



Proposed Development at Hollingworth Road and Rakewood Road, Littleborough

Lighting Assessment

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	Name	Position	Signature	Date
Prepared by:	Gareth Davies	Principal Lighting Consultant	GD	September 2023
Reviewed by:	Ailsa McClymont	Graduate Environmental Lighting Consultant	AM	June 2024
Approved by:	Neil Young	Senior Associate Environmental Consultant	NY	June 2024

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1 Introduction

1.1 Introduction

- 1.1.1 Stantec UK Ltd has been commissioned by Bloor Homes North West ('the Applicant') to prepare a Lighting Assessment for a planning application for a residential led development ('Proposed Development') at Hollingworth Road and Rakewood Road, Littleborough ('the Site'). The Site and immediate surrounds are within the jurisdiction of Rochdale Borough Council ('RBC').
- 1.1.2 The Lighting Assessment has been developed with regards to The Institution of Lighting Professionals' (ILP) Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (2013) (ILP PLG04) and the information contained within ILP Guidance Notes for the Reduction of Obtrusive Light (2021) (ILP GN01)^a.

1.2 Site Location and Context

- 1.2.1 The Site comprises two parcels of land, Hollingworth Road (the land parcel to the west in **Figure 1.1**) and Rakewood Road (the land parcel to the east in **Figure 1.1**), with a combined total of 21.49 hectares (ha).
- 1.2.2 The Hollingworth Road land parcel is bounded to the north by the Rochdale Canal and the former Akzo Nobel site. The latter is now controlled by Vistry Partnerships and is currently under development for up to 127 dwellings (planning application ref: 21/01146/FUL). To the east is Hollingworth Road, with agricultural land beyond. To the south is Lake Bank (road) which borders Hollingworth Lake and a number of residential dwellings. The south-eastern part of the Hollingworth Road land parcel comprises a public car park for visitors to Hollingworth Lake. To the west are residential dwellings associated with the settlement of Smithy Bridge.
- 1.2.3 The Hollingworth Road land parcel predominantly comprises land used for grazing of cattle with field boundaries enclosed by dry stone walls and hedgerows. There are eight parcels of land in total surrounding Lower Cleggswood Farm, central to the Site and accessed via Heald Lane which runs south to Lake Bank. Heald Lane is a Public Right of Way ('PRoW').
- 1.2.4 The Hollingworth Road land parcel is variable in topography, with land falling away from a central ridge through the Site to the east and dropping steeply towards the Rochdale Canal to the north and rising to the west to a plateau. This variable topography is characteristic of the surrounding landscape.
- 1.2.5 The Hollingworth Road land parcel is identified as residential allocation ('Policy JP Allocation 20: Land North of Smithy Bridge') in the Places for Everyone ('Pfe') document, which became part of the statutory development plan in March 2024^b.

- 1.2.6 The Rakewood Road land parcel is located approximately 185 m to the east of the Hollingworth Road land parcel and is centred approximately at National Grid Reference SD 94042, 15228. The Rakewood Road land parcel is bordered by Rakewood Road to the south, the Hollingworth Country Park car park and RSPCA building to the west and agricultural land to the north and east.

1.3 Proposed Development

- 1.3.1 The Proposed Development comprises:
- Planning application seeking full permission for residential development including the construction of vehicular/pedestrian accesses, landscape measures, open spaces and associated works at land off Hollingworth Road, alongside reconfiguration of and extension to the existing car park and associated works off Rakewood Road; and outline planning permission for the development of a primary school (access into the school site to be considered - all other matters reserved for future approval).
 - It is anticipated that the proposed development will provide approximately 312 dwellings (Use Class C3) and a Primary School (Use Class F1) and extension of the existing car park. The site encompasses a total land area of approximately 21.49 hectares.

Figure 1.1: Site Location Plan

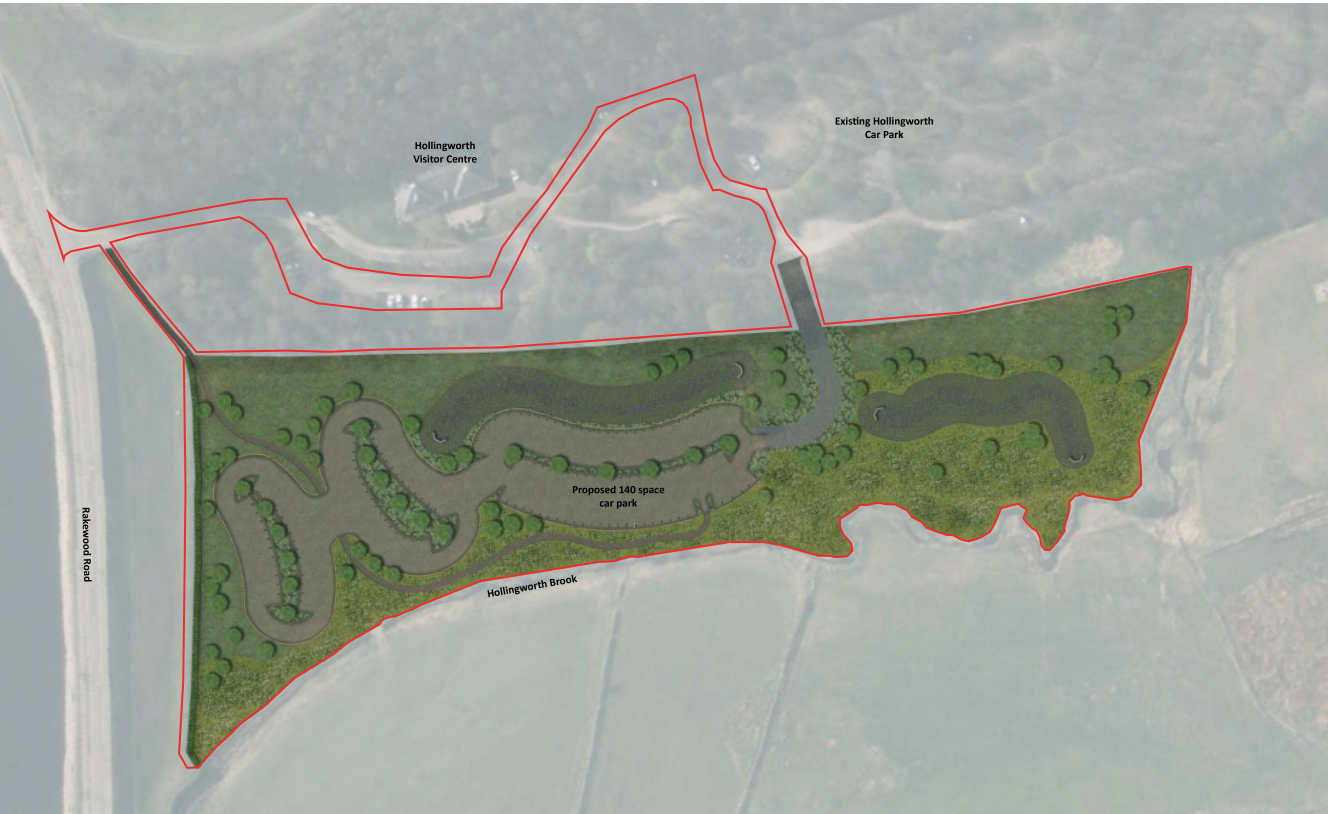


a <https://theilp.org.uk/publication/guidance-note-1-for-the-reduction-of-obtrusive-light-2021/>
b <https://www.greatermanchester-ca.gov.uk/what-we-do/planning-and-housing/places-for-everyone/>

Figure 1.2: Illustrative Masterplan of Hollingworth Road land parcel



Figure 1.3: Illustrative Masterplan of Rakewood Road land parcel



2 Methodology

2.1 Lighting Assessment Process

- 2.1.1 This section provides an outline of the methods and procedures that are followed when undertaking the Lighting Assessment including how the baseline lighting conditions are determined and the assessment process undertaken. The methodology developed has due regard for the process detailed within Institution of Lighting Professionals’ Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (2013) (ILP PLG04) and the information contained within ILP Guidance Notes for the Reduction of Obtrusive Light (2021) (ILP GN01)^a.
- 2.1.2 Lighting has differing potential impacts on various environmental factors and as such the focus and results of assessment at given receptors will vary according to the factors present. **Table 2.1** provides a summary overview of the considerations against the three most common factors interacting with light. **Table 2.1** also states the scope for assessment and where conclusions are drawn within this report or technical information and commentary provided to the relevant discipline to inform their assessment.

2.2 Key Terms

Artificial Lighting at Night (ALAN)

- 2.2.1 Artificial [Additional] Lighting at Night (ALAN) is used to describe lighting sources that do not occur naturally and are the result of human intervention. This primarily relates to light from electric sources but can also include fire and manipulation of natural light through optics as examples. In the case of electric lighting ‘artificiality’ refers to both the method of creation (only occurring with human intervention) and the spectral qualities as very rarely do ‘artificial’ sources accurately match the spectral characteristics of the primary occurring natural light sources.
- 2.2.2 “Natural” light sources can be considered as sunlight, moonlight (sunlight reflected from the moon), starlight, meteorological instances (lightning as temporary in nature and Aurora), Geothermal (volcanic), and bioluminescence of certain species. Moonlight as the primary natural light source at night is capable of providing up to ~0.3lux under ideal full moon conditions^b, however, is typically significantly less. Starlight is considered as negligible. Understanding the contributions of natural light sources is important in establishing baseline lighting conditions.

Table 2.1: Obtrusive Light Considerations against EIA Factors, Roles and Responsibilities within this Assessment

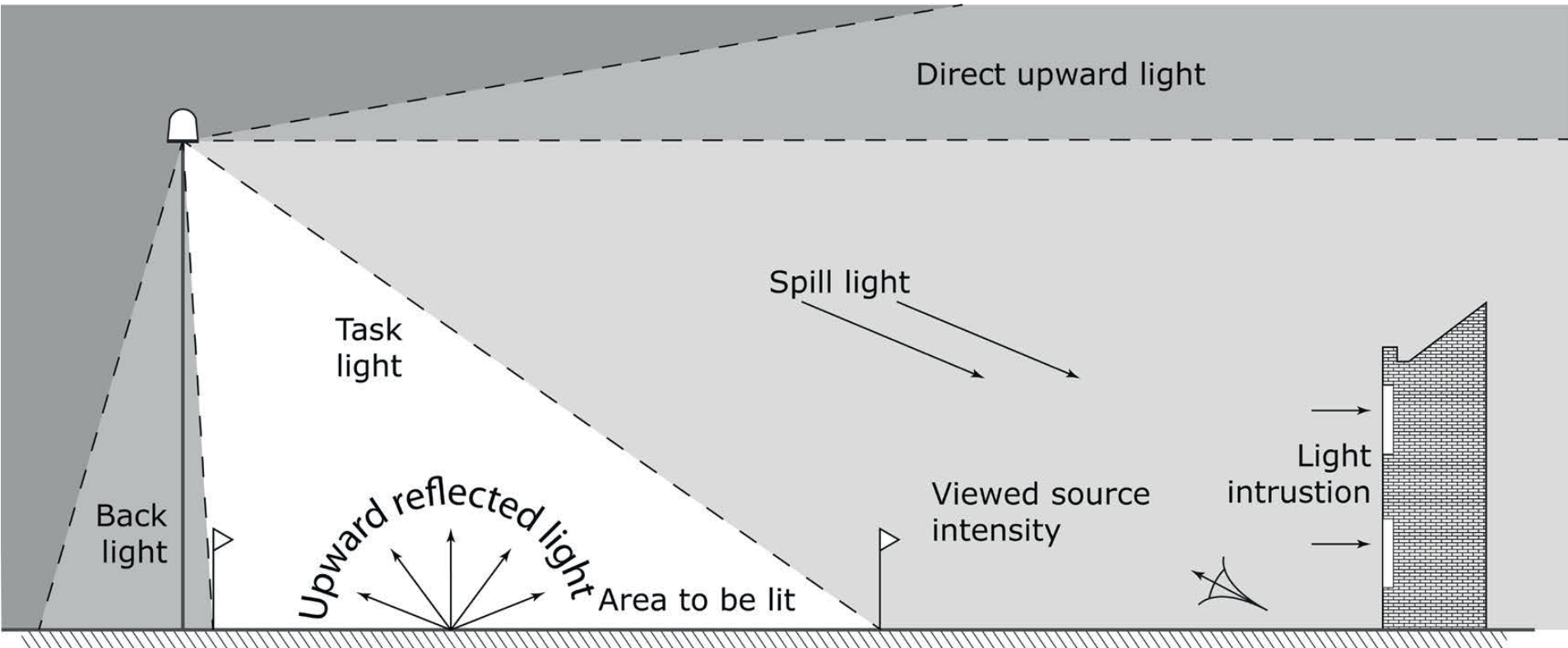
Landscape/Townscape (Visual) & Cultural Heritage	Population and Human Health	Biodiversity
Considers the appearance of the Proposed Development within the context of its surroundings and any resulting change to the character of an area. This also captures the potential impacts on heritage locations and settings. Visual considerations include aspects such as the quality of dark skies and capacity to see celestial objects. Quantifiable limits on obtrusive light, as stated in The Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light (2021) (ILP GN01-21), may be used as measurable thresholds alongside qualitative assessments.	Typically starts by considering light in the context of the Clean Neighbourhoods and Environments Act 2005 “artificial light emitted from premises so as to be prejudicial to health or a nuisance” The established definition of health from the World Health Organisation is that ‘health is a state of complete physical, social and mental wellbeing and not simply the absence of disease or infirmity’. This category also considers appropriate lighting for the safe and efficient undertaking of task within the development and avoiding disruption to activities surrounding the development Perceptions of personal and property safety from crime. For the safe use of a space and performance of tasks within an area, relevant standards and guidance documents are used alongside qualitative assessment.	Light occurring outside of the natural diurnal cycle having the potential to disrupt the health and behaviour of biodiversity (flora and fauna). Considers the changes in lighting conditions relative to the habitats and species identified within or surrounding the Site. Quantified thresholds will vary by habitat and species present.
Within this application the Lighting Impact Assessment has drawn conclusions regarding the significance of the night-time visual receptors in accordance with the criteria set out in Table 2.7 .	Within this application the Lighting Assessment has drawn conclusions regarding the significance of the night-time visual receptors in accordance with the criteria set out in Table 2.7 .	Lighting Assessment provides qualitative and quantitative commentary on baseline, expected lighting conditions and mitigation measures. For the assessment of the significance of effect at identified receptors please refer to Environmental Statement: Volume II

a <https://theilp.org.uk/publication/guidance-note-1-for-the-reduction-of-obtrusive-light-2021/>
b How bright is moonlight? Christopher C M Kyba, Andrej Mohar, Thomas Posch Astronomy & Geophysics, Volume 58, Issue 1, 1 February 2017, Pages 1.31–1.32, <https://doi.org/10.1093/astrogeo/atx025>

Light Pollution & Obtrusive Light

- 2.2.3 The terms light pollution and obtrusive light are often used interchangeably however can be considered as distinct, with obtrusive light falling within the broader definition of light pollution.
- 2.2.4 The United Nations Economic Commission for Europe (UNECE) defined air pollution as [highlighting for emphasis]
- “The introduction by man[humans], directly or indirectly, of substances or energy into the air resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems and material property and impair or interfere with amenities and other legitimate uses of the environment...”^a*
- 2.2.5 It is recognised that any form of ALAN, regardless of how well controlled has the capacity to disrupt the ‘natural’ daily cycle of light and dark, with associated effects to ecosystems, amenities and legitimate uses of the environment. The effects of individual lighting installations may be minimal and barely perceivable in isolation however cumulatively can be seen as resulting in far greater effects.
- 2.2.6 Obtrusive Light can be determined by the definition of “obtrusive” and is considered to occur when the magnitude of light pollution generated becomes “noticeable or prominent in an unwelcome or intrusive way”. This definition can be assessed both objectively (quantitatively) and subjectively (qualitatively). Typical criteria are discussed in **Section 2.5**.
- 2.2.7 Whilst lighting installations may not result in obtrusive light it is important to acknowledge that they will likely result in light pollution as an inevitable by-product of illuminating an area or feature and lighting schemes should seek to minimise the quantity of light pollution regardless of if obtrusive light thresholds are neared and require consideration.

Figure 2.1: Types of Light Pollution



^a 1979 CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION <https://unece.org/sites/default/files/2021-05/1979%20CLRTAP.e.pdf>

2.4 Baseline Conditions and Selection of Receptors

2.4.1 The process of establishing the baseline conditions and identifying receptors for study is partially cyclic with both elements influencing the scope of the other.

