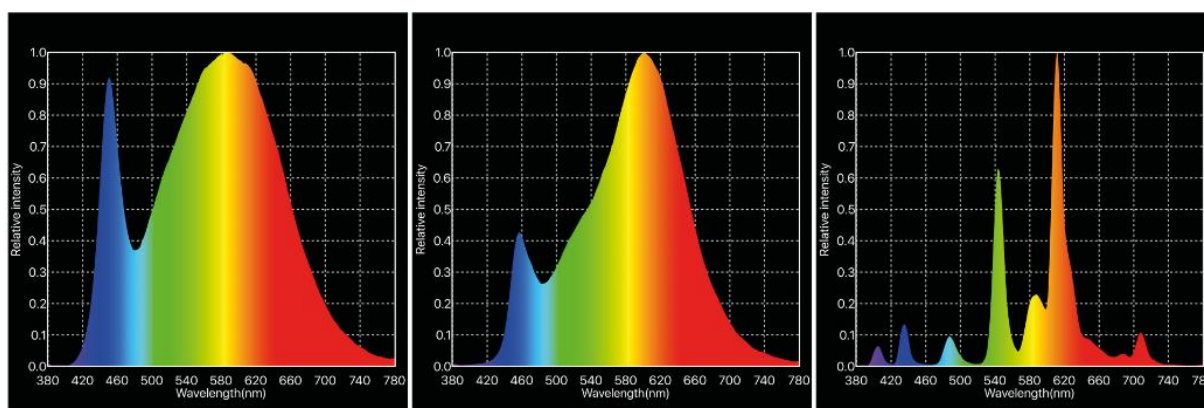
- 5.1.21 LED technology will be installed across the Proposed Development. In general, a colour temperature of 4,000K will be specified for all luminaires (refer to Inset 5.1).



Inset 5.1 Indicative presentation of colour temperature

5.1.22 Where sensitive ecological receptors are present with sensitivity to artificial lighting, a warmer colour temperature <3,000K will be considered. There is strong evidence that there are significant advantages in reducing the presence of blue spectral content with minimised wavelengths below 500nm (see Inset 5.2, a colour temperature of 21K). Refer to ILP Guidance Note GN08: Bats and Artificial Lighting for further details. Immediately adjacent to the River Tees, a colour temperature of 2,700K will be considered.

5.1.23 In discrete locations, such as pedestrian crossings 4,000K light sources can be used to make these task areas more visually distinctive compared to 3,000K surroundings, and therefore enhance the safety of the crossing. Refer to ILP TR12 Lighting of Pedestrian Crossings for further information.



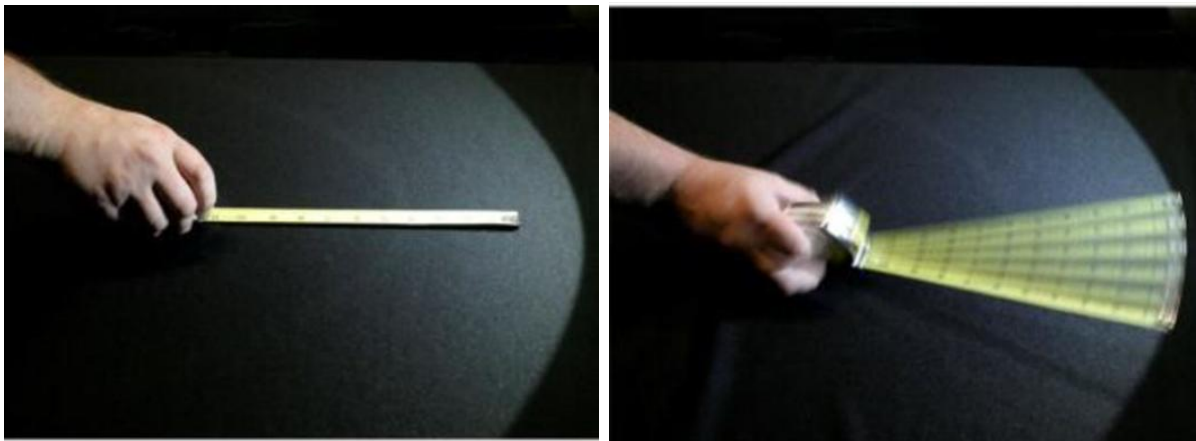
Inset 5.2 Typical, relative colour spectrum of LED light sources (left to right 4,000K, 3,000K, 2,300K)

5.1.24 A colour rendering index Ra greater than 80, in accordance with the international colour code, will be specified for all white-light sources. In particular, where improved visual quality and accurate rendition can facilitate tasks and human interactions.

5.1.25 LED light sources can be susceptible to high-frequency flicker. Flicker effects may not always be obvious to the human eye but have the potential

to exert harmful effects on health and safety, for example rotary equipment may appear stationary. The various adverse effects of flicker include eye strain, fatigue, headache, migraine, blurred vision as well as photo epilepsy in sensitive individuals. A specification to minimise flicker will be considered when selecting the luminaires for the Proposed Development (refer to Inset 5.3).

- 5.1.26 Many LED drivers can dim down to 1% output while maintaining Flicker Frequency above 500Hz. The requirements of IEEE 1789–2015 will be considered for all LED drivers across the Proposed Development.



