

Water Eaton

PR6a : Land East of Oxford Road

Environmental Statement Appendix 12.1:
Lighting Baseline Survey

Bellway


STRATEGIC
LAND



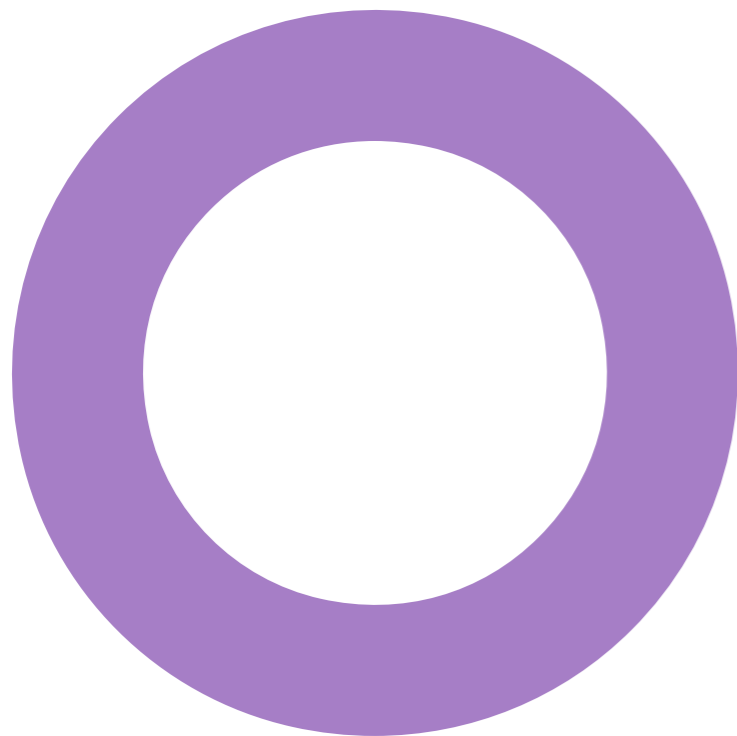
WE / LIG1 / P01

PR6A - Land east of Oxford. Savills.

16-16913

LIGHTING IMPACT ASSESSMENT - BASELINE SURVEY
PR6A - LAND EAST OF OXFORD.
JULY 2021

DOC-16-16913-5A-20210625-SMK-PR6A-BLS-01



Audit sheet.

Rev	Date	Description	Prepared	Verified
01	16/07/2021	First issue	SMK	DDM

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Contents.

Audit sheet	2
Introduction	3
1.0 Proposed Development Summary	4
2.0 Environmental Zones & Guidance	5
3.0 Site Survey	9
4.0 Sky Glow - Site and wider area	62
5.0 Baseline site and Environmental Zone classification	64
6.0 Glossary of terms	65

Introduction.

This survey reviews the artificial lighting currently installed on the Application Site area and adjacent surrounding areas.

Comment is made regarding the resulting lighting levels found, with regard to current standards and guidelines, where relevant. Receptors are assessed with regard to their present individual lighting conditions to enable a future assessment to be made of the potential impact the Proposed Development may have.

To the north of the proposed development is a well lit park & ride facility, coupled with Oxford Parkway station. To the east is predominately open space and agricultural fields. South of the site is a floodlit sports facility and to the west is a golf course, a business park and residential properties.

The immediate area is lit utilising a mixture of column heights between 6 to 16m a variety of distributions, there is a mixture of discharge and "flat bed" LED fittings. In the suburban areas there are a mixture of fitting types and styles.

The survey was carried out on Wednesday 5th May 2021. A walk around was carried out during the day to assess site conditions, access and safety. During this time photographs and notes were made. The measurements were taken in the night between 9.40 pm and 12.30 am. Weather conditions while taking the readings were partially overcast but dry. No moon was visible in the sky.

Measurements taken with a calibrated hand-held Minolta T-10a light meter. Serial Number: 20013532. Calibration certificate: 129825/ABU (Copy available on request).

Measurements taken at least 1 hour post sunset and at stabilised levels of darkness.

Horizontal meter readings taken at ground level.

Vertical light meter readings taken at 1.5m.



Figure 1.1. Site overview with approximate redline - from Microsoft mapping.

1.0 Proposed development summary.

Shown below is a plan view of the site, the proposal for planning is for residential purposes.

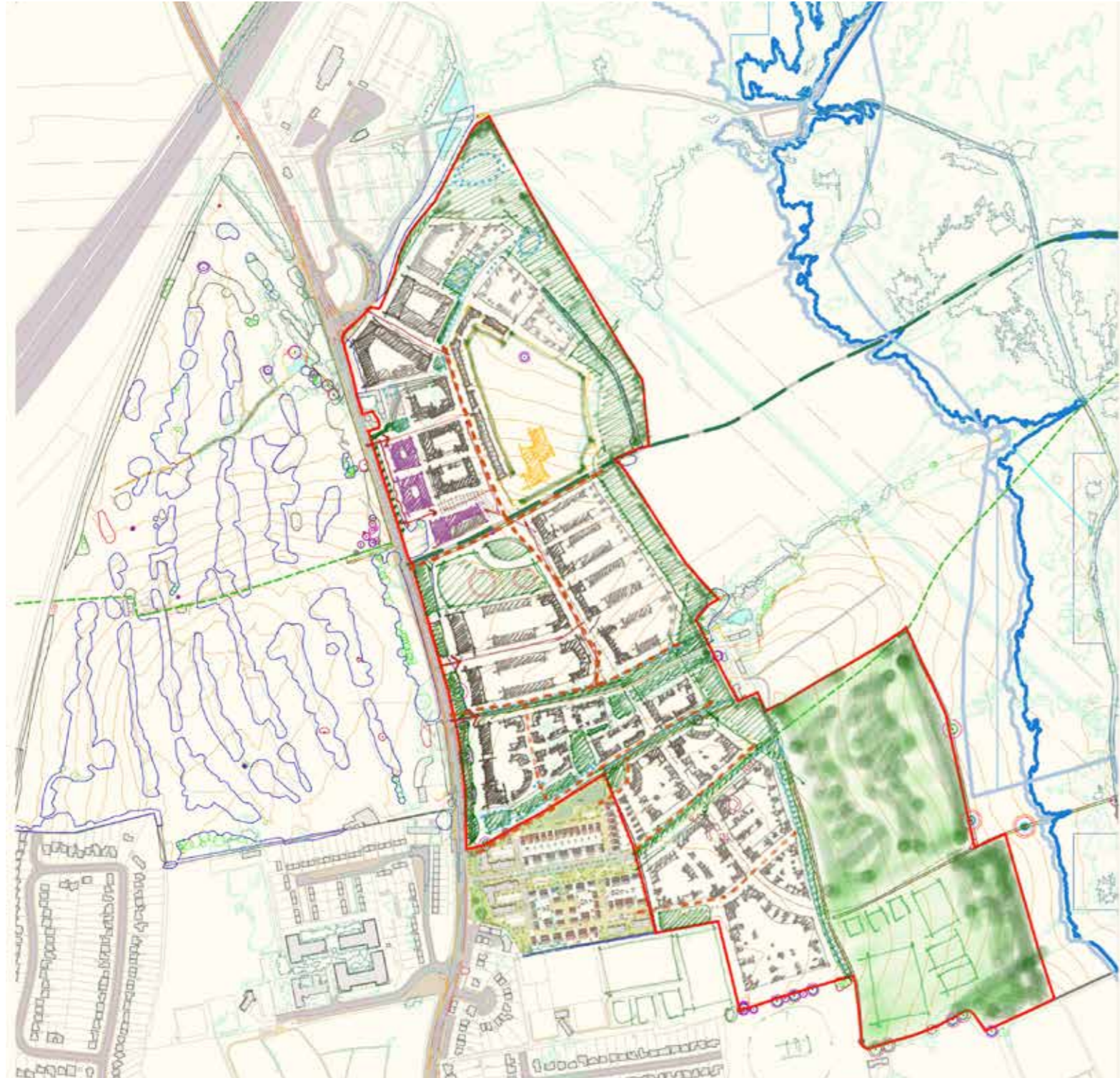


Figure 1.2 Section from provisional masterplan.

2.0 Environmental zones & guidance.

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

Tables 1 & 2 are taken from: Guidance Notes for the Reduction of Obtrusive Light (GN01/2021), (CIE150:2017). These define areas in terms of usage and light levels. They provide guidance on the levels of light typically found and acceptable levels of light spill.

Notes:

1. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.
2. Rural zones under protected designations should use a higher standard of policy.
3. Zone E0 must always be surrounded by an E1 Zone.
4. Zoning should be agreed with the local planning authority and due to local requirements a more stringent zone classification may be applied to protect special/ specific areas.
5. SQM (Sky Quality Measurements) referenced by the International Dark-Sky Association (IDA), the criteria for E0 being revised in mid 2019 but not retrospective.
6. Astronomical observable dark skies will offer clearer views of the Milky Way and of other objects such as the Andromeda galaxy and the Orion Nebula.
7. Although values of SQM 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK.

Light technical parameter	Application conditions	Environmental zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (Ev)	Pre-curfew	n/a	2 lux	5 lux	10 lux	25 lux
	Post-curfew	n/a	<0.1 lux*	1 lux	2 lux	5 lux

Note:

* If the installation is for public (road) lighting then this may be up to 1 lux.

2.0 Environmental zones & guidance.

Table 3 - (CIE 150 table 3 (amended)): Limits for the luminous intensity of bright luminaires ⁴ .							
Light technical parameter	Application conditions	Luminaire group (projected area A_p in m^2)					
		$0 < A_p \leq 0.002$	$0.002 < A_p \leq 0.01$	$0.01 < A_p \leq 0.03$	$0.03 < A_p \leq 0.13$	$0.13 < A_p \leq 0.50$	$A_p > 0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E0						
	Pre-curfew	0	0	0	0	0	0
	Post-curfew	0	0	0	0	0	0
	E1						
	Pre-curfew	0.29 d	0.63 d	1.30 d	2.50 d	5.10 d	2,500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 d	1.30 d	2.50 d	5.00 d	10.00 d	7,500
	Post-curfew	0.29 d	0.63 d	1.30 d	2.50 d	5.10 d	500
	E3						
	Pre-curfew	0.86 d	1.90 d	3.80 d	7.50 d	15.00 d	10,000
	Post-curfew	0.29 d	0.63 d	1.30 d	2.50 d	5.10 d	1,000
	E4						
	Pre-curfew	1.40 d	3.10 d	6.30 d	13.00 d	26.00 d	25,000
	Post-curfew	0.29 d	0.63 d	1.30 d	2.50 d	5.10 d	2,500
	Aid to gauging A_p		2 to 5 cm	5 to 10cm	10 to 20 cm	20 to 40 cm	40 to 80 cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m^2)		0.0008	0.004	0.016	0.063	0.251	>0.5
Notes:							
1. d is the distance between the observer and the glare source in metres;							
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions;							
3. A_p is the apparent surface of the light source seen from the observer position.							
4. For further information refer to Annex C of CIE 150.							
5. Upper limits for each zone shall be taken as those with column $A_p > 0.5$.							

2.0 Environmental zones & guidance.

Table 4 - (CIE 150 table 5): Maximum values of upward light ratio (ULR) of luminaires.

