

H2 Lighting assessment

Homes and Communities Agency
Northstowe Phase 2
Appendix J2 – Lighting Assessment

Report Ref

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Glossary of terms

EA	Environment Agency
ILP	Institute of Lighting Professionals
CENA	Clean Neighbourhoods and Environment Act
CIE	Commission Internationale de l'Eclairage
BS	British Standard
CIRIA	Construction Industry Research and Information Association
GLVIA	Guidelines for Landscape and Visual Impact Assessment
DEFRA	Department for Environment Food & Rural Affairs
HSE	Health and Safety Executive
EIA	Environmental Impact Assessment
HDR	High Dynamic Range
LVIA	Landscape and Visual Impact Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organisation
IDA	International Dark-Sky Association
ES	Environmental Statement
VP	Viewpoint

1 Introduction

1. This assessment considers the effects of artificial lighting resultant from the proposed Northstowe Phase 2 development and the Southern Access Road (West).
2. Previously an artificial lighting impact assessment was carried out to support the 2007 planning application for the entire Northstowe development. In 2012 an additional assessment was carried out for the Northstowe Phase 1 Development. This lighting impact assessment also considers the cumulative effects of the development.
3. A light obtrusion assessment of the site in the vicinity for Northstowe Phase 2 Development site and the Southern Access Road (West) has been undertaken with consultations with SCDC. The assessment includes a desk study, baseline survey, construction and operational phases.
4. The proposed Southern Access Road (West) consists of a single carriageway with hard shoulder connecting the B1050 and Longstanton Road. Two roundabouts are to be constructed at the east and west end of the road. The site is intended to be illuminated utilising sodium light sources.
5. A desktop study was undertaken to identify relevant legislation, planning policy and good practice guidance in relation to identifying the standards relevant to the site and the external lit environment.

2 Review of Proposed Development

6. This assessment provides a commentary and assessment on the impact of obtrusive artificial light in relation to the proposed Northstowe Phase 2 and Southern Access Road (West) Planning Applications. A full description of the site and the proposed development is provided within Chapter 3 of the ES, Volume I.
7. The lighting assessment describes the baseline nocturnal lighting conditions and the potential light impact during site construction and operation resulting from the development in relation to current light obtrusion guidance.
8. The characteristics of light obtrusion that have been considered include light source intensity, light spill, skyglow and façade illuminance as defined by the Institute of Lighting Professionals (ILP).

3 Approach and methods

3.1 Introduction

9. No lighting assessment was originally scoped into the EIA for Northstowe Phase 2; however it was subsequently requested by SCDC which recommended the assessment scope for Phase 1 should be followed. Within that Scoping report, Chapter 10 Landscape and Visual Effects outlines the likely significant effect in relation to lighting as follows:

10. *‘Changes to sensitive view into the site, including from designated areas such as Longstanton conservation area, and including changes to night time views as a result of increased lighting.’*
11. *The night time visual assessment will be informed by a lighting study, which will include a night time survey of baseline lighting levels and consideration of new sources of light associated with the proposed development, such as roads, buildings and sports pitches.’*

3.2 Legislation and guidance

12. Environmental Protection Act: The Environmental Protection Act 1990 (Section 102 of the Clean Neighbourhoods and Environment Act (CENA): 2005, gives local authorities the power to consider obtrusive artificial light as a Statutory Nuisance. The Act makes ‘exterior light emitted from premises so as to be prejudicial to health or a nuisance’ a criminal offence.
13. ILP Guidance Notes for the Reduction Obtrusive Light 2011: The ILP has proposed lighting guidance and criteria for lighting impact assessments with a recommendation that they are incorporated at the local plan level. The guidance defines various forms of light pollution and describes a series of environmental zones (Table 1) against which limits for obtrusive light are defined. These guidance notes therefore provide suitable criteria against which the effects of artificial lighting have been assessed in this chapter.
14. Landscape Institute: Guidelines for Landscape and Visual Impact Assessment: The Guidelines for Landscape and Visual Impact Assessment (GLVIA) is an industry standard work which presents an authoritative statement of the principles of assessment. It offers advice on the process of assessing the landscape and visual effects of developments and their significance; it also includes a new expanded chapter on cumulative effects and updated guidance on presentation.
15. DEFRA Lighting in the Countryside: Towards Good Practice 2001: This guidance provides advice on good lighting types and installations for street, sports and security lighting. It describes how to avoid light obtrusion of the night sky, glare hazards to drivers and nuisance to neighbours.
16. Construction Industry Research and Information Association: Good practice guidance documents prepared by the Construction Industry Research and Information Association (CIRIA) note that lighting on construction sites is typically required for onsite security and health and safety requirements during the night-time period and is temporary and short-term in nature.
17. CIE 150: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations: This guide sets out guidelines for assessing the environmental impacts of outdoor lighting and gives recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels.
18. CIE 126: Guidelines for Minimising Sky Glow: The report gives general guidance for lighting designers and also policy makers about the ways the interference by sky glow of astronomical observations can be reduced or even avoided. The report gives guidance for the design of lighting installations and lighting equipment.

19. CIE 136: Guide to the Lighting of Urban Areas: The purpose of this publication is to supplement the recommendations for the lighting of public thoroughfares within urban areas. This guide includes the justification for the lighting of these public thoroughfares and methods of lighting specific areas such as cycle tracks, pedestrian areas and malls, residential and other non-arterial routes, alleys and lanes.
20. BS EN 12464 Part 2: Lighting of Workplaces, Outdoor Workplaces: This British Standard focuses on the recommendations for outdoor work places that are used at night and advice on limiting the effects of light obtrusion within the environment.
21. BS EN 13201 Road Lighting Part 2: Performance Requirements 2003: This standard defines lighting classes for road lighting according to photometric requirements and aiming at the visual needs of road users.
22. BS 5489 Part 1 2003 provides recommendations on the general principles, aesthetic and technical aspects of road lighting and advises on statutory provisions, operation and maintenance of lighting. The standard provides recommendations for the design of lighting for all types of highways and public thoroughfares, including those specifically for pedestrians and cyclists, and for pedestrian subways and bridges. It also provides recommendations for the design of lighting in urban centres and public amenity areas.

3.3 Study Area

23. The extent of the study area includes the main Phase 2 development area and the Southern Access Road (West) site, their immediate surroundings and key sensitive residential properties which may be subject to a change in existing lighting conditions. The study area does not take into account medium or long distance views into the sites, as the focus of this assessment is to ensure that statutory nuisance issues from lighting associated with the proposed developments are effectively mitigated.
24. The locations of the viewpoints of the above survey are detailed in Table 1 below:

Table 1: Viewpoint locations

VP	Location	Grid Reference	Viewing Direction
VP1	Magdalene Close, Longstanton	52°16'50.03"N 0°3'9.12"E	NE
VP2	Rampton Rd, Longstanton	52°16'40.76"N 0°2'59.61"E	SE
VP3	Woodside, Longstanton	52°16'34.78"N 0°3'3.17"E	NE
VP4	Clive Hall Drive, Longstanton	52°16'28.43"N 0°3'15.53"E	NE
VP5	Wilson's Rd, Longstanton	52°16'14.83"N 0°2'57.37"E	SW
VP6	Church View, Oakington	52°15'51.29"N 0°4'18.29"E	NW
VP 7	Oakington Rd, Oakington	52°15'59.78"N 0°4'46.22"E	NW (Not Surveyed)