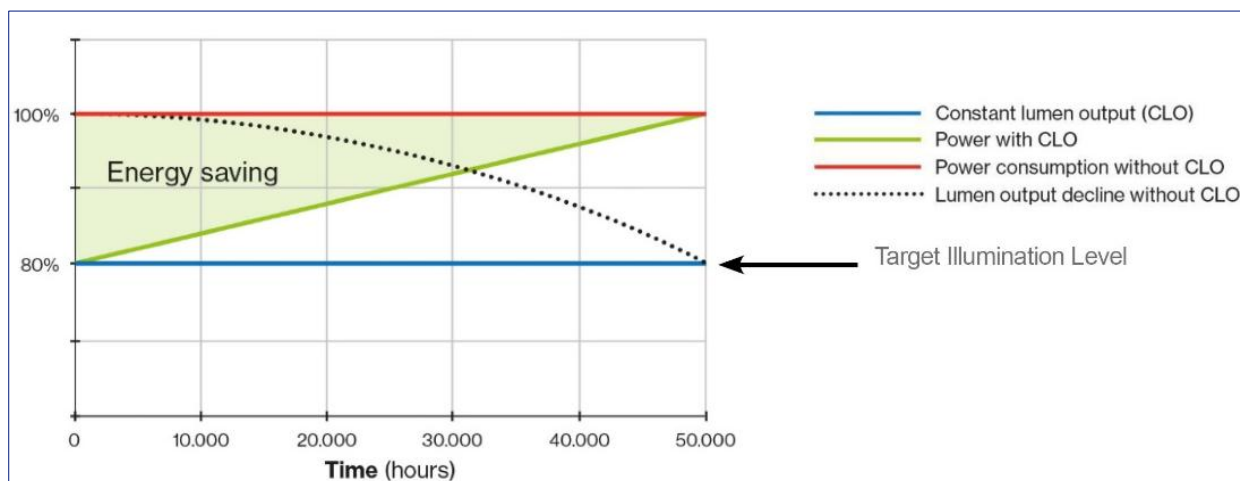
Inset 5.3 Flicker effect from an LED light source

Lighting controls

- 5.1.27 LED light sources can be dimmed to reduce energy consumption and increase luminaire longevity via the use of appropriate control technology integrated into the luminaire enabling the luminous intensity to respond in balance with available ambient light. Other lighting controls can include automatically lighting activation in response to traffic flows, occupancy sensors, timers or remote controls.
- 5.1.28 The illumination of each external space or access route will follow the guidance defined in Section 1.7. During off-peak periods or during the quieter seasons, the illumination levels can be reduced by one lighting class (such as P2 to P3). This will avoid unnecessarily over-lighting the external environment when the traffic usage is at its lowest.

Constant Light Output (CLO)

- 5.1.29 Electronic controls within the LED drivers will be considered to compensate for reduced performance and to omit the need for over-lighting and maintain constant illumination at the required target level. This control technology is called Constant Light Output (CLO). Inset 5.4 demonstrates how this can be used to derive energy savings over the lifetime of the light source.



Inset 5.4 CLO example

Luminaire specification summary

5.1.30 In summary, the following luminaire and light source performance characteristics will be set out in the Detailed Lighting Strategy:

- lifetime basis L90B10 >100,000hrs (lumen output is $\geq 90\%$ with no more than 10% failing to meet this performance after 100,000 hours);
- energy efficiency, efficacy >120 luminaire lumens/Watt;
- colour rendering >80CRI;
- colour consistency;
- minimised flicker: avoid visible blinking, flickering or strobing effects i.e. Flicker Factor should be less than 5%;
- minimum protection rating: IP65 and IK09;
- a ULR of zero for all luminaires and mounted with zero tilt 'horizontal cut-off';
- luminaires from one manufacturer and product family (where possible);
- marine grade, corrosion resistant Class 5 (EN ISO 9223 [Ref 16]). galvanic protection to screws, accessories and fixings; and
- die cast aluminium housings.

5.2 Operational lighting requirements

5.2.1 This section outlines the operational lighting requirements to be adopted for different infrastructure across the Proposed Development. These principles

will be adopted as part of the Detailed Lighting Strategy by the EPC Contractor(s).

General requirements

5.2.2 The following general requirements should be adopted to avoid impacts to sensitive ecological receptors:

- any artificial lighting will be directed away from the Site boundary features in order to maintain their suitability as dark corridors for bats and other notable species sensitive to lighting;
- all luminaires will lack UV elements when manufactured. Metal halide, compact fluorescent sources should not be used. LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability;
- a warm white light source (2700Kelvin or lower) will be adopted to reduce blue light component and, where possible, light sources should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats;
- only luminaires with a negligible or zero Upward Light Ratio, and with good optical control, will be considered;
- luminaires will always be mounted horizontally with no light output above 90° and/or no upward tilt;
- the potential to incorporate a Central Management System (CMS) and physical screening options behind light sources adjacent to vegetated areas will be explored as an option in the detailed Lighting Strategy. The CMS provides the ability to dim or turn off individual or groups of luminaires when not in use or during less busy times. Dimming can be precisely controlled, with dimming states often being as low as 10 or 20%. Due to the electrical difficulties of maintaining a dimming state of under 10%, luminaires will be set to off below this point. If this is not practical, sufficient justification will be provided within the detailed Lighting Strategy;
- where possible, internal luminaires will be recessed (as opposed to using a pendant fitting) where installed in proximity to windows to reduce glare and light spill;
- any pathways throughout the Site that require artificial lighting will be addressed via the use of waymarking inground markers (low output with cowls or similar to minimise upward light spill) to delineate path edges; and

- only if all other options have been explored, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed.

