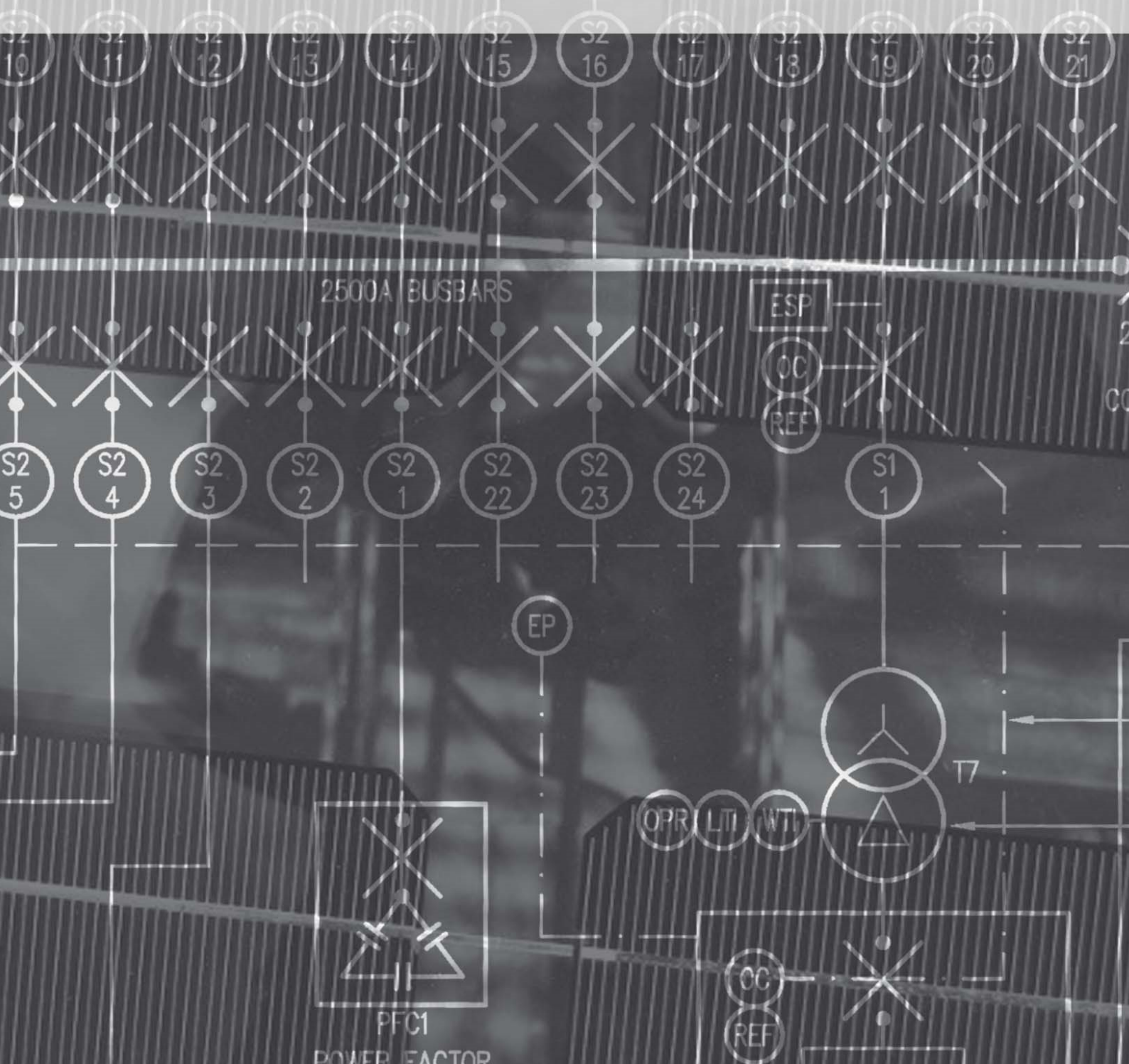


# Begbroke Science Park Light Pollution Statement

1<sup>st</sup> April 2015

DOC-16-02308-LG-001 P2



## INTRODUCTION

1. In recent years good practice guidance has identified that the growing recognition that excessive, poorly designed and badly aimed lighting may have adverse effects on the external environment at night. Excessive lighting can lead to light encroachment and trespass, sky glow and glare while excessive quantities of lighting apparatus can spoil daytime views.