Light technical parameter	Environmental zone				
	E0	E1	E2	E3	E4
Upward light ratio (ULR)/%	0	0	2.5	5	15

Note:

This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow. This is the traditional method to limit sky glow and is suitable to compare different single luminaires.

Table 5 - (CIE 150 table 6): Maximum values of upward flux ratio of installation (of four or more luminaires).

Light technical parameter	Type of installation	Environmental zone				
		E0	E1	E2	E3	E4
Upward flux ratio (UFR)/%	Road	n/a	2	5	8	12
	Amenity	n/a	n/a	6	12	35
	Sports	n/a	n/a	2	16	15

Notes:

Table 5 allows the effect of both direct and reflected upward components of a whole installation to be taken into account. The factor being the upward flux ratio (UFR) and CIE 150 suggests that table 5 is used for all installations consisting of four or more luminaires.

Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULR and UFR.

2.0 Environmental zones & guidance.

Table 6. Example lux levels for reference (ILP GN 08/18)				
Lighting conditions	Lux level		Lighting conditions	Lux level
British summer sunshine	50,000		Typical side road lighting	5
Overcast sky	5,000		Minimum security lighting	2
Well-lit office	500		Twilight	1
Minimum for easy reading	300		Clear full moon	0.25 to <1
Passageway or outside working area	50		Typical moonlight/cloudy sky	0.1
Good main road lighting	5-20		Typical starlight	0.001
Sunset	10		Poor starlight	0.0001
Source: IPCCTV specialists use-IP Ltd. Referenced in ILP Guidance note 08/18 "Bats and artificial lighting in the UK."				

The table above provides a reference for light levels experienced in a variety of internal & external settings. The values are typical averages that would be measured. The information can be used when assessing the magnitude of impact in later appendices. The table is taken from ILP Guidance Note 08/18 Bats and artificial lighting in the UK.

3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton.



View from lane to Water Eaton.



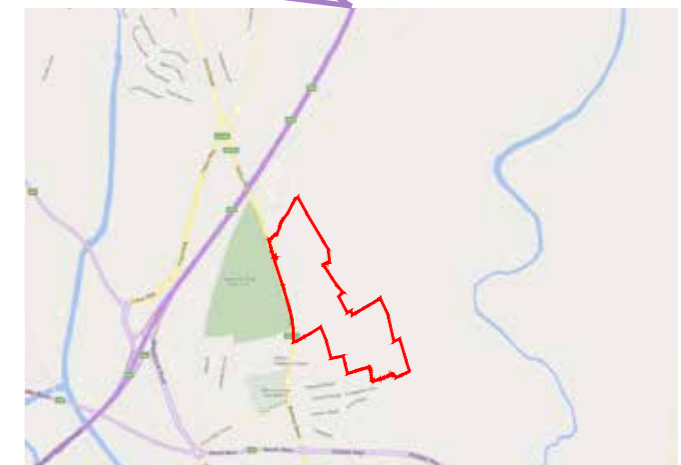
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton, bridge over A34.



View from lane to Water Eaton, bridge over A34.



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton, bridge over railway.



View from lane to Water Eaton, bridge over railway.



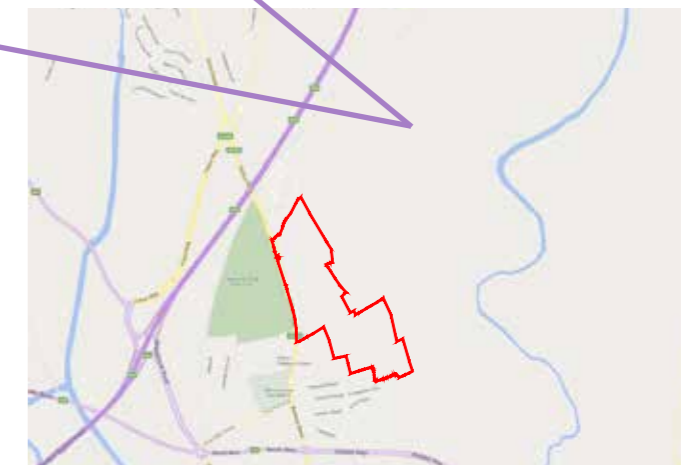
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Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton.



View from lane to Water Eaton.



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from A34.



View from A34.



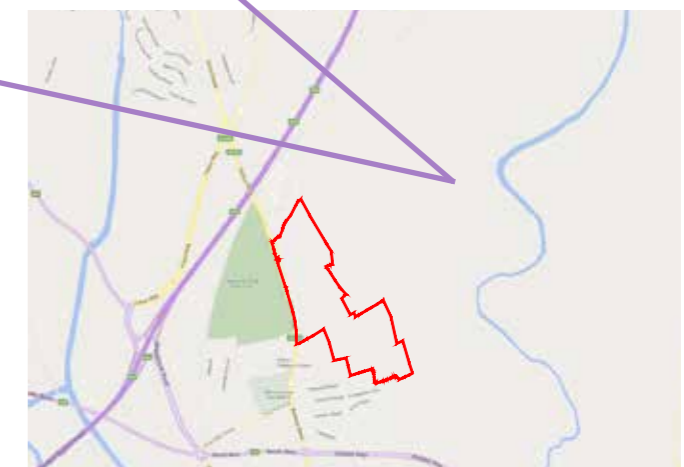
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Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton.



View from lane to Water Eaton.



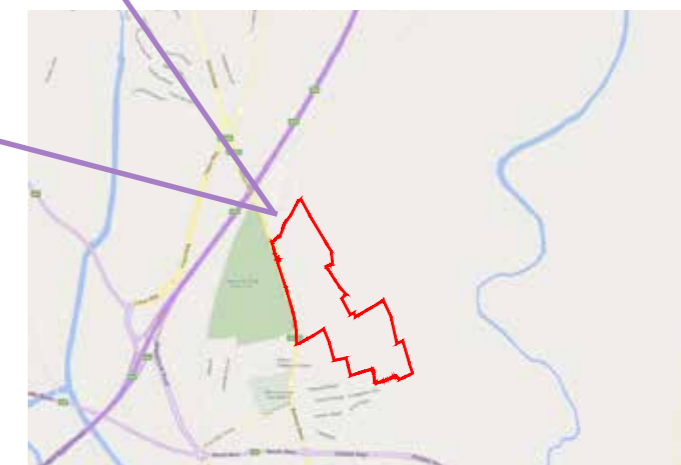
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from park and ride.



View from park and ride.



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton.



View from lane to Water Eaton.



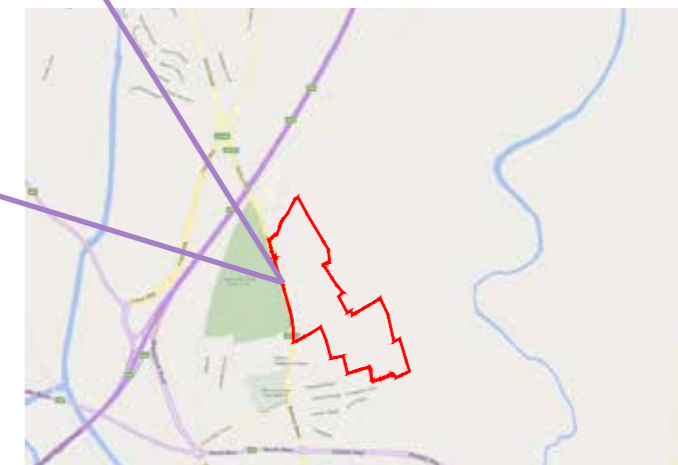
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to Water Eaton/junction with Oxford Road.



View from lane to Water Eaton/junction with Oxford Road.



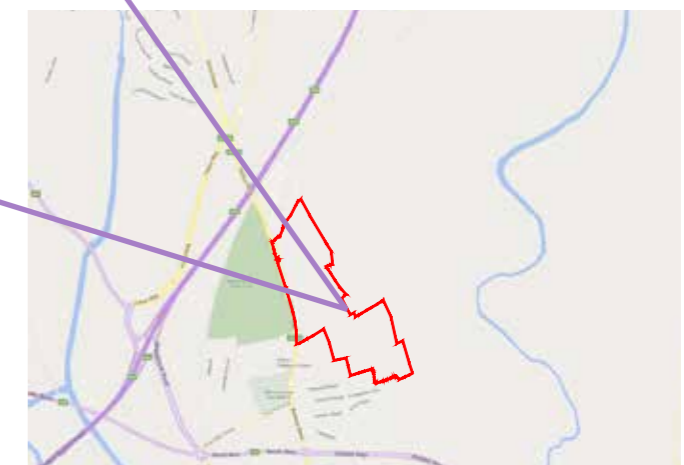
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from farmhouse.



View from farmhouse.



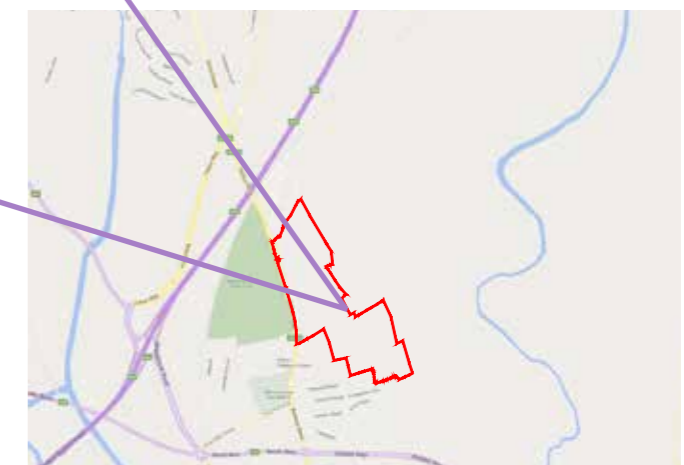
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Daytime site photographs showing site conditions & the variety of luminaires.

View from farmhouse.



View from farmhouse.



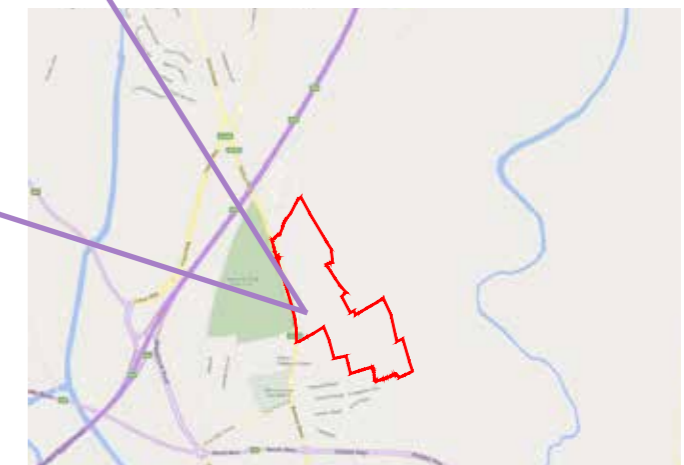
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to farmhouse.



View from lane to farmhouse.