Receptors

2.4.2 According to the guidelines set out in the ILP PLG04, receptors are specific elements affected by a development. Table 2.2 provides examples of receptors that may be considered. Receptors can be individual locations (e.g. identified bat roost) or grouped instances (a row of houses facing onto application site). Receptors are filtered throughout the assessment process, with those likely to be affected by the Proposed Development carried forward to the assessment.

2.4.3 The lighting assessment primarily focuses on existing receptors affected by the Proposed Development however can include future receptors either as external receptors on cumulative developments or created receptors as part of the development where either one portion of the development may influence another or external light sources may exert influence on the Proposed Development.

Desk-based Study

2.4.4 An initial desk based-study is undertaken to establish the geographic scope of the assessment and identify potential receptors for further study. The desk based assessment seeks to use the following information:

- Freely available mapping and aerial & street photography (Google, Bing, Openstreetmap)
- GIS datasets and mapping (Stantec GIS portal, with equivalent information available through DEFRA Multi-Agency Geo-Information for Countryside (MAGIC) Map Application)
 - Proximity based scheduling of key receptor categories
- NASA Black Marble Visible Infrared Imaging Radiometer Suite (VIIRS) annual datasets, visualised through www.lightpollutionmap.info
- Local plans and policies
- Reports, surveys and dialogue with related disciplines

Day/Night Site Survey

2.4.5 The site and surrounds are visited by day and by night. At selected locations photographic and/or illuminance readings are taken to support the understanding of the baseline conditions.

Table 2.2: Types of Receptors and Receptor Selection Methods

Landscape/Townscape (Visual) & Cultural Heritage	Population and Human Health	Biodiversity
Receptors will typically be determined as a subset of LVIA viewpoints focussed on where there is activity occurring at night. Heritage receptors will be agreed with heritage consultant and filtered through their direct use at night or views to the heritage asset in the context of the Proposed Development. The visual appearance of the Proposed Development and resulting quality of night sky at surrounding residential and leisure locations may also be considered. ■ Areas of Outstanding Natural Beauty (AONB) ■ National Parks ■ Dark Sky Core (E0) ■ Environmental Lighting Zone) or Buffer Zones ■ Local outdoor leisure locations such as country parks or viewpoints ■ World Heritage Sites ■ Conservation Areas	Residential properties, considering potential impacts on both sleeping and general accommodation. Industrial, Commercial, Educational, and Sports Facilities where changes in lighting condition may affect capacity to perform the required tasks at these receptors. Transportation, including roads (motor vehicle, cyclist), rail, and aerodrome where changes in lighting condition may have the potential to cause safety concerns. Public realm, maintaining or generating attractive, and welcoming usable space.	Receptors for study will be agreed with the project Ecologist and may include: Designated Nature Conservation Sites e.g. Sites of Special Scientific Interest (SSSI); Ramsar (wetland) sites; and Local Nature reserves. Retained Habitats (hedgerows, trees, ponds) surrounding within or at the boundary of the Site. Identified bat roosts, badger sets or similar. Created or improved habitats forming part of the Proposed Development

Photography

2.4.6 Survey locations are used to inform the baseline conditions at identified receptors and identify receptors. Where practical survey locations directly correlating to the identified receptors are visited, however depending on the type and location of the receptor, photographic or photometric measurements directly at the receptor itself may not be viable. In these instances, survey locations as close to the receptor or representative of the relationship of the receptor to the Site are used. These provide the basis for “Informed Assessment” as detailed in ILP PLG04.

2.4.7 Photography is taken with due regard to ILP PLG04 and ILP Guidance Note 10 Night-time Photography. Multiple photographs may be taken and stitched to form panoramas. Photography is intended to provide support to the narrative of the assessment. Unless explicitly stated otherwise photography is not intended to be reproduced as ‘verified views’.^a

2.4.8 Cameras and camera settings are detailed within Appendix A .

a “Verified views” as per Landscape Institute Technical Guidance Note 06/19 Visual Representation of Development Proposals

Illuminance Readings

2.4.9 Illuminance readings are taken horizontally at ground level and vertically at appropriate heights above ground level for the receptor to characterise the quantity the contributions of existing natural and artificial light at each location.

2.4.10 Illuminance readings are taken using a Extech Easy View 30 Light Meter. The calibration certificate, including for low illuminance calibration, is included within Appendix B.

Sky Quality Measurements

2.4.11 Whilst reference is made to the Sky Quality Metric (SQM) within ILP GN01, sky quality measurements are not captured as part of the site survey process. SQM readings require the perfect conditions (clear skies and moon below horizon) and ideally repeated measurements to give an accurate result, which cannot be ensured within the single site visit process. Where SQM metrics are available from reputable local sources then these will inform the Environmental Lighting Zone selection.

Environmental Lighting Zones

- 2.4.12 ILP GN01 and ILP PLG04 detail Environmental Zones based on CIE150. These are based on the existing character and ambient lighting levels at a given site or receptor. For the purpose of this report the phrase Environmental Lighting Zone (ELZ) has been used to reduce potential confusion with any other zoning occurring applicable to environmental considerations.
- 2.4.13 The Environmental Lighting Zone characterises the Site and surrounding areas with classifications determining the obtrusive light limitations at the Proposed Development (emitter) and Sensitive Receptors (on or outside of the Site). Where the Site and receptors have varying Environmental Lighting Zones then thresholds applicable Environmental Lighting Zone at the location of the respective receptor are applied.
- 2.4.14 The Environmental Lighting Zone is established alongside the baseline conditions. Where the Local Planning Authority has published Environmental Lighting Zones these will be applied, however in the absence of published zoning these will be determined as part of the baseline lighting conditions.

2.5 Obtrusive Light Criteria

- 2.5.1 In the absence of any additional local, site specific or project legislation, policies or guidance thresholds published within ILP GN01 will be applied and used to judge the magnitude and significance of changes to lighting conditions resulting from the project. Where values can be expected to, or are calculated to exceed these thresholds then it is reasonable to judge the lighting installation as generating obtrusive light. Whilst maximums are set for these criteria either as a whole or based on the Environmental Lighting Zone, lighting is contextual and values below the thresholds can also be considered obtrusive (See also discussion on Clean Neighbourhoods and Environment Act within [Section 3](#).)
- 2.5.2 Thresholds for key light pollution metrics are shown within [Table 2.4](#) to [Table 2.6](#).

Table 2.3: Environmental Lighting Zones

Environmental Lighting Zone	Surrounding	Lighting Environment	SQM	Examples
E0	Protected	Dark	20.5+	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places.
E1	Natural	Intrinsically dark	20 to 20.5	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness	~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.
Environmental lighting Zone E0 must always be followed by and E1 Environmental Lighting Zone Additional note from CIE 150, not currently widely adopted within the UK - <i>Regardless of the level of urban development the recommendations for Environmental Lighting Zone E1 or E0, should be followed for all locations within 100km of a major optical astronomy observatory. Regardless of the level of urban development the recommendations for Environmental Lighting Zone E2 (or better) should be followed for locations within 30km of an operating urban optical astronomy observatory and for locations between 100km and 300km from a major optical astronomy observatory.</i>				
Based on Table 1 within CIE 150 / Table 2 within ILP GN01				

Table 2.4: Collated Obtrusive Light Criteria, adapted from ILP GN01 / CIE 150

	Limitation of skyglow				Limitation of illumination on surrounding premises		Limitations of the effect of over-lit building façades and signs		Limitation of bright luminaires in the field of view (Viewed Source Intensity)	Limitation of the effects on transport systems (disability glare)
Environmental Lighting Zone	Upward light ratio (ULR) / %	Upward Flux Ratio			Maximum values of vertical illuminance on properties. Illuminance in the vertical plane [Ev] (lux)	Maximum permitted values of average surface Luminance (cd/ m2)				
						Building Façade Illuminance	Sign luminance			
Road	Amenity	Sports	Pre-curfew	Post-curfew						
E0	0%	/	/	/	n/a	n/a	<0.1 cd/m²	<0.1 cd/m²	Refer to Table 2.5	Refer to Table 2.6
E1	0%	2	/	/	2 lux	< 0.1lux*1	<0.1 cd/m²	50 cd/m²		
E2	2.5%	5	6	2	5 lux	1 lux	5 cd/m²	400 cd/m²		
E3	5%	8	12	6	10 lux	2 lux	10 cd/m²	800 cd/m²		
E4	15%	12	35	15	25 lux	5 lux	25 cd/m²	1000 cd/m²		
	Considered the primary approach to limit skyglow. Useful to compare luminaire types and specifications and mitigate contributions of each luminaire within an installation	Upward flux ratio is not applicable to all projects and only studied in highly sensitive areas or in the proximity of significant optical observatories. Refer to section 6.4.3 of CIE 150 for further information on upward flux ration and calculation method.			The values are the summation of all lighting installations		Taken as the product of the design average illuminance and reflectance divided by π	Taken as the product of the design average illuminance and reflectance divided by π (pi), or for self-luminous signs, its average luminance		Applied where lighting installations in the vicinity of transport fall outside of normal or typical development conditions.
					*1 If the installation is for public (road) lighting then this may be up to 1 lux					
					The values apply to both pre- and post-curfew, except that in Zones 0 and 1 the values shall be zero post-curfew. The values for signs do not apply to signs for traffic control purposes.					
Based upon Tables 2,5, 6 & 7 within CIE 150 and Tables 3, 6, 7 & 8 within ILP GN01										

Limitation of skyglow

- 2.5.3 The primary metric for establishing upward light is as a percentage of the total luminous flux for the luminaire or scheme directly emitted above the horizontal. This does not include indirect (reflected) light from illuminated surfaces.
- 2.5.4 ILP GN01 list the criteria as “*Maximum values of upward light ratio (ULR) of luminaires*”. This implies this is considered on a luminaire by luminaire basis, with the commentary going on to state “*Some lighting schemes will require the deliberate and careful use of upward light... to which these limits cannot apply. However, care should always be taken to minimise any upward waste light by the proper application of suitably directional luminaires and light controlling attachments.*”
- 2.5.5 In the event that direct deliberate and careful use of upward light is required then the definition of ULOR α from CIE150 can be considered which considers the “*proportion of total luminous flux of all lamps considered in a luminaire or installation which is emitted above the horizontal plane, passing through the luminaires in the installed position*” (where α is the installed position). It is understood that the obstructions of fixed objects being illuminated can be factored into the calculation.
- 2.5.6 Whilst maximum ULRs are given for an Environmental Lighting Zone this should not be considered as clear permission to emit upward light. Schemes should be conscious of luminaire selections with upward light as an informed, considered and deliberate application.
- 2.5.7 The Upward Flux Ratio method includes consideration of indirect light, however is typically only applied to highly sensitive areas or in the proximity of significant optical observatories.

Limitation of illumination on surrounding premises

- 2.5.8 The published acceptable values on the vertical plane are typically most applicable to residential properties where spill light has the potential to disrupt the occupants, particularly in sleeping accommodation. Values are established based on expected conditions within the environmental lighting zone. Alternate values may be acceptable depending on the use of the property and health and safety assessment.
- 2.5.9 Illuminance readings should be typically taken on the outside face at the centre of a window. Thresholds are cumulative and should consider existing light sources. Where access to private property or the elevations of a given window is not practical then readings along the accessible boundary of a property or the Site are used as reference and to inform the likely the conditions at façades.

Table 2.5: Limitation of bright luminaires in the field of view

Environmental Lighting Zone	Application Conditions	Luminaire group (projected area A_p in m^2)					
		$0 < A_p \leq 0.002$	$0.002 < A_p \leq 0.01$	$0.01 < A_p \leq 0.03$	$0.03 < A_p \leq 0.13$	$0.13 < A_p \leq 0.50$	$A_p > 0.5$
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 cd
	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 cd
	Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	500 cd
E3	Pre-curfew	0.86 d	1.9 d	3.8 d	7.5 d	15 d	10,000 cd
	Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	1,000 cd
E4	Pre-curfew	1.4 d	3.1 d	6.3 d	13 d	26 d	25,000 cd
	Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	2,500 cd

d = distance between the observer and luminaire (glare source) in meters
 A_p = apparent surface area of the light source as seen from observer position
The Maximum luminous intensity emitted by luminaire (I in candela (cd)) values are obtained by multiplying d (distance of the observer from light source) by the value appropriate value in the table obtained for the environmental lighting zone and apparent surface area of the light source.
Where multiple luminaires are in close proximity and perceived as a single source the cumulative values of the luminaire outputs should be considered.
The upper limit for each Environmental Lighting Zone shall be taken as those within column $A_p > 0.5$

Table based upon Table 3 within CIE 150 / Table 4 within ILP GN01

Table 2.6: Maximum values of Threshold Increment and viewing direction in the path of travel

Light technical parameter	Road Classification			
	No road lighting	M6 / M5	M4 / M3	M2 / M1
Veiling Luminance (L_v)	0.037 cd/m ²	0.23 cd/m ²	0.40 cd/m ²	0.84 cd/m ²
Threshold Increment (TI)	15% based on adaption luminance of 0.1 cd/m2			
	The veiling luminance values specified in this table are based upon on a permissible TI value of 15%			
TI = The measure of disability glare expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare, the reduction in visibility caused by intense light sources in the field of view. L_v = The luminance that would need to be superimposed on a scene in object space to reduce the scene's contrast by an amount equal to the added retinal illuminance from scattered light on the scene's retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view				
Table based upon Table 4 within CIE 150 / Table 5 within ILP GN01				

Limitations of the effect of over-lit building façades and signs

2.5.10 Applicable when providing dedicated facade illuminance or general area illuminance also provides extensive illuminance to a facade.

2.5.11 Illuminated advertising signage should be assessed as advised in the ILP Professional Lighting Guide 05 (PLG05); The Brightness of Illuminated Advertisements

Limitation of bright luminaires in the field of view

2.5.12 This metric is intended for locations with extended viewing durations and as part of the quality of a given view and not for passing observation. At outline stage it is possible to consider this factor qualitatively, based on expected prominent light sources. At detailed stage the calculations are based on the relationship between the distance of the viewer and the size and intensity of observed light source.

Limitation of the effects on transport systems

2.5.13 Requires calculation when extreme contrasts or atypical lighting installations are applied within the vicinity of highways networks.

2.6 Establishing expected lighting conditions within the Proposed Development

Outline Applications

2.6.1 The approaches to lighting the space are discussed narratively along with the best practice and embedded mitigation measures to be applied.

2.6.2 Selected photometric calculations and studies may be undertaken at identified sensitive locations.

2.7 Assessment

2.7.1 ILP PLG04 permits a direct assessment of impacts and effects against a 7 point scale tracking major to minor beneficial, neutral and minor to major adverse respectively. This considers the sensitivity of receptors and magnitude of change as part of the assessment without breaking these out as separate stages. ILP PLG04 criteria consider the assessment as a whole without reference to the three distinct factors identified as related to lighting. **Table 2.7** is adapted from PLG04 to identify criteria and considerations against these factors. For beneficial effects overarching criteria is given with the narrative assessment expanding upon the significance of the benefit. For adverse effects, criteria are expanded upon for the major, moderate and minor significances to support the narrative assessments.

Table 2.7: Assessment Criteria and Considerations by Factor

		ILP PLG04 General Criteria	Criteria by Individual Factors		
			Landscape/Townscape (Visual) & Cultural Heritage	Population and Human Health	Biodiversity
Beneficial Positive	Major	Significant improvement in night environment and/or reductions in glare, spill light and sky glow etc.	Changes to lighting resulting from the development actively improve the quality and value of the view from the receptor location.	Reductions in obtrusive lighting levels at a receptor.	Light occurring outside of the natural diurnal cycle having the potential to disrupt the health and behaviour of biodiversity (flora and fauna). Considers the changes in lighting conditions relative to the habitats and species identified within or surrounding the Site. Quantified thresholds will vary by habitat and species present.
	Moderate	Noticeable improvement in night environment and/or reductions in glare, spill light and sky glow etc.		Improvement of safety at a receptor.	
	Minor	Slight improvement in night environment and/or reductions in glare, spill light and sky glow etc.		Activation of facilities by night associated with health and wellbeing.	
Neutral Negligible		No significant effect or overall effects balancing out	No significant effect or overall effects balancing out. Narrative assessment will state the varying beneficial and adverse components of the assessment.		
Adverse Negative	Minor	Slight increase in visibility of Site, glare, and sky glow etc.	Changes to lighting from the development actively reduce the quality of and value of views from a receptor location. Examples; ■ Introduction of lighting into a previously unlit setting (unless actively improving the view) ■ Imbalance of lighting conditions relative to baseline at receptor (e.g. commercial illuminance levels viewed from residential setting). ■ Lighting to areas or features that are inappropriate for illumination. ■ Lighting at inappropriate times.	Small increase in obtrusive light proportional to existing baseline condition. Noticeable lighting sources as distraction.	Changes (typically increase) in lighting that may (negatively) influence behaviour of identified species.
	Moderate	Noticeable increase in visibility of Site, glare, and sky glow etc.		Noticeable increase in Obtrusive Light with values falling inside thresholds for Environmental Lighting Zone Discomfort glare	
	Major		Significant increase in visibility of Site, glare, and sky glow etc.	As above plus: ■ Poor quality lighting installation failing to meet obtrusive lighting guidelines resulting in glare, sky glow. ■ Excessive illumination greater than requirements for task at development.	Obtrusive light values outside of thresholds for Environmental Lighting Zone Disability glare preventing safe undertaking of tasks at receptor
Extracted from Figure 12 within ILP PLG04					

- 2.7.2 Due to the hybrid nature of the scheme the assessment is based on expected lighting conditions informed by the parameters plan and illustrative masterplans.
- 2.7.3 Unless otherwise stated or requested within Local Policies or Supplementary Planning Documents (SPDs) the criteria and thresholds listed within ILP GN01 are used as reference points for assessment.
- 2.7.4 Criteria are shown across all factors for reference, however conclusions for some factors may be drawn by the respective disciplines as outlined in **Table 2.1**.