Roads: primary vehicular lighting

5.2.3 Inset 5.5 shows a typical arrangement for a primary vehicular road (dual carriageway).

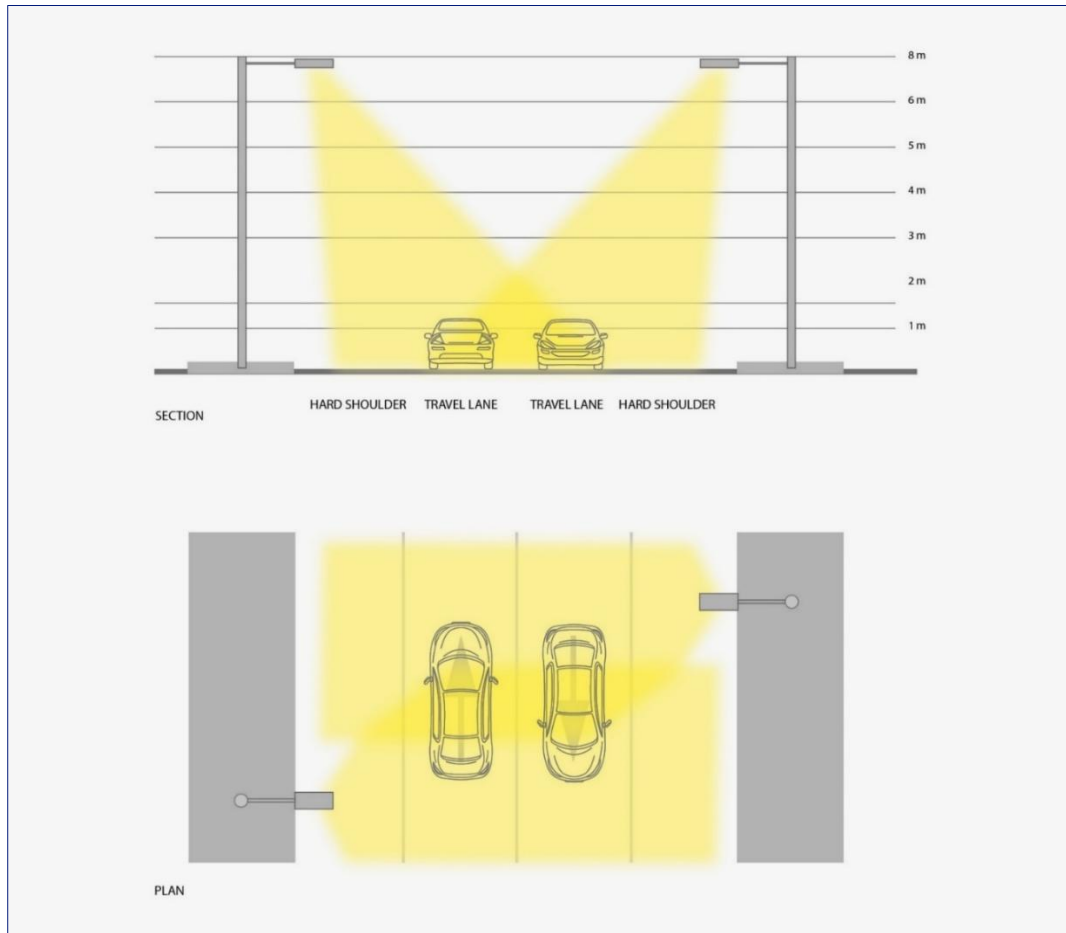
5.2.4 The following principles will be considered for roads within the Detailed Lighting Strategy:

- a good uniformity of lighting over the road will be achieved by utilising road lighting luminaires mounted on columns with an opposite arrangement;
- dual carriageways will be satisfactorily lit by means of opposite arrangements mounted on the outside edges of the road, or by twin luminaires on the central reserve;
- the preferred height of the road lighting luminaires will be 8m above finished ground level and the chosen luminaire will be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact;
- precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source; and
- base hinged columns will be preferred across the site to minimise high level maintenance. All columns will be base hinged, as standard. If there are specific conditions where this is not possible then this should be reviewed on a case-by-case basis.

5.2.5 The lighting criteria of the HS classes are based on the hemispherical illuminance of the road area and are expressed by the average hemispherical illuminance and the overall uniformity of this illuminance.

5.2.6 The requirements of the lighting classes reflect the category of road user in question or the type of road area. Therefore, the M classes (motor vehicle lanes) are based on the road surface luminance, while the P classes (pedestrian areas) and HS classes (Hemispherical illuminance classes) are based on the illuminance of the road area. Note in particular the requirements for facial illumination where necessary to support CCTV surveillance. These lighting classes are defined within the BS EN 13201

series (Road lighting) and are supported by BS 5489-1:2020, which provides guidance on their selection and application in the UK.



