

## APPENDIX 11.1: LIGHT POLLUTION, IMPACTS AND MITIGATION

### GENERAL

A11.1.1 Light pollution is a generic term for all the adverse impacts that artificial lighting can have after dark. It takes a number of forms and this Appendix describes the different forms that light pollution can take and explains how they can be mitigated as much as possible.

A11.1.2 Light pollution impacts can be placed under five headings as shown in Table A11.1 below.

**Table A11.1: Light pollution impacts**

Category	Type of Impact
Nuisance	(1) excessive illumination falling on bedroom windows (2) glare causing visual disability or discomfort
Loss of amenity	(3) light spill onto property/gardens, changing their character after dark
Visual	(4) light presence – light sources and other lit elements appearing in dark views (5) local sky glow appearing over new lit development (6) general brightening of night sky, reducing visibility of stars and affecting astronomical observation
Hazard	(7) glare causing visual disability (8) light sources affecting visibility and interpretation of signals, runway lights, etc.
Disturbance (ecology)	(9) light spill onto dark habitat, reducing its ecological value (esp. in relation to bats) (10) UV light emission, affecting airborne invertebrates

A11.1.3 In Appendix 11.3 a Lighting Strategy has been set out for the Proposed Development. The Strategy is designed to ensure that the best lighting design principles are employed on the Proposed Development and this is taken into account in the explanations that follow.

## **NUISANCE**

### **(1) Excessive illumination falling on bedroom windows**

A11.1.4 The ILP Guidance Notes recommends limits to the illuminance (lighting level, measured in lux) reaching bedroom windows. This is to prevent sleep patterns for occupants being adversely affected. The limits vary according to the environmental zone of the existing location and have been set to encourage appropriate lighting design.

A11.1.5 In practice these limits can be comfortably met in virtually every circumstance and the Lighting Strategy will ensure this is the case for the Proposed Development.

### **(2) Glare causing visual disability or discomfort**

A11.1.6 The ILP Guidance Notes recommends limits to the intensity of any light source that can be seen by an observer outside the lit development. This is to prevent a source of light dazzling an observer to the extent that it significantly affects their ability to see properly or it causes discomfort. As before, the limits vary according to the environmental zone of the existing location and have been set to encourage appropriate lighting design.

A11.1.7 Again, these limits can be comfortably met in virtually every circumstance and the Lighting Strategy will ensure this is the case for the Proposed Development.

## **LOSS OF AMENITY**

### **(3) Light spill onto property/gardens, changing their character after dark**

A11.1.8 Light spill into the curtilage of a residential property can affect its character after dark, as can light spill onto the property itself. This can be considered as a loss of amenity for the resident, as their immediate night time environment has been altered and there is no easy way for them to remedy it.

A11.1.9 Where such light spill acts as a crime deterrent, or reduces the fear of crime, or provides better accessibility for someone with visual impairment, this can be seen as a benefit. However, the presumption is usually that it is unwanted.

A11.1.10 Through careful design, it can readily be ensured that this impact is prevented and that the illumination falling within any residential property

curtilage will, to all intents and purposes, be zero. This is incorporated into the Lighting Strategy.

## **VISUAL**

### **(4) Light presence – light sources and other lit elements appearing in dark views**

A11.1.11 This impact refers to what an observer would see of the development in a night time view. It is the night time equivalent of the daytime visual impact. Night time elements that are potentially visible are light sources and any surface that is being illuminated, whether it be the target surface (such as a service yard) or a surface that is receiving light incidentally (such as a building facade).

A11.1.12 This type of impact is not measurable and therefore there is no guidance on any limiting values. The magnitude of the impact is a matter of judgement, taking into account the existing night time view. The magnitude is lessened for those views where an observer is subject to direct illumination from, say, a nearby street light, or where light spill from a nearby light source illuminates the foreground. This is because the observer's vision can no longer be fully dark adapted, resulting in lowered visual sensitivity to the new light presence in the field of view.