2.8 Mitigation

- 2.8.1 Where the potential for adverse effects is identified, strategies and methods for mitigating these are proposed. At this stage it is unfeasible to develop full solutions and calculated schemes. The solutions are proposed with sufficient degree of confidence in their deliverability.
- 2.8.2 The extent and nature of mitigation proposed is proportionate to the level of adverse effects recorded under the expected lighting conditions.
- 2.8.3 Mitigation is also used to discuss further over and above considerations that whilst not changing the assessment conclusions could be understood to further reduce impact and minimise light pollution.

2.9 Residual Effects

- 2.9.1 Where mitigation is applied then the impact and effects after mitigation has been applied are considered. Residual effects are only considered where mitigation is required and expected to change the levels of impact and effect.

2.10 Cumulative

- 2.10.1 Considers the development within the context of identified planned, approved or in progress developments where applicable.

3 Legislation, Policy, Standards, and Guidance

3.1 Legislation

Provision of Lighting

- 3.1.1 Requirements to illuminate an area are largely informed by the duty of care of service providers and employers to their members of the public and employees. This is best summarised within **The Workplace (Health, Safety and Welfare) Regulations 1992^a**:

“8. -(1) Every workplace shall have suitable and sufficient lighting.”

- 3.1.2 The provision of Lighting within a scheme should therefore be based on appropriate assessment of the task being undertaken and risks associated. In the absence of specified illuminance levels within legislation at outline stage appropriate lighting is understood based on industry standards and guidelines (See **Section 6**).

Light Pollution & Obtrusive Light

Clean Neighbourhoods and Environment Act (CNEA)

- 3.1.3 Section 102 of The Clean Neighbourhoods and Environment Act (2005)^b amended Section 79 of the Environmental Protection Act (EPA) 1990 by extending the statutory nuisance regime to include light nuisance, by stating the following (key text highlighted in bold):

“102 Statutory nuisance: lighting

*(1) Section 79 of the **Environmental Protection Act** 1990 (c. 43) is amended as follows.*

*(2) In subsection (1) (matters constituting statutory nuisances) after paragraph (fa) (as inserted by section 101 (2)) insert— “(fb) **artificial light emitted from premises so as to be prejudicial to health or a nuisance;**”.*

- 3.1.4 The CNEA also lists types of premises for which the statutory nuisance does not apply, summarised as

Subsection (1) (fb) does not apply to artificial light emitted from [premises occupied for defence purposes]..., (a) an airport; (b) harbour premises; (c) railway premises, not being relevant separate railway premises; (d) tramway premises; (e) a bus station and any associated facilities; (f) a

public service vehicle operating centre; (g) a goods vehicle operating centre; (h) a lighthouse; (i) a prison”

- 3.1.5 Guidance produced by the Department of Environment, Food and Rural Affairs (DEFRA) in April 2006, on Section 101 to 103 of the CNEA, extends the duty on local authorities to ensure their areas are checked periodically for existing sources of statutory nuisances.

- 3.1.6 If a light nuisance is considered by a local authority to exist, the local authority must serve a notice on the person responsible requiring the abatement of the nuisance, and/or restricting or prohibiting its recurrence.

- 3.1.7 Section 103 of the CNEA extends the defence of best practical means to those statutory nuisances where light is emitted from industrial, trade or business premises and also from relevant outdoor sport facilities.

- 3.1.8 It should be noted that this Lighting Impact Assessment considers lighting pollution and obtrusive light as part of the planning process and seeks to avoid potential scenarios in which “statutory nuisance” could occur, using the terms of the CNEA as a frame of reference for acceptable development in the absence of any specific local legislation or policies. “Statutory nuisance” is determined through a separate legal regime ultimately judged by the courts.

Biodiversity and Ecology

- 3.1.9 Lighting can be seen as factor in various legislation on the protection of habitats and species. The extent of legislation applicable is dependent on the habitats and species present in and surrounding the Proposed Development. Refer to the **Environmental Statement: Volume II** for a comprehensive breakdown of applicable legislation.

Highways Lighting

- 3.1.10 There is no statutory requirement to provide road lighting or to install a particular class of lighting if a decision is made by a Highway Authority to light a particular road. However, the provision of road lighting on a previously unlit road is governed by the statutory requirements below.

- 3.1.11 In England and Wales, the Highways Act (1980), Section 97^c, empowers a Highway Authority to provide lighting for any highway or proposed highway for which they are or will be the Highway Authority.

- 3.1.12 In addition, the Public Health Act (1985), or the Parish Councils Act (1957) give district, borough, town or parish councils the power to provide lighting on a highway, although the consent of the Highway Authority is required under the Local Government Act (2000), Section 29.

3.2 National Policy

National Planning Policy Framework (NPPF)

- 3.2.1 The National Planning Policy Framework was last updated on 20th December 2023, (based upon the existing policy first published in March 2012, and intervening updates).

- 3.2.2 Whilst lighting can be a factor in the consideration of many of the policies, artificial lighting is explicitly addressed within section 15^d, “Conserving and enhancing the natural environment”, with paragraph 191 stating:

“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 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”

- 3.2.3 Alongside the direct lighting specific reference above, lighting can be considered a contributing factor within biodiversity considerations, notably addressed in paragraph 186:

“if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused”

Planning Practice Guidance (PPG)

- 3.2.4 The Government’s Planning Practice Guidance (published in 2012 and updated in 2018, 2019 and 2021) web-based resource^e presents specific guidance questions and considerations regarding light pollution. These questions are addressed through the lighting assessment process, however the structure of the report and assessment is based upon methods detailed within ILP PLG04.

^a <https://www.legislation.gov.uk/ukxi/1992/3004/regulation/8>.
Note - The following regulations are also relevant to the responsibility to provide safe space of which lighting is a part.
Health and Safety at Work etc. Act 1974, <https://www.legislation.gov.uk/ukpga/1974/37/>
The Management of Health and Safety at Work Regulations 1999, <https://www.legislation.gov.uk/ukxi/1999/3242/>

The Construction (Design and Management) Regulations 2015 (CDM), <https://www.legislation.gov.uk/ukxi/2015/51>

^b <https://www.legislation.gov.uk/ukpga/2005/16/section/102>

^c <https://www.legislation.gov.uk/ukpga/1980/66/section/97>

^d <https://www.gov.uk/guidance/national-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment>

^e <https://www.gov.uk/guidance/light-pollution>

3.3 Local Policy

Places for Everyone Joint Development Plan	
3.3.1	The Placed for Everyone Plan (adopted 21st March 2024) includes the following references to lighting: Policy JP-G8: A Net Enhancement of Biodiversity and Geodiversity <i>“Where appropriate, a development should: mitigate air pollution impacts on Manchester Mosses SAC; mitigate urban edge, functionally linked land and recreation disturbance impacts on the South Pennine Moors SAC/SPAs; and assess and potentially mitigate boat movement, water pollution. and light spillage and shading impacts on the Rochdale Canal SAC...”</i> Rochdale Borough Core Strategy^a 3.3.2 The Rochdale Borough Core Strategy (adopted in October 2016) includes the following references to lighting: Policy G9 - Reducing the impact of pollution, contamination and land instability <i>“...reduce all forms of pollution... in the borough, by:</i> <i>“b. Requiring that development does not have impacts that lead to an unacceptable increase in air, water, noise, light or other pollution;</i> <i>c. Ensuring sensitive new developments such as housing, schools and hospitals are not adversely affected by existing sources of pollution such as roads and certain types of industry;...”</i> 3.3.3 The supporting text goes on to state: <i>“Lighting schemes for new developments will need to have full regard to minimising negative impact on residential areas, the character of the area, biodiversity and the night sky.”</i> Policy P3 - Improving design of new development 3.3.4 Policy P3, cites lighting as a consideration in <i>“Incorporating design measures that design out crime and ensure developments and spaces are safe to use and access.”</i>

Policy DM1 - General development requirements	
<i>“All development proposals, including changes of use of land and buildings, extensions and alterations, will be expected to demonstrate that they:... Mitigate against any impacts due to noise, air, dust, light and odour pollution,... where such mitigation is identified as being necessary;”</i>	
Rochdale Borough Supplementary Planning Documents	
Biodiversity and Development Supplementary Planning Document (January 2008, updated February 2017) 3.3.5 Lighting during both operational and construction phases is acknowledged as a consideration within the “Design and Development Principles for Biodiversity” with a requirement to <i>“Consider the effects of artificial lighting and spot flood lighting which can affect bats and night feeding birds;”</i> Public Realm Design Guide, A guide to creating good streets and spaces (September 2007) 3.3.6 This guide includes references to lighting as part of defining the character of an area, allowing for safety of movement and avoiding clutter. A hierarchy of spaces is referred to with statements such as: <i>“lamp columns may be free standing in wider streets, whereas lights may be attached to buildings in a mews.”</i> 3.3.7 Lighting is also cited within the context of perceptions of safety of green spaces. Residential Design Guide (September 2007) 3.3.8 Lighting is referenced in the role of providing safe and secure developments repeating some of the key elements from the Public realm Design Guide. 3.3.9 The SPD also highlights a need to consider lighting at appropriate stage of development design and being appropriate stylistically to the development.	

Urban Design Guide (September 2007)	
3.3.10	This SPD references lighting’s role in defining the character of an area and supporting visual connections along routes between spaces.
3.3.11	The guide includes a clause to <i>“use energy efficient street lighting that minimises light pollution”</i> .
Local Highways Lighting Policies and Guidance	
3.3.12	No published streetlighting policies have been identified, however contact has been made with the delivery partner for highways lighting to inform expected requirements. This is discussed within Section 6.2 .

a <https://www.rochdale.gov.uk/downloads/download/266/core-strategy>

3.4 Standards & Guidance

British Standards

BS 5489-1:2020 Design of road lighting - Lighting of roads and public amenity areas:

3.4.1 BS 5489-1 is a British Standard for road lighting design, providing guidance and recommendations that are intended to support the BS EN (British and European) 13201 series. This document provides recommendations on the general principles of road lighting including aesthetic and technical aspects, operation, and maintenance, means of minimising energy consumption and limiting the impact on the environment. The guidance provides recommendations for the design of lighting for urban centres, public amenity areas and smart cities. A simple method for selection of road lighting class is included within this standard.

BS EN 13201-1:2014 -Road lighting - Guidelines on selection of lighting classes

3.4.2 Provides guidelines and a sequenced method for the selection of the most appropriate lighting class for a given situation. The decision on whether a road should be lit is defined in the national road lighting policy, This document does not give the criteria on which a decision to light an area can be made, nor on how a lighting installation should be used. The document is typically applied when the selection process within BS 5489-1 is not sufficient.

BS EN 13201-2:2015 - Road lighting – Performance requirements (Revised February 2020):

3.4.3 Defines road lighting performance requirements, detailed as lighting classes, and considers the environmental aspect of road lighting.

BS EN 12464-2:2014 Light and lighting - Lighting of work places Outdoor work places:

3.4.4 This European Standard specifies lighting requirements for outdoor work places, which meet the needs for visual comfort and performance.

Department for Transport (DfT)

Local transport Note 1/20, Cycle Infrastructure Design (July 202) (DfT LTN1/20)

3.4.5 This document sets out a comprehensive national standard for design of cycle infrastructure, the document does not replace the requirements for local authorities to produce their own standards, however it is understood that this document will form the basis for any local design guides.

Institution of Lighting Professionals (ILP)

The Institution of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light (2021) (ILP GN01)^a

3.4.6 This guidance provides advice on lighting including the recommendation to local planning authorities to specify Environmental Lighting Zones for exterior lighting based on the existing external ambient lighting levels in the area. These documents also provide design guidance including thresholds over which lighting may be considered obtrusive. The ILP publication is based on the International Commission on Illumination (CIE) Guide On The Limitation Of The Effects Of Obtrusive Light From Outdoor Lighting Installations, 2nd Edition:2017 (CIE150:2017). The criteria and values relating to obtrusive light are considered the de-facto thresholds in population and human health assessments, in the absence of additional local guidelines or policies.

ILP Professional Lighting Guide 04: Guidance on Undertaking Environmental Lighting Impact Assessments (2013) (ILP PLG04)

3.4.7 This document sets out a methodology and practical guidance on the production of Lighting Impact Assessments. The document covers the typical contents of a Lighting Impact Assessment alongside practical guidance on surveys, photography, photometric calculations, and qualitative and quantitative assessment.

ILP Guidance Note 10 Night-time Photography (2019)

3.4.8 This guide provide advice for taking night-time photographs of exterior lighting installations including for formal reports and assessments.

ILP Guidance Note 08: Guidance Note Bats and Artificial Lighting in the UK (2023) (ILP GN08)^b

3.4.9 This is a joint publication with the Bat Conservation Trust and provides a summary of current research into the responses of various bat species to ALAN. The document sets out a hierarchy of mitigation (avoidance first, mitigation second, compensation last) with a clear preference of avoidance of ALAN where practicable. The document sets out advice and workflows for ecologists and lighting professionals to collaborate to achieve the most effective solution in delivering an appropriate solutions. This is supported by a number of case study examples.

Guidance Note 09: Domestic exterior lighting: getting it right! (2019) (ILP GN09)^c

3.4.10 Targeted primarily at end users, although applicable to developers the guide provides general advice on ensuring domestic external lighting serves the required purpose, provides appropriate levels of illumination, but does not become a cause for concern to adjacent residents or affect the natural environment surrounding a property.

ILP Professional Lighting Guide 23 – Lighting for Cycling Infrastructure, (2020) (ILP PLG23)

3.4.11 A comprehensive review of current lighting standards and guidance applicable to cycling infrastructure. This document includes guidance for cycle tracks where surfaces are shared with pedestrians and cycle lanes forming either part of the carriageway sharing the space with motorised vehicles or sharing the footway with pedestrians. The document also discusses the need for lighting, environmental and ecology impacts and explains how appropriate lighting levels should be determined including facilities such as storage and parking facilities.

3.4.12 This document will be of use to all those considering improving or constructing cycling infrastructure, determining the need for lighting installing, the environment impact or the effect on ecology.

Chartered Institute of Building Services Engineers (CIBSE), Society of Lighting and Lighting (SLL)

Lighting Guidance 06: The Outdoor Environment 2016 (CIBSE LG6)

3.4.13 Provides general and specific lighting design criteria for the outdoor environment. The guide covers many technical aspects which are likely to be of interest to designers. It presents lighting solutions to basic visual problems and individual characteristics of outdoor lighting applications.

Other

Responsible Lighting at Night (ROLAN) Manifesto^d

3.4.14 The ROLAN manifesto represents provides 10 key points which work towards responsible lighting at night. Whilst by no means definitive and comprehensive the manifesto provides an overview and framework into which many of the topics regarding light pollution, obtrusive light and responsible, sustainable lighting design can be developed. Both the ILP and SLL are signatories to the manifesto. The ROLAN manifesto is shown in full within **Appendix D**.

a <https://theilp.org.uk/publication/guidance-note-1-for-the-reduction-of-obtrusive-light-2021/>
b <https://theilp.org.uk/publication/guidance-note-8-bats-and-artificial-lighting/>

c <https://theilp.org.uk/publication/guidance-note-9-domestic-exterior-lighting-getting-it-right>
d https://www.cibse.org/media/okepdnfn0/rolan-manifesto-white-background_low-res.pdf

4 Baseline Lighting Conditions

4.1 Introduction

4.1.1 This section provides a general overview of the baseline conditions for the Site and Surrounds. The baseline of individual receptors are discussed alongside the assessment within **Table 7.1**. The baseline lighting conditions have been informed by a combination of desk based study and day/night site survey. The record of the day/night survey can be found within **Appendix A**.