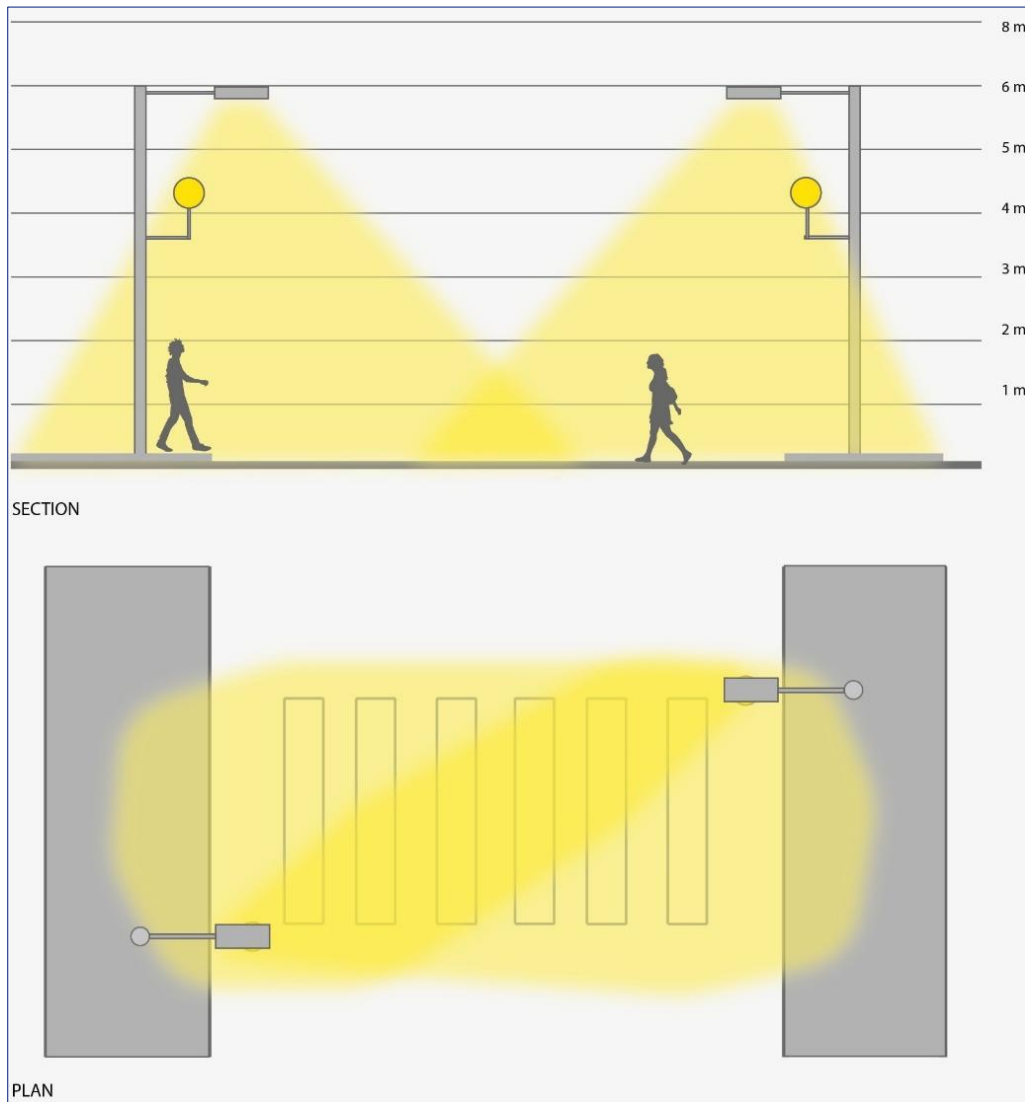
Inset 5.5 Typical primary vehicular lighting arrangement

Pedestrian crossing lighting

- 5.2.7 The objective of pedestrian crossing illumination is to improve distinctive visual identification of the crossing user to approaching car drivers, as well as providing safe illumination of the crossing surface. ILP TR12 [Ref 6] details specific pedestrian crossing lighting requirements and these should be adopted within the Detailed Lighting Strategy.
- 5.2.8 A pedestrian crossing is a designated point on a road designed to help pedestrian cross safely, whereas primary / secondary crossings often refer to staggered crossings, where a central traffic island splits a crossing into two separate stages.
- 5.2.9 Inset 5.6 shows a typical arrangement for a pedestrian crossing and Inset 5.7 shows a typical arrangement for primary and secondary pedestrian path lighting exclusive to pedestrians.

Typical pedestrian crossing

- 5.2.10 In principle, the following will be considered in the Detailed Lighting Strategy:
- pedestrian crossing lighting will illuminate any pedestrian who is approaching (both at and on the crossing) in such a manner as to make them clearly visible to the approaching driver;
 - a good lighting uniformity over the road will be achieved by utilising road lighting luminaires mounted on the outside edges of the road with a staggered arrangement. The road lighting luminaires will be of side asymmetric distribution specifically designed for this application to provide appropriate illumination on the horizontal and vertical plane;
 - at pedestrian crossings it is best practice to have supplementary luminaires mounted on an extended beacon pole either located on an offset bracket or designed to wrap around the pole. This aids the lighting of the crossings, reduces street clutter and improves all-round visibility;
 - as pedestrian crossings are considered to be conflict areas for the purpose of lighting, it is recommended that the carpet and adjacent footway 'waiting area' are illuminated to a higher level than of the road to draw the attention of the approaching driver to the proximity of a pedestrian crossing and to illuminate the pedestrian on the crossing and adjacent footways; and
 - the chosen luminaire is recommended to be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.