VP	Location	Grid Reference	Viewing Direction
VP 8	Rampton Drift, Oakington	52°16'24.05"N 0° 5'13.35"E	NW (Not Surveyed)
VP 9	Rampton Drift, Oakington	52°16'48.40"N 0° 3'42.43"E	SE
VP 10	Rampton Rd, Longstanton	52°17'0.73"N 0° 3'48.99"E	SE
VP 11	Reynolds' Drove between Longstanton and Rampton	52°17'10.21"N 0° 4'11.53"E	SW (Not Surveyed)
VP 12	Rampton Rd between Rampton and Cottenham	52°17'23.70"N 0° 6'13.66"E	SW
VP 13	Rampton Rd between Willingham and Rampton	52°17'46.15"N 0° 4'29.94"E	SW
VP 14	Hill Row on the A1123, Haddenham	52°21'48.73"N 0° 6'58.81"E	SW
VP 15	Hattons Rd on the B1050, Longstanton	52°15'42.60"N 0° 1'41.24"E	NE
VP 16	Crafts Way, Bar Hill off the A14	52°15'13.90"N 0° 1'37.53"E	NE
VP 17	Down a footpath off Cuckoo Lane, Lolworth	52°15'27.66"N 0° 0'12.41"E	NE
VP 18	Manor Lane, Boxworth	52°15'49.15"N 0° 1'24.64"W	NE
VP 19	Dry Drayton Rd, Oakington off the A14	52°15'7.68"N 0° 3'8.72"E	N
VP 20	Down a track on High Street, Aldreth	52°20'5.78"N 0° 6'57.04"E	SW

3.4 Methodology

25. The approach and methodology used to assess the baseline lighting conditions on and in the immediate vicinity of the Main Phase 2 development site and Southern Access Road (West) site (i.e. the Northstowe Phase 2 development) involved a desk study and a baseline lighting survey on-site and in the immediate vicinity.

3.4.1 Desk study

26. A desk study has been undertaken to identify relevant legislation, planning policy, good practice guidance in relation to lighting following the standard methodology outlined in 'Lighting in the Countryside: Towards Good Practice' 2001. As part of the desk based assessment, relevant legislation, development plan policy and good practice guidance documents have been reviewed to determine the key lighting policy and guidance at a national, regional and local level

3.4.2 Baseline lighting surveys

27. As part of the assessment process a visual day and quantitative nocturnal survey of existing lighting conditions was undertaken on 2 July 2014 and 3 July 2014

during the period of 22:00hrs to 03:45hrs. The ambient conditions noted at this time were: Temperature 15-22°C with overcast skies and good visibility.

28. It is anticipated that the baseline lighting level is unlikely to significantly change in the area surrounding the proposed Northstowe Phase 2 development prior to its construction.
29. A total of 17 of the 20 viewpoints used in the Landscape and Visual Impact Assessment (LVIA) were used as the basis for undertaking nocturnal lighting measurements (Table 1). The remaining three viewpoints were considered to have no significance impact in the overall assessment and therefore these were excluded from the nocturnal survey. All viewpoints surveyed were orientated towards the proposed Northstowe Phase 2 development site.
30. Measurements were recorded in accordance with the guidelines of ILP GN01.
31. Lighting measurements were taken using the following calibrated test equipment:
 - ATP DT-8809A illuminance meter
 - Minolta LS100 luminance meter
 - Canon EOS 300D SLR digital camera
32. Generally, luminance measurements were recorded in the vertical plane towards the Northstowe Phase 2 Development site; many viewpoints were too distant from the development site for illuminance measurements to be attributable to any single source of obtrusive light.
33. Digital photographs were taken towards the Phase 2 Northstowe Development site from each viewpoint to illustrate the extent of the existing nocturnal lighting conditions. In addition, the following methodology was applied to create a high dynamic range image which is then calibrated, using real-world luminance measurements, to illustrate the luminance profile of selected viewpoints:
 - Camera aperture fixed at (f-12). ISO set at 1600, for very low lighting conditions.
 - White balance to manual, no contrast adjustment, no saturation adjustment, no sharpness adjustment
 - Photographs taken at different exposure times (1/20s, 1/10s, 1/5s, 1/3s, 2/3s, 1s, 2s, 4s, 8s, 15s).
 - Images are processed by Radiance software to create a single image where each pixel is correctly exposed, i.e. a high dynamic range (HDR) image.
 - Images are calibrated using the on-site luminance measurements to create a falsecolour representation of the scene.

3.4.3 Digital Images

34. Digital photographs were taken at each viewpoint looking towards the development site. The purpose of which is to create a calibrated image with a high dynamic range to present the luminance profile of the scene. This offers a greater comprehension of the scene.
35. The objective of these luminance profile images is to provide a baseline statement which can be compared against any 3D computer simulations of the proposed

lighting at the main phase 2 development area and along Southern Access Road (West) when viewed from these locations.

36. The digital images and falsecolour images of the various viewpoints between Viewpoint 1 to Viewpoint 20 are provided in Appendix K2.

3.4.4 Key Definitions

37. In accordance with the Guidance Notes for the Reduction of Obtrusive Light, the following definitions are used to describe lighting effects in this assessment:

Light spill: the unwanted spillage of light onto adjacent areas and may affect sensitive receptors, particularly residential properties; (this includes the spill of light from a badly aimed floodlight straying beyond the task area such as light into windows or a neighbouring property).

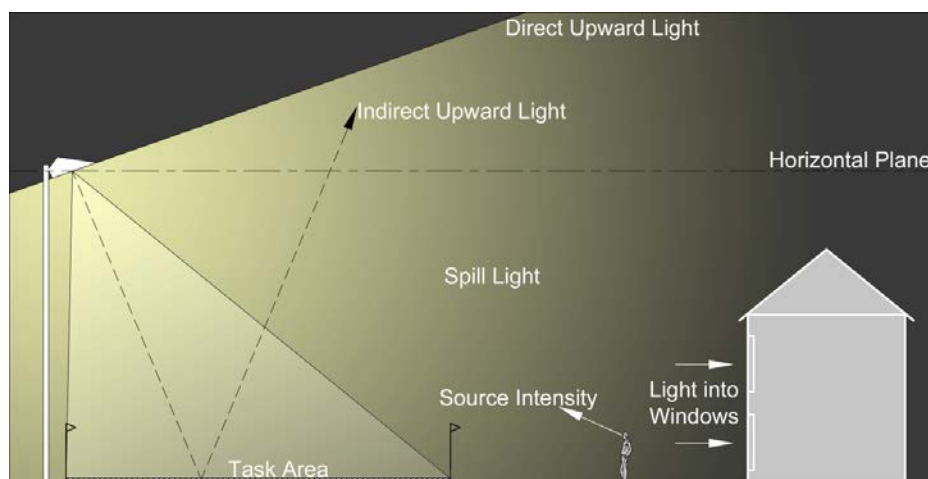
Source Intensity: how bright the source appears to an observer (uncomfortable brightness of the light source against a dark background which results in dazzling the observer, which may cause nuisance to residents and a hazard to road users; and

Façade Luminance: light trespass into windows (the spilling of light beyond the boundary of a property which may cause nuisance to others. It should be noted that the term ‘trespass’ is no longer used by practitioners and ‘light nuisance’ is now the preferred term).

Sky glow: a combination of direct upward light and indirect upward light. (the 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;

38. The above outline of the light obtrusion characteristics are illustrated below:

Figure 1: Light obtrusion characteristics



3.4.5 ILP Lighting Zones

39. The ILP Guidance Notes for the Reduction of Obtrusive Light: GN01 define environmental zones appropriate to the location of the proposed development (Table 2).