4.1.2 References to survey locations and receptors are contained within square brackets to support the descriptive baseline.

4.2 The Site

4.2.1 The Hollingworth Road land parcel (See **Figure 1.1** & **Figure 5.1**) is located northeast of Smithy Bridge and is broadly bounded by the Rochdale Canal and former Akzo Nobel Site (now Vistry Partnership and under construction of up to 127 dwellings) to the north, Hollingworth Road to the east, Lake Bank to the south and residential properties of Smithy Bridge to the west.

4.2.2 The Hollingworth Road land parcel comprises predominantly unlit agricultural land **[C]** (primarily used for livestock grazing), with the compound of Lower Cleggswood Farm, approximately central to the site being the only fixed ALAN sources within the Site.

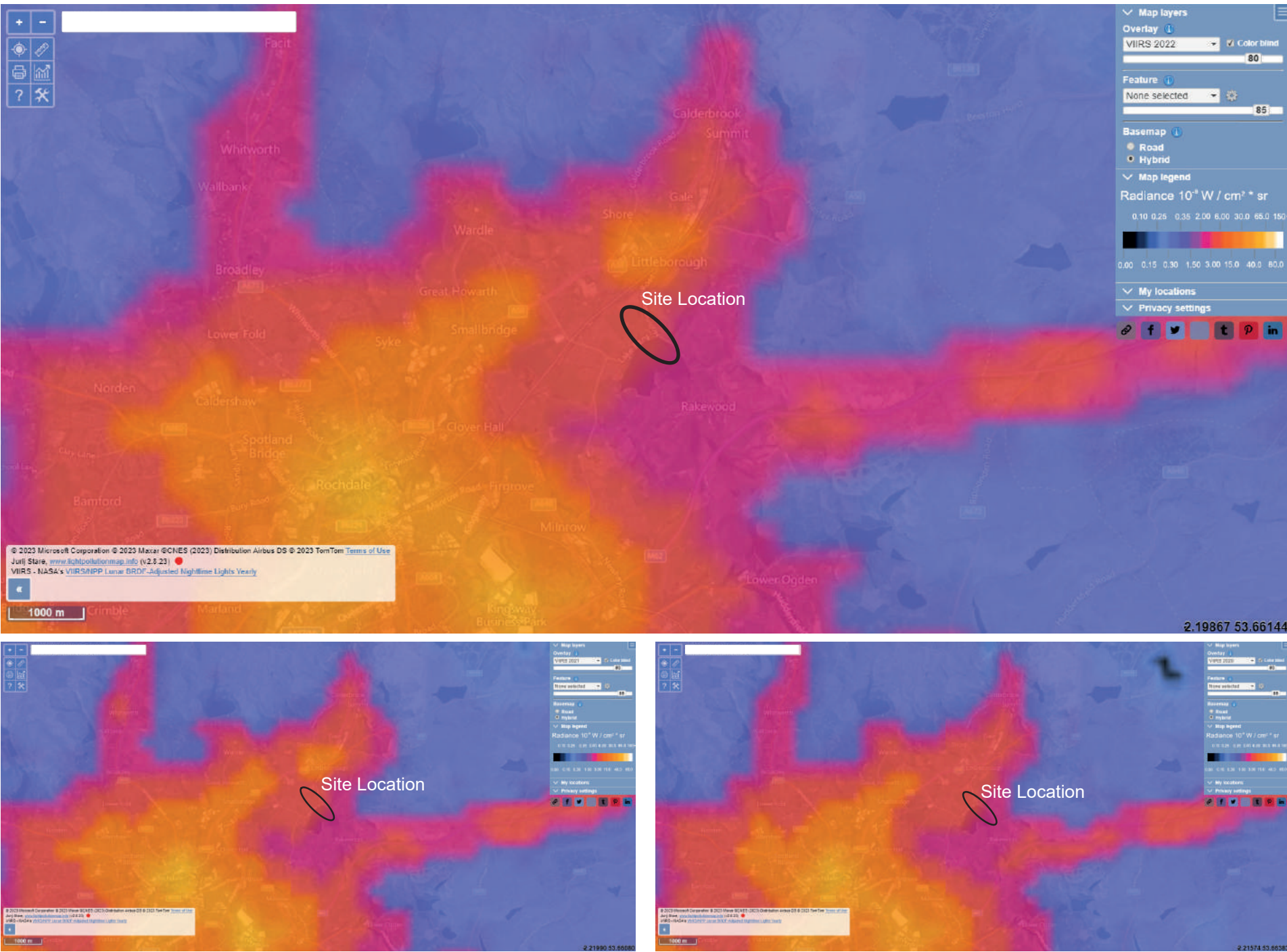
4.2.3 Lower Cleggswood Farm includes a residential dwelling, and a number of smaller barns and outbuildings. Light egress from the residential properties and a single external floodlight on the northern facade was observed during the survey **[D][F]**, however a number of external floodlights were noted during the day survey and it is assumed that lighting is present within some of the barns and outbuildings. This lighting appears largely localised to the compound with the exception of a small (assumed <10W) presence activated floodlight at the residential entrance orientated to shine along Heald Lane, which can also be understood to have a higher than desired upward light ratio.

4.2.4 Heald Lane within the site is unlit.

4.2.5 At the southern end the Site, approaching the dam of Hollingworth lake, the land becomes marshy and does not appear to be used agriculturally. The south east corner of the Site is currently used as a car-park for the Hollingworth Lake **[G]**; the car-park is unlit, however vehicle headlamps may be present (entry to the car-park is closed at 18:00, however exit is possible meaning there is no limit on the timings of cars being present).

4.2.6 The Rakewood Road land parcel comprises predominantly unlit agricultural land, with the Hollingworth Country Park Car Park to the north with associated RSPCA building. The roads and car parks within this area are unlit, however bulkhead lighting on the visitor centre is present, including outside of core operating hours.

Figure 4.1: Satellite VIIRS data for 2022 - 2020
Data sets have been visualised through the website <https://www.lightpollutionmap.info/>



NASA's Black Marble project, operates daily collection of data from the Visible Infrared Imaging Radiometer Suite (VIIRS), a component of the Suomi National Polar-orbiting Partnership (NPP) satellite. VIIRS consists of 22 spectral bands from the ultra-violet to the mid-infrared, one of which is able to observe nighttime lights, the day night band (DNB). DNB is a panchromatic band sensitive to visible and near-infrared wavelengths. The resolution is 15arcseconds. Black Marble's processing removes cloud-contaminated pixels and corrects for atmospheric, terrain, vegetation, snow, lunar, and stray light effects on the VIIRS Day/Night Band (DNB) radiances.

The products are calibrated across time, validated against ground measurements, and include quality indicators for each data set.

The normalisation and aggregating of data sets, alongside the survey time (~midnight to 01:30) means not all sources fully captured within annual data sets however the information provides a useful indication of the trends and general character of an area.

4.2.7 Light intrudes onto the Hollingworth Road land parcel in a number of locations, notably on the eastern boundary from street lighting along Hollingworth Road [E] and on the west from street lighting and domestic lighting from properties and streets bordering the Site.

4.2.8 The elevated portions of the Site have extensive views to the surrounding area and onwards [C], whilst the Site is unlit it is difficult to consider it as rural or dark based on the surrounding conditions.

4.3 Surrounds

General Highways Lighting

4.3.1 Streetlighting is present along the majority of surrounding streets. Streetlighting appears to be predominantly from cosmopolis lamps within fully cut-off luminaires, with more recent development adopting LED luminaires. LED colour temperatures appear <4000K within the public realm.

4.3.2 Streetlighting was noted on a number of smaller rural roads extending out the lit footprint of the area.

Wider Surrounds By Direction

4.3.3 The Rochdale Canal borders the northwest of the Hollingworth Road land parcel [A] [Receptor LTG01] and is unlit, with a towpath on its northern bank. Immediately north of the canal is a railway line, which is unlit, however headlights and internal lighting from the train can be seen illuminating the canal as trains pass. Northwards of the rail line the land drops away to the River Roch before rising again as development associated with Littleborough and Dearnley begins [K] [Receptor LTG04]. North of the rail line is unlit for between 130 and 230 metres providing a darker corridor between the Site and development to the north however with the landforms a clear visual connection is present [B] [C] [K].

4.3.4 The northeast of the Hollingworth Road land parcel currently borders unlit land [D] however this area is under construction for up to 127 new dwellings. Streetlighting and domestic lighting can be expected as the primary light sources within the development. Whilst this site is under development by Vistry the recently completed sites around Dearnley Avenue [K] can be considered analogous to expected conditions.

4.3.5 Further northeast is Littleborough town centre and railway station. Typical streetlighting and domestic lighting is visible in this area, although notable light sources are present as cooler and more intense areas (with distinctive upward light and light presence) are present around Littleborough Station and the industrial/commercial units of New Mill Street [C-East] [D].

4.3.6 North of the River Roch the land broadly slopes upward meaning many residential properties have elevated and 'terraced' views southwards towards the Site. At higher elevations around the area of Shore, views can be over extended distances including to Manchester [J] [Receptor LTG04].

4.3.7 East of the Hollingworth road land parcel is Hollingworth Road [F]; the road is lit along the length with metal halide luminaires. These are on a central management system however switching or dimming was not witnessed during the survey. Spill light from the road has an influence over the Site with vertical illuminance of >3lux a few metres into the site, reducing to 0.2lux approximately 25m westwards [Receptor LTG 12].

4.3.8 East of Hollingworth Road the land slopes upwards with a number of farmhouses visible to the Site.

4.3.9 To the southeast, residential dwellings are present along Hollingworth Road, with the Wine Press public house located on the junction of Hollingworth Road, Lake Bank and Rakewood Road [H]. The forecourt and facade of the Wine Press are lit from cool white LED floodlights mounted along the eaves. For the most part these are orientated downwards, however tilt angle on a few present potential for upward light. The beam spread of luminaires does provide some additional illumination to the highway outside the terrace area.

4.3.10 The car-park is illuminated by similar floodlights with one unit noted as orientated close to vertical resulting in significant upward light and projection across to side of adjacent residential properties.

4.3.11 Lake Bank and Rakewood Road as the perimeter of the lake is illuminated with heritage style lanterns (fully cut-off, no direct upward light) using metal halide/white son sources [H] [I]. Heritage lanterns extend along the 'promenade' sections of the lake perimeter, stopping at the junction with Syke Road on the eastern side and across the full northern extent of the lake to the junction with Smithy Bridge Road. Streetlighting continues along Rakewood Road south of Syke Road reverting to typical column luminaires.

4.3.12 The footpaths surrounding Hollingworth Lake on the southern side are unlit. Lighting is present at the Pavillion Cafe at the southern side of the lake. The Cafe is advertised as "open to late" and was witnessed closing up with lighting switch off at 21:00 during the survey [I] [Receptor LTG07].

4.3.13 Further south is a campsite with some amenity and circulation lighting. Further south again is the M62 which is illuminated along its length in this area. The Rakewood Viaduct is a prominent feature with both the fixed streetlighting and lights on moving vehicles visible from a substantial part of the site and surrounds.

4.3.14 The north bank of Hollingworth lake includes a small leisure area with restaurants, takeaways and watersports centre. Façade and signage lighting to some of these establishments increase the ambience within the immediate vicinity [I] [H].

4.3.15 West of the Hollingworth Road land parcel is predominantly residential properties within Smithy Bridge, which have both gable end and rear garden views onto the site depending on the orientation of surrounding roads [B] [C] [E] [Receptor LTG02]. Streetlighting is present as per the typical conditions in all the adjacent residential streets.

4.3.16 Garden and security lighting was observed during the survey with a couple of instances of presence detection floodlights on façades of building triggered that also generated spill light into the Site and surrounding properties.

4.4 Environmental Lighting Zone

4.4.1 Whilst the Site sits close to areas of darkness in the Pennines, it is surrounded by light, both closely and at a medium distance in most locations. Consequently it is not possible to consider the Site as E1 'Intrinsically Dark' and is difficult to consider the wider area as a E2 'relatively dark outer suburban location'. The descriptive category of E3 'small town centres of suburban locations' being is consistent with the immediate surrounds. Satellite imagery of district brightness demonstrated in **Figure 4.1** clearly shows the Site within the influence of the surrounding lit developments and highways.

Table 4.1: Proposed Environmental Lighting Zone

ELZ	Lighting Environment	Examples	Surrounding
E1	Intrinsically dark	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.	Natural
E2	Low district brightness	Sparsely inhabited rural areas, village or relatively dark outer suburban locations.	Rural
E3	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations.	Suburban
Based on Table 1 within CIE 150 / Table 2 within ILP GN01			

4.4.2 Having noted this it is proposed that the Site itself is considered as an E2 Environmental Lighting Zone for the purposes of assessment reflecting a desire for “relatively dark outer suburban location” transitioning eastwards to the Pennines. Whilst an E2 Environmental Lighting Zone is proposed the lighting strategy and installations will seek to minimise light pollution and obtrusive light to well below thresholds shown in **Table 2.4 to Table 2.6** .

5 Receptors

5.4.1 Receptors have been identified based on the desk-based study and in conjunction with the findings of the day/night survey. A proposed receptor scoping document was submitted as part of the Environmental Statement (ES) scoping in February 2023 (see Appendix C). The receptors taken forward to assessment are based on a refinement of that list incorporating findings from the desk-based study and day/night survey. Selected receptors along with factors being considered for each are shown within Table 5.1 and Figure 5.1.

Table 5.1: Selected Receptors

Receptor ID	Description	Supporting Survey Locations	Key Factors		
			Vis	PHH	Bio
LTG 01	Rochdale Canal SSSI, Leisure location	A			
LTG 02	Residential properties bordering the site to the west	B, E, C			
LTG 03	Future residential properties on Vistry site	D, C			
LTG 04	General views from the North	J, K, C			
LTG 05	Residential Properties along Hollingworth Road	F			
LTG 06	Hollingworth Lake / general views from the South	H			
LTG 07		I, C			
LTG 08	Ecological Habitat identified on corner of Site	D			
LTG 10	Treeline bordering existing car park within Site	F, G			
LTG 11	Pond within the site	D, F			
LTG 12	Future residents of the development	F			

Primary consideration at receptor (High/Medium Sensitivity)
Secondary consideration at receptor (Medium/Low Sensitivity)
Not applicable at receptor

Figure 5.1: Receptor Locations



KEY

Receptors

- XX Visual / Heritage Receptor
- YY Population & Human Health Receptor
- ZZ Biodiversity Receptor

Receptor type indicates primary focus of assessment at location, other factors may be applicable at each location.

6 Expected Lighting Conditions

6.1 Construction Lighting

- 6.1.1 Development of a detailed construction lighting scheme is not feasible at this stage, prior to engagement of contractors. Consideration of construction lighting will be included as part of the Construction Environmental Management Plan (CEMP), to be secured through a suitably worded planning condition. The principles to be incorporated are outlined below.
- 6.1.2 Lighting is required for the safe undertaking of tasks alongside facilitating safe and secure access to offices, compounds, welfare facilities, parking areas, fuel storage areas and plant storage areas. Fixed lighting is anticipated to be limited to site accommodation and plant areas, with temporary task lighting applied to working areas.
- 6.1.3 The extent and duration of illumination should be minimised as far as practicable, for example, lighting of areas not currently occupied and all night illumination of storage and compounds should be avoided.
- 6.1.4 The proposed development construction will occur over multiple phases and an extended duration with the potential for compounds to be relocated dependent on phases. Care should be taken to ensure that disruption to intended operational green and dark corridors is not disrupted from the placement of temporary lighting within them, particularly towards end of construction phasing.
- 6.1.5 Given the extended construction periods it is likely that portions of the Site will be completed and occupied whilst construction work is ongoing elsewhere, consequently construction lighting needs to consider both the existing receptors and newly created receptors as portions of the site become occupied.
- 6.1.6 The principles identified within **Table 6.1** will be applied and expanded upon in the design and location of temporary construction lighting.