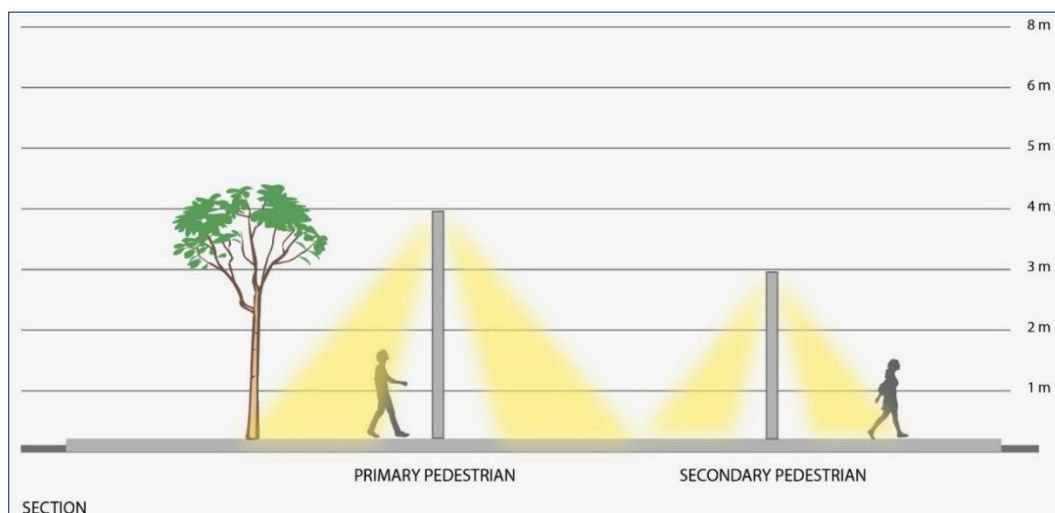
Inset 5.6 Pedestrian crossing typical lighting arrangement

[Primary and second pedestrian crossing](#)

5.2.11 In principle, the following will be considered in the Detailed Lighting Strategy:

- pedestrian path lighting will use white light sources which will be dimmable;
- a good uniformity over the ground will be achieved by utilising luminaires with a side throw that directs the light towards the ground and not upwards;
- the chosen luminaire will be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact;

- a single sided beam or a dual sided beam can be used depending on the width of the path. The paths can be satisfactorily lit by means of opposite or staggered arrangements mounted on the outside edges of the road, or by twin luminaires on the central path only;
- the preferred height of the pedestrian paths lighting luminaires will be 4m and 3m above finished ground level for primary and secondary pedestrian respectively, as these heights are closer to human scale than the taller luminaires used for road lighting;
- illumination performance will improve the users' perceptions of safety with particular attention paid to provide good facial illuminance; and
- base hinged columns are preferred to minimise high level maintenance.

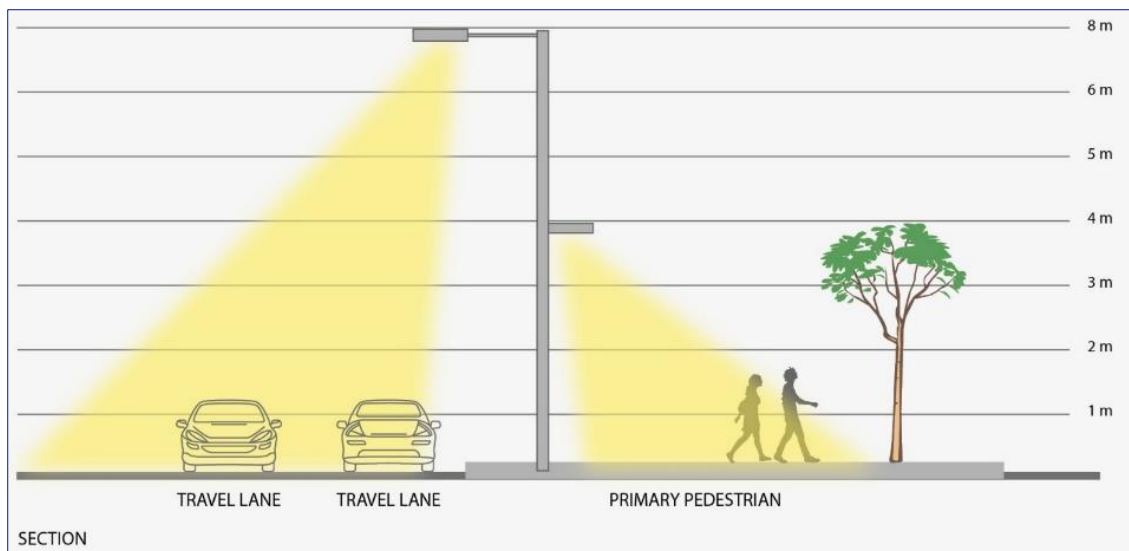


Inset 5.7 Typical lighting arrangement for primary and secondary pedestrian paths

Pedestrian paths adjacent to vehicular routes

- 5.2.12 In instances where pedestrian pathways are adjacent to any vehicular routes, consideration will be given to pedestrian path lighting provided via the road lighting luminaire or a luminaire mounted off the road lighting column. This will de-clutter the roads and paths and promote consistency in luminaire equipment (refer to Inset 5.8).
- 5.2.13 In principle, the following will be considered in the Detailed Lighting Strategy:
- pedestrian path lighting will use white light sources which will be dimmable;

- the height of the luminaires for pedestrian paths will follow the same strategy of either 4m (primary paths) or 3m (secondary paths) that is closer to the human scale, whereas the road lighting luminaires will follow the strategy of 8m;
- the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level;
- precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source; and
- illumination performance will improve the users' perceptions of safety with particular attention paid to provide good facial illuminance.