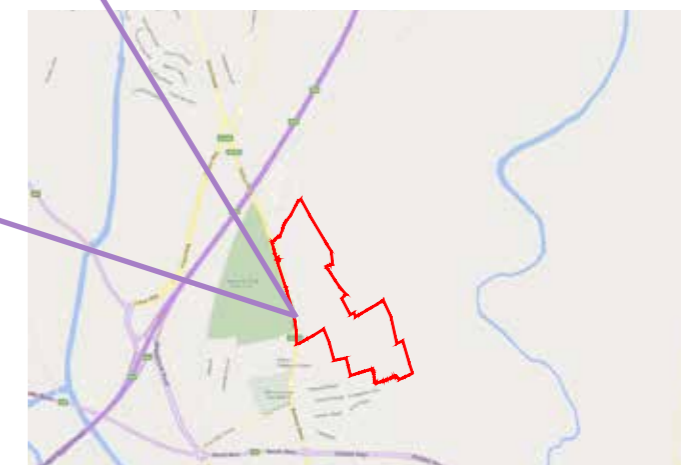
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from lane to farmhouse/junction with Oxford Road.



View from lane to farmhouse/junction with Oxford Road.



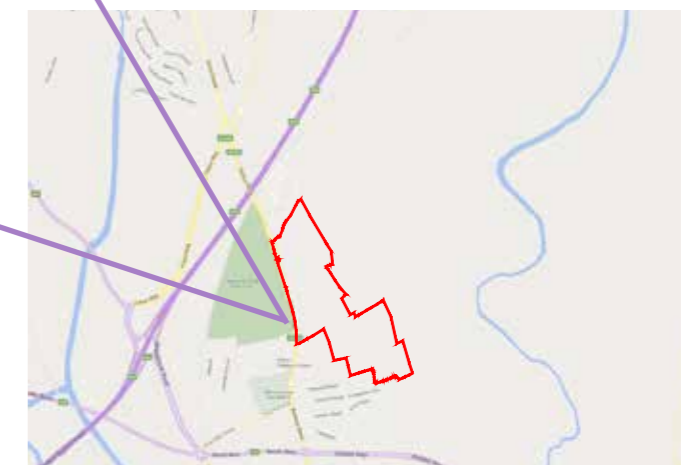
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from North Oxford Golf Club.



View from North Oxford Golf Club.



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from south west boundary of proposed development.



View from south west boundary of proposed development.



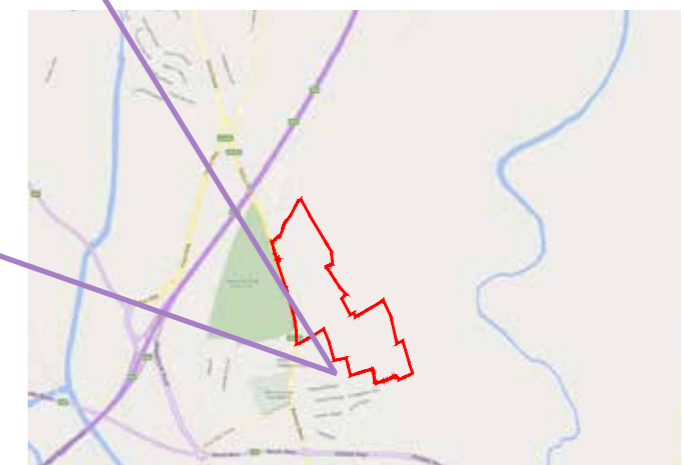
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View adjacent to flood lit playing areas.



View adjacent to flood lit playing areas.



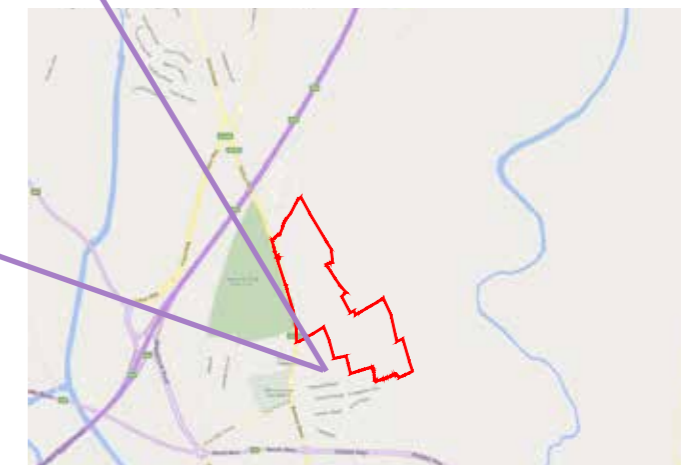
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View adjacent to flood lit playing areas.



View adjacent to flood lit playing areas.



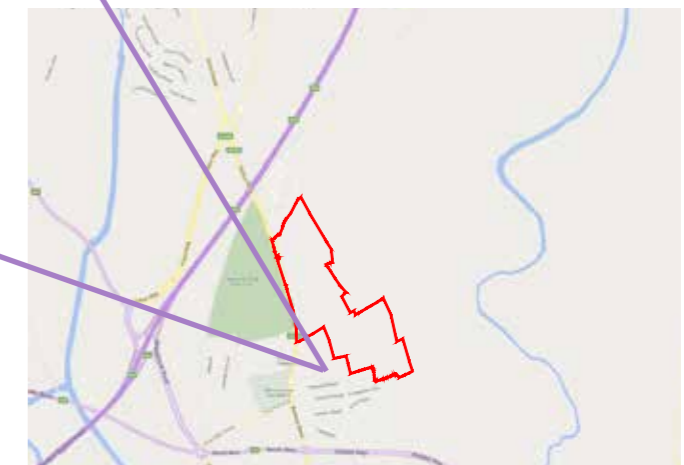
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View adjacent to flood lit playing areas.



View adjacent to flood lit playing areas.



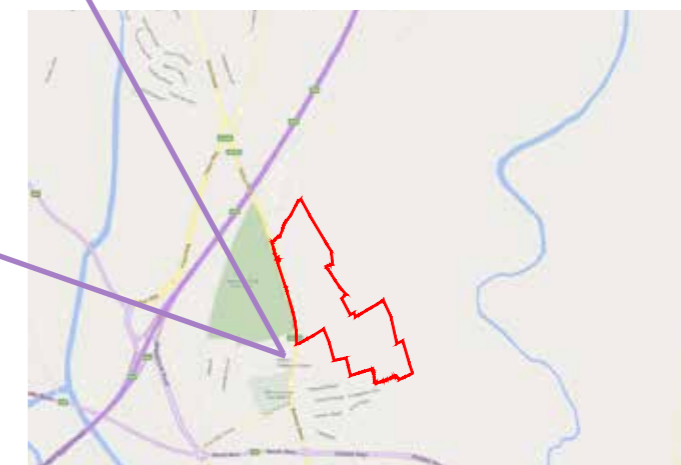
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Jordan Hill Road.



View from Jordan Hill Road.



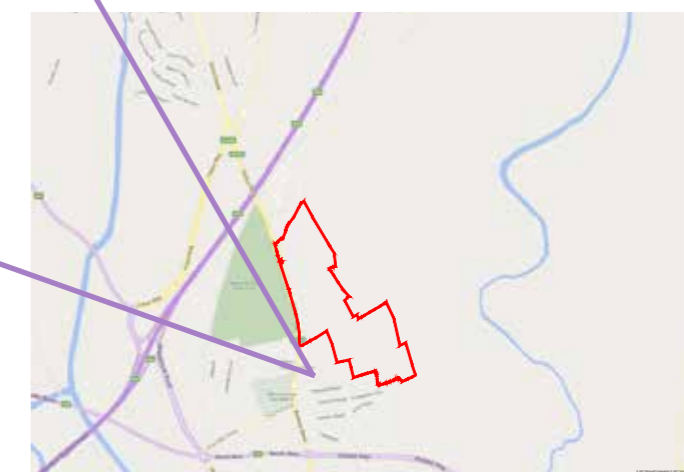
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View adjacent to flood lit playing areas (Tennis club).



View adjacent to flood lit playing areas (Tennis club).



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from car park adjacent to flood lit playing areas.



View from car park adjacent to flood lit playing areas.



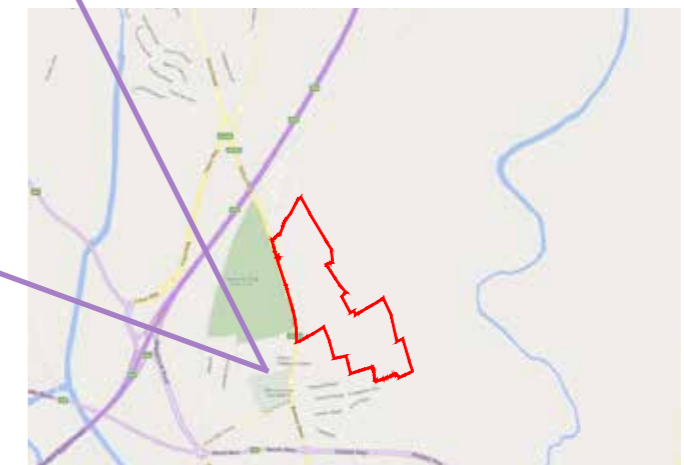
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Jordan Hill business park.



View from Jordan Hill business park.



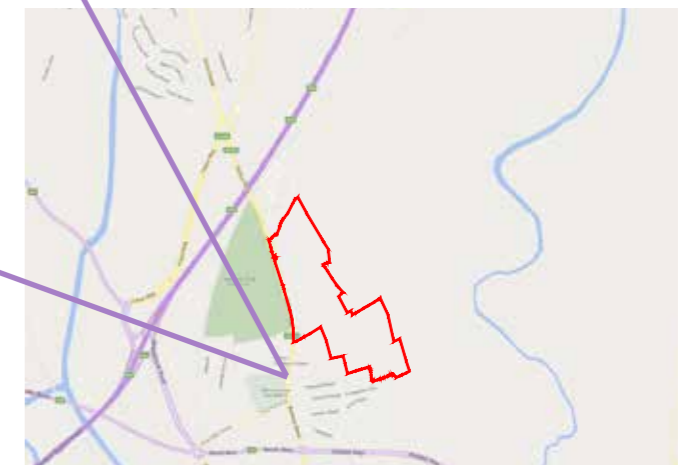
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from tennis club/junction with Oxford Road.



View from tennis club/junction with Oxford Road.



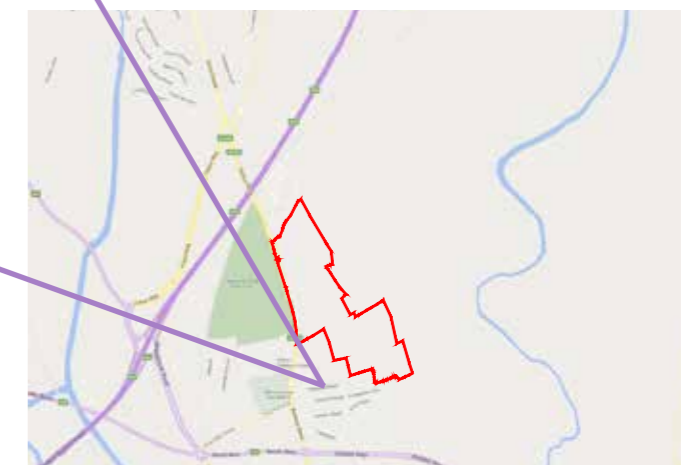
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Hayward Road.



View from Hayward Road.