Table 6.1: Principles for Construction Lighting

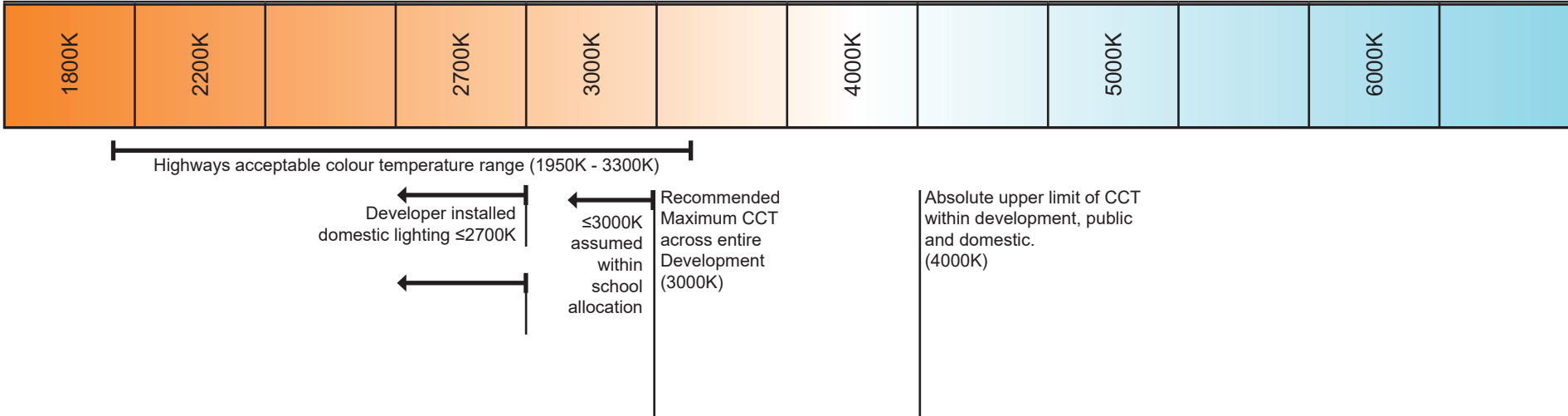
Management and Supervision	
Construction task lighting will be limited to agreed working hours for the development.	A nominated person within each construction organisation to conduct reviews of proposals for construction lighting installations and verify consistency with the CEMP and minimisation of Obtrusive light. Inspection the lighting installation should be undertaken on initiation of new lighting sources and at appropriate intervals thereafter. Appropriate records of temporary scheme approval and inspection should be retained as part of the CEMP.
Lighting will to be operational only for the duration of each task and switched off when no longer required.	
Long Term Installations / Site Compounds, Offices and Welfare Buildings	
Luminaires on fixed / long term features to use with dark-sky considerate luminaires, avoiding tilt angles that expose the light source or contribute to upward light.	Visual screening, such as hoardings can be applied to surrounds of compounds to contain light within those locations. Where practical luminaires should be mounted below the upper height of the screening so light sources are not visible from external to the compound.
Warmer colour temperatures of ≤3000K to be used wherever practicable.	
Use low light or infrared flood lighting with CCTV where appropriate.	Minimise the external application of linear battens or bulkheads with clear, ribbed or opal polycarbonate diffusers. Whilst providing general illumination the wide distribution of these luminaires emits a significant percentage of their output as upward light, particularly when mounted on vertical surfaces. Use within structures or on underside of canopies/scaffolding may yield source visibility and some upward light but this is greatly reduced compared to their application along the side of paths or hoardings.
Security and access lighting will be controlled through photocell and presence detection wherever practical.	
For vehicle circulation areas where pedestrian movement is not present consideration of unlit routes with passive (retroreflective) markers indicating routes, junctions, and crossings.	
Temporary Task Lighting	
Lighting to only be operational only for the duration of each task and switched off when no longer required.	Temporary shielding and screening applied between task areas and sensitive receptors.
Portable or temporary task lighting to be appropriate scale and mounting height and distance from task, avoiding extreme tilt angles of luminaires. The use of a greater number of lower output luminaires correctly positioned is considered preferable to a smaller number of high output luminaires covering an expansive area.	Subject to phasing of the highways re-alignment and opening of road sections there is a potential for temporary streetlight from portable towers to be in place. Designs for these should be verified for contrast and glare where the requirement for temporary streetlighting is identified.

6.2 Operational Lighting

General Requirements

- 6.2.1 Lighting should be consistent with, or better than, the obtrusive lighting thresholds for the Environmental Lighting Zone. The Site is currently considered an E2 Environmental Lighting Zone. Whilst the defining of Environmental Lighting Zones establishes maximum values for various criteria, these should not be considered as explicit permission to generate light pollution up to these thresholds, and the scheme should seek to avoid and minimise light pollution at each opportunity.
- 6.2.2 The correlated colour temperature (CCT) of light sources should be as warm as practicable with colour temperatures ≤3000K favoured.

Figure 6.1: Proposed Correlated Colour Temperature (CCT) Application



6.2.3 Luminaires should be fully cut-off wherever possible without detriment to the safety of an area. Uplighting of signage, landscape or architectural features should be avoided.

Highways Lighting^a

Adopted Roads

- 6.2.4 It is understood that the majority of highways will be proposed for adoption by the Local Highways Authority. As discussed within paragraph 3.1.10 there is no statutory requirement to illuminate highways, however it is expected that adopted highways (roads) will be illuminated. Highways lighting designs are expected to form a condition of the application with development in conjunction with RBC's highways team and service providers.
- 6.2.5 RBC is serviced by the Community Lighting Partnership (CLP) in the provision and maintenance of highways lighting.
- 6.2.6 In correspondence with CLP, design specifications for a similar development have been provided, which have been used to inform the expected lighting conditions. By reference to the recently completed development at Dearnley Avenue (see survey location K) a requested lighting class of P4 is anticipated for the proposed development.
- 6.2.7 Assessment has been made based on assumption of P4 lighting classes applied, with a desire to see the minimum appropriate class applied throughout the scheme (see Table 6.2 for performance requirements).
- 6.2.8 It is understood that CLP currently favours Holophane V-Max luminaires which are available in 3000K, 4000K and phosphor corrected Amber correlated colour temperature. 3000K is assumed within this application.
- 6.2.9 Column heights are understood to be a maximum of 6 meters on residential roads throughout.
- 6.2.10 On the Western portion of the development a number of roads and shared private access terminate along the ridgeline. Views to and from these edges of development should be considered with the proposal that columns are not used along this outer edge (either outer or inner edge of road or driveway) allowing a softer transition into the central green corridor. Reduced or omission of streetlighting in these areas would not only lessen the visual impacts for views to the site but also increase the quality of views out for residents (See Survey point C-East) through not having a strong foreground lighting presence along the access routes (private driveway or adopted highway).

Figure 6.2: Expected Lighting Conditions, Constraints and Opportunities



Table 6.2: Highways Lighting Requirements (P Class)

Extract from BS EN 13201-2:2015 Table 3 — P lighting classes					
Class	Horizontal Illuminance			Additional requirement if facial recognition is necessary	
	$\bar{E}$ (average) minimum maintained	Maximum Average ^{*1}	E_{min} [maintained]	$E_{v,min}$ [maintained]	$E_{sc,min}$ [maintained]
P1	15.0	22.5	3.0	5.0	5.0
P2	10.0	15.0	2.0	3.0	2.0
P3	7.5	11.3	1.5	2.5	1.5
P4	5.0	7.5	1.0	1.5	1.0
P5	3.0	4.5	0.6	1.0	0.6
P6	2.0	3.0	0.4	0.0	0.2
^{*1} - To provide for uniformity, the actual value of the maintained average illuminance shall not exceed 1,5 times the minimum maintained average value indicated for the class - values are shown for ease of reference					

a <http://www.clp.uk.com/oandr>

6.2.11 Luminaires are due to be linked to a central control system. This may enable part-night dimming however the assessment is undertaken on the assumption of full-night operation to ensure worst-case scenario is assessed.

Footpaths / Cyclepaths

6.2.12 There are multiple footpaths that link across the Site, crossing over the existing North/South PRow (linking from Lake Bank to the Canal). Specifications for other developments note a lighting class of P5 'for remote footways'.

6.2.13 It is proposed that only selected footpaths are illuminated as indicated within **Figure 6.2**.

6.2.14 Consideration should be given to the availability of alternate lit routes with minimal inconvenience to users in the decision to illuminate or not illuminate.

Car park

6.2.15 The Rakewood Road land parcel is a proposed extension of the Hollingworth Country Park Car Park.

6.2.16 It is suggested that the proposed car park retains the principles of the existing car park and remains unlit. This will be in accordance with the ELZ and lit character of the surrounding area.

6.2.17 There is no requirement to light private highways and vehicle movement areas, the British Standards stated in **Section 3.4** providing guidance. Bollards may be implemented in future design stages for low level lighting and way finding to mitigate concerns for user safety.

School Lighting

6.2.18 The assessment considers the potential presentation and performance requirements of the proposed primary school.

6.2.19 Lighting within the school site is expected to follow the illuminance values within BS EN12464-2 and CIBSE Lighting Guide 5, Lighting for Education.

6.2.20 Lighting is anticipated for car-parking and circulation between buildings alongside any lit sports facilities.

6.2.21 Luminaires used across the Site should be cut-off, avoiding upward light, particularly for building mounted bulkheads which should be mounted at heights to allow downward light and facial recognition without large ambient luminous surfaces.

6.2.22 External lighting should be 3000K or less in correlated colour temperature.

6.2.23 Within the context of a primary school it is considered unlikely that sports pitches will be lit unless serving dual use as part of wider community sports provision. If sports pitches, assumed as small sized multi use games area (MUGA), are to be lit then these are expected to be lit based on CIBSE Lighting Guide 04, Sports Lighting and to not exceed class III, General training, recreational and school sports, levels of illuminance. Control systems and variable illuminance levels should be considered to set illuminance levels according to sport occurring at a given time, avoiding over illuminance. It is expected that sports lighting will be curfewed at between 22:00 and 23:00 based on condition with local authority.

6.2.24 Any lit sports facilities should be located adjacent to the spine road and village local centre and away from perimeter retained woodland and buffers.

6.2.25 Across the school site, lighting should be reduced to the minimum required for security and safe access outside of opening hours. The use of dual level presence detection should be considered.

Parks, Recreation and Green Spaces

6.2.26 Ideally green spaces within the development should be unlit other than where required for primary active travel corridors and circulation routes as identified in **Figure 6.2**.

6.2.27 This is in response to the landscape corridors created within the site and in recognition of biodiversity.

6.2.28 It is not anticipated that formal play areas will be illuminated such as the proposed NEAP.

Residential Dwellings

6.2.29 For individual private dwellings, external lighting at front and side doors can be expected, subject to the property's relationship to the street and any streetlighting present. Where external entrance lighting is provided, luminaires should be photocell and motion controlled, such that they are only active when approached during the hours of darkness. Selection of luminaires shall consider the sensitivity and orientation of motion detector to reduce the instances of false triggering. External residential luminaires where provided shall be dark-skies compliant with no direct upward light, bare lamps and or lit diffusers in the vertical plane shall be avoided.

6.2.30 Exterior lighting to rear gardens is likely to be determined by individual occupants in the long run. At the outset it is advised that the developer provides adequate switched external lighting with no upward light or distinctly visible light sources. Whilst occupants may choose to amend over time, the provision of well-considered external lighting reduces the likelihood of poorly applied occupant installations.

6.2.31 Domestic lighting should be 3000K or less, preferably 2700K or less. Cool white, 3200K and greater shall be avoided.

6.2.32 The principles established within ILP GN09 "Domestic exterior lighting: getting it right"^a should be applied across the scheme.

6.2.33 For entrances to multiple dwellings external lighting linked to photocell with two levels of output such that the lower level is active from dusk to dawn with higher illumination level triggered on presence detection. The same considerations as private dwellings will be required in luminaire selection and mounting locations. Separation of sensors and luminaires may be applicable to allow sensors to trigger lighting for wider areas in the instance of parking areas.

^a <https://theilp.org.uk/publication/guidance-note-9-domestic-exterior-lighting-getting-it-right/>

7 Assessment

7.1 Basis of Assessment

- 7.1.1 The Assessment has been made based on professional qualitative opinion using the baseline data gathered and discussed alongside the provided parameter plans and illustrative masterplan.

Illustrative Masterplans

- NW111-PD-1002A Location Plan.pdf
- NW111-PD-1001 [Coloured Layout].pdf
- 35025-RG-LD-03 REV B Illustrative Plan - A0.pdf

Expected Lighting Conditions

- Reference to similar developments within the vicinity of the Site
- Correspondence with the local authority's highways lighting provider
- Proposed good practice and embedded primary mitigation

Assumptions and Limitations

- 7.1.2 The lighting survey was undertaken in August 2023. Vegetation was in full leaf which provides maximum screening on views. The later hours of darkness for the survey means that there is limited domestic and commercial activity present by comparison to early evening hours in winter months. We have sought to account for and infer the winter baseline based on the desk and site based studies.

7.2 Construction Lighting Assessment

- 7.2.1 The impacts of construction lighting are temporary transitioning to operational assessments, with potential for the greatest level of impact at tail-end of construction period when both operational lighting conditions are almost at the fullest and temporary construction light remains.

- 7.2.2 A broad assessment of construction lighting against the three main factors is provided highlighting specific receptors where applicable.

Visual

- 7.2.3 Initially isolated instances of lighting around compounds or working locations can be expected, these will be most prominent to residents in close proximity to the Site (**Receptors LTG 02, LTG 03 and LTG 05**), before becoming progressively screened or incorporated into the wider lit development.

- 7.2.4 Whilst temporary construction lighting is not as high an aesthetic quality as operational lighting, the smaller lit areas associated with construction lighting offset this consideration.

- 7.2.5 A **minor adverse** effect is anticipated.

Population and Human Factors

- 7.2.6 On the basis that temporary construction follows the approaches set down within the expected lighting conditions and is considerably applied, a maximum of **minor adverse** impacts are expected for surrounding residential receptors. This reflects potential for small increases in light spill to properties if residential compounds or temporary works lighting is in closer proximity to the residential properties. Curfews on working hours mean that causes are likely limited to access and security lighting on compounds.

- 7.2.7 Where new access to Hollingworth Road is created changes to streetlighting may be required and temporary streetlighting applied. In these cases applying temporary lighting consistent with performance requirements of BS5489 means **neutral/negligible** effect are anticipated.

Biodiversity

- 7.2.8 The expected lighting conditions, alongside the application of measures outlined in the CEMP (to be secured via condition) mean that it should be possible to avoid excessive increases in lighting to sensitive areas. Particular care in the application of the CEMP is required around **Receptors LTG 11** (pond) based on the proximity of developed area.

- 7.2.9 A **minor adverse** effect is anticipated.

- 7.2.10 Refer to **Environmental Statement: Volume II** for full assessment.

7.3 Operational Lighting Assessment

- 7.3.1 Broadly speaking the introduction of lighting associated with a development into previously unlit land is adverse from a visual and biodiversity perspective. The extent of adverse effect is then based on magnitude of the change and lit quality of the development.

- 7.3.2 Assessment conclusions are proposed for visual receptors, asserted for Population and Human Health receptors in relation to Obtrusive light by reference to ILP GN01, with commentary provided for biodiversity receptors intended to enable the ecologist to consider lighting within their assessment and reporting.