Inset 5.8 Typical lighting arrangement for pedestrian paths combined with vehicular

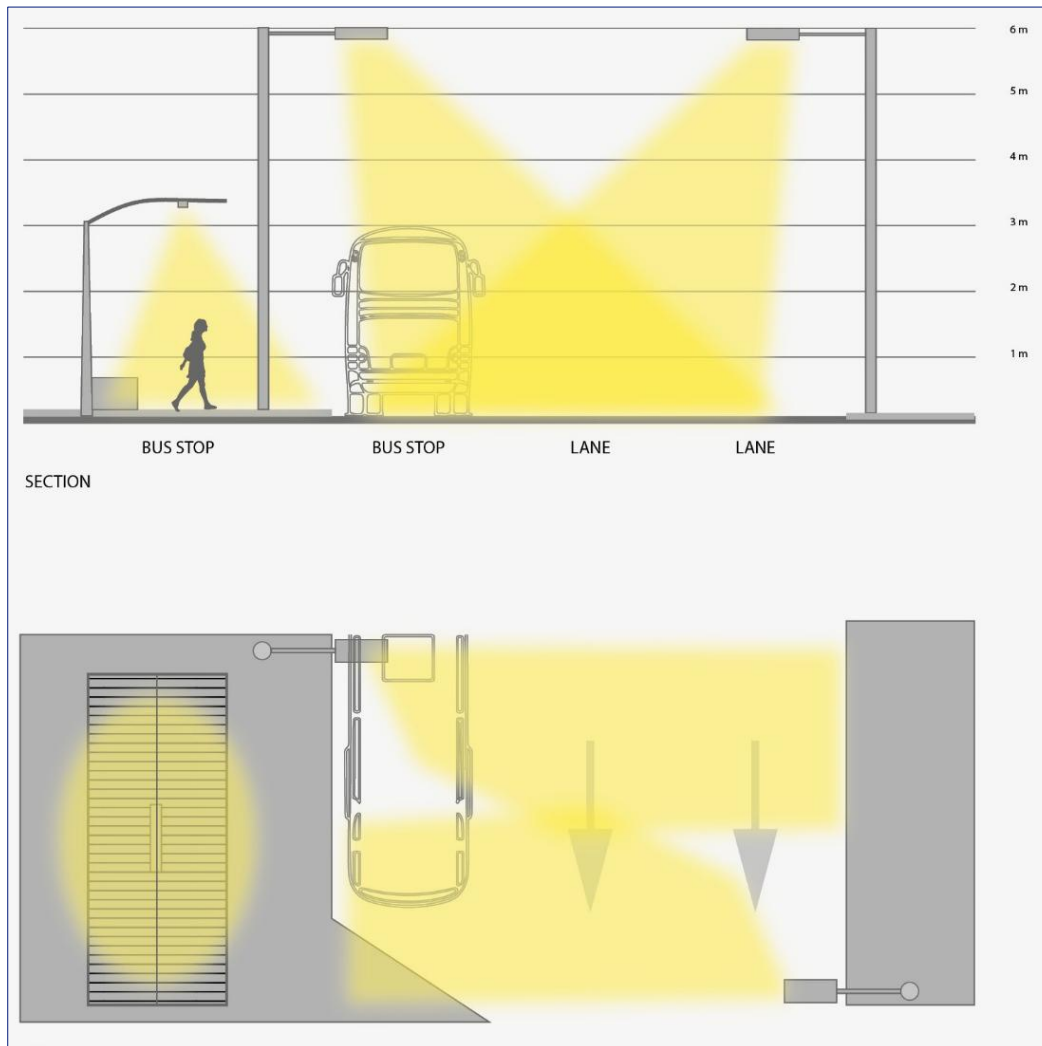
[Loading bay](#)

5.2.14 Inset 5.9 shows a typical lighting arrangement for a loading bay.

5.2.15 In principle, the following will be considered in the Detailed Lighting Strategy:

- the area will be illuminated by the use of column mounted luminaires with luminaires;
- lighting will use white light sources which will be dimmable;

- the lighting will have reduced output during off-peak periods, dimming the lighting uniformly down to an appropriate level. Lighting will be switched off where daylighting levels permit;
- a good uniformity over the road and loading bay will be achieved by utilising road lighting luminaires mounted on columns with a staggered arrangement;
- the preferred height of the road lighting luminaires will be 6m above finished ground level to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level; and
- precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.