## LEGAL FRAMEWORK AND EXISTING GUIDANCE

2. Until recently there were no legal regulations governing 'light pollution' issues. This has changed with 'The Clean Neighbourhoods and Environment Act 2006' becoming law after receiving Royal Assent.
3. The Clean Neighbourhoods and Environment Act contains a range of measures to improve the quality of the local environment by giving Local Authorities and the Environment Agency additional powers to deal with a range of issues which, significantly, includes light pollution. The particular light pollution issue it highlights is that related to light spillage from buildings within the Act, and the notes from DEFRA which accompany the Act, clarify this in the following terms :

*'Measure proposed –*

*It is proposed to extend the list of statutory nuisances to include artificial light and nuisance caused by insects. Artificial light that was prejudicial to health or a nuisance would become a statutory nuisance. The measure on artificial light would apply to light emitted from residential, commercial and industrial premises, but with exemptions for premises used for activities for which artificial light is essential or required by legislation for operational, security or health and safety reasons, and street lighting. This measure would extend existing duties of local authorities under EPA 1990'*

*Further -*

*'Including these as statutory nuisances allow local authorities to serve nuisance abatement notices on those responsible for contraventions in respect of nuisance lighting and nuisance from insects. It would also allow for individuals to institute proceedings through a magistrates' court.*

The Act finally highlights the benefits of controlling light pollution -

*'a) Artificial Light:*

*Benefits*

- *Reduction of light nuisance*
- *Promotion of good practice and improved relationships between neighbours in some cases.'*

4. The key statements within the DEFRA guidance, which accompany the Act and were published in 2007, are as follows –

*“85. Local authorities have a duty to take reasonable steps, where practicable, to investigate any complaints of artificial light nuisance; it is expected that the following sources will generate most complaints:*

- *Domestic security lights*
- *Commercial security lights*
- *Healthy living and sports facilities (see below)*
- *Domestic decorative lighting*
- *Exterior lighting of buildings and decorative lighting of landscapes*
- *Laser shows / sky beams / light art”*

5. However the guidance goes on to say –

*“88. Efficient and high-quality lighting installations that help people to see where they are going and bring security to both themselves and their property can be designed so as to produce minimal impact on the environment. The management and maintenance of such lighting that limits both glare and dark shadows is also essential for people with a visual impairment.”*

*And*

*“90. Artificial light nuisance may be, but is not necessarily, the same as light pollution. Artificial light nuisance is a source of light that in the opinion of a trained public health professional, who makes an assessment on a case by case basis, interferes with someone’s use of their property, and / or is or might be prejudicial to someone’s health.”*

6. The development of this site therefore offers an opportunity for the team to lead the way in creating a sensitive solution that takes into account all the many issues that come under this heading.

#### **Obtrusive Light Guidance**

7. Even though there are no universal laws which exist regarding light pollution issues, although certain councils do include lighting clauses within their own local planning requirements, there is guidance and good practise reports available which set out a general approach, in design terms, for acceptable levels of light, for a range of geographical sites, as they relate to the wider landscape in which they are situated.
8. The recognised publication produced by Institute of Lighting Professionals - ‘Guidance notes for the reduction of Light Pollution GN01’ (2011) which forms the basis for the lighting design for the site and sets out design parameters for minimising light pollution.

**Institute of Lighting Professionals, Guidance Notes for the Reduction of Light Pollution (2011)**

9. This guidance note gives examples of good and bad practice in lighting installations, includes simple diagrammatic examples of such installations, and explains the concept of environmental zoning including the amount of upward light acceptable within these zones whether they be towns/cities or rural villages.
10. The following table identifies the limiting obtrusive light threshold values with respect to the Environmental Zone classification.

Environmental Zone	Sky glow ULR (Max %) (1)	Light into Windows EV (2)		Source Intensity I (cd) (3)		Building Luminance (4) L (cd/m <sup>2</sup> ) Av. Before curfew
		Before Curfew	After Curfew	Before Curfew	After Curfew	
E0	0	0	0	0	0	0
E1	0	2	0	2500	0	0
E2	2.5	5	(1*)	7500	500	5
E3	5	10	2	10000	1000	10
E4	15	25	5	25000	2500	25

Where:

E0 – Protected Surroundings, Dark Light Environment - e.g. UNESCO Starlight Reserves, IDA Dark Sky Parks

E1 – Natural Surroundings, Intrinsically Dark Lighting Environment – e.g. National parks, Areas of Outstanding Natural beauty etc.