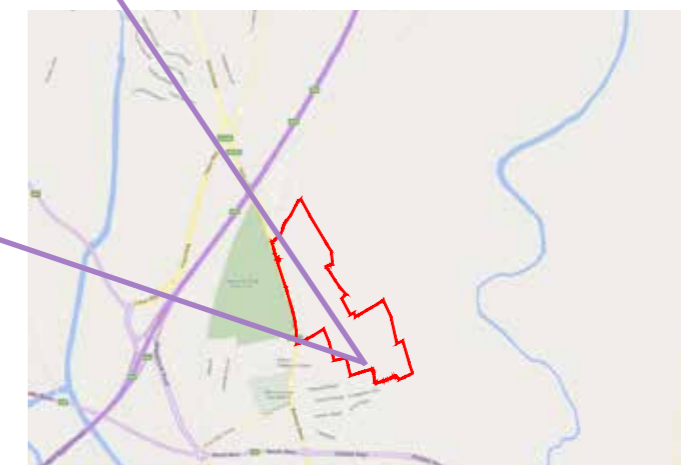
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from southern boundary of proposed development.



View from southern boundary of proposed development.



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from southern boundary of proposed development.



View from southern boundary of proposed development.



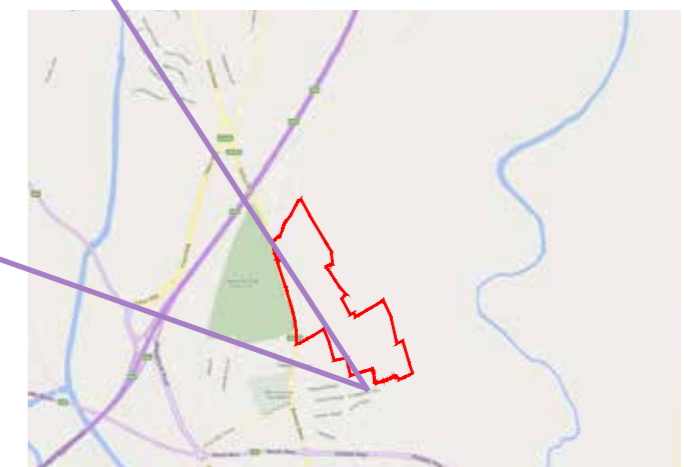
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Cuttleslowe Park.



View from Cuttleslowe Park.



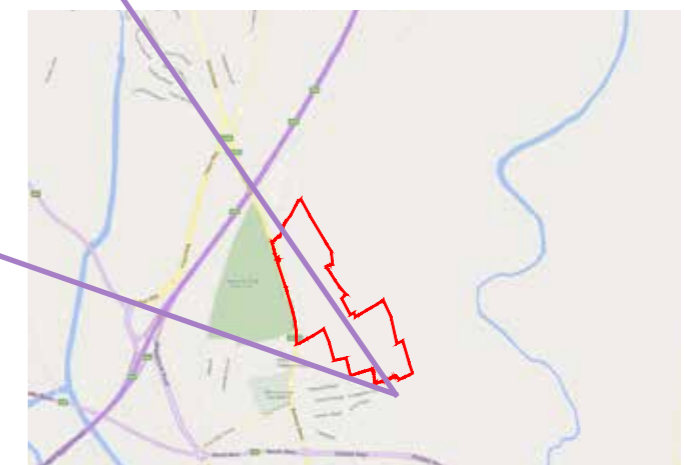
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Cuttleslowe Park, adjacent to local authority depot.



View from Cuttleslowe Park, adjacent to local authority depot.



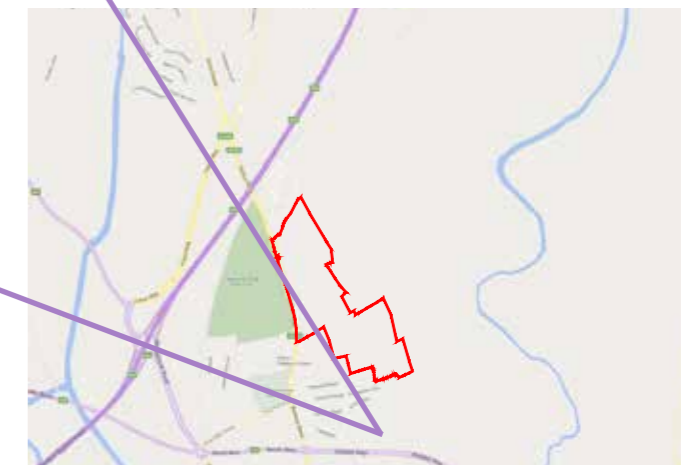
3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Cuttleslowe Park.



View from Cuttleslowe Park.



3.0 Site survey.

Daytime site photographs showing site conditions & the variety of luminaires.

View from Priors Forge.



View from Priors Forge.



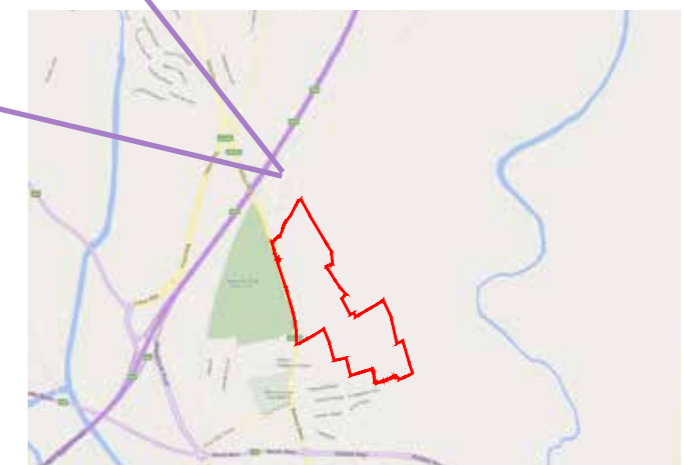
3.0 Site survey.

Night time site photographs showing site conditions & the variety of luminaires.

View railway depot.



View of park and ride.



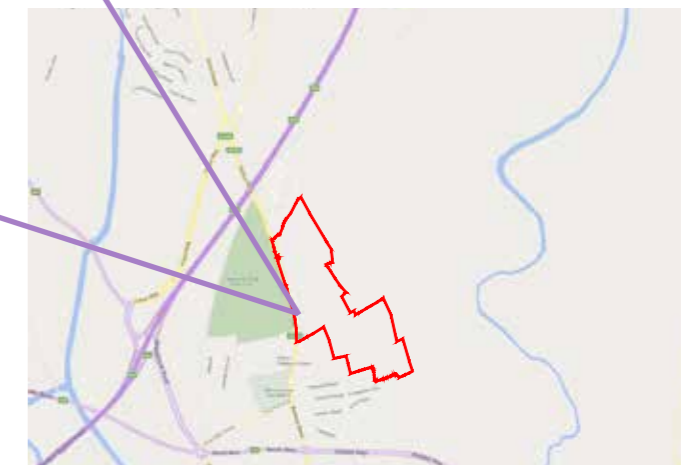
3.0 Site survey.

Night time site photographs showing site conditions & the variety of luminaires.

View from lane to farmhouse.



View from lane to farmhouse.



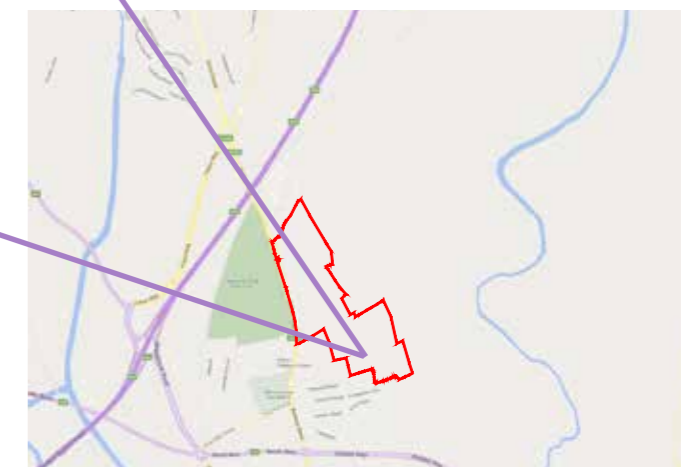
3.0 Site survey.

Night time site photographs showing site conditions & the variety of luminaires.

View east of flood lit playing areas.



View east of flood lit playing areas.



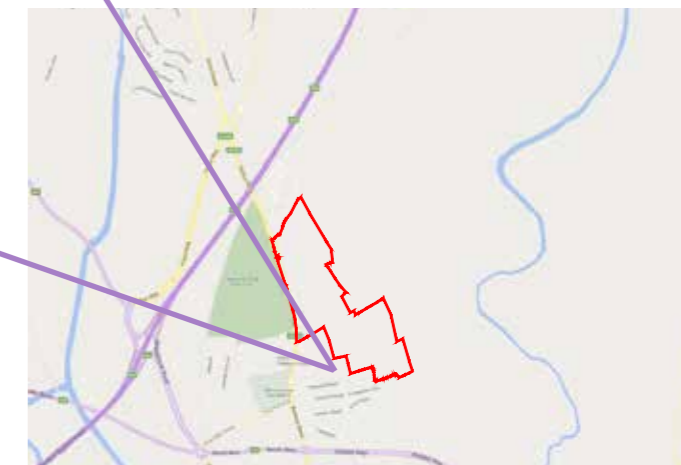
3.0 Site survey.

Night time site photographs showing site conditions & the variety of luminaires.

View adjacent to flood lit playing areas.



View adjacent to flood lit playing areas.



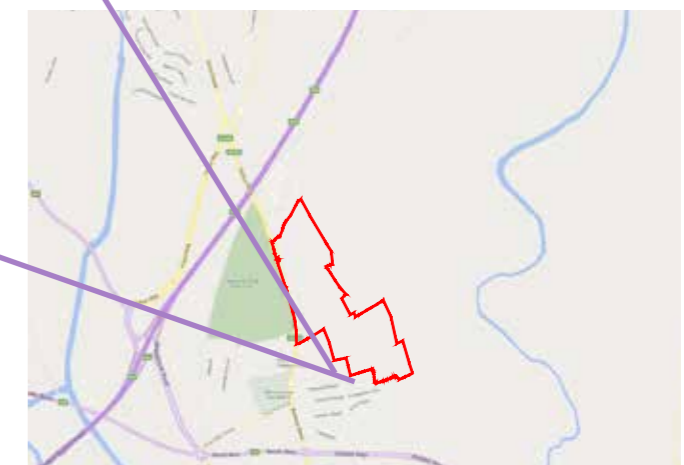
3.0 Site survey.

Night time site photographs showing site conditions & the variety of luminaires.

View from car park adjacent to flood lit playing areas.



View adjacent to flood lit playing areas.