Table 2: Environmental zones appropriate to the location of proposed development

Zone	Description
E0	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Intrinsically dark areas – National parks and areas of outstanding natural beauty
E2	Low district brightness areas – Rural or small village locations
E3	Medium district brightness areas – Small town centres or urban locations
E4	High district brightness areas – Town or city centres

40. The environmental zone appropriate for the proposed Phase 2 Development is considered to be Zone E2. The obtrusive light limits defined in ILP GN01 are summarised in Table 3.

Table 3: Obtrusive light limits

Environmental Zones	Sky Glow UWLR ¹ (Max %)	Light into Windows Ev ² (lux) Pre/Post Curfew	Source Intensity I ³ (kcd) Pre/Post Curfew	Average Building Luminance L ⁴ (cd/m ²) Pre-curfew
E0	0	0	0	0
E1	0.0	2.0 / 1.0	2.5 / 0.0	0.0
E2	2.5	5.0 / 1.0	7.5 / 0.5	5.0
E3	5.0	10.0 / 2.0	10.0 / 1.0	10.0
E4	15.0	25.0 / 5.0	25.0 / 2.5	15.0

41. The curfew is defined as a time after which stricter requirements for the control of obtrusive light will apply. This is often a condition of the use of lighting applied by the local planning authority. If not otherwise stated it is suggested that the curfew would be at 22:30hours.
42. In the absence of statutory guidance, it is proposed that the ILP ‘Guidance Notes for the Reduction of Obtrusive Light’ will be used to provide suitable assessment of existing lighting conditions and a nationally understood reference upon to assess changes to the baseline conditions. The guidance levels for light trespass into windows have been used as the principal criteria for assessing the impacts associated with the proposed development. However, given the subjective nature of sky glow and glare, it is difficult to quantify the potential impacts due to a number of variables including the fact that sky glow is measured as a percentage change and glare from a light source is dependent on the type and distance from the light source. There are also no set criteria to quantify the potential effects on ecological and landscape receptors.

¹ UWLR = Upward Light Ratio: max permitted % of luminaire flux emitted directly up into the sky.

² Ev = vertical illuminance (lux): measure of light reaching neighbouring facades.

³ I = light intensity (candelas): measure of brightness of the light source.

⁴ L = luminance (candelas per sq. metre): measure of how bright a surface appears

43. Therefore, in addition to the criteria provided in the ILP Guidance Notes, the impact magnitude and significance and duration of the impacts will be evaluated using the assessment scale outlined below.

3.5 Significance criteria

44. The significance of the effect is based on the magnitude of change as a result of the proposed development and the importance of the affected receptor/receiving environment. Magnitude/scale of change is assessed on a scale of large, medium, small or negligible. Further details regarding the evaluation criteria are provided below. The importance of the affected receptor/receiving environment is assessed on a scale of high, medium, low or negligible.
45. To determine the magnitude/scale of the change in lighting levels at the sensitive residential property, the following criteria are evaluated using professional judgement:
- Type of lighting installations during construction and post construction;
 - The duration of the lighting anticipated;
 - The distance between the proposed lighting installations and the sensitive residential property;
 - Type of view (e.g. direct, intermittent or restricted);
 - Existing and proposed screening;
 - Potential change in ILP Environmental Zone; and
 - Potential for statutory nuisance.
46. The degree of the effect is assessed using the matrices outlined below. Effects that are moderate or above are considered to be significant.

		Importance of receptor			
		High	Medium	Low	Negligible
Magnitude/scale of change	Large	Very substantial	Substantial	Slight to moderate	Negligible
	Medium	Substantial to moderate	Moderate	Slight	Negligible
	Small	Moderate to slight	Slight	Slight to Negligible	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Significance	Definition
Very Substantial	Large change in illuminance levels at the windows of residential properties as a result of light spill and glare and for adverse effects, the likelihood of exceeding the ILP criteria and creation of statutory nuisance.
Substantial	Medium to large change in illuminance levels at the windows of residential properties as a result of light spill and glare. For adverse effects this is likely to be broadly within the ILP criteria and a statutory nuisance is considered unlikely to be determined.
Moderate	Medium change in illuminance levels at the windows of residential properties as a result of light spill and glare. For adverse effects the change is likely to be within the ILP criteria and a statutory nuisance is considered unlikely to be determined.
Slight	Small change in illuminance levels at the windows of residential properties as a result of light spill and glare. For adverse effects the change is likely to be within the ILP criteria and a statutory nuisance is considered unlikely to be determined.
Negligible	No change in illuminance levels at the windows of residential properties as a result of light spill and glare.

4 Baseline conditions

47. No lighting assessment was originally scoped into the EIA for Northstowe Phase 2; however it was subsequently requested by SCDC which recommended the assessment scope for Phase 1 should be followed⁵. Within that Scoping report, Chapter 10 Landscape and Visual Effects outlined the likely significant effect in relation to lighting as follows:
48. *‘Changes to sensitive view into the site, including from designated areas such as Longstanton conservation area, and including changes to night time views as a result of increased lighting.*
49. *The night time visual assessment will be informed by a lighting study, which will include a night time survey of baseline lighting levels and consideration of new sources of light associated with the proposed development, such as roads, buildings and sports pitches. Given that this issue will be addressed in the landscape and visual effects assessment, it is not considered appropriate to include a separate lighting assessment within the ES’*
50. The above likely significant effect was assessed within Chapter 4, Landscape and Visual Effects of the Phase 1 ES, February 2012.
51. SCDC’s Scoping Opinion, September 2011 provided the following comments on *‘Landscape and Visual Effects’* during Phase 1 Development:

⁵ 2011 Scoping Report for Northstowe Phase 1.

52. *‘Lighting impact can be wide and there can be significant adverse effects on ecology and possible statutory nuisance to the amenity of residential premises both during the construction and operational phases. The effects/impacts of construction and operational artificial lighting on existing and proposed sensitive residential premises should be considered within the ES. The 2007 ES had a separate chapter on Lighting, which was robust and comprehensive with adequate mitigation measures. It is likely that the assessment in the main remains valid subject to some validation of baselines levels. It is recommended that the potential impact associated with any artificial lighting should be considered as a separate topic or at the very least the ES should make it clear in the contents that artificial lighting impact has been assessed to include the impact on existing and proposed residential premises’.*
53. The SCDC’s scope for the Phase 1 Development has been adopted for Phase 2 to ensure that the ES is supported by a Lighting Technical Report which would include new day and night time surveys. This has been taken into account in the landscape and visual, natural heritage and community, economic and social chapters of the ES.
54. The following potentially significant effects are examined in this report:
55. *Effects during construction:* Increase in light spill and potential glare (associated with lighting installations) to existing local residential receptors
56. *Effects post-construction:* Increase in light spill and potential glare (associated with lighting installations) to existing local residential receptors
57. The following effects not considered significant for this report:
58. *Effects on future residential receptors:* The potentially significant lighting effects of light spill and glare that are generated by the proposed development on future residential receptors have not been considered in the scope of this assessment. It is considered that new lighting installations will be designed in accordance with current guidelines and best practice in order to prevent/minimise any nuisance or disturbance by light obtrusion. All new external lighting installations will be operational prior to the arrival of any future residential receptors and thereby they will not experience a change in the baseline conditions. Therefore, this is not considered further in this report.
59. Effects considered elsewhere in the environmental statement:
60. *Effects on animal habitats:* The assessment of potentially significant lighting effects on ecological species (in particular sensitive bat species) has been ‘*scoped out*’ of this assessment and is assessed within Chapter 10 – Ecology. Results from the lighting surveys have been used within this chapter to demonstrate the existing lighting conditions at sensitive ecological receptors. Therefore, this is not considered further in this report.
61. *Night time views:* As outlined above, the potentially significant lighting effects to night time views (as viewed by residents and all other users of the surrounding area) including those from designated areas have been assessed within Chapter 14– Landscape and Visual Effects. This includes appropriate consideration of potentially medium and long distance views. Therefore, these potential effects are not considered further in this report.