Inset 5.9 Loading bay typical lighting arrangement

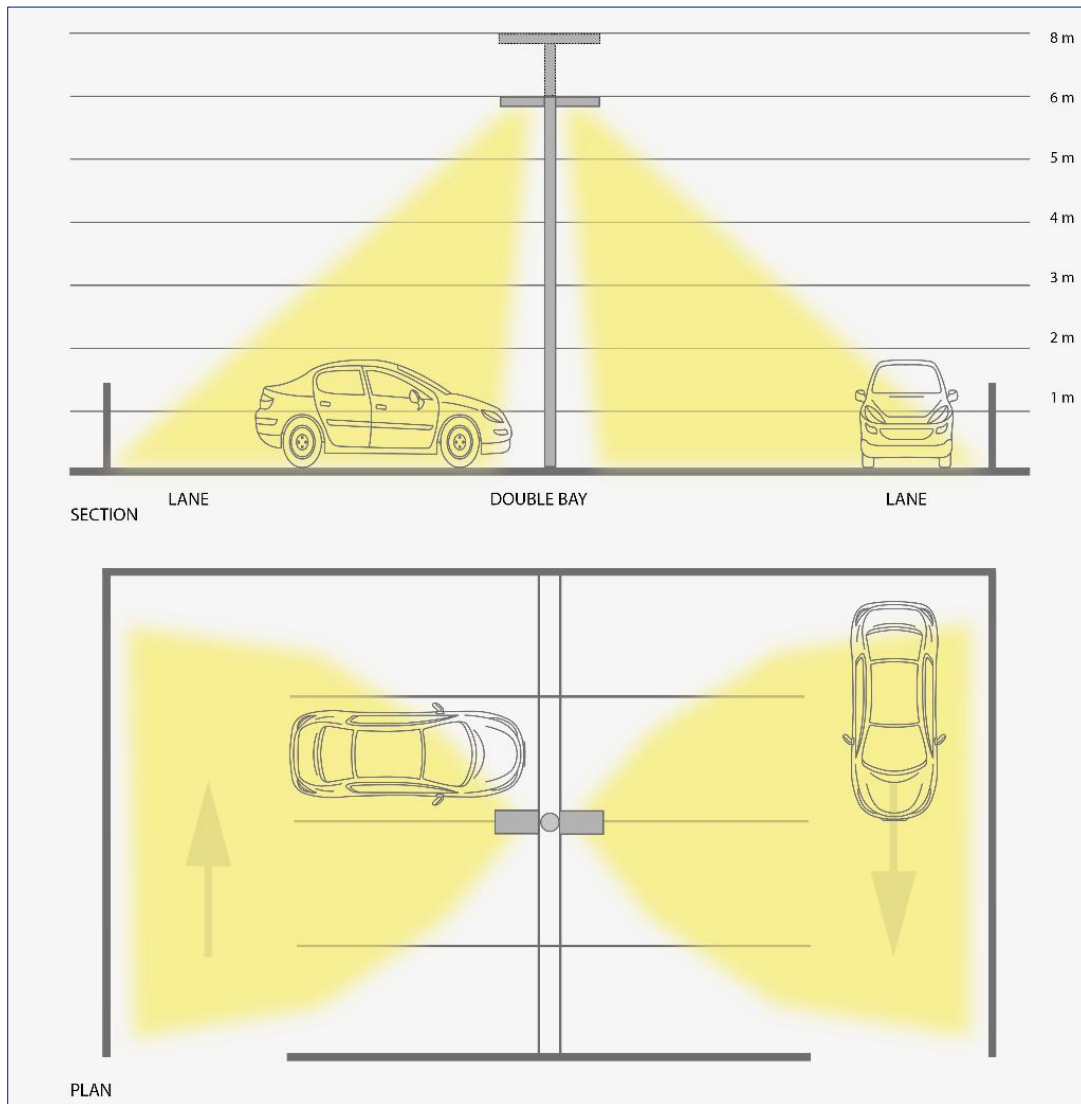
Car parks

5.2.16 Inset 5.10 shows a typical arrangement for a car park, double parking bay and access.

5.2.17 In principle, the following will be considered in the Detailed Lighting Strategy:

- car park lighting will use white light sources which will be dimmable;
- a good uniformity over the space will be achieved by utilising luminaires mounted on columns located in between the parking spaces;
- precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source;

- columns will be aligned with the parking space lines to minimise chance of collision;
- column height will be 6-8m, optimised for efficient spacing and uniformity and dependant on the scale of the car park;
- the preferred height of the column mounted luminaires will not exceed 8m above finished ground level to minimise light obtrusion and environmental impact; and
- the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level.



Inset 5.10 Double parking bay typical lighting arrangement

Wide-area lighting schemes

- 5.2.18 The lighting installation for the wide-area lighting arrangement will typically comprise high-mast floodlighting systems (refer to Inset 5.11).
- 5.2.19 In principle, the following will be considered in the Detailed Lighting Strategy:
- high-mast columns will be coordinated to avoid clashes with below ground services infrastructure;
 - the masts will be sited so that floodlights do not create glare, which could adversely affect visibility of staff on the ground or within buildings overlooking the high masts;
 - floodlight masts are normally configured to provide lighting of the area from two directions to avoid shadowing. The preferred lighting

arrangement illustrated in Inset 5.11 is a typical high-mast floodlighting column configuration;

- the highest tilt angle and/or peak intensity (in the case of asymmetric floodlights) should not exceed 65°;
- a glare rating GR<40 should be considered in safety critical areas;
- base hinged columns or raise/lower luminaire cradles will be considered to mitigate the safety risks associated with high-level maintenance but may not be practicable in all scenarios. Their application will be subject to a risk assessment contributed to be the designer and end-user; and
- drivers will be installed at ground level in the column to minimise high-level maintenance.



Inset 5.11 Wide area lighting arrangement

Quayside lighting schemes

- 5.2.20 Due to the restrictions of the movable CSU, which will travel the 250m length of the quay on rails, it is not possible to light the task areas on the ships from land mounted columns.
- 5.2.21 The lighting schemes at quayside areas where loading and unloading of feedstock occurs will comprise two lighting systems; lighting to the CSU and general quayside lighting.
- 5.2.22 Occupancy sensing will be utilised where lighting is directly adjacent to the River Tees due to the sensitivity of the location. Occupancy sensing will be configurable with an appropriate 'time-out', particularly on the quayside where loading and unloading will occur, to avoid frequent/nuisance switching.