3.0 Site survey.

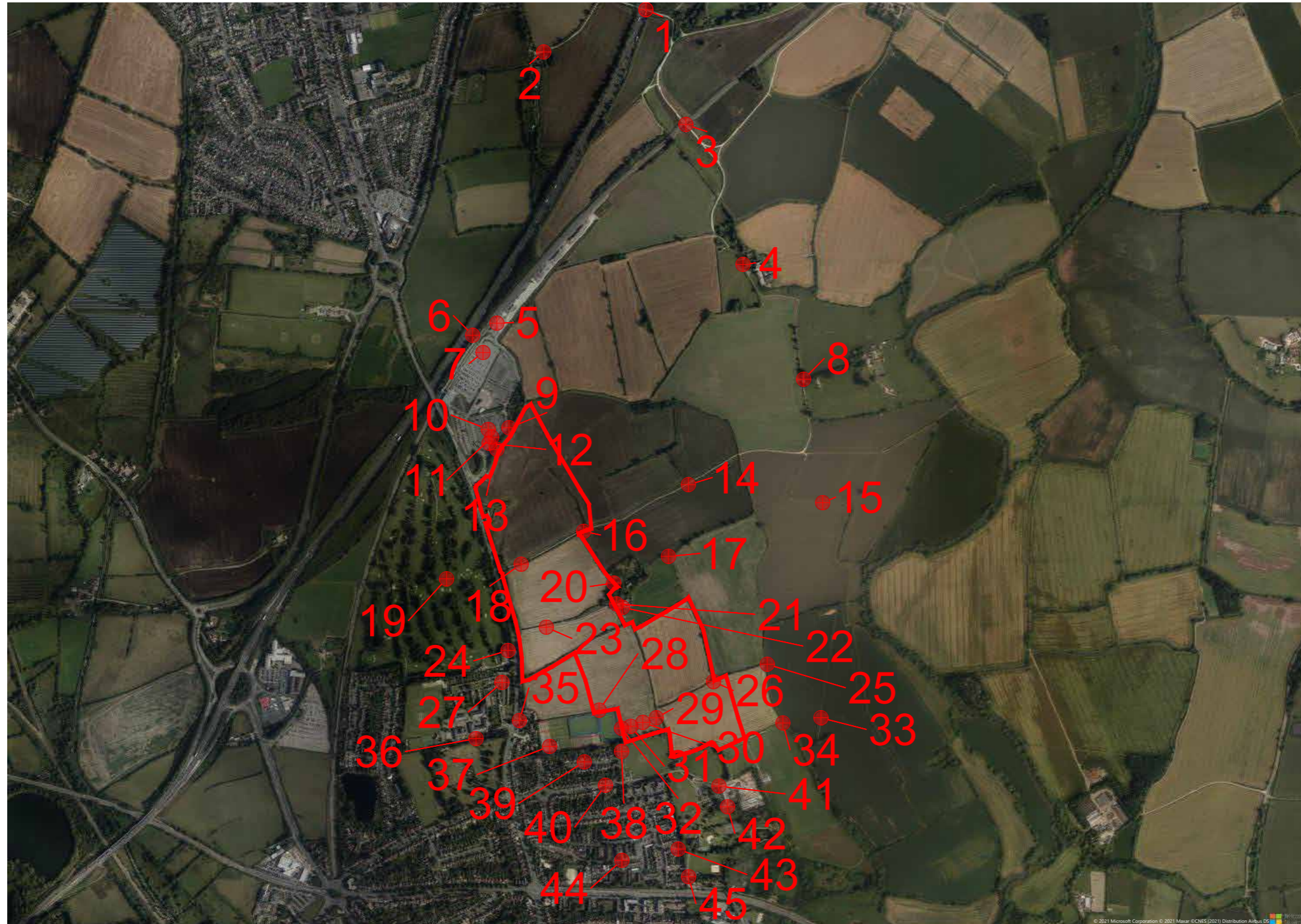


Figure 2.1 Image taken from Microsoft mapping - Showing survey points.

3.0 Site survey.

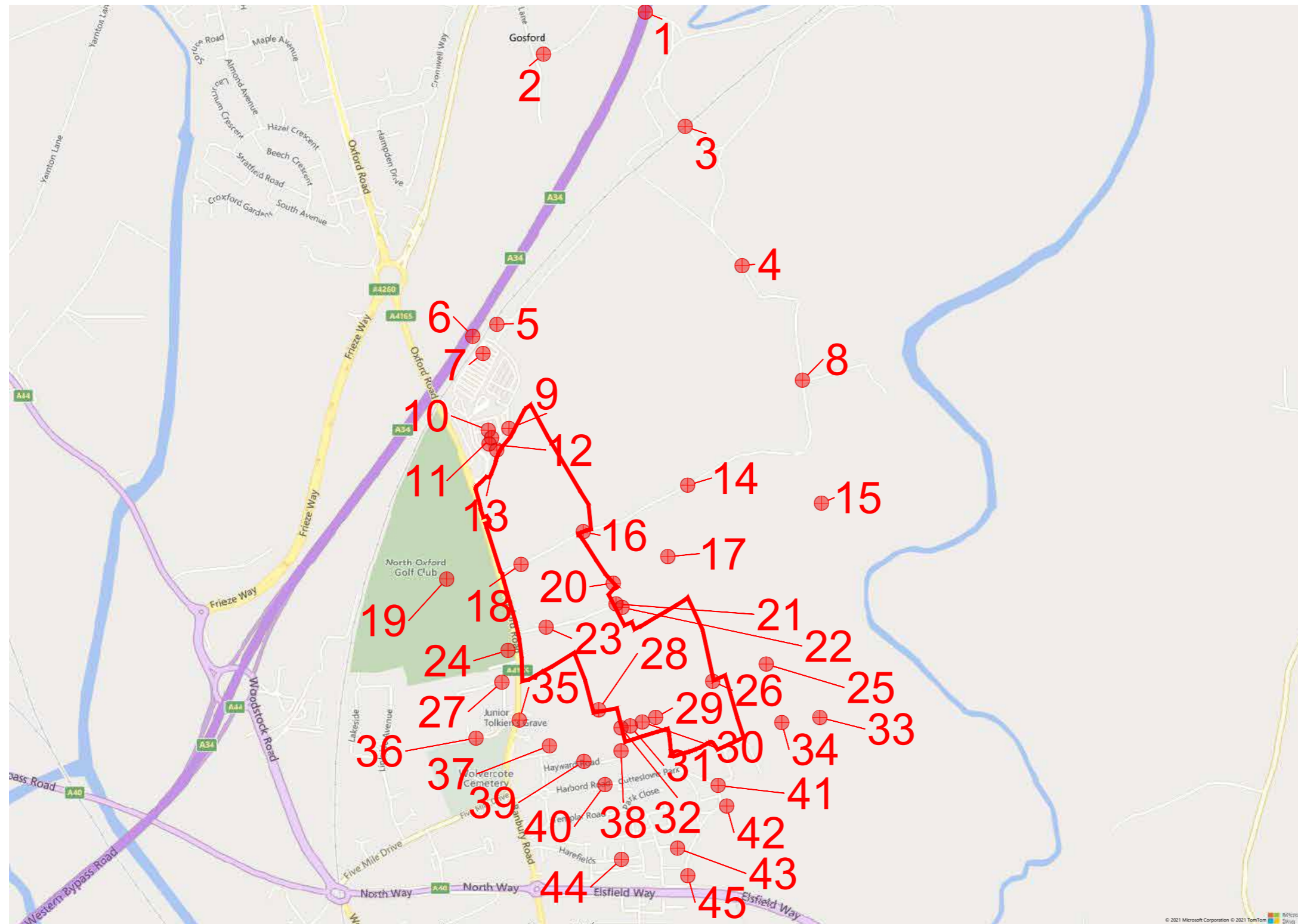


Figure 2.2 Image taken from Microsoft mapping - Showing survey points.

3.0 Site survey.



Figure 2.3 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
1	Watereaton Lane - Bridge over A34	0.15	0.15	North	E1	
2	Watereaton Lane	0.15	0.15	North	E1	
3	Bridge over railway	0.15	0.15	North	E1	

3.0 Site survey.



Figure 2.4 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
4	Lane adjacent to residential property	0.15	0.15	North	E1	
5	Rail Depot	20.00	10.00	North	E4	No access estimated values
6	A34 Layby	2.50	7.50	East	E3	Unlit road, values recorded are from transient vehicle headlights

3.0 Site survey.

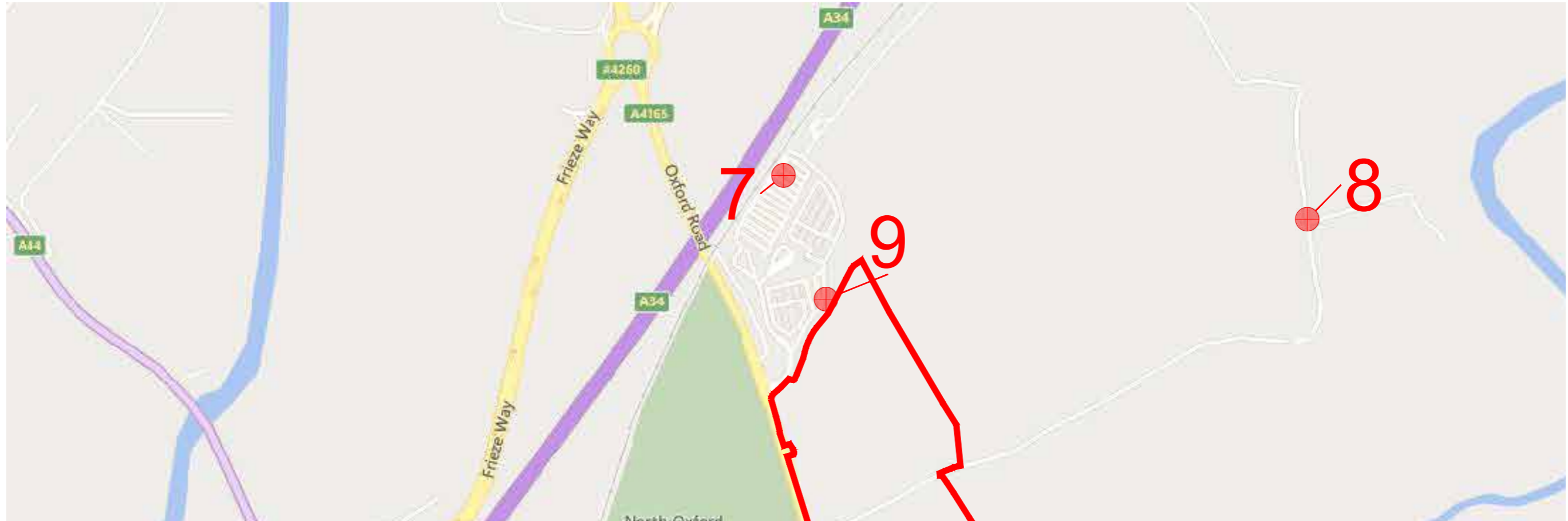


Figure 2.5 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
7	Park & Ride	15.52	18.54	East	E4	
8	Near Water Eaton Manor	0.15	0.15	North	E1	
9	Park & Ride - access road, adjacent to fence	12.20	14.67	West	E3	Note, trees on the other side of the fence reasonable screening.