62. It is anticipated that recommendations contained in this report will be used to inform the future detailed lighting specification for the proposed development.
63. The baseline conditions are those surveyed and documented during the nocturnal survey which took place on the night between 2 July 2014 and 3 July 2014. In general the majority of the surroundings of Main Phase 2 development area and the Southern Access Road (West) were found to have artificial lighting levels expected of rural and small village locations. Refer also to Figure 2 LVIA Viewpoints used in the Lighting Assessment for locations of the measurement viewpoints.
64. The measured values of vertical plane illuminance and peak luminance at the selected viewpoints facing the Main Phase 2 development area and the proposed Southern Access Road (West) recorded during the survey are detailed in Table 4 below.

Table 4: Survey numerical data results:

VP	Maximum Luminance (cd/m ²)	Maximum Vertical Illuminance (lux)
VP 1	47.31cd/m ² (Streetlamp) 0.16cd/m ² (Peak sky glow)	0.2lux
VP 2	0.32cd/m ² (Peak sky glow)	0.01lux
VP 3	0.11cd/m ² (Peak sky glow)	0.01lux
VP 4	0.16cd/m ² (Peak sky glow)	0.01lux
VP 5	0.13cd/m ² (Peak sky glow)	0.01lux
VP 6	8369cd/m ² (Streetlamp)	1.4lux
VP 7	Not Surveyed	Not Surveyed
VP 8	Not Surveyed	Not Surveyed
VP 9	0.08cd/m ² (Peak sky glow)	0.01lux
VP 10	0.05cd/m ² (Peak sky glow)	0.01lux
VP 11	Not Surveyed	Not Surveyed
VP 12	0.14cd/m ² (Peak sky glow)	0.01lux
VP 13	0.11cd/m ² (Peak sky glow)	0.01lux
VP 14	0.11cd/m ² (Peak sky glow)	0.01lux
VP 15	0.10cd/m ² (Peak sky glow)	0.01lux
VP 16	0.35cd/m ² (Peak sky glow)	0.6lux

VP	Maximum Luminance (cd/m ²)	Maximum Vertical Illuminance (lux)
VP 17	0.07cd/m ² (Peak sky glow)	0.01lux
VP 18	0.05cd/m ² (Peak sky glow)	0.01lux
VP 19	0.11cd/m ² (Peak sky glow)	0.01lux
VP 20	0.13cd/m ² (Peak sky glow)	0.01lux

65. The guidance for limiting obtrusive light considers the spill light entering a dwelling as a result of the installation being studied. Given that the viewpoints were typically more than 1km from the proposed development site, any spill light recorded viewpoint could not be attributable to any one light source at the Northstowe Phase 2 Development or environs.

4.1.1 Survey – General Site Observations

66. The majority of the illuminance levels recorded in Table 4 relate to road or street lighting. It is assumed such lighting will operate during both pre-curfew and post-curfew periods. By observation the results of the survey are consistent with the criteria set by the ILP for the Environmental Zone E2.
67. The nocturnal artificial lighting around the Northstowe Phase 2 development site comprises mainly of road and street lighting in context with the suburban environment. A mixture of sodium (orange) and mercury (white) based light sources were observed. In particular, the lighting of residential roads and highways is characterised by sodium light sources.
68. On the night of the survey, it was also observed that there was little or no noticeable moonlight throughout the survey due to cloud cover.
69. Skyglow was observed around the site and can be seen in the viewpoint photographs; this is particularly evident in Viewpoint 3 and 15 (Appendix K2). It could be said that the magnitude of skyglow observed is typical of any town in the region.
70. Observations from the various viewpoints can otherwise generally be split into two categories namely ‘South’ and ‘North’ and those in close proximity to ‘Southern Access Road (West)’. Commentary specific to these locations can be found below.
71. Viewpoints 5, 6, 15 and 19 are in direct observation of the proposed Southern Access Road (West).

4.1.2 Survey – Observations from the North

72. The northern viewpoints are located either side of the village Rampton close to the site with one in the Aldreth village and the furthest viewpoint on Hill Road close to Haddenham village.
73. It was observed that the remote viewpoints (VP14 and VP20) close to Haddenham and Aldreth villages overlook the proposed site across green fields without any

obstructions. Local road lighting on Hill Road being the only localised contribution to the level of artificial light recorded at VP14 which was considered to be insignificant. The level of sky glow observed in the direction of Willingham and the Cottenham was also considered to be insignificant.

74. The only light sources captured within viewpoints VP12 and VP13 on Rampton Rd are those of the distant road lights (using high pressure sodium lamps) beyond the site on the A14 Huntingdon Road. No significant sky glow was observed at these viewpoints.

4.1.3 Survey – Observations from the South

75. The southern viewpoints can be divided into those that are south of the A14 and those that are in closer proximity to the proposed Northstowe Phase 2 development site in Longstanton and Oakington.
76. The viewpoints that are a significant distance from the Northstowe Phase 2 development site (VP15, VP16, VP17, VP18, VP19) and south of the A14 are generally shielded from the site. It was observed that there are few dwellings located in Bar Hill, Lolworth and Boxworth with an unobstructed view to the site. Local light sources such as the road lighting on the A14 and the distant town of Longstanton are more likely to be viewed as a source of nuisance to nearby dwellings. The significant distance of these viewpoints from the development means that any light reaching these locations will not attribute in any significant quantity to the existing lighting schemes around the viewpoints.
77. The southern viewpoints within closer proximity of the Northstowe Phase 2 development site (VP1, VP2, VP3, VP4, VP5, and VP6) are generally located within the villages of Longstanton and Oakington. The nature of the terrain will not prevent the site from being observed from the majority of these viewpoints. Viewpoint 6 is situated within Oakington and is in a residential cul-de-sac; any light from the development site will not have a significant effect on the light levels due to the existing streetlamps and obstructed view.
78. Viewpoints 1, 2, 3 and 4 are all located off a public road. The existing light levels from these viewpoints are contributed to from the streetlamps and skyglow from the Longstanton town.

4.1.4 Survey- Southern Access Road (West)

79. The road lighting on the proposed development of the Southern Access Road (West) will be have an unobstructed view from VP5, VP6, VP15 and VP19.
80. The viewpoints south of the A14 (VP16, VP17, VP18) are unlikely to be affected by Southern Access Road (West) development as it appears to be obscured from these locations.
81. The proposed road development is directly visible from Viewpoint 5. Currently, the existing illuminance recorded during the site survey is attributable to sky glow. The road lighting from the A14 is visible but is not providing any significant illuminance due to the distance of Viewpoint5 from the A14. It is anticipated that the unobstructed view and close proximity to the proposed Southern Access Road (West) will result in increased obtrusive light at VP5.

82. Viewpoint 6 is located within a residential cul-de-sac with no direct view to the proposed Southern Access Road (West). A road lighting column in close proximity to VP6 contributes to significantly to obtrusive light nearby. It is considered that the existing road lighting will be viewed as a greater source of nuisance in comparison to the proposed Southern Access Road (West).
83. A dwelling is located in very close proximity to VP15 which will have a direct view towards the proposed Southern Access Road (West). The illumination levels recorded around this development are minimal, with the main contribution to luminance attributable to the skyglow above Cambridge. It is anticipated that the the proposed Southern Access Road (West) will result in increased obtrusive light at VP15.
84. Viewpoint 19 will have an unobstructed view of the proposed road development and there are currently no significant sources of illuminance around VP19. It is anticipated that the proposed Southern Access Road (West) will result in increased obtrusive light at VP19.
85. All the other viewpoints are deemed to be a significant distance from the proposed development or observing in another direction. It can therefore be assumed that local light sources such as road lighting and the skyglow attributed to other local developments are a more significant contributor to the light obtrusion than the Southern Access Road (West) development.