- 7.3.3 The baseline conditions, expected changes resulting from the Proposed Development and resulting impacts from operation conditions are discussed in **Table 7.1**

Table 7.1: Assessment of Identified Receptors - Operational Conditions

Receptor ID	Receptor Description	Applicable Survey Locations	ELZ	Factors			Baseline Description	Operational Phase Assessment
				Vis	PHH	Bio		
LTG 01	Rochdale Canal SSSI, Leisure location	A, B	E2				The canal adjacent to the Site is essentially unlit. The canal towpath is unlit and whilst light sources are visible to the south (houses and streetlighting along Brown Lodge Drive) these are sufficient distance that they are not providing attributable quantities of light. The embankment of the rail line to the north provides obstruction of views to the north, with the distances to lit development north such that light contributions are only in ambient lighting and not attributable. The canal is illuminated briefly from headlamps and internal lighting from passing trains. Illuminance values were not able to be captured during the survey. To the northeast the Vistry site (under construction) will introduce lit development into the foreground of views from the canal. The south bank of the canal, west of the Site, is well vegetated to rear gardens with a steep incline, there is limited visibility of domestic light sources to the south until the bridge where the canal enters a more urban setting with development directly adjacent to the canal.	Visual - The topography of the Site and location of lit development set back south of the ridgeline means there will be limited direct views of new lit development. The western half of the development being set back from the ridgeline reduces direct views with the eastern half of the development is largely screened by the Vistry development (under construction) and topography. Light presence in the form of ambience, skyglow and contrast of the skyline will hint at the development's presence. The canal is within a suburban context and as such the night-time character of the area does not change. The increase in ambience and skyglow means a minor adverse effect is anticipated. PHH - Based on the distance of lit development from the canal and lit developments present to the northeast (Vistry, under construction) and west (Smithy Bridge) of the Site it is not considered that the development will result in a loss of amenity to users of the canal for commuting or leisure. A neutral/negligible effect is recorded. Biodiversity - The distance between lit development and topography, with lit development on high ground and screened from canal by the ridgeline means no quantifiable and attributable increase in illuminance is anticipated from the development. Refer to Environmental Statement: Volume II for full assessment.
LTG 02	Residential properties bordering the site to the west	B, E, C	E2				These properties are currently adjacent to the unlit Site and benefit from views across unlit foreground to lighting in Dearnley (north), Littleborough (northeast) Hollingworth Lane (east) and the corner of Hollingworth Lake and M56 viaduct (southeast). There are residential properties on the hillside east of Hollingworth Lane with associated domestic lighting. Properties towards the centre and northern end of the receptors have the broadest range of views based on the topography of the site. Properties to the southern end have darker views with topography screening Dearnley and Littleborough, allowing predominately unlit hillsides to be within north and east. Some external garden lighting was observed during the day survey and although not active at night, some garden 'floodlights' may result in spill light to the Site. Existing residential external and security lighting may be resulting in obtrusive light for existing residents at a number of locations.	Visual - The western portion of the proposed development directly abuts existing residential properties and will introduce lit development, partially obscuring views onwards to largely unlit hillsides. This is considered a <i>"noticeable increase in visibility"</i> by reference to ILP PLG04. Having noted this the relational lit intensity of residential to residential reduces this from <i>"significant problems with increase in visibility"</i> resulting in a moderate adverse effect. PHH - As residential led development adjacent to residential led the intensity of development is not anticipated to result in obtrusive thresholds being exceeded. A neutral/negligible effect is therefore recorded. It is worth noting that some existing domestic security lighting may result in obtrusive light to new properties within the development (Survey location E) however this can be mitigated within re-orientation of luminaires. Biodiversity - N/A
LTG 03	Future residential properties on Vistry site	D, C, F	E2				The border of the Site and the land being developed by Vistry is effectively unlit other than as it approaches Hollingworth Road where streetlighting has influence over the site (based upon measurements taken around survey location F) Whilst the Vistry site currently benefits from unlit borders visually as a new development within allocated land and as part of the wider allocations the visual sensitivity is not considered applicable.	Visual - N/A PHH - As residential led development adjacent to residential led the intensity of development is not anticipated to result in obtrusive thresholds being exceeded. A neutral/negligible effect is anticipated. Biodiversity - N/A

Receptor ID	Receptor Description	Applicable Survey Locations	ELZ	Factors			Baseline Description	Operational Phase Assessment
				Vis	PHH	Bio		
LTG 04	General views from the North	J, K, C	E2 / E1				Views from the north observe the Site as an expanse of unlit land. From lower elevations around Featherstall Road the Site is mainly identifiable along the west with residential and streetlighting defined, and the high ground of the Site on the west obscuring views onwards. A few isolated residences and properties are visible on hills east of the Site. Hollingworth Road is partially visible particularly where streetlighting also illuminates the treelines around Hollingworth Lake car park. Note: E1 Environmental Lighting Zone is considered for the few number of individual properties further spread out on hillside north of Littleborough.	Visual - The western portion of the Site on higher ground has the potential to be prominent as a new urban edge. Whilst the proposed development will result in additional lighting, the location between two existing areas of light (Hollingworth Road to the east and existing residential to the west) means that it is not expanding outside of the boundaries of the existing lit extents. A minor adverse effect is anticipated based on the increase in ambience and upward light associated with the development. PHH - N/A Biodiversity - N/A
LTG 05	Residential Properties along Hollingworth Road	F, H	E2				These properties are located on the east side of Hollingworth Road, predominantly opposite the trees surrounding the car-park for Hollingworth Lake; the northernmost two properties having a view a direct view into the fields of the Site. At the southern end of the road adjacent to terraced properties façades are directly onto the pavement, with vertical illuminance from streetlighting on the face of properties above the thresholds for obtrusive light, in illuminance on the vertical plane for the Environmental Lighting Zone (noting that Streetlighting falls outside of the CNEA as not being emitted from a premise). To the northern end, properties are set-back from the highway and it was not possible to take measurements at the face of these properties.	Visual - Whilst the visibility of the site becomes more noticeable, the foreground lit road means existing residents are not benefiting from an unlit site under baseline conditions. The intensity of school and residential led development is not anticipated to become excessively prominent over and above the lighting along Hollingworth Road. A minor adverse effect is recorded. PHH - The lit intensity of a primary school (assuming no illuminated sport pitch) coupled with residential development is not anticipated to generate obtrusive light at thresholds detailed within ILP GN01. Primary school lighting can be expected to be notably reduced prior to curfew hours based on typical operating hours. A neutral/negligible effect is recorded. Biodiversity - N/A

Receptor ID	Receptor Description	Applicable Survey Locations	ELZ	Factors			Baseline Description	Operational Phase Assessment
				Vis	PHH	Bio		
LTG 06	Hollingworth Lake / general views from the South	H	E2				The topography of the area, means that the majority of the Site is not directly visible in views from the south (from lake level). Lake Bank Road as a dam structure shields the ground level of the site at the closest location, with trees surrounding the car park area also reducing views northwards. At night prominent lit features are present in the external lighting of The Wine Press public house just east of the Site, heritage lighting surrounding the lake promenade and around the small leisure and commercial area adjacent to the lake to the west of the Site.	Visual - The southern areas of the development are located north of Lake Bank Road and at a lower elevation to the edge of the lake. The existing hedgerow along the top of the dam and Lake Bank increase the height of screening in views from the south. Light presence is expected however expansive views of new light sources in streetlighting or windows is not anticipated from the surrounds of the lake. West of the area of direct Site adjacency to the lake where residential properties back onto residences along Heald Close, visibility of some of the lit development (streetlights, light egress) may be visible between existing dwellings, resulting in a small increase in lit development visible. Views from greater elevations south of the site can be expected to see over the screening and into the site. Having noted this the proposed development is viewed in the context of lighting on all four sides. As the proposed development is viewed in the context of lit foreground elements around Hollingworth Lake and light presence and direct visibility of lights within Dearnley and Littleborough north of the Site a minor adverse effect is proposed. PHH - PHH in this instance reflects the capacity for Hollingworth Lake and surrounds to exist as a leisure location. As highways lighting is present along the northern and eastern side of the lake along the majority of the northern side of the lake the proposed development is not deemed to impede the function of the lake and surrounding promenade/footpaths. A neutral/negligible effect is recorded. Biodiversity - N/A
LTG 07	Hollingworth Lake / general views from the South	I, C	E2					
							Within the visual extent of the site, streetlighting and domestic lighting is visible around Shore and Clough on the hillside north of Littleborough; these light sources being approximately 2.5km north of the survey location. It is understood that in more elevated views from the south, a greater proportion of the Site would become visible, although equally with a greater proportion of lit development north of the site within Littleborough and Dearnley.	
LTG 08	Ecological Habitat	D	E2				The area around the habitat does not receive any attributable ALAN at present. The development on the Vistry site adjacent avoids development in close proximity to this location. Other than skyglow ambience no ALAN is illuminating the location with illuminance reading of ~0.04lux recorded during the survey.	Visual - N/A PHH - N/A Biodiversity - The nearest lit development within the proposed development is ~35m from the receptor to the southeast, and at a lower elevation. West of the receptor lit development is further away and at notably greater elevation. Based on the distances and elevation changes no notable increase in illuminance around the habitat is anticipated.
LTG 10	Treeline bordering existing car park within Site	F, G	E2				The outer face of the treeline facing westwards is essentially unlit and in 'darkness'. The northern outer face receives noticeable spill light from Hollingworth Road, over a distance of approximately 30m from the road. There is no illumination within the car-park, and the trees to the north and within the 'dog-leg' are essentially unlit. Lighting from Lake Bank spills down the north side of the dam bank and into the car park did not appear to be entirely detrimental. This illumination was not observed as entirely detrimental to biodiversity with a small deer observed on the grass bank during the time of the survey.	Visual - N/A PHH - N/A Biodiversity - The proposed development means it is unlikely that the treeline can be retained at baseline conditions. Land adjacent to the north of the treeline is allocated to Primary School use. Due to the outline nature of this element of the proposed development, the extent and layout is not yet known. The typical operating hours of a school are such that lighting falls outside of most sensitive hours for the majority of the year. Refer to Environmental Statement: Volume II for full assessment.

Receptor ID	Receptor Description	Applicable Survey Locations	ELZ	Factors			Baseline Description	Operational Phase Assessment
				Vis	PHH	Bio		
LTG 11	Pond within the site	F, D					The pond is essentially unlit, falling beyond the influence of spill light from Hollingworth Road, and sufficiently distanced from the farm compound that any external lighting is unlikely to result in measurable increases at the pond. The north and northeast of the pond are screened by trees. The pond has been identified as a foraging location for bats.	Visual - N/A PHH - N/A Biodiversity - The proposed development comes within reasonable proximity of the pond, particularly on the western edge. It is expected that horizontal illuminance can be reasonably managed through careful design and potential accessories, however light egress from properties contributing to illuminance in the vertical plane has the potential to occur. The illustrative masterplan showing a comparatively low density of dwellings along this boundary coupled with the likelihood of all internal luminaires being active with no window treatments applied mean instances of values exceeding 0.4lux ("dark" by reference to ILP GN08) vertical are considered unlikely and localised. Refer to Environmental Statement: Volume II for full assessment.
LTG 12	Future residents of the development	F					Highways lighting from Hollingworth Road spills into the site, with the influence visible over ~30m from the street. (Receptor F). 3.4lux vertical was recorded vertically(~1.7m AGL) at the base of the field edge back opposite the existing gate entrance on the sites eastern boundary, reducing to 0.2lux at approximately 25m into the Site.	Visual - N/A PHH - Within the context of an E2 Environmental Lighting Zone maximum illuminance on the vertical plane is given as 5lux pre-curfew and 1lux post curfew. Whilst the existing baselines values at the indicative frontage of properties are unlikely to exceed these thresholds, cumulatively with lighting along the private access may result in values above the targeted thresholds. Upper floors of dwellings will not experience the same vertical illuminance as recorded at the baseline and therefore the likely locations of sleeping accommodation are not anticipated to exceed thresholds. A minor adverse impact is proposed. Biodiversity - N/A

8 Mitigation

8.3.1 Based on the expected lighting conditions and with embedded primary mitigation and best practice no significant adverse impacts are anticipated. Having noted this, opportunities remain for further improvements and mitigation of light pollution which may be applicable for exploration as part of the detailed lighting plan to be secured via condition.

Highways Lighting

Lighting Classes & Selective Lighting

- 8.3.2 Whilst it is understood that a P4 lighting class is the typical approach for residential streets, consideration could be given to reducing illuminance classes for subsidiary streets. This will be undertaken during the streetlighting design (anticipated as a condition of the application) and in discussion with Rochdale Borough Council.
- 8.3.3 Application of the selection criteria within BS5489-1 within the context of the proposed E2 Environmental Lighting Zone (recognising the existing baseline as more separated from urban development by comparison to the Dearnley Avenue Scheme) suggests that a P5 lighting class could be applied for the majority of secondary roads and cul-de-sacs, although it is recognised that the primary road through the proposed development linking from Hollingworth Road in the east to Bridge Bank Road in the west may require higher class, in this case proposed as P4.

Table 8.1: Selection of Lighting Class

Selection according to BS 5489-1:2020				
Table A.5 — Lighting classes for subsidiary roads				
Road User / Speed		Pedestrian and Cyclist Only	Speed Limit v ≤ 30mph (All traffic types)	
Environmental Lighting Zone		E1 to E4	E1 to E2	E3 to E4
Traffic Flow	Busy	P5	P4	P3
	Normal	P5	P5	P4
	Quiet	P6	P5	P4

8.3.4 As previously discussed consideration should given to the extent over which lighting is required with a proposal to allow roads and private shared access on the fringes of the developed areas and adjacent to unlit land to be unlit, softening the transition to landscape areas and allowing views out across the landscape from properties on higher elevations.

Correlated Colour Temperature

- 8.3.5 Whilst the ecology assessment in Chapter 7 of the Environmental Statement has not identified a need for targeted spectra of light sources, consideration could be given to phosphor Converted Amber (PC Amber) variants of the highways authority's preferred luminaires. The amber appearance is akin to older sodium technologies, however is not monochromatic and allows for higher colour rendering. The reduction in blue light is understood to reduce scattering and skyglow compared to 'whiter' CCT's of LED.
- 8.3.6 This approach also requires consideration of continuity of lit areas and the varying lit characteristics of the colour temperatures. Having noted this, the level of homogeneity across the wider views is comparatively low with a range of lighting technologies and colour temperatures visible (Survey locations C-East & C-West).

Residential Lighting

Covenants and conditions

- 8.3.7 Covenants on properties are recommended as a method of long-term mitigation of poor quality and obtrusive light being installed by residents at a future date. Whilst it is difficult to prevent residential occupants from making amendments to their homes, the inclusion of a suitably worded covenant regarding avoidance of upward and obtrusive light, including colour temperature specifications of 'warm-white', allows for effective and swifter enforcement if required in the future. This can be accompanied by information within homeowners information pack reminding residents of the quality nature of their surrounding environment and encouraging ongoing responsibility towards that. This may be particularly applicable to dwellings at the periphery of the Proposed Development and those with a relationship to the retained woodland. Whilst the proposed buffer zone can be considered to provide some attenuation of light due to distance, the distance of the buffer is predicated on appropriate and responsible application of domestic lighting.

9 Cumulative Assessment

9.3.1 The following applications have been considered for cumulative assessment with the proposed development. The cumulative development from the Site mean impacts are limited to visual receptors within wider views, outside of the cumulative effects of lit development on upward light, skyglow and district ambience

Table 9.1: Cumulative Schemes for Consideration

Application ID	Description	Location & Distance to Site	Status	Cumulative Assessment Comments
21/01146/FUL	Residential development - erection of up to 127 residential dwellings including new vehicular access points, footpaths, cycle paths, boundaries, landscaping, creation of open space, a pumping station and other associated works	Former Akzo Nobel Site Directly Adjacent to Site - northeast	Approved 3 April 2023	Included as assumed complete within baseline assessment as under construction, therefore no change in effects.
22/00830/VRCON	Section 73 application for minor material amendment to planning permission 20/00639/FUL (Demolition of the existing buildings, hardstanding areas and sports pitches, and the erection of 47 dwelling houses including provision of associated roads, footways, public open space, parking areas, drainage, landscaping and boundary treatments along with ground levelling works, works to trees and ponds and other associated works) relating to external and internal amendments to house types including addition of roof openings, and alterations to site levels	The Soccer Village (former Birchinley Manor Equestrian Centre), Wildhouse Lane, Milnrow, OL16 3TW ~1550m south	Approved 17 May 2021	Potentially visible in extended views from the north from higher elevations (LTG04). With the site changing from sports use (with existing car park lighting a potentially lit pitches) to residential there is a small change in general ambience. A minor adverse effects remains for receptor LTG 04 views from the north.
21/00701/FUL	Part demolition of existing school / children's centre / gym, erection of a new school building of up to two storeys and erection of temporary classrooms, with reconfigured and additional car parking, access and landscaping	Littleborough Community Primary School, Calderbrook Road, Littleborough, OL15 9HW ~ 1,400m (north)	Approved 11 August 2021. NB. Non Material Amendment application approved 5 August 2022 (REF: 22/00899/ANM).	Located within the lit urban realm background to views of or from the site results in no change to assessment based on cumulative consideration
22/01039/FUL	Erection of a residential development for 61 dwellings (to include 2no. Use Class C2 residential care dwellings for children), access, landscaping, open space, SUDs, and associated works	Land To The West Of New Street Littleborough ~400m northwest		Both developments continue the increase in lit developments within the vicinity of the site. Individually there is no change to the general night-time character of the area. However, cumulatively they result in increased skyglow, extending the range from lit areas clearer views of night skies are visible. Cumulative effects of minor adverse remain for the wider visual receptors LTG 04, LTG 06 and LTG 07.
22/01364/FUL	Residential development: erection of up to 199 dwellings including vehicular access on to Smithy Bridge Road, with internal highways, car parking, footpaths, cycle paths, boundaries, gardens, open space and other associated works	Land West Of Smithy Bridge Road, Littleborough ~650m west	Valid Nov 2022 – Awaiting Decision	
20/00607/FUL	Residential development of 100 dwellings together with associated access, earthworks, landscaping, public open space, and on-site infrastructure (including the capping of artesian well)	~200m north	Approved 27 January 2021	Constructed and operational, although streetlighting may not have been adopted and commissioned within the central management system. This is captured within the baseline conditions therefore no change to assessments.