3.0 Site survey.

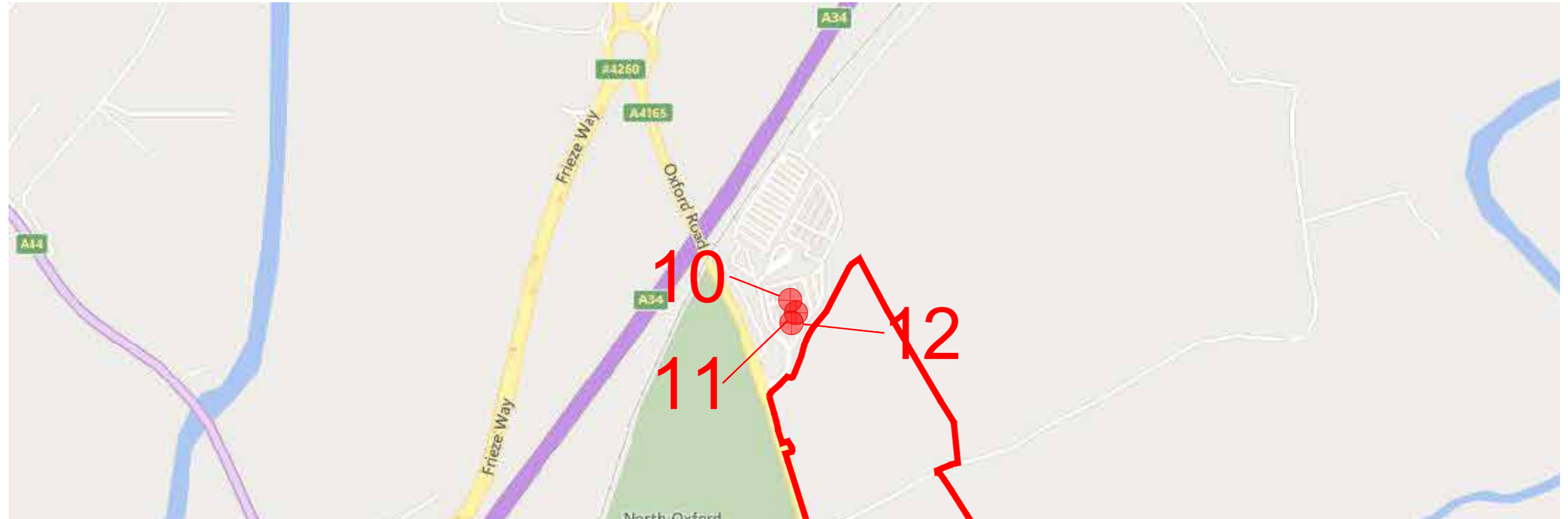


Figure 2.6 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
10	Park & Ride	3.04	11.81	North	E3	
11	Park & Ride	8.12	26.08	South	E4	
12	Park & Ride - directly under lighting column	50.24	39.40	West	E4	Note, four fittings on column

3.0 Site survey.

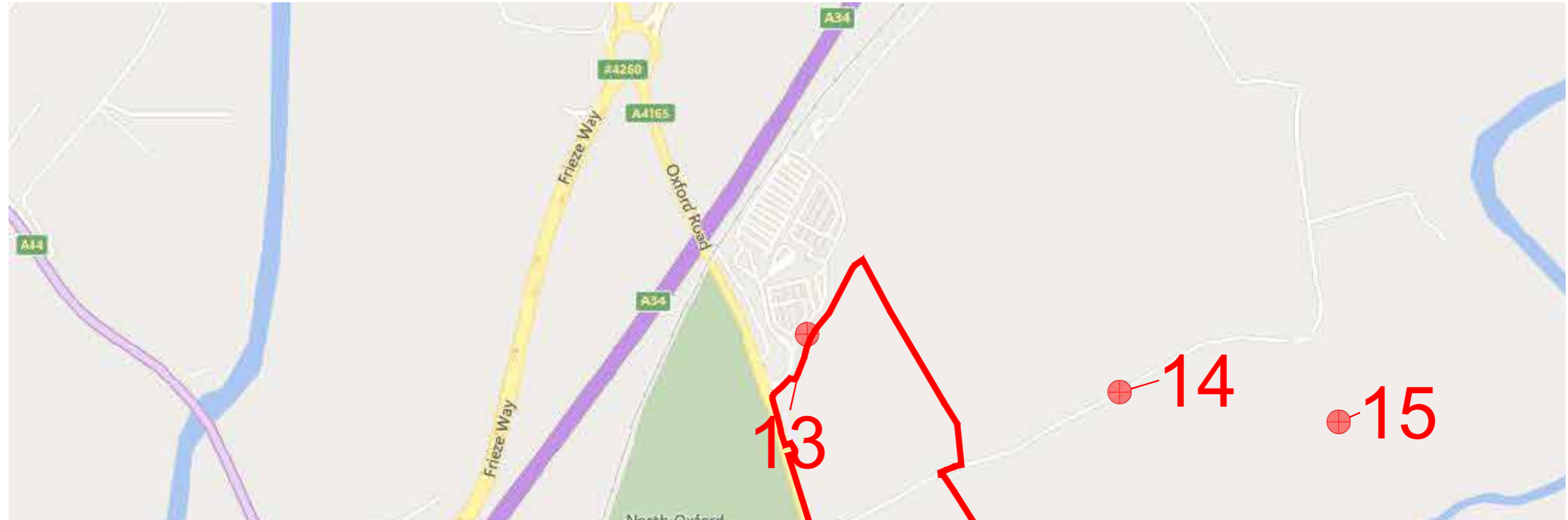


Figure 2.7 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
13	Park & Ride - access road	4.15	7.80	North	E3	
14	Water Eaton - footpath	0.15	0.15	North	E1	
15	Water Eaton - footpath	0.15	0.15	North	E1	

3.0 Site survey.



Figure 2.8 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
16	Site boundary - footpath	0.15	0.15	North	E1	
17	Site boundary	0.15	0.15	North	E1	
18	Footpath	0.15	0.15	North	E1	

3.0 Site survey.



Figure 2.9 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
19	Footpath - golf course	0.15	0.15	North	E1	
20	Site boundary	0.15	0.15	North	E1	
21	St Frideswide - Farmhouse	0.15	0.15	North	E1	

3.0 Site survey.



Figure 2.10 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
22	St Frideswide - Farmhouse	0.15	0.15	North	E1	
23	St Frideswide - access road	0.15	0.15	North	E1	
24	Golf course - car park	0.15	0.15	North	E1	

3.0 Site survey.

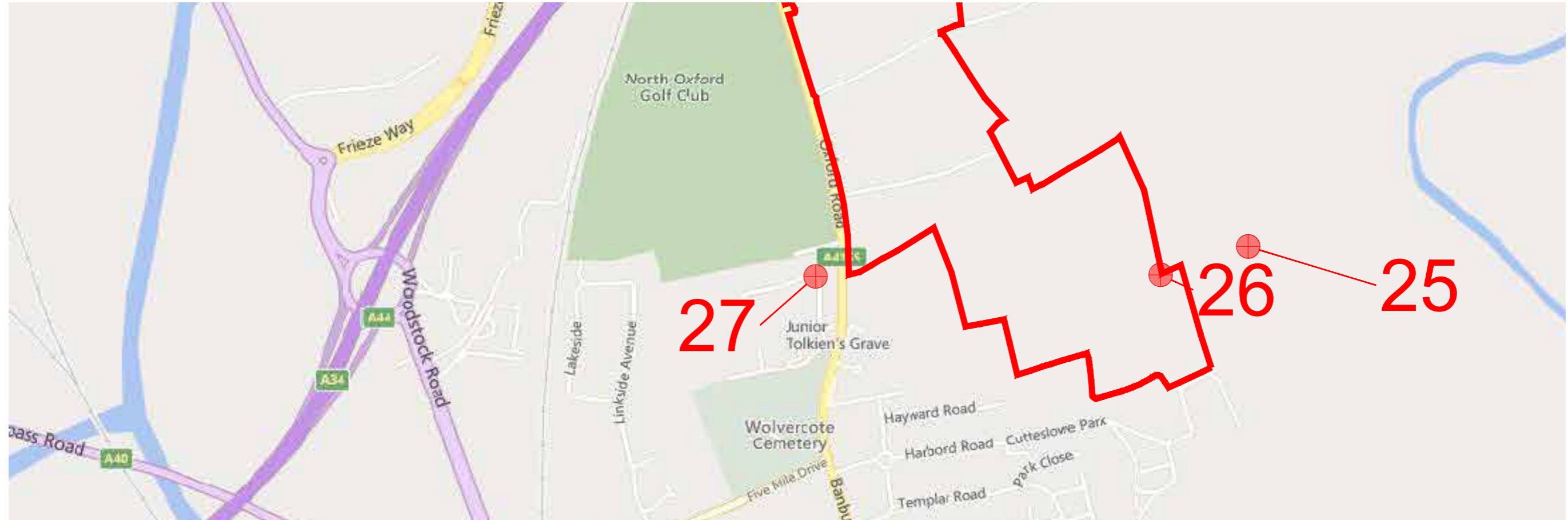


Figure 2.11 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
25	Site boundary	0.15	0.15	North	E1	
26	Site boundary	0.15	0.15	North	E1	
27	Jordan Hill	1.14	2.30	East	E2	

3.0 Site survey.

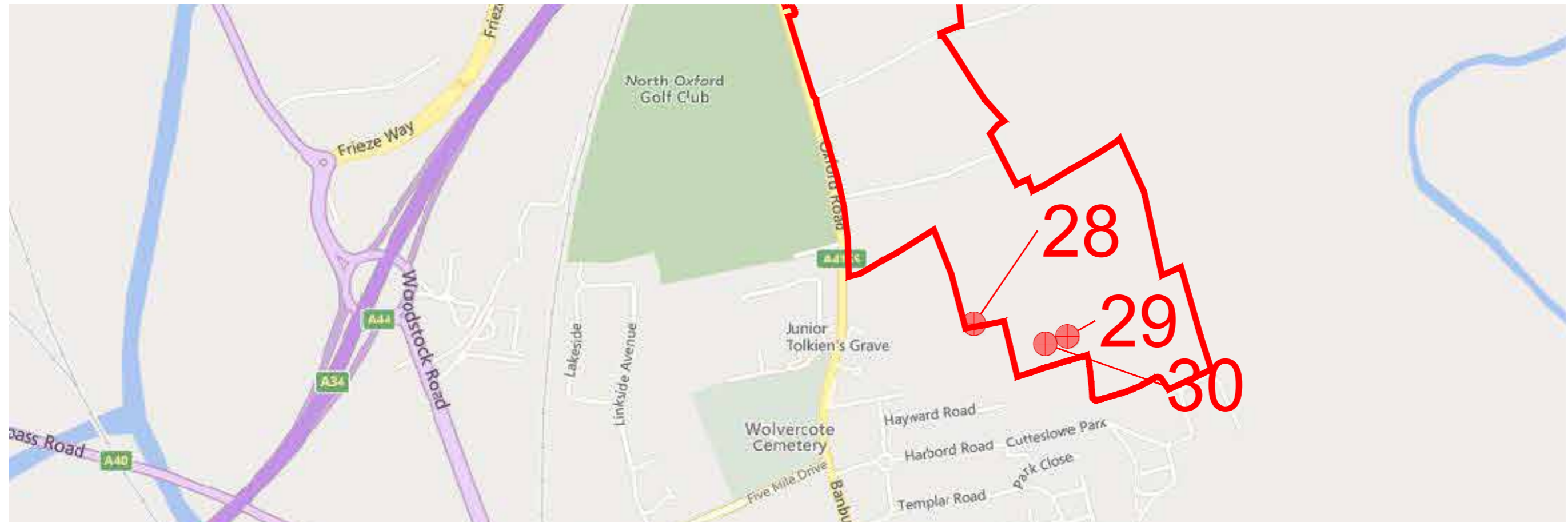


Figure 2.12 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
28	Hockey club - northern edge	0.15	0.15	North	E1	Sports lighting not in operation
29	Field adjacent to sports lighting	0.13	0.76	West	E1	Some sports lighting in operation. Approximately 130m from touch line
30	Field adjacent to sports lighting	0.94	3.27	West	E3	Sports lighting in operation. Approximately 80m from touch line