E2 – Rural Surroundings, Low District Brightness Light Environment - e.g. Village or relatively dark outer suburban locations

E3 – Suburban Surroundings, Medium District Brightness Light Environment - e.g. Small town centres or suburban locations

E4 – Urban Surroundings, High District Brightness Light Environment - e.g. Town/city centres with high levels of night-time activity

ULR = Upward Light Ratio of the Installation is the maximum permitted percentage of luminaire flux that goes directly into the sky.

Ev = Vertical Illuminance in Lux - measured flat on the glazing at the centre of the window.

I = Light Intensity in Candelas (cd)

L = Luminance in Candelas per Square Metre (cd/m<sup>2</sup>)

Curfew = the time after which stricter requirements (for the control of obtrusive light) will apply; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

\* = Permitted only from Public road lighting installations

- (1) Upward Light Ratio – Some lighting schemes will require the deliberate and careful use of upward light, e.g. ground recessed luminaires, ground mounted floodlights, festive lighting, 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) Light Intrusion (into Windows) – These values are suggested maxima and need to take account of existing light intrusion at the point of measurement. In the case of road lighting on public highways where building facades are adjacent to the lit highway, these levels may not be obtainable. In such cases where a specific complaint has been received, the Highway Authority should endeavour to reduce the light intrusion into the window down to the post curfew value by fitting a shield, replacing the luminaire, or by varying the lighting level.
- (3) Luminaire Intensity – This applies to each luminaire in the potentially obtrusive direction, outside of the area being lit. The figures given are for general guidance only and for some sports lighting applications with limited mounting heights, may be difficult to achieve.
- (4) Building Luminance – This should be limited to avoid over lighting, and related to the general district brightness. In this reference building luminance is applicable to buildings directly illuminated as a night-time feature as against the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

### **Light Pollution – Common Causes and Impacts**

11. In general, the key impacts of poorly designed lighting which can, together, combine to cause light pollution are as follows:
  - Glare: Poorly designed or poorly installed lighting can cause a great deal of glare that can severely hamper the vision of pedestrians, cyclists, and drivers, creating a hazard rather than increasing safety. Glare occurs when the site user sees light directly from the fixture (or lamp) and contrast ratios are high.
  - Light Trespass/Encroachment: Poor outdoor lighting shines onto neighbourhood properties and into bedroom windows, reducing privacy and hindering sleep, while the spill light onto properties can create an unattractive look to the area if the light patterns are accidental rather than planned.
  - Energy Waste: Much outdoor lighting wastes energy because it is not well-designed with light not directed where it is required. This waste results in high operating costs and increased environmental pollution from the extra power generation needs.
  - Sky Glow: A large fraction of poor lighting shines directly upwards, creating the adverse sky glow above towns and cities that washes out views of the dark night sky, taking away an important natural resource. In addition to the cost savings, less sky glow will allow future generations to enjoy the beauty of the stars.
12. Light pollution is known to create an adverse effect on visual impression, well-being and can also have a detrimental and disrupting impact on existing natural surroundings and ecological systems.
13. Lighting equipment, and its function, is an important consideration when designing any lighting scheme. On any site, a well-designed lighting scheme can ensure the minimum adverse impact to the night environment.
14. To minimise the potential for the causes and resultant effects from light pollution future lighting design should adhere to the following obtrusive light technical guidance and standards where appropriate:
  - Institute of Lighting Professionals – Guidance Notes for the Reduction of Obtrusive Light GN01: 2011;
  - CIE 150:2003 – ‘Guide on the limitation of the effects of obtrusive light from outdoor lighting installations’;
  - CIBSE SLL – Guide to Limiting Obtrusive Light 2012;
  - CIE 126 (1997) Guidelines for Minimising Sky Glow.

### **Lighting and Natural Surroundings**

15. In the absence of specific obtrusive light guidance specific to natural surroundings reference is given to guidance relating to natural nocturnal systems (Bat Conservation Trust).
16. The Bat Conservation Trust (BCT) and the Institution of Lighting Engineers (now the Institute of Lighting Professionals) have produced the 'Bats and Lighting in the UK'. This document is aimed at lighting engineers, lighting designers, planning officers, developers,



bat workers and anyone specifying lighting and is intended to raise awareness of the impacts of lighting on bats and mitigation is suggested for various scenarios.