5 Potential effects

86. The potential effects are to be assessed as follows:

5.1 Site establishment and construction effects

87. Good practice guidance documents prepared by the Construction Industry Research and Information Association (CIRIA) note that lighting on construction sites is typically required for onsite security and health and safety requirements during the night-time period and is temporary and short-term in nature. However, it also notes that potential affects towards surrounding receptors will need to be minimised through the controlled application of lighting in accordance with current best practice standards.
88. It is anticipated that the key potential sources of lighting during the construction phase will include the following for both the Main Phase 2 development area and Southern Access Road (West) development:
 - Floodlight and security lighting associated with temporary car parking areas for workers, the secure compound and any perimeter fencing/hoarding.
 - Security and health and safety lighting associated with working areas, (e.g. where equipment is stored and safety hazards may be present).
 - The potential for fugitive light spill and glare from internal lighting associated with site offices and welfare facilities.
 - Lighting required for operational purposes associated with construction when working during the late afternoon in the winter period (including light from headlamps of vehicles).

89. The intended working hours will be from 07:30hrs to 19:00hrs Monday to Friday and from 07:30hrs to 13:00hrs Saturdays and only minimal working on Sunday or bank holidays. However certain operations are seasonal and weather dependent and these circumstances it may be necessary to extend working hours to take advantage of daylight hours, subject to prior agreement of SCDC.
90. Consequently, it is likely that sources of light will be predominate in winter months when working hours fall within hours of darkness. However it is assumed that some of level of security lighting (associated with compound and perimeter fencing/hoarding will be required during periods of darkness.

5.2 Operational effects

91. Details of the lighting of Northstowe Phase 2 development will be submitted as part of detailed applications for development plots. The external lighting specification and design will be prepared with due regard to the sensitivities of surrounding receptors and in accordance with the Design Code. The lighting specification will include the appropriate selection of column heights, light fittings and luminaire design to ensure that the intensity and direction of the lighting is controlled through retaining tilting angles close to the horizontal to ensure the effects of light spill and glare are minimized. In order to undertake the assessment of likely lighting effects it has been necessary to make assumptions in terms of lighting specification to be adopted.
92. It is assumed that the Northstowe operational lighting will be associated with the following elements:
- Primary and secondary streets (and residential streets);
 - Principal cycle/pedestrian routes (on and off road);
 - Dedicated cycleway along primary street and existing byway and public rights of way;
 - Key public amenity areas;
 - Car parking areas and service yards associated with the employment and mixed use areas to the north and the primary school/community centre;
 - Town Centre, including employment uses; and
 - Decorative lighting associated with some of the key buildings and illuminated advertisements is anticipated.
93. The Southern Access Road (West) shall be designed in accordance with BS EN 13201:2003 and BS 5489: 2004. The lighting class for the roundabouts has been specified as CE1, with all approaches being lit to ME2. The height of the columns range from 8m to 12m.
94. The operational lighting for the Southern Access Road (West) will be associated with the following elements:
- Primary roads;
 - Roundabouts;
 - Secondary roads;
 - Signage; and

- Principal cycle/pedestrian roads

5.3 Mitigation and enhancement

5.3.1 Construction Phase

95. Measures already included in the pre-mitigation scenario include:

- Procedures will be implemented to ensure effective liaison with the neighbouring properties, adjacent residents and local community through newsletters, letter drops (when construction activities are likely to affect local residents) and information boards.
- The sites will be registered to the Considerate Constructors Scheme to ensure the construction process is audited and monitored with the aim of maintaining the highest possible standards: and
- Specifically in relation to temporary lighting, lighting will be kept to the minimum required for the activity (meeting health and safety requirements) and lighting will be located and directed away from the residential properties where possible.

96. The measures required during construction will be installed and arranged with reference to current health and site safety requirements and lighting design best practice, to provide low impact lighting schemes. The impact of any obtrusive light effects on the nocturnal environment will be reduced by the application of the following measures:

- Adhere to best practice measures as recommended by the ILP, CIRIA, Health and Safety Executive (HSE) and CIE guidance;
- Consultation with SCDC and feedback from any nuisance issues from, public liaison activities;
- The use of temporary works lighting will be minimised in terms of frequency and duration wherever possible;
- Confine lighting to the task area (using horizontal cut-off optics and zero floodlight tilt angles);
- Orientate floodlights away from any dwellings;
- Use lower power security lighting where possible (and ensure minimal horizontal/vertical light spill);
- Operate a curfew and minimise the duration of any floodlighting;
- Operating during normal working hours (where 24 hour working is not required);
- Specify the lowest powered light sources possible;
- Keep task lighting local to the task; avoid 'wide-area' lighting schemes;
- No luminaires must be allowed to emit light above the horizontal plane;
- All lighting will be aimed to where it is required utilising and chose precision optics which keep the light where it's needed;
- Plant lighting needs to be shielded from view by the neighbouring dwellings and sensitive habitats;

- Low key security lighting, where appropriate, will use movement sensor controlled or uses ‘part-night’ dimming;
- Use the site cabins etc. to provide shielding of the lighting from beyond the sites;
- Minimise the height of lighting columns; and
- Observe a curfew period when practicable.

5.3.2 Operational Phase



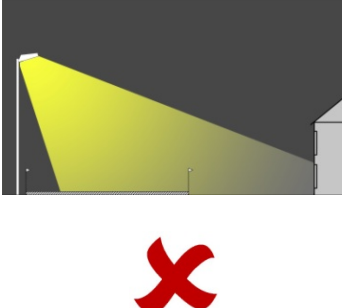



97. In order to minimise any environmental impact due to obtrusive light, a comprehensive lighting masterplan will be required to be developed in subsequent design stages in consultation with SCDC. It is expected that these details will be prepared as part of the design code for Phase 2. This lighting masterplan will comprise:

- Liaison with 3rd parties (e.g. police/emergency services);
- Zonal identification strategy for the site-wide lighting;
- Layout drawings / ‘lighting map’;
- Lighting performance design requirements;
- Calculations to illustrate compliance with appropriate design guides (e.g. BS EN 12464) and light obtrusion guidance notes (e.g. ILP GN01, CIE 150);
- Datasheet for all lighting fixtures and columns;
- Column types and locations;
- Feature lighting details;
- Beautification lighting details;
- Illuminated signage details; and
- As the masterplan is developed, 3D computer modelling techniques will be used to demonstrate the environmental impact of the nocturnal lighting and also develop mitigation methods to counter any obtrusive light.

98. Additional measures to be taken to minimise light obtrusion from any lighting installed will comprise:

- Use of physical barriers e.g. buildings to obscure the view of lighting from external sensors;
- Use modern technologies with constant output control gear. Light output will reduce with time and age and traditionally the scene is over-lit when new to ensure the lighting level is still acceptable after a period of time. Modern lighting control technologies enable the lighting to be maintained at the optimum output level throughout the life of the installation.);
- Luminaires correctly specified to efficiently place the light on the task area and not beyond. Light source not visible from beyond the development site;
- Area lighting with horizontally mounted asymmetric luminaires with good horizontal cut-off optics i.e. no direct upward light;
- Impose a curfew; extinguish all non-essential lighting after 22.30; and

- Examples of typical mitigation methods recommended in ILP GN01 are set out below.