3.0 Site survey.

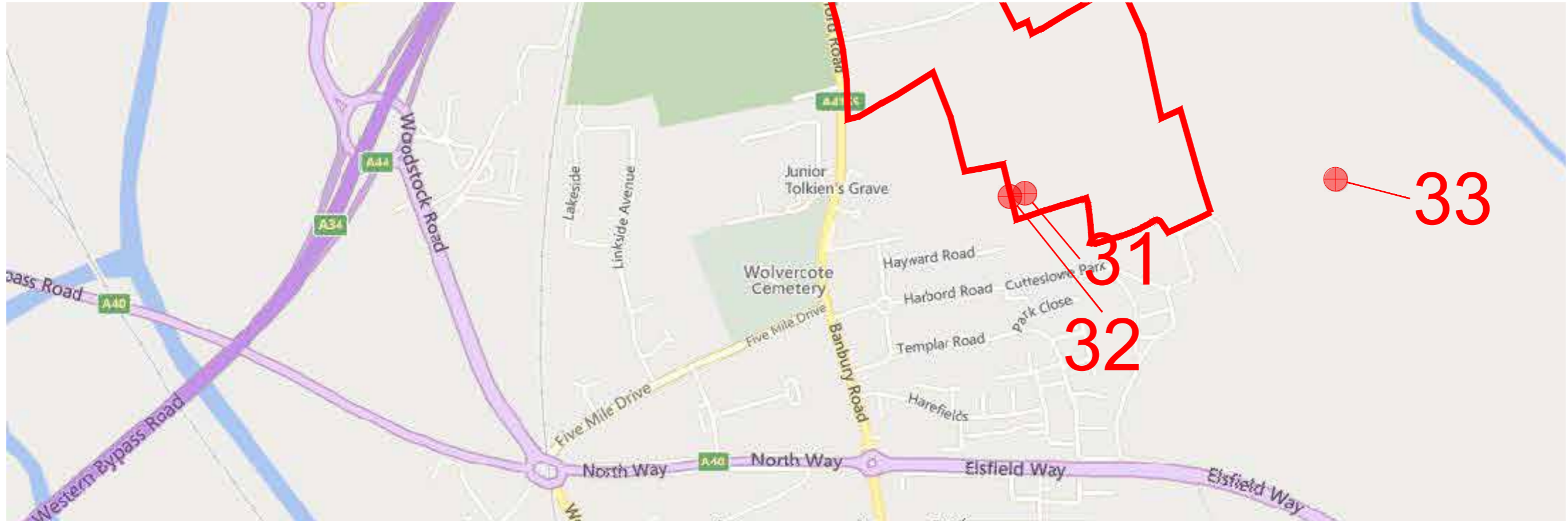


Figure 2.13 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
31	Field adjacent to sports lighting	4.03	11.39	West	E3	Sports lighting in operation. Approximately 35m from touch line
32	Field adjacent to sports lighting	30.00	37.10	South	E4	Sports lighting in operation. Approximately 10m from touch line
33	Southern field	0.15	0.15	North	E1	Sports lighting not in operation

3.0 Site survey.



Figure 2.14 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
34	Site boundary	0.15	0.15	North	E1	Sports lighting not in operation
35	Banbury Road	7.68	5.93	West	E3	
36	Jordan Business Park	4.49	5.58	West	E3	Note, SOX lamps, no internal lighting to the offices.

3.0 Site survey.



Figure 2.15 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
37	Tennis & Hockey Club - car park	0.40	0.15	North	E1	Sports lighting not in operation
38	Cricket pitch	0.15	0.15	North	E1	Sports lighting not in operation
39	Heywood Road	2.65	4.76	West	E3	

3.0 Site survey.



Figure 2.16 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
40	Harbord Road	0.04	5.06	South	E3	
41	Local authority - works depot	0.66	3.26	East	E3	PIR controlled lighting
42	Cuttleslowe Park	0.48	1.56	East	E2	PIR controlled lighting

3.0 Site survey.



Figure 2.17 Image taken from Microsoft mapping - Showing survey points.

Survey Location	Location Name	Peak Illuminance Measurement (Lux) Horizontal at ground level	Peak Illuminance Measurement (Lux) Vertical at 1.5m	Peak Illuminance Measurement - Direction	Representative Environmental Zone	Comments
43	Sparsey Place	4.07	7.13	West	E3	
44	Harefields	1.40	2.52	East	E2	
45	Oxford Beach	0.08	0.25	South	E1	

3.0 Site survey.

Sky quality measurements were taken within the redline of the proposed development. Three readings are taken within 50m of the position shown and the results averaged out. The ideal conditions for survey are, astronomical darkness (typically 2 hours past sunset), a cloud free sky and no moonlight. Measurements were taken with a Unihedron SQM-L Sky Quality Meter with lens. Serial Number: 2.190C48.

During the survey, cloud coverage was approximately 70% , readings were taken at approximately 11.50pm. No moon was visible in the sky. These conditions were not perfect for a survey, however on average there are a limited number of hours of clear moonless skies in astronomical darkness in the UK. Therefore the readings taken are indicative only.

As per the International Dark sky Association (IDA) guidelines a number of measurements were taken and the results averaged out.

The resultant SQM figures for the location:

- SQM1 19.40 magnitudes per square arcsecond.

This figure is only an indicative reading as the manufacturers stated tolerance on this equipment is $\pm 10\%$. Therefore given the survey conditions and stated tolerance in our professional judgement the locations would be classified as E1/E2. See Table (Page 5) for a details.



Figure 3. Map showing SQM location.

4.0 Sky glow - site and wider area.

Figure 4 below, CPRE – Great Britain’s light pollution and dark skies gives a broad brush indication of the upwards light (sky glow) experienced for the year 2015 for the proposed development and further surrounding locations.

Map showing local geography of the site to be viewed in conjunction with Figure 5.

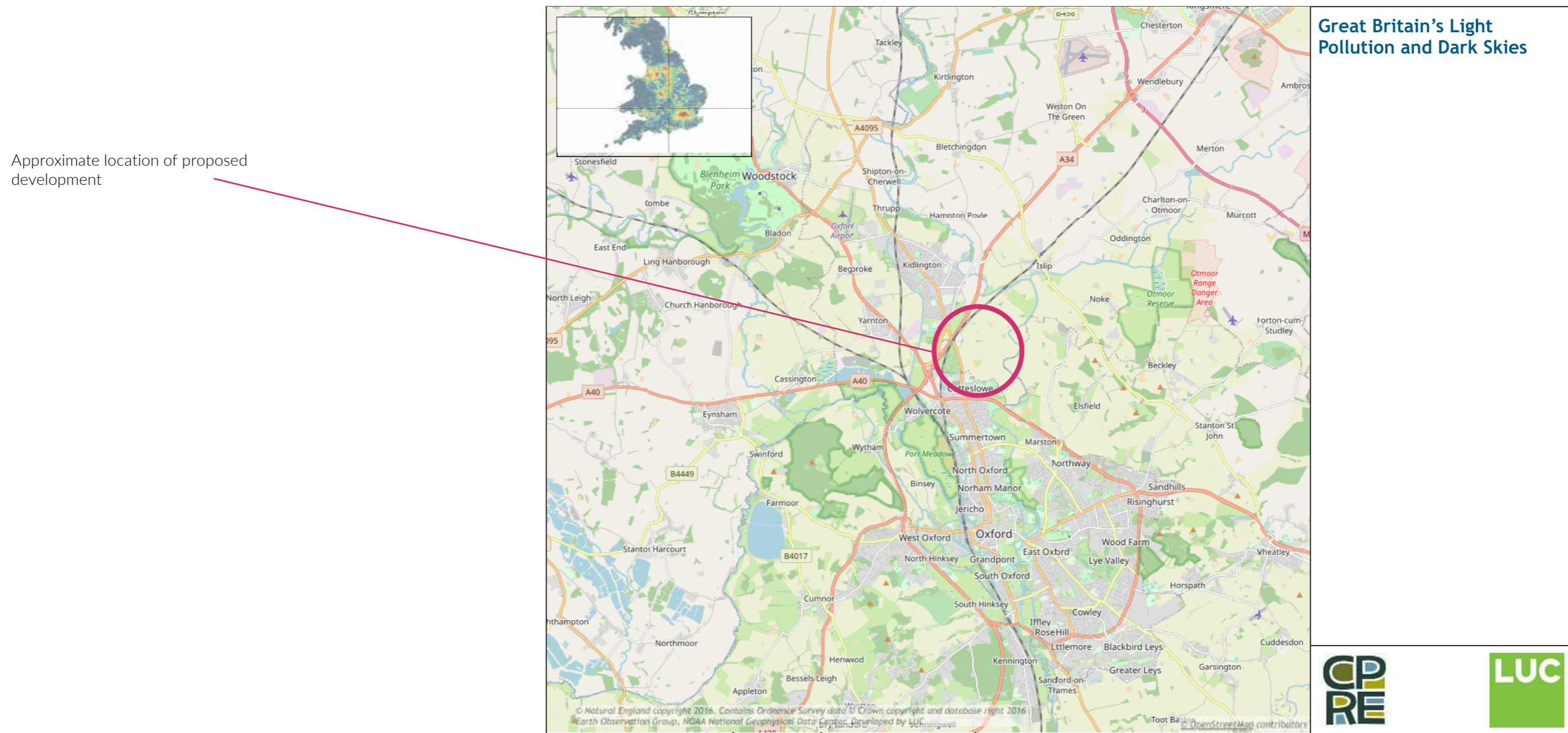


Figure 4.

4.0 Sky glow - site and wider area.

Figure 5 below, CPRE – Great Britain’s light pollution and dark skies gives a broad brush indication of the upwards light (sky glow) experienced for the year 2015 for the proposed development and further surrounding locations.

- Shades of blue show the ‘darkest’ levels of sky glow
- Shades of red ‘brightest’ levels of sky glow

Satellite measurements range from 0 (being a dark sky) to 255 (being a saturated bright sky at night – city centre). The development is situated in the third/fourth brightest band for sky glow.