17. In addition, recent BCT Interim guidance 2014 states that where lighting equipment utilises LED, a colour correlated temperature (CCT) of lower than 4200K should be used. This spectral composition has reduced blue light and UV light content (known to be detrimental to invertebrate nocturnal activities) and is more in line with traditional recognised acceptable lamp sources (low pressure and high pressure sodium).
18. 'Bats and Lighting in the UK' states a limiting threshold of 3 Lux. However this is subject to species and currently there is a lack of evidence regarding the light levels below which there are no/reduced impacts on bats. Responses of bats to light levels are likely to vary between species and between behaviours. A "light threshold" below which there is little impact on bats may not exist for some species which may be light averse regardless of intensity.
19. Light levels at the site should be considered in the context of the light levels (lux data) recorded during pre-development lighting and bat surveys. Where possible post-development light levels should be as close to the mean naturally occurring light levels recorded at key areas of bat use on the site pre-development. Where this is not possible, a precautionary approach should be taken to keep light levels as low as possible, until further research is completed.

## THE APPLICATION SITE, EXISTING DEVELOPMENT AND SURROUNDING AREAS

20. The Application Site is outlined within **Figure 1**.

### Sensitive Receptors

21. The closest residential property is approximately 380m from the Application Site northern boundary.
22. As a precautionary measure the perimeter planter boundary is considered as being a representative sample area for light impact assessment relating to natural surroundings. (**Figure 2**).

### Existing Artificial Lighting to the Existing Development and Application Site

23. The Application Site and immediate developed areas are artificially lit to achieve illuminance levels in line with approved H&S requirements.
24. The predominant sources of existing artificial lighting comprise of (**Figure 3**):
  - Column mounted lanterns to surrounding access roads;
  - Feature light columns to central landscape areas;
  - Illuminated bollards to building and landscape perimeter access routes;
  - Wall mounted bulkhead lanterns to building access areas; and
  - Internal lighting (potential light leakage from glazed elevations).
25. Based on professional judgement, it is considered that the existing and proposed built development will screen future lighting developments towards the eastern, southern and

western perimeters of the Site and as a result a cumulative increase (existing and proposed) in the lit condition is unlikely.

26. Areas to the North of the Application Site (unscreened) currently experience light trespass from the existing installations up to a distance of approximately 50m from the Site boundary. This is primarily as a result of light spill from the northern access road.
27. The on-site measured horizontal illuminance values to northern unscreened areas are as follows (**Figure 2**):

- Access roadway – 6.4 Lux;
- 50m north of Application Site boundary – 0.1 Lux;
- Northern Perimeter Planter Boundary – <0.1 Lux.

#### **Existing Artificial Lighting to Surrounding Adjacent Areas**

28. The surroundings are predominately natural and are unlit apart from road junctions along Sandy Lane.

#### **Environmental Zone and Threshold Limiting Values**

29. In view of the existing lit condition to the Site and surrounding areas it is considered (and on a precautionary basis) the Site is representative of an E2 Environmental Zone (E2 – Rural Surroundings, Low District Brightness Light Environment - e.g. Village or relatively dark outer suburban locations).
30. The ILP threshold limiting values for obtrusive light to sensitive **residential** receptors (E2 Zone) are defined as being:
  - Zone E2 Direct Sky glow: 2.5%
  - Zone E2 Vertical Light into Windows: 5 Lux (pre curfew), 1 Lux (post curfew)
  - Zone E2 Source Intensity: 7,500 cd (pre curfew), 500cd (post curfew)
31. With respect to **natural surroundings and nocturnal systems** the Bat Conservation Trust publication 'Bats and Lighting in the UK' states a limiting threshold of 3 Lux, however as previously mentioned this is subject to species.