Continuous Ship Unloaders

- 5.2.23 Lighting mounted to the CSU will provide local lighting to the task areas (Inset 5.12), as the loading and unloading will happen directly underneath.
- 5.2.24 The following principles will be considered in the Detailed Lighting Strategy:
- lighting mounted to the CSUs will be directed downward to prevent glare and light spill beyond the task area and into Zone E2 (Inset 3.2). Carefully selected optics and louvres will be used, ensuring a focused beam over the task area, and to minimise upwards light spill; and
 - by mounting lighting to the CSUs, the lighting can be targeted to where the unloading is happening, limiting light spill to with the quayside area.



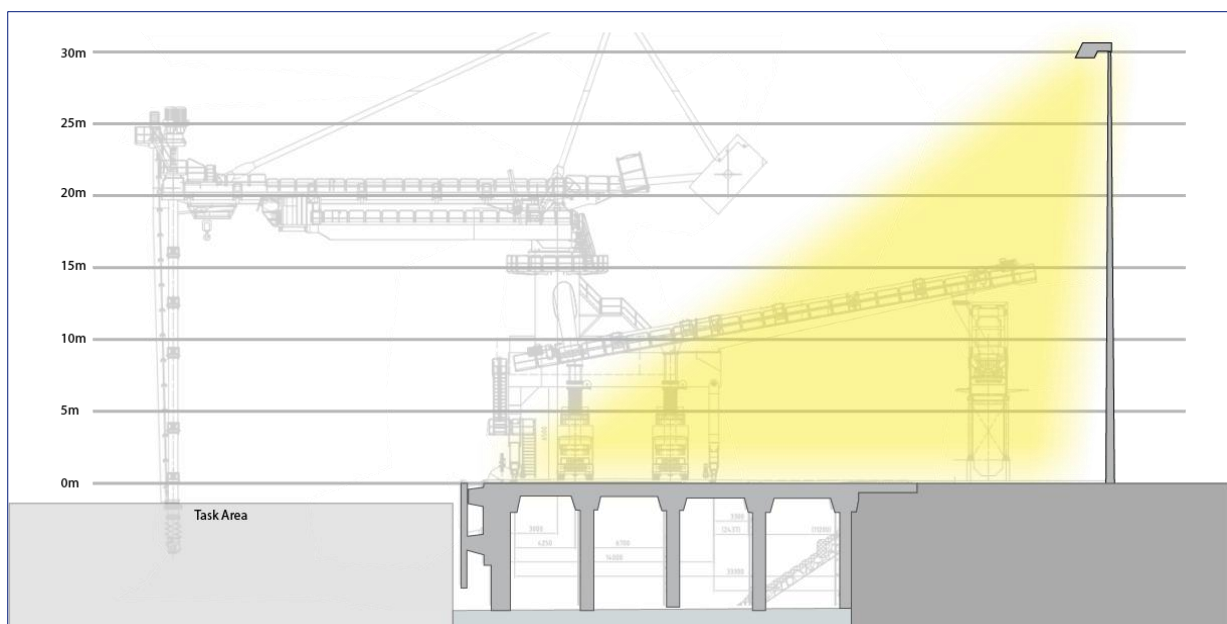
Inset 5.12 CSU lighting example

General quayside lighting

- 5.2.25 General lighting to the quayside storage and loading area will be provided by high-mast lighting system set further back from the quayside to avoid clashes with the CSUs and conveyor systems, which can move on rails the entire length of the quay (Inset 5.13).
- 5.2.26 The following principles will be considered in the Detailed Lighting Strategy:
- high-mast lighting will be set back approximately 35m from the quay edge, past the obstruction line, to provide clearance from the CSU rails and conveyors. The high masts will also be coordinated with below ground cable trenches;
 - the high masts will be approximately 30m in height to ensure that the area between the columns and the quay edge will be lit to the appropriate light levels in Table 2.1. CSU mounted lighting will provide

supplementary local area task lighting for the unloading/loading activities;

- to avoid upward light, asymmetric floodlights will be selected with an appropriate photometry that does not require the floodlight to be tilted above horizontal, for the purpose of avoiding upward light and light spill over the water;
- a glare rating $GR < 40$ should be considered in safety critical areas; and
- drivers will be installed at ground level in the column to minimise high-level maintenance.



Inset 5.13 **Indicative quayside lighting schemes**

6 Summary

- 6.1.1 This Framework Lighting Strategy has been prepared to support the DCO application for the Proposed Development.
- 6.1.2 This strategy provides high level lighting criteria and principles that demonstrate best practice for mitigating light obtrusion and potential nuisance beyond and from the Site. The lighting strategy aims to minimise impacts on the nationally and internationally designated ecological habitats present around the Proposed Development, whilst balancing the safe operation of the SAF plant. The strategy outlines mitigation measures to manage the impact of light obtrusion over the River Tees, including sensitively selected colour temperatures and optics and a suitable control schedule.
- 6.1.3 During the Front End Engineering Design (FEED) process the location and scale of all activities and processes within the Site will be refined. A Detailed Lighting Strategy will be developed by the EPC Contractor(s) for the construction and operational phase of the Proposed Development. This Strategy will include the following:
- detailed calculations using computational light modelling software such as Dialux, Relux, AGI to show compliance with the lighting design standards for both general and emergency lighting;
 - lighting specification for all luminaires capturing the technical lighting specification requirements and light obtrusion requirements listed within in this Framework Lighting Strategy;
 - lighting layouts showing the setting-out, mounting heights and tilt angle of all luminaires; and
 - lighting control techniques.
- 6.1.4 Complying with the recommendations listed within this Framework Lighting Strategy will ensure that the Proposed Development provides a negligible impact on the surrounding receptors.

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