Description	Example of Non-Compliance	Example of Good Practice
Luminaires with no upward light spill (i.e. horizontal 'flat glass' lens, compact light source for better light control)		
Luminaires correctly specified and installed to efficiently place the light on the task area and not beyond		
Area lighting with horizontally mounted asymmetric luminaires		

5.4 Residual Effects

102. The lighting strategy for each phase of the Northstowe Phase 2 development will be designed to comply with the criteria for an E2 Environmental Zone under current ILP guidance (2011) for light spill, glare and sky glow. The use of low light pollution lanterns with flat glass lenses and horizontally mounted floodlights will ensure adherence to this criteria.
103. In addition, as a secondary form of mitigation, the retention of existing landscaping and provision of new landscape planting will further screen and soften the effects of installed artificial light sources. Given the close proximity of the Main Phase 2 development area to Longstanton, Oakington and Rampton, it is considered that there is likely to be a direct, permanent, long-term residual effect on such residential properties of small to medium magnitude and of slight adverse significance. The Southern Access Road (West) is deemed to have a direct,

permanent, long-term effect of small to medium magnitude and of moderate adverse significance on local existing residential properties

5.4.1 Site enabling and construction residual effects

104. The construction phase will require temporary lighting for the illumination of the contractor's compound and on general construction activities. To mitigate the impact on surrounding sensitive receptors the lighting requirements during the construction phase will be managed through a Construction Environmental Management Plan. The temporary lighting will be restricted to meet on-site life safety and security requirements. The overall residual effect on sensitive receptors during the construction process of the main Phase 2 development area is considered to be of minor adverse to negligible significance. The overall residual effect on sensitive receptors during the construction process of Southern Access Road (West) is considered to be of moderate adverse significance.

5.4.2 Operational residual effects

105. Details of lighting will be submitted as part of detailed applications for development plots. The external lighting specification and design will be prepared with due regard to the sensitivities of surrounding receptors and in accordance with the Design Code. The lighting specification will include the appropriate selection of column heights, light fittings and luminaire design to ensure that the intensity and direction of the lighting is controlled through retaining tilting angles close to the horizontal to ensure the effects of light spill and glare are minimized. In order to undertake the assessment of likely lighting effects it has been necessary to make assumptions in terms of lighting specification to be adopted.

5.5 Cumulative Effect

106. The appearance of sky glow was considered as part of the assessment of the external lighting conditions. At the time of the lighting surveys carried out on 2 July and 3 July 2014, it was noted that the sites are partially surrounded by an existing brightly lit environment and is adjacent to an established semi-urban/village location.
107. The increase in sky glow associated with the proposed Northstowe development is considered to be negligible based on the likelihood of a noticeable change from the baseline conditions when viewed from the surrounding area. This is considered applicable to both Phase 1 and Phase 2 of the proposed development.
108. The increase in sky glow associated with the proposed Southern Access Road (West) is considered to be moderate adverse based on the likelihood of a noticeable change from the baseline conditions when viewed from the surrounding area.
109. Cumulative effects of light trespass and glare are unlikely to arise from the development and operation of the Phase 1 and Phase 2 site developments due to distance between locations and individual site contexts. In addition, the Phase 2 Development is not of a relevant scale or nature that would generate significant cumulative effects on the nocturnal environment to that considered for the Phase 1 Development.

5.6 Limitations and Assumptions

5.6.1 Limitations

110. No limitations were applicable to the assessment.

5.6.2 Assumptions

Site Survey

111. The site survey illuminance levels relate to road and street lighting. It is assumed that such lighting will operate during both pre-curfew and post-curfew periods.

112. The level of sky glow observed during the site survey is typical of any town in the region with no single significant source of obtrusive light and representative of an E1 and E2 Environmental Zone category.

Construction Phase

113. During the construction phase, it is likely that sources of light will be predominate in winter months when working hours fall within hours of darkness. However it is assumed that some of level of security lighting (associated with compound and perimeter fencing/hoarding will be required during periods of darkness.

114. It is anticipated that the key potential sources of lighting during construction phase will include the following:

- Floodlight and security lighting associated with temporary car parking areas for workers, the secure compound adjacent to the northern boundary and any perimeter fencing/hoarding.
- Security and health and safety lighting associated with working areas, (e.g. where equipment is stored and safety hazards may be present).
- The potential for fugitive light spill and glare from internal lighting associated with site offices and welfare facilities.
- Lighting required for operational purposes associated with construction when working during the late afternoon in the winter period (including light from headlamps of vehicles).

Operational Phase

115. During the operational phase of the Northstowe Phase 2 development, it has been necessary to assume that the lighting specification in terms of column heights, light fittings and luminaire design will be selected to provide minimal light spill and glare.

116. It is assumed that the Northstowe Phase 2 development operational lighting will be associated with the following elements:

- Primary and secondary streets (and residential streets);
- Principal cycle/pedestrian routes (on and off road);
- Dedicated cycleway along primary street and existing byway and public rights of way;
- Key public amenity areas;

- Car parking areas and service yards associated with the employment and mixed use areas to the north and the primary school/community centre;
- Town Centre, including employment uses; and
- Decorative lighting associated with some of the key buildings and illuminated advertisements is anticipated.

5.7 Assessment Summary Matrix

Table 5 provides a summary of the lighting effects that have been assessed.

Table 5: Assessment Summary Matrix

Key: +ve (beneficial), -ve (adverse), D (direct), InD (indirect), ST (short term), MT (medium term), LT (long term), P (permanent), R (reversible)

Assessment Summary Matrix				
Description of Effects	Significance of Effects:	Description of Mitigation Measures and Enhancement	Description of Residual Effects	Significance of Residual Effects
Site enabling works and construction assessment				
Light spill beyond main Phase 2 development area	Medium magnitude, slight -ve, D, MT	Best practice lighting design, regular consultation and public liaison activities, cut-off optics on temporary luminaires, commissioning and monitoring.	Light spill beyond main Phase 2 development area	Small magnitude, slight -ve, D, MT
Skyglow from main Phase 2 development area	Medium magnitude, slight -ve, D, MT	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky.	Skyglow from main Phase 2 development area	Medium magnitude, slight -ve, D, MT
Light source intensity from main Phase 2 development area	Medium magnitude, slight -ve, D, MT	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky. Best practice lighting design, commissioning and monitoring. Consider use of lower powered lighting and efficient optics. Use floodlight cowls and other screening devices.	Light source intensity from main Phase 2 development area	Small magnitude, slight -ve, D, MT
Light spill beyond Southern Access Road (West)	Medium magnitude, moderate -ve, D, MT	Best practice lighting design, regular consultation and public liaison activities, cut-off optics on temporary luminaires, commissioning and monitoring.	Light spill beyond Southern Access Road (West)	Small magnitude, moderate -ve, D, MT

Assessment Summary Matrix				
Description of Effects	Significance of Effects:	Description of Mitigation Measures and Enhancement	Description of Residual Effects	Significance of Residual Effects
Skyglow from Southern Access Road (West)	Medium magnitude, moderate -ve, D, MT	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky.	Skyglow from Southern Access Road (West)	Medium magnitude, moderate -ve, D, MT
Light source intensity from Southern Access Road (West)	Medium magnitude, moderate -ve, D, MT	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky. Best practice lighting design, commissioning and monitoring. Consider use of lower powered lighting and efficient optics. Use floodlight cowls and other screening devices.	Light source intensity from Southern Access Road (West)	Small magnitude, moderate -ve, D, MT
Operational assessment				
Light spill beyond main Phase 2 development area	Medium magnitude, slight -ve, D, P	Best practice lighting design, curfew lighting controls, cut-off optics on luminaires, height of columns kept to a minimum, flood lights with asymmetric beams, avoid over lighting, commissioning and monitoring.	Light spill beyond main Phase 2 development area	Small magnitude, slight -ve, D, P
Skyglow from main Phase 2 development area	Medium magnitude, slight -ve, D, P	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky.	Skyglow from main Phase 2 development area	Medium magnitude, slight -ve, D,P
Light source intensity from main Phase 2 development area	Medium magnitude, slight -ve, D, P	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky. Best practice lighting design, commissioning	Light source intensity from main Phase 2 development area	Small magnitude, slight -ve, D,P