#### **PRECAUTIONARY INTERNAL AND EXTERNAL LIGHTING APPROACH**

32. A considered lighting scheme, which is controllable and mindful of light pollution issues, means that money can be saved in the long term by minimising power use and maximising available light. It is the intention to install a quality lighting scheme that creates the required impression and illuminance requirements, whilst ensuring user well-being - as lighting should benefit people not disturb or disrupt.
33. The following outlines a 'precautionary' internal and external lighting approach, for the purposes of this obtrusive light statement.
34. The future detailed lighting designs will consider best practice standards and technology, as appropriate. The lighting specification and design for the Proposed Development of the Site will be prepared by a specialist lighting engineer with due regard to the sensitivities of surrounding receptors. The lighting specification will include the appropriate selection of heights, light fittings and luminaire design to ensure that the intensity and direction of the

lighting is controlled in order that the effects of light spill (internal and external), glare and sky glow are minimised. Consideration should be given, where applicable, to the measures in appropriate best practice guidance and standards.

35. Where applicable all functional lighting is to be designed to comply with relevant codes and guidance, as follows:

- BS5489-1: 2013 – Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas;
- BS EN 13201-2: 2003 – Road lighting – Part 2: Performance requirements;
- BS EN 12464-2:2007 – Lighting of Work Places – Part 2: Outdoor work places;
- CIBSE LG6 – 1992 – Lighting Guide - The Outdoor Environment.
- BS EN 12464-1:2011 – Light and Lighting – Lighting of Work Places – Part 1: Indoor work places;

### **Internal Lighting**

36. It is intended that internal lighting is specified with consideration given to the positions relative to glazed elevations and the necessary photometric control to contain and minimise any potential for direct light leakage. Whilst acknowledging design standards, the considered internal lighting follows a ‘precautionary’ approach and expected to consist of the following generic equipment types and design factors:

- Laboratories – The precautionary approach is based on being suspended direct / indirect suitably IP rated fluorescent / LED luminaires to achieve 500 Lux at task plane with localised specialist task lighting;
- Office / Meeting – The precautionary approach is based on being suspended direct / indirect fluorescent / LED luminaires to achieve 500 Lux at task plane;
- Circulation – The precautionary approach is based on being ceiling recessed LED downlights to achieve 100 Lux at floor plane;
- Reception – The precautionary approach is based on being suspended direct / indirect fluorescent / LED luminaires to achieve 300 to 500 Lux at task plane with supporting LED accent and feature lighting;

### **External Lighting**

In view of limiting direct light spill and the surrounding area visibility of lighting product, whilst acknowledging design standards and subject to H&S assessment, the considered external lighting follows a ‘precautionary’ approach and expected to consist of the following generic equipment types and design factors:

- Functional Landscape – It is intended that all functional lighting is kept at a minimum height and is screened to minimise lamp visibility and any potential obtrusive light spill. The precautionary approach is based on being consistent in performance and appearance with the existing lighting specification and comprises post top / feature 5m column mounted LED lantern (CCT <4200K) and illuminated bollards to achieve 10 Lux 0.25% uniformity minimum to access routes;



- Building Access – It is proposed that building access areas are lit locally with controlled downwards directed wall mounted fixtures, at minimum heights, to provide safe and identifiable passage whilst minimising the light product presence and lit appearance. The precautionary approach is based on being wall mounted LED bulkhead with upwards obtrusive light shielding to achieve 20 to 50 Lux at floor plane;

### **Mitigation Measures**

37. In order to minimise potential obtrusive light from the future lighting proposals the following mitigation measures are to be considered within the detailed lighting design and strategies for the Site:

#### **Internal Lighting**

- Internal lighting design levels carefully considered to meet relevant industry standards and to ensure over lighting is eliminated;
- Luminaires positioned outside of a 750mm zone from the internal building envelope;
- Where local to glazed openings, luminaires are to be specified with consideration given to photometric distribution and orientation to contain light relative to the task area;
- Automated occupancy based switching.

#### **External Lighting**

- Ensuring the use of controlled light distribution, optimised optics (flat glass - controlled light distribution below the horizontal) and careful luminaire positioning, orientation and minimal heights are employed in the scheme design to minimise obtrusive light trespass and night time visibility;
- Where possible utilise LED technology to minimise light trespass and to maximise energy savings;
- Appropriate luminaire shielding to minimise light trespass and night time visibility;
- Adopting a light quality that minimises disruption to existing ecological systems / natural surroundings (<4200K CCT).
- Adopting an appropriate control strategy for the operational lighting so that, when not required and subject to Health and Safety assessment, non-essential lighting is dimmed/switched off in order to further reduce the impact;
- The retention of and proposed natural screening to limit luminaire visibility and obtrusive light trespass to surrounding areas.