Figure 9.1: Locations of Cumulative schemes



10 Conclusion & Summary

10.3.1 Stantec UK Ltd has been commissioned by Bloor Homes North West ('the Applicant') to prepare a Lighting Assessment for a planning application for a residential led development ('Proposed Development') at Hollingworth Road and Rakewood Road, Littleborough ('the Site'). The Site and immediate surrounds are within the jurisdiction of Rochdale Borough Council ('RBC').

10.3.2 The Lighting Assessment has been undertaken with due regard to The Institution of Lighting Professionals' (ILP) Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (2013) (ILP PLG04) and the information contained within ILP Guidance Notes for the Reduction of Obtrusive Light (2021) (ILP GN01)^a.

10.3.3 The assessment is based upon an understanding of the baseline conditions established through desk-based study alongside a day/night site survey undertaken 22nd/23rd August 2023. The expected lighting conditions have been informed by the illustrative masterplan parameter plans issued by Bloor Homes.

10.3.4 The Site comprises two parcels of land, Hollingworth Road and Rakewood Road, with a combined total of 21.49 hectares in the north-eastern part of Rochdale, Greater Manchester.

10.3.5 The Proposal includes lit development in the form of lit streets, domestic interior and exterior lighting along with internal and external lighting for a school site, along side the expansion of an unlit car park off Rakewood Road. None of the uses and activities proposed are anticipated to require large expanses of intense illumination (e.g. sports pitches or industrial safety), with the development being residential led in nature.

10.3.6 With the extent and nature of the Proposed Development it is considered that the Site itself is within an E2 Environmental Lighting Zone for the purposes of assessment reflecting a desire for "relatively dark outer suburban location" transitioning eastwards to the Pennines. Whilst an E2 Environmental Lighting Zone is assumed the lighting strategy and installations will seek to minimise light pollution and obtrusive light to well below thresholds.

10.3.7 From a population and human health perspective, provided care and consideration is taken within the design and installation of lighting schemes, no significant 'obtrusive light' at thresholds exceeding those stated within ILP GN01 is anticipated.

10.3.8 Whilst sky glow and loss of night skies was considered in this assessment, the introduction of new sources of light is considered to have minor adverse effects due to the Site being surrounded by lit development.

10.3.9 Due to the topography and natural screening within the Site there is limited visibility from the south of the Site. The proposed development will mainly impact directly adjacent neighbours and views from the North.

10.3.10 However, whilst the proposed development will result in additional lighting, the location between two existing areas of light (Hollingworth Road to the east and existing residential to the west) means that it is not expanding outside of the boundaries of the existing lit extents.

10.3.11 Overall whilst the proposed development represents an increase in lit area, the topography and surrounding screening, coupled with the expected best practice lighting installations limits the predicted impacts to some local immediate views and an awareness of the site in extended vistas, and limited increases in illuminance to the boundaries and hedgerows. Therefore, no significant impacts are expected.

^a <https://theilp.org.uk/publication/guidance-note-1-for-the-reduction-of-obtrusive-light-2021/>

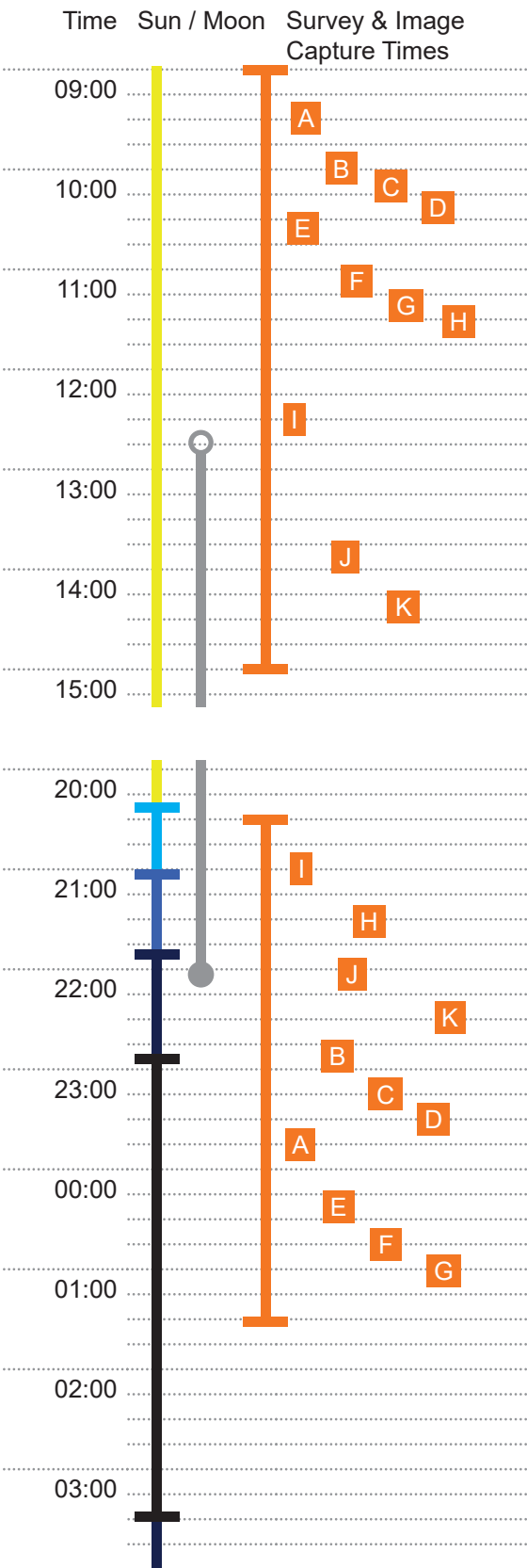
Appendix A - Record of Baseline Survey

Survey			
Day		Night	
Start	End	Start	End
09:00	15:00	20:30	01:30
Weather		Weather	
Overcast, light rain and mist during late morning		Generally clear, moving cloud cover, some mist within valleys to east.	
Notes		Notes	
As summer months, vegetation in full leaf offering maximum screening.		As summer months, vegetation in full leaf offering maximum screening. Late hours of night survey means reduced domestic and commercial activity is captured.	

Sun / Daylight				
Daytime -	Civil Twilight [CT]	Nautical Twilight [AT]	Astronomical Twilight [NT]	Night
Sun above horizon	Centre of sun < 6° below horizon	Centre of sun < 12° below horizon	Centre of sun <18° below horizon	Centre of sun >18° below horizon
05:59 to Sunset @ 20:22	20:22 - 21:00	21:00 - 21:49	21:49 - 22:48	22:48 to 03:34 (23rd)

Moon 			
Moonrise	Moonset	Moonrise	Moonphase
12:44 (115°)	22:02 (241°)	-	32.6% Illuminated - (First Quarter)

All times are shown as local time (British Summer Time)



Photography

Primary Photography

Day and night photographs were taken using a Nikon DX5300, with an AF-S Nikkor 35mm 1:1.4G lens. Both day and night images were taken from tripod mounted positions ~1.7m above ground level. Daytime images were shot using automatic settings. Night-time images were shot from tripod mount matching location and mounting height as far as practicable. Camera settings for night-time images were manual with aperture and exposure time manually adjusted to capture a representative image of the conditions, camera settings for night images are shown accompanying the images.

Within each panorama camera settings have been retained as consistent across the view meaning in areas of extreme variation results in some under and over exposure.

Day panoramas have been compiled using the automated photomerge function within Adobe Photoshop and cylindrical projection. Where possible the same process has been applied for night images, however the limited available detail in night-time images automated stitching is rarely feasible. Night-time panoramas are therefore created in Adobe Photoshop by overlaying the night-time photos on the daytime panoramic image and manually aligning and blending. Unless otherwise stated on image notes no additional exposure correction or further post processing has been applied.

Based on the limited natural and artificial light within the site extended exposures have been used to capture sufficient detail and context of the scene. These represent an increased brightness of the sky than witnessed during the survey and fractionally greater detail than was perceivable by the naked eye (recognising that adaptation was impacted by viewing camera screens and requirement for torch use to make notes)

Supplementary Photography

Additional photography has been captured via a 360° camera mounted. Selected extracts from the 360° images are included to support the context of survey locations. Additional 360° images have been orientated to give a full perspective of the skyline, allowing for an understanding of the relationships between light sources and overall character of an area relative so sky glow.

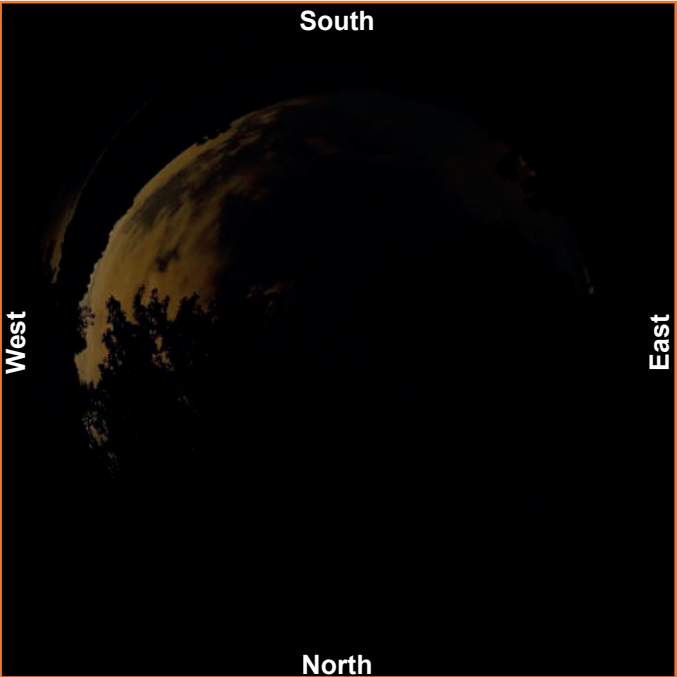
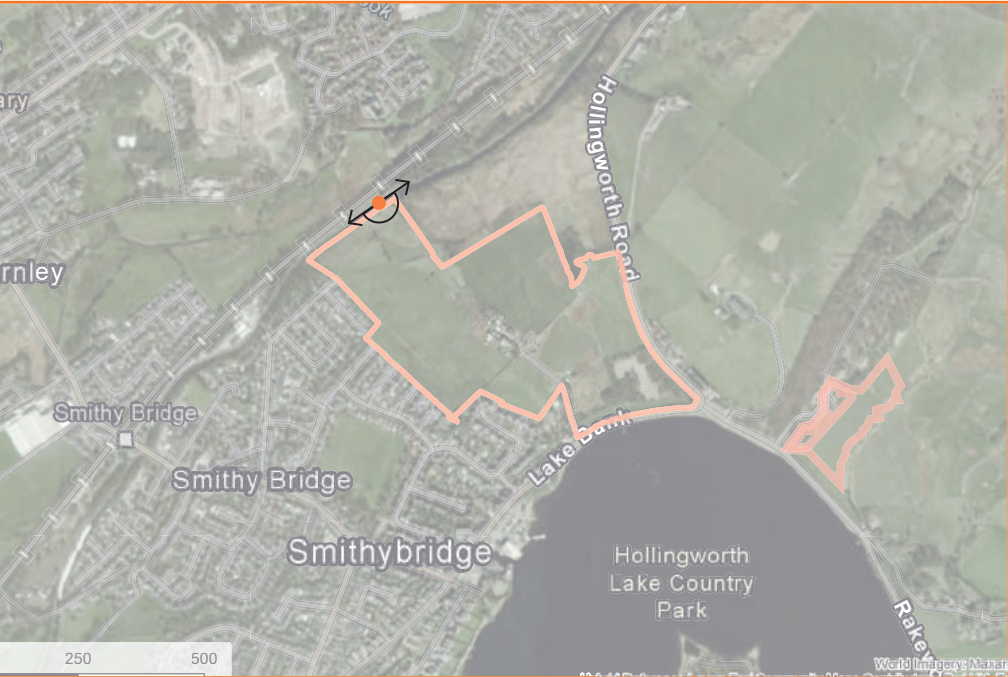
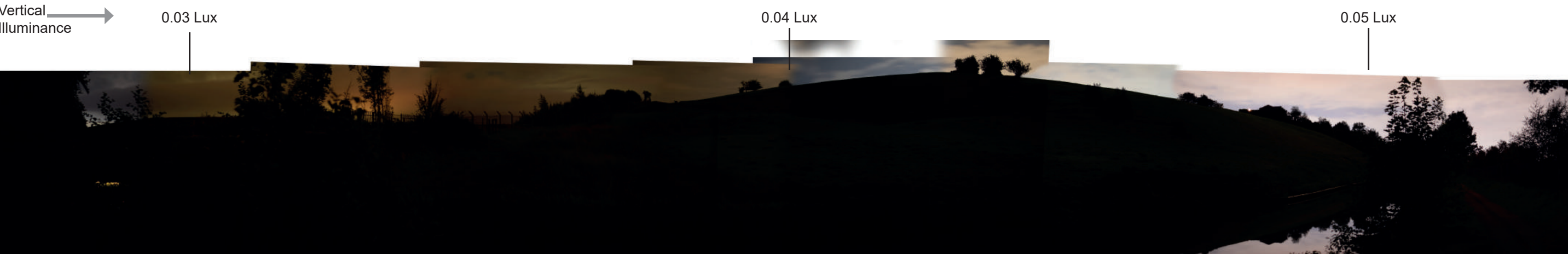
Illuminance Readings

Illuminance readings were taken at selected locations using and Extech Easy View 30 illuminance meter. The calibration certificate is shown within **Appendix B** Illuminance readings were taken horizontally at ground level and vertically approximately 1.8m above ground level. For vertical illuminance readings the sensor was mounted directly above the camera lens using the hot shoe of the camera.

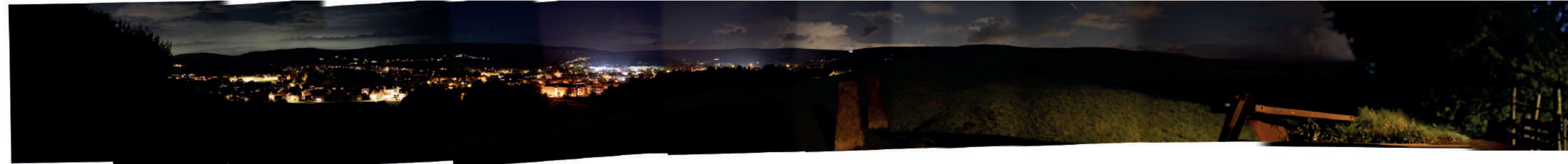
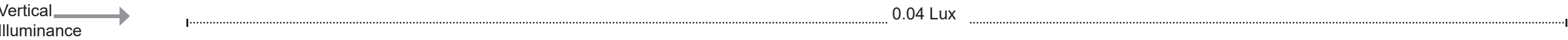
Figure A.1: Photographic Survey Locations



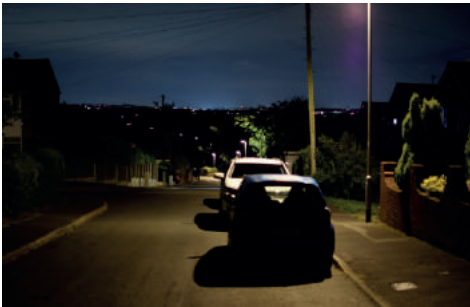
World Imagery: Maxar, Microsoft
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin,