A11.1.13 Mitigation is achieved by placing light sources out of sight of sensitive receptors where possible; minimising illumination falling onto vertical surfaces (such as building facades); and taking advantage of screening provided by mounding, planting, and the development buildings themselves. This is in line with the Lighting Strategy.

### **(5) Local sky glow appearing over new lit development**

A11.1.14 This impact refers to what an observer would notice in the sky above the development in a night time view. The effect is most pronounced on misty or hazy nights, where light is scattered by particles of water or dust suspended in the atmosphere, or when there is a reasonably low cloud base to act as a reflector for any upward light.

A11.1.15 Mitigation is achieved by complying with the recommended limits in the ILP Guidance Notes for upward light emission. The limits vary according to the environmental zone of the existing location and have been set to encourage appropriate lighting design. The Lighting Strategy will ensure that these limits are met for the Proposed Development.

A11.1.16 However, while this controls the performance of the lighting units themselves by setting limits to how much light they emit above the horizontal plane, it cannot control how much is reflected back up from illuminated surfaces, nor how much emitted light is scattered into the atmosphere on its way down to the target surface. These two factors are what give rise to potential local sky glow over new lit development. To mitigate it as much as possible, lighting must be accurately targeted and kept to a minimum, and this design principle is also incorporated into the Lighting Strategy.

A11.1.17 The magnitude of the impact is a matter of judgement, taking into account the existing night time view. Again, the magnitude is lessened for those views where an observer is subject to direct illumination from, say, a nearby street light, or where light spill from a nearby light source illuminates the foreground, because the observer's vision is not fully dark adapted.

#### **(6) General brightening of the night sky, reducing visibility of stars and affecting astronomical observation**

A11.1.18 Clear views of the night sky are adversely affected by stray light that rises through the atmosphere and is scattered back towards the observer. It can affect observations with the naked eye, binoculars and telescopes, by reducing contrast and obscuring fainter stars. Even on the clearest nights some scattering can occur.

A11.1.19 Stray light from major conurbations can have a significant effect over distances of tens of kilometres and therefore it is the remoter locations that will afford the best observations of the night sky. However, it is not likely that any one development will make a noticeable difference to the clarity of night sky views from such locations. This is especially true given the prevalence of existing lit development in the region.

A11.1.20 Nevertheless, the ILP Guidance Notes gives recommendations for limiting upward light emission from new lighting installations and compliance with these will prevent new development from contributing to this widespread problem. This has been incorporated into the Lighting Strategy.

### **HAZARD**

#### **(7) Glare causing visual disability**

A11.1.21 For roads, railways and navigable waterways, very bright sources of light can cause glare, disabling adequate vision and creating a safety hazard. Such glare is easily avoidable by designing in compliance with the ILP

Guidance Notes and, where necessary, complying with additional requirements stipulated by highway, rail and navigation authorities, as described in the Lighting Strategy.

**(8) Light sources affecting visibility and interpretation of signals, runway lights, etc.**

A11.1.22 The colours or patterns of lights can cause confusion to train drivers and aircraft pilots at night. With careful design, in consultation with the responsible authorities, this can be completely avoided. This is incorporated into the Lighting Strategy.

**DISTURBANCE**

**(9) Light spill onto dark habitat, reducing its ecological value (esp. in relation to bats)**

A11.1.23 Similar to light pollution type (3), light spill onto dark habitat changes its character to the extent that it may affect light sensitive nocturnal fauna. This is especially true of bats and airborne insects.

A11.1.24 This impact is mitigated by careful design, in collaboration with ecologists, as described in the Lighting Strategy, to ensure any light spill levels are sufficiently curtailed and, if possible, completely eliminated.

**(10) UV light emission, affecting airborne invertebrates**

A11.1.25 Some light sources in widespread use emit significant amounts of UV light. Airborne invertebrates are particularly attracted by UV emissions and it can upset local insect populations and alter bat feeding patterns. With the availability of LED light sources, it is now feasible to avoid using UV-emitting sources close to ecologically sensitive areas, thus preventing any adverse effects. This is incorporated into the Lighting Strategy.