Assessment Summary Matrix				
Description of Effects	Significance of Effects:	Description of Mitigation Measures and Enhancement	Description of Residual Effects	Significance of Residual Effects
		and monitoring. Consider use of lower powered lighting and efficient optics. Use floodlight cowls and other screening devices.		
Light spill beyond Southern Access Road (West) including cumulative effect	Medium magnitude, moderate -ve, D, P	Best practice lighting design, curfew lighting controls, cut-off optics on luminaires, height of columns kept to a minimum, flood lights with asymmetric beams, avoid over lighting, commissioning and monitoring.	Light spill beyond Southern Access Road (West) including cumulative effect	Small magnitude, moderate -ve, D, P
Skyglow from Southern Access Road (West) including cumulative effect	Medium magnitude, moderate -ve, D, P	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky.	Skyglow from Southern Access Road (West) including cumulative effect	Medium magnitude, moderate -ve, D,P
Light source intensity from Southern Access Road (West) including cumulative effect	Medium magnitude, moderate -ve, D, P	Ensure all luminaires have horizontal cut-off optics and are installed to prevent direct light up into the sky. Best practice lighting design, commissioning and monitoring. Consider use of lower powered lighting and efficient optics. Use floodlight cowls and other screening devices.	Light source intensity from Southern Access Road (West) including cumulative effect	Medium magnitude moderate -ve, D, P
<p><i>Key: +ve (beneficial), -ve (adverse), D (direct), InD (indirect), ST (short term), MT (medium term), LT (long term), P (permanent), R (reversible)</i></p>				

Appendix A

ILP Guidance Notes - GN01

Appendix A ILP Guidance Notes – GN01

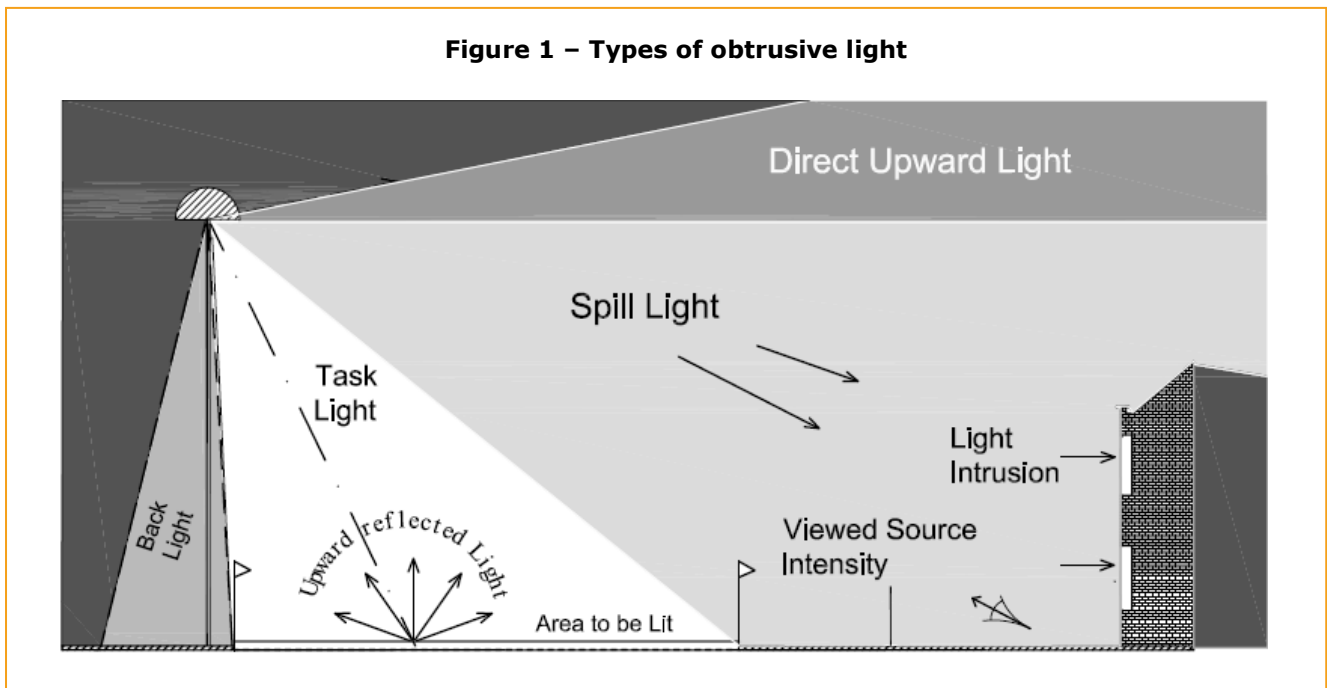
GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT

“Think before you light - The right amount of light, where wanted, when wanted.”

Man's invention of artificial light has done much to safeguard and enhance our night-time environment but, if not properly controlled, **obtrusive light** (sometimes referred to as light pollution) can present serious physiological and ecological problems.

Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task.

Sky glow, the brightening of the night sky, **Glare** the uncomfortable brightness of a light source when viewed against a darker background, and **Light Intrusion (“Trespass”)**, the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others and waste money and energy. Think before you light. Is it necessary? What effect will it have on others? Will it cause a nuisance? How can you minimise the problem?



Do not "over" light. This is a major cause of obtrusive light and is a waste of energy. There are published standards for most lighting tasks, adherence to which will help minimise upward reflected light. Organisations from which full details of these standards can be obtained are given on the last page of this leaflet.

Dim or switch off lights when the task is finished. Generally a lower level of lighting will suffice to enhance the night time scene than that required for safety and security.

“Good Design equals Good Lighting”

Any lighting scheme will consist of three basic elements: a light source, a luminaire and a method of installation.

Light sources (Lamps)

Remember that the light source output in LUMENS is not the same as the wattage and that it is the former that is important in combating the problems of obtrusive light.

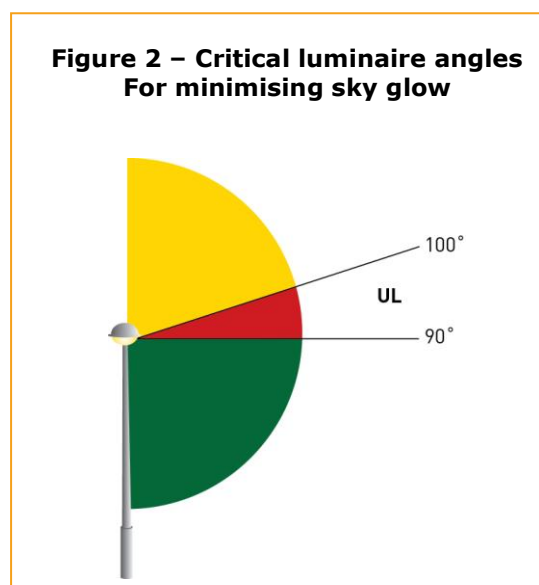
Most nighttime visual tasks are only dependant on light radiated within the visual spectrum. It is therefore NOT necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically designed to do so. It is also understood that light from the shorter wavelengths of the spectrum has important effects on both flora and fauna that should be considered.