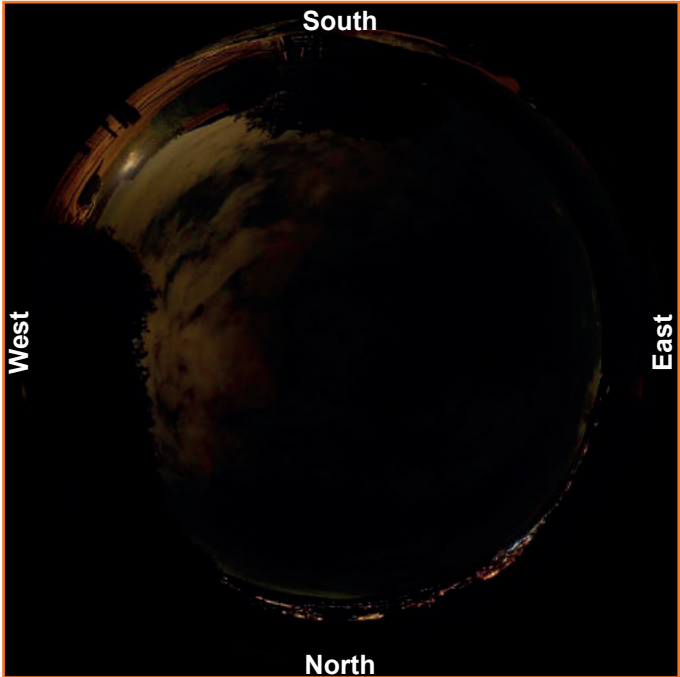
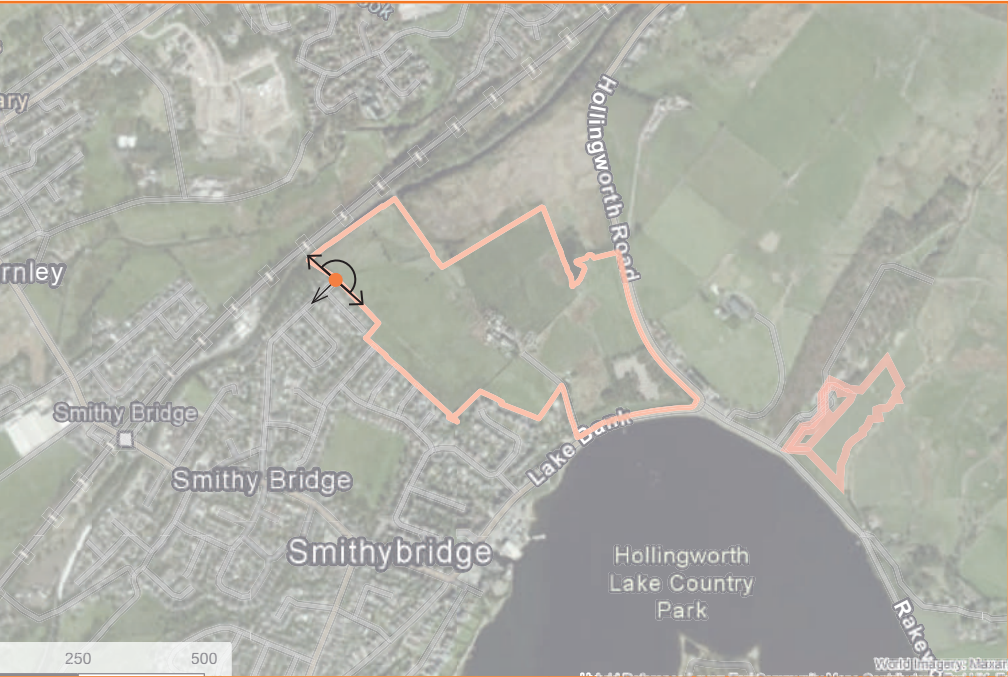
Horizontal Illuminance - 0.03 Lux	
Notes:	
All directional annotations are approximate	
Location essentially unlit, no direct sources of ALAN observed contributing to illuminance.	
Passing trains temporarily cast light onto canal from headlamps and side windows	
To east streetlighting along Holingworth Lane can be seen reflecting in the canal	
Survey Location	
A	
Rochdale Canal	
Camera & Lens	
Nikon DX5300 / AF-S Nikkon 35mm 1:1.4G	
Day Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 09:30	Auto
Photo Editing	
Photoshop automerger, Cylindrical projection	
Night Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22,23:55	f/2, 13sec, ISO200
Photo Editing	
Overlaid & aligned with daytime image, manually blended panorama, no geometric distortion.	



View along Brown Lodge Drive
Extract from Theta Z1
Automatic HDR Settings
View composed and exported from Theta desktop application



View along Brown Lodge Drive
Taken from field gate, within Site
Nikon DX5300
f/2, 1.3sec, ISO200
Vertical Illuminance 0.91lux

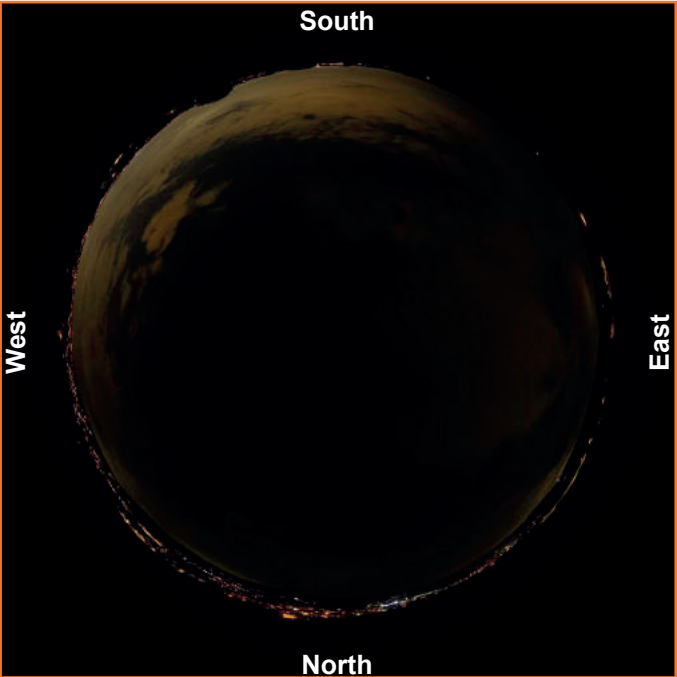
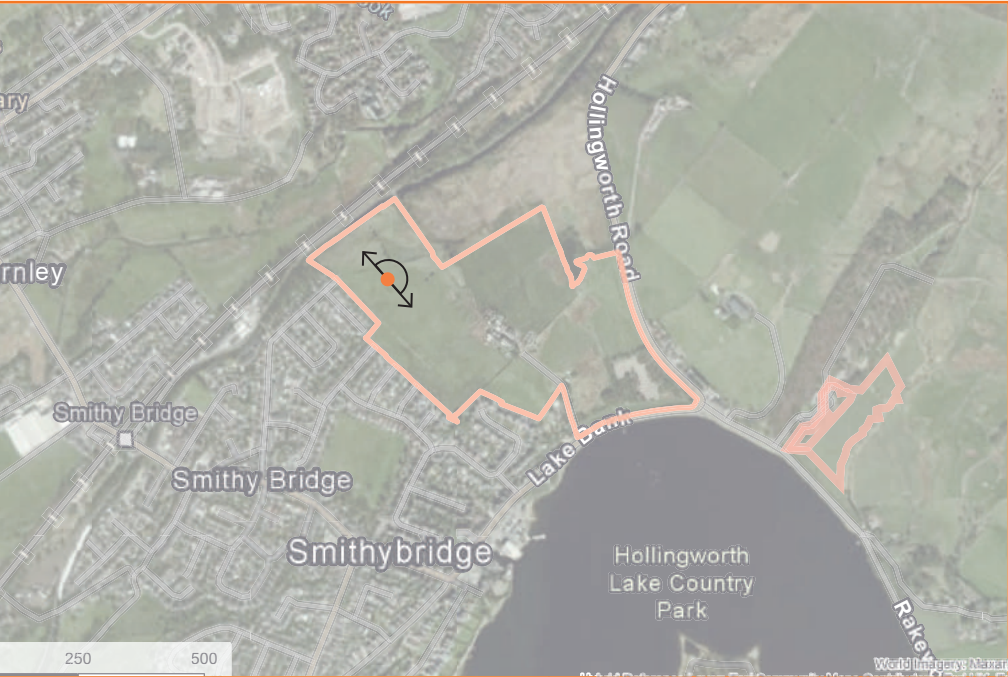


Notes:

All directional annotations are approximate

Streetlighting along Brown Lodge Drive extends into Site (note extended shadows), influence estimated at ~30m from boundary

Survey Location	
B	
Boundary of Site and Brown Lodge Drive, PRoW	
Camera & Lens	
Nikon DX5300 / AF-S Nikkor 35mm 1:1.4G	
Day Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 10:00	Auto
Photo Editing	
Photoshop automerage, Cylindrical projection	
Night Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 23:00	f/2, 10sec, ISO200
Photo Editing	
Overlaid & aligned with daytime image, manually blended panorama, no geometric distortion.	

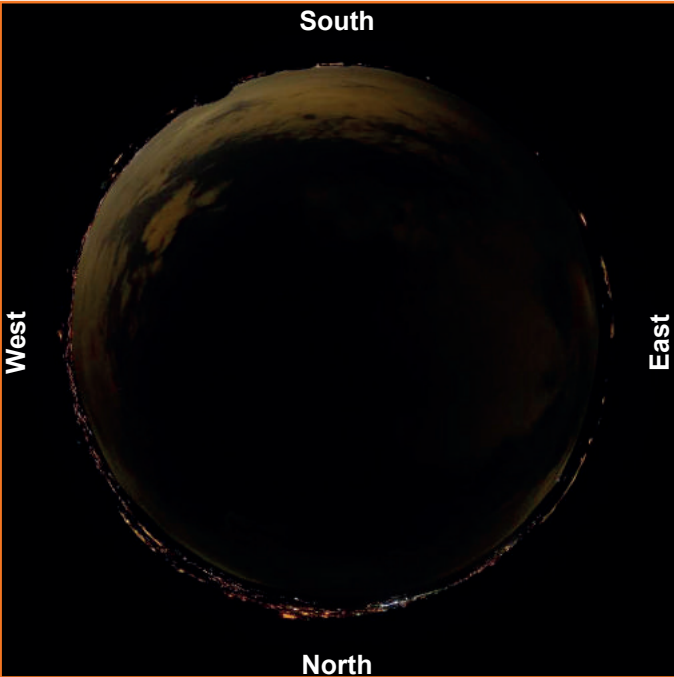
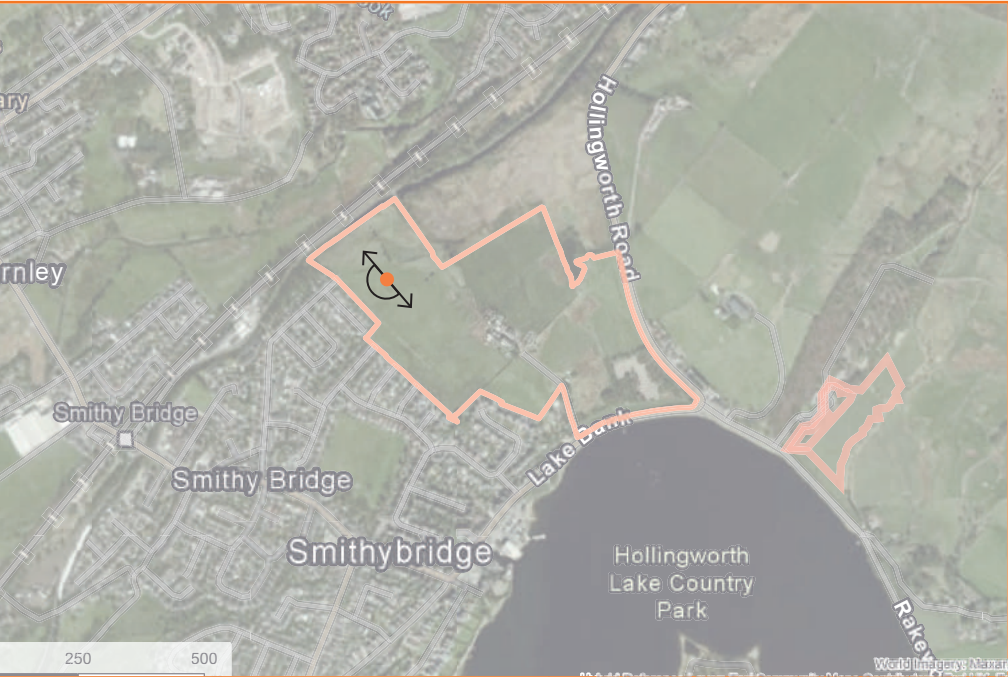


Vertical Illuminance ranging from 0.05 - 0.06 across panorama

Notes:

All directional annotations are approximate

Survey Location	
C - East	
Panorama from highpoint within the Site	
Camera & Lens	
Nikon DX5300 / AF-S Nikkor 35mm 1:1.4G	
Day Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 10:10	Auto
Photo Editing	
Photoshop automerge, Cylindrical projection	
Night Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 23:15	f/2, 10sec, ISO200
Photo Editing	
Overlaid & aligned with daytime image, manually blended panorama, no geometric distortion.	

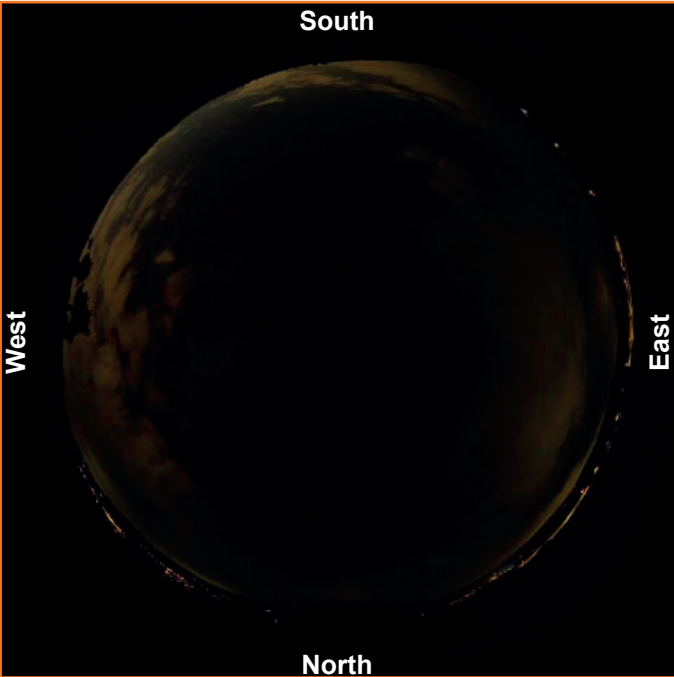
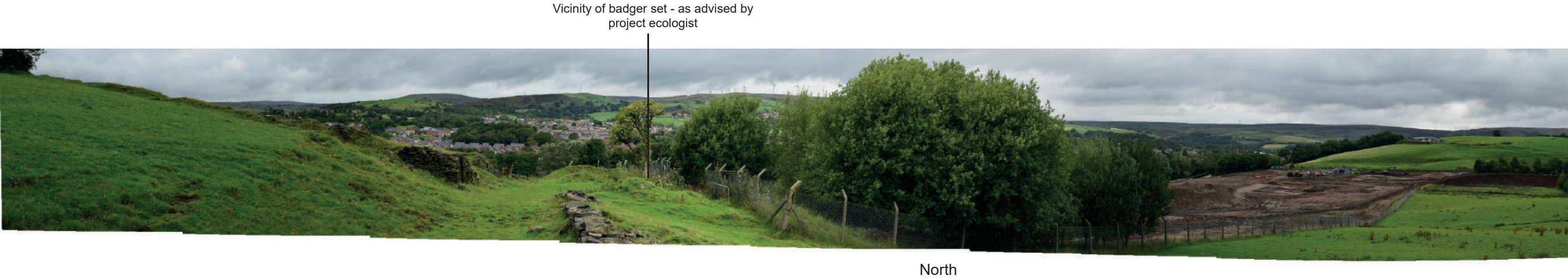


Vertical Illuminance ranging from 0.05 - 0.07 across panorama

Notes:

All directional annotations are approximate

Survey Location	
C - West	
Panorama from highpoint within the Site	
Camera & Lens	
Nikon DX5300 / AF-S Nikkor 35mm 1:1.4G	
Day Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 10:10	Auto
Photo Editing	
Photoshop automerger, Cylindrical projection	
Night Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 23:15	f/2, 10sec, ISO200
Photo Editing	
Overlaid & aligned with daytime image, manually blended panorama, no geometric distortion.	



Vertical Illuminance 0.04 lux typical across panorama

No current sources of ALAN directly illuminating vicinity of badger set.

Notes:

All directional annotations are approximate

Survey Location	
D	
Looking north from PRow in centre of Site nr. boundary with Vistry site & habitat	
Camera & Lens	
Nikon DX5300 / AF-S Nikkor 35mm 1:1.4G	
Day Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 10:20	Auto
Photo Editing	
Photoshop automerge, Cylindrical projection	
Night Image	
YYYY/MM/DD & Time	Camera Settings
2023/08/22, 23:30	f/2, 10sec, ISO200
Photo Editing	
Overlaid & aligned with daytime image, manually blended panorama, no geometric distortion.	