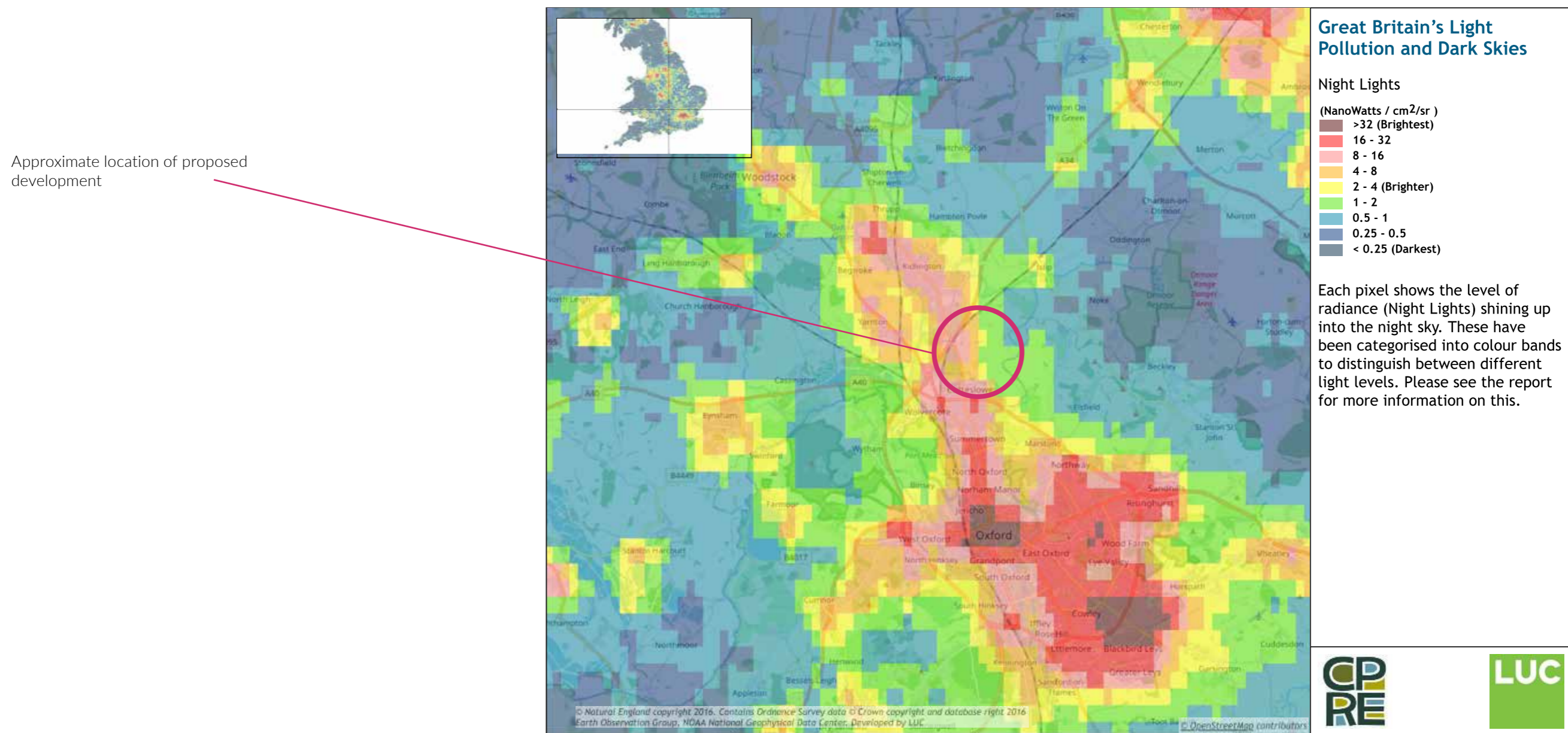


Figure 5.

5.0 Baseline site and environmental zone classification.

To assess the site we refer to the ILP guidance notes for the reduction of obtrusive light (2021) and CIE150.

In Figure 4 (adjacent map) areas would be classified as:



- **E1 Natural, Dark, (SQM 20 to 20.5+). Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.**

The areas with no colour coding would be classified as E1. Given the proximity to areas with higher levels of illumination it is likely that areas may often have a direct view of light fittings or sky glow is likely to be visible. There may however be pockets of land where sky glow is limited and the horizon is clear of light sources.



- **E2 Rural, Low district brightness (SQM ~ 15 to 20). Sparsely inhabited rural areas, village or relatively dark outer suburban locations.**

Areas around the application site are lit to a level which fits the above categorization. Only the west would be regarded as mostly unlit. The type of light fittings, spacings between luminaires coupled with the type of road and traffic density would in our professional judgement lead to this conclusion. There are small pockets of landscaped green space where horizontal light levels would be in line with an E1 category, however vertical levels of illumination, sky glow and the presence of light on all horizons would place those areas in a higher classification.



- **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**

Two areas immediately adjacent to the application site, involve high levels of night time activity. The Park & Ride in the north and the sports facility in the south. The Park & Ride was still illuminated past midnight, whilst the sports facility had a 9.30/10pm switch off during the site survey.

The light levels recorded will place these in an E3/E4 category. The type of luminaires, visibility from adjacent areas, height & positioning support this conclusion.

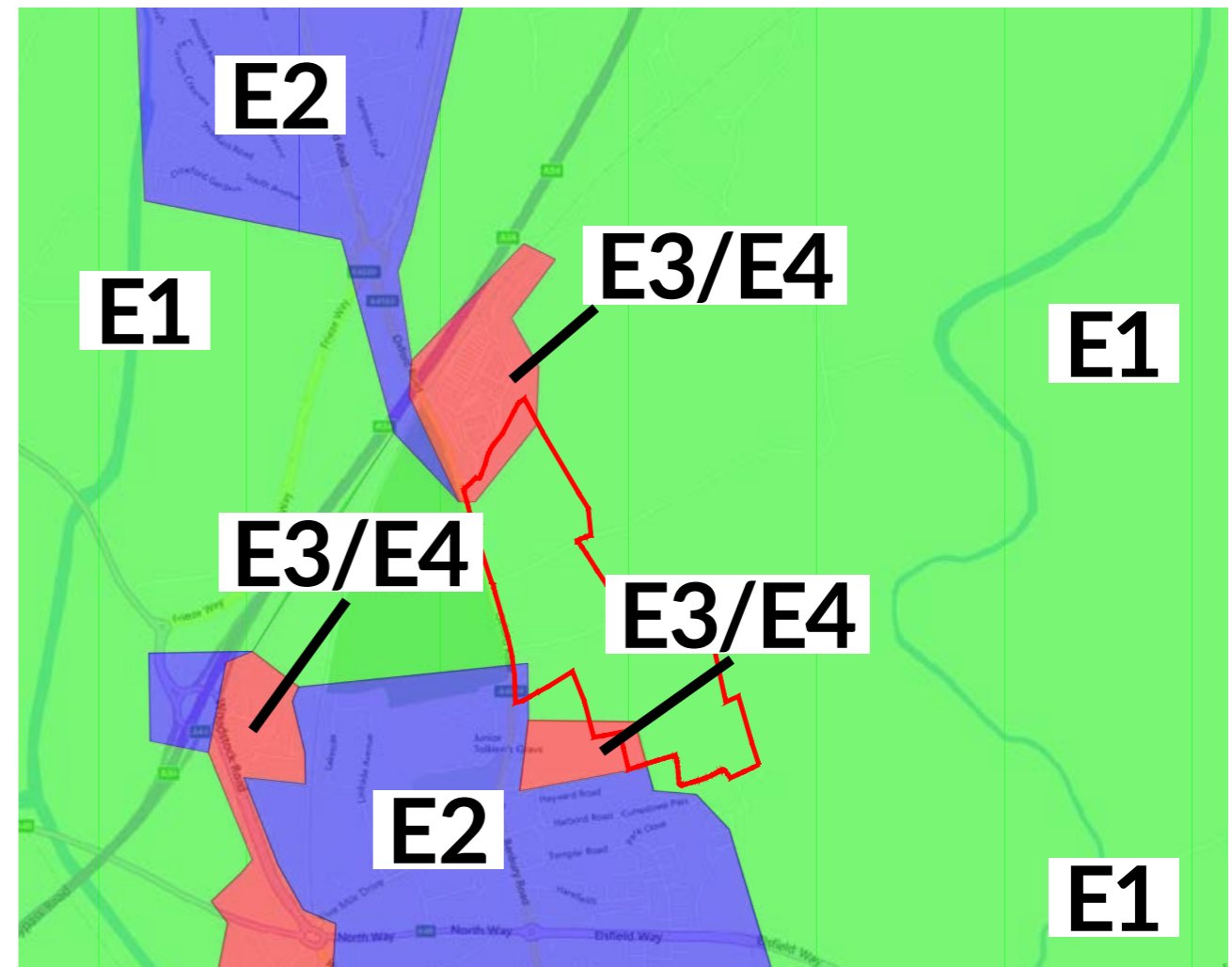


Figure 6. Map showing environmental lighting zones - Approximate red line of site shown.

6.0 Glossary of terms.

- AONB, Areas of Outstanding Natural Beauty.
- Candela, (cd) is the base unit of luminous intensity in the International System of Units (SI); that is, luminous power per unit solid angle emitted by a point light source in a particular direction.
- CIE, Commission Internationale de l'Eclairage (International Commission on Illumination).
- Direct Sky glow: the direct upward spill of light into the sky, which can cause a glowing effect and is often seen above cities when viewed from a dark area.
- Glare: (viewed source intensity) the uncomfortable brightness of the light source against a dark background which results in dazzling the observer, which may cause nuisance to residents and a hazard to road users.
- IDA, International Dark-Sky Association.
- Illuminance, is calculated as the density of lumen's per unit area and is expressed using lux (lumen's/square meter). Illuminance can be measured using a light meter.
- ILP, Institution of Lighting Professionals.
- Light trespass/intrusion (vertical and horizontal): the spilling of light beyond the boundary of a property, which may cause nuisance to others.
- Lumen's, a measure of the quantity of light, referred to as luminous flux or just flux, emitted by a light source. For example, a 60-watt incandescent bulb provides about 840 lumen's.
- Luminance is a photometric measure of the luminous intensity per unit area of light travelling in a given direction. It describes the amount of light that passes through, is emitted or reflected from a particular area, In basic terms it would often be referred to as the "brightness" of an object typically when viewed against a dark background. This can be measured using a light meter but is more often calculated.
- Lux, is the SI derived unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is equal to one lumen per square metre.
- Maintenance factor, usually a percentage is allowed for in lighting calculations to allow for the effects of time on fittings and their surroundings. Light sources, drop in output, fittings and surroundings become dirtier, several factors combine to reduce the amount of light available. A typical maintenance factor would be 70% this would ensure an installation was still meeting required light levels in for example 3 years. For this report a factor of 100% (unity) has been used, that is a day one, worst case scenario.
- Receptors, ecological, human, heritage, natural. These define positions around a site which may be impacted. Different receptors have various degrees of tolerance to increased light levels. For example an additional 10 lux in an already highly lit area (E4) could be described as negligible, whereas 0.5 lux to an ecological receptor in an intrinsically dark area (E1) could be described as major/adverse.
- Spill light: the unwanted spillage of light onto adjacent areas and may affect sensitive receptors, particularly residential properties and ecological sites.
- ULR, Upward Light Ratio. Expressed as a percentage of upward light compared to downward light.
- UNESCO, United Nations Educational, Scientific and Cultural Organization.



SEAN KIELTHY

SENIOR DESIGNER/ENVIRONMENTAL LIGHTING

01454 806807

SEANKIELTHY@HOARELEA.COM

HOARELEA.COM

155 Aztec West
Almondsbury
Bristol
BS32 4UB