## **COMPLIANCE**

### **Surrounding Residential**

38. Based on professional judgement of the existing light condition, the development lighting proposals and mitigation measures it is considered that due to the distance from the Application Site the internal and external proposed development lighting proposals will not create light pollution in excess of guidance Environmental Zone (E2) thresholds.

**Northern Perimeter Planter Boundary (sample natural surroundings receptor)**

39. As an indicator of obtrusive light trespass relative to natural surroundings, baseline measurements at the northern perimeter planter boundary were recorded as being < 0.1 Lux.
40. Based on professional judgement of the existing light condition, the development lighting proposals and mitigation measures it is considered that any obtrusive light condition can be minimised to the prevent potential detrimental increase in impact to the surrounding natural environment.

**Obtrusive Light Overview**

41. As an obtrusive light overview it is considered, that there are sufficient technical standards to ensure that the external lighting proposals will not create light pollution in excess of the identified thresholds and is unlikely to cause a detrimental impact to sensitive receptors and the surrounding natural environment. Therefore, other than the measures identified and being subject to an approved final design, it is considered there is no further requirement for planning control to mitigate the effects of proposed external lighting.

Figure 1 – Application Site (NTS)

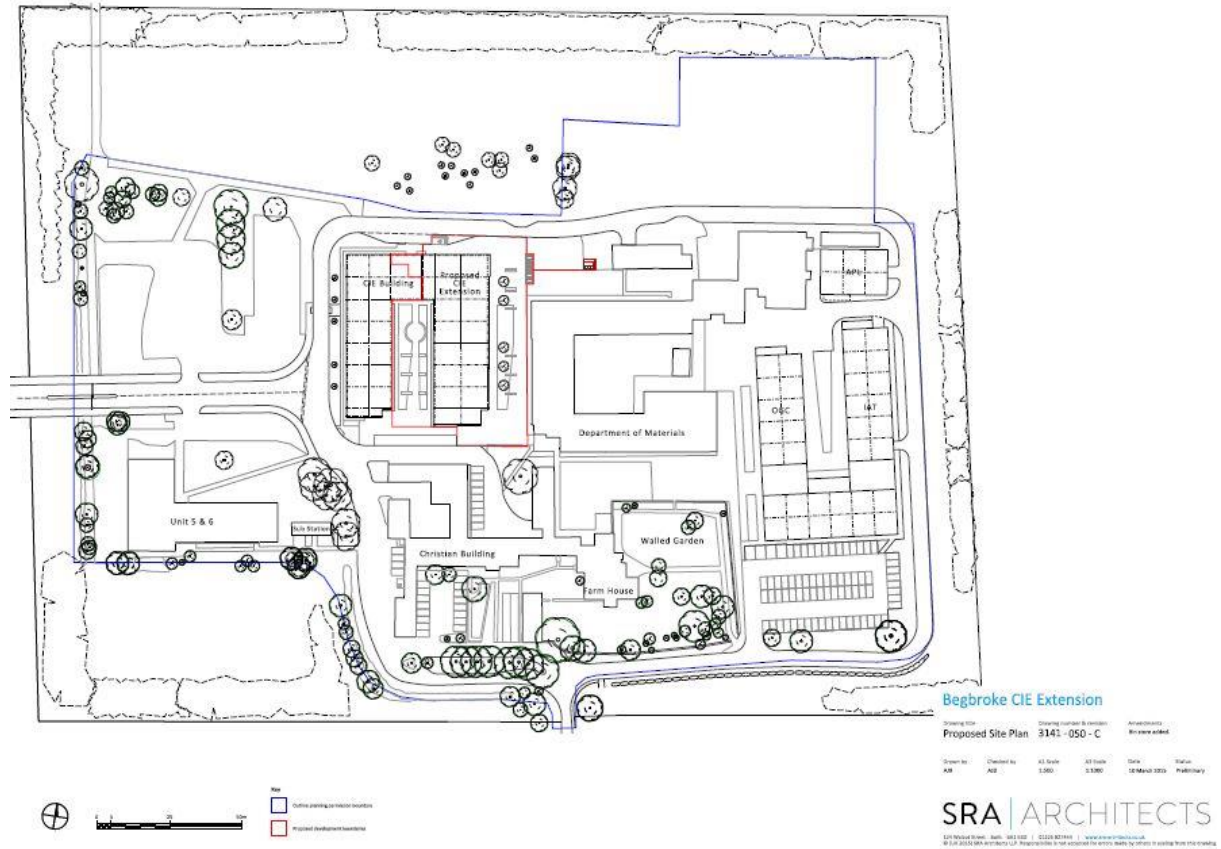


Figure 2 – The Application Site, Baseline Condition and Sensitivities (NTS)

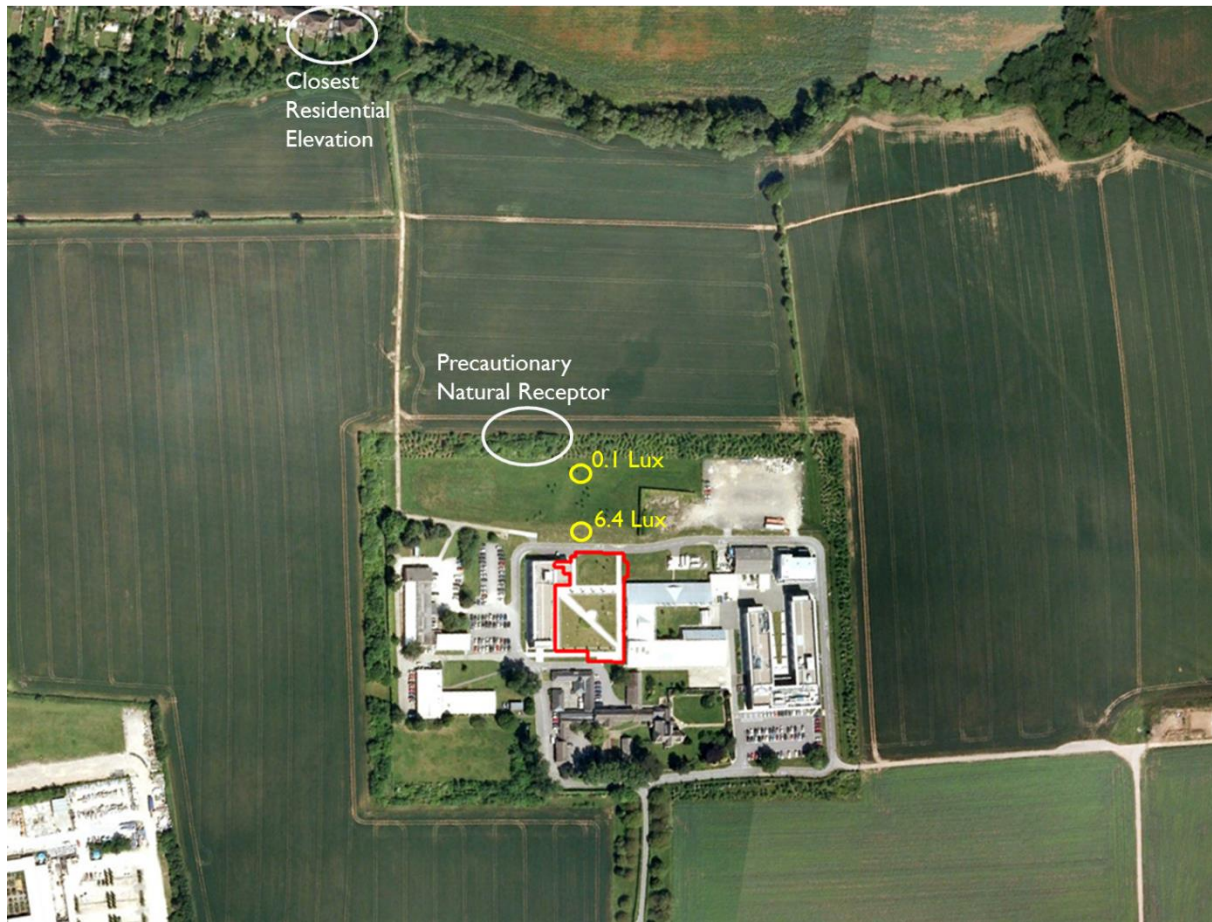




Figure 3 – Existing Artificial Lighting to the Application Site and Surrounding Adjacent Areas