Research indicates that light from the blue end of the spectrum has important non-visual effects on the health of the human body, in particular in our sleep/wake patterns. It is therefore important to appreciate that while in obtrusive light terms the use of blue light should be minimised, there are many night-time tasks such as driving and sports where to be fully awake is an important aid to safety.

Luminaires

Care should always be taken when selecting luminaires to ensure that appropriate products are chosen and that their location will reduce spill light and glare to a minimum.

Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal. The most sensitive/critical zones for minimising sky glow are those between 90° and 100° as shown in Figure 2 and referred to as the lower, upward light output zone (UL).



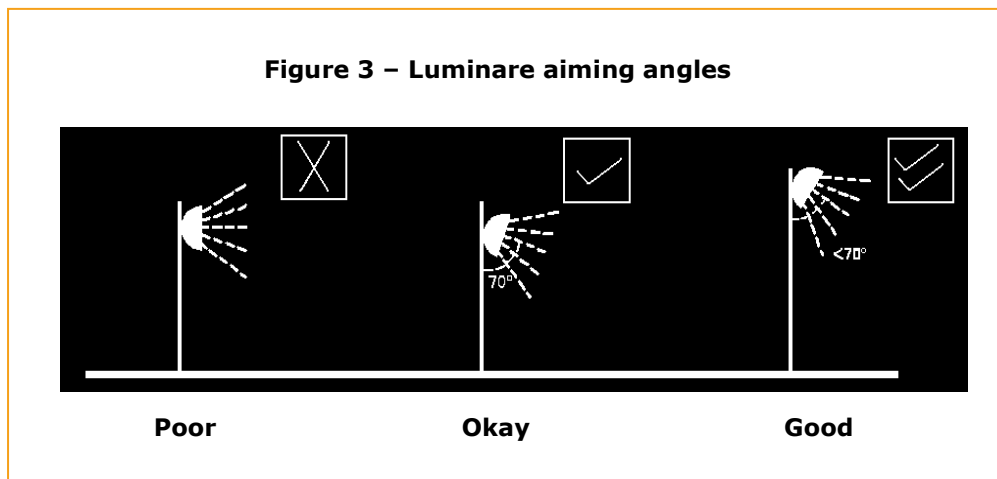
For most sports and area lighting installations the use of luminaires with double-asymmetric beams designed so that the front glazing is kept at or near parallel to the surface being lit should, if correctly aimed, ensures minimum obtrusive light.

Appendices 1 and 2 to these notes gives more details of how to choose and if necessary modify luminaires.

Installation

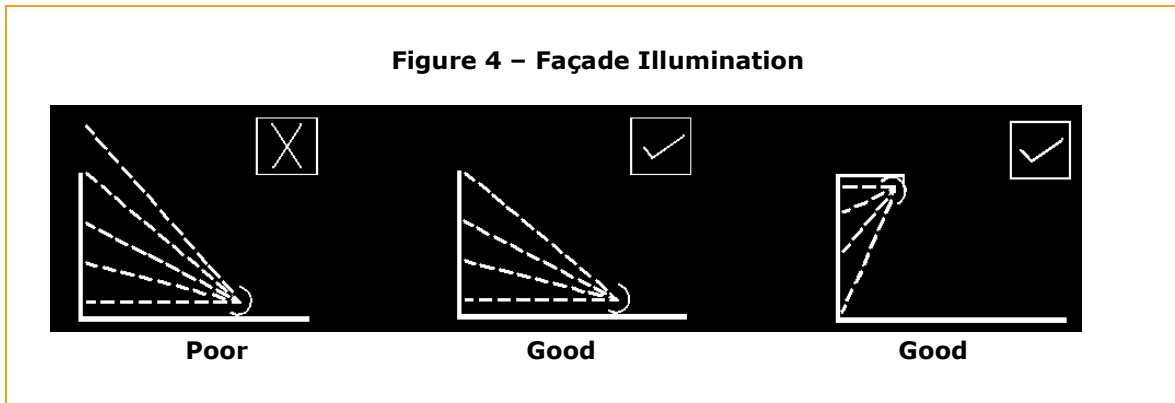
In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation. The requirements to control glare for the safety of road users are given in Table 3.

Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°. Higher mounting heights allow lower main beam angles, which can assist in reducing glare. In areas with low ambient lighting levels, glare can be very obtrusive and extra care should be taken when positioning and aiming lighting equipment. With regard to domestic security lighting the ILP produces an information leaflet GN02:2009 that is freely available from its website.



When lighting vertical structures such as advertising signs, direct light downwards wherever possible. If there is no alternative to up-lighting, as with much decorative lighting of buildings, then the use of shields, baffles and louvres will help reduce spill light around and over the structure to a minimum.

For road and amenity lighting installations, (see also design standards listed on Page 5) light near to and above the horizontal should normally be minimised to reduce glare and sky glow (Note ULR's in Table 2). In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape. However in some urban locations, luminaires fitted with a more decorative bowl and good optical control of light should be acceptable and may be more appropriate.



Since 2006 “Artificial Light” has been added to the list of possible Statutory Nuisances in England, Wales and Scotland. The monitoring of such nuisances will be the responsibility of Environmental Health Officers (EHOs) for which separate guidance is being produced.

With regard to the planning aspect, many Local Planning Authorities (LPAs) have already produced, or are producing, policies that within the planning system will become part of their local development framework. For new developments there is an opportunity for LPAs to impose planning conditions related to external lighting, including curfew hours.

The Scottish Executive has published a design methodology document (March 2007) entitled [“Controlling Light Pollution and Reducing Energy Consumption”](#) to further assist in mitigating obtrusive light elements at the design stage.

ENVIRONMENTAL ZONES

It is recommended that Local Planning Authorities specify the following environmental zones for exterior lighting control within their Development Plans.

Table 1 – Environmental Zones			
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

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.

NB: Zone E0 must always be surrounded by an E1 Zone.

DESIGN GUIDANCE

The following limitations may be supplemented or replaced by a LPA's own planning guidance for exterior lighting installations. As lighting design is not as simple as it may seem, you are advised to consult and/or work with a professional lighting designer before installing any exterior lighting.

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers

Environmental Zone	Sky Glow ULR [Max %] ⁽¹⁾	Light Intrusion (into Windows) E _v [lux] ⁽²⁾		Luminaire Intensity I [candelas] ⁽³⁾		Building Luminance Pre-curfew ⁽⁴⁾
		Pre-curfew	Post-curfew	Pre-curfew	Post-curfew	Average, L [cd/m ²]
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	2,500	0	0
E2	2.5	5	1	7,500	500	5
E3	5.0	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

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

E_v = **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/m²)**

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.

Table 3 – Obtrusive Light Limitations for Exterior Lighting Installations – Road Users		
Road Classification ⁽¹⁾	Threshold Increment (TI)	Veiling Luminance (Lv)
No road lighting	15% based on adaptation luminance of 0.1cd/m ²	0.04
ME6/ ME5	15% based on adaptation luminance of 1cd/m ²	0.25
ME4/ ME3	15% based on adaptation luminance of 2cd/m	0.40
ME2 / ME1	15% based on adaptation luminance of 5cd/m ²	0.84

TI = Threshold Increment is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation

Lv = Veiling Luminance is a measure of the adaptation luminance caused by the disability glare from the obtrusive light installation

(1) = Road Classifications as given in BS EN 13201 - 2: 2003 Road lighting Performance requirements. Limits apply where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and for viewing directions in path of travel. For a more detailed description and methods for determining, calculating and measuring the above parameters see CIE Publication 150:2003.

RELEVANT PUBLICATIONS AND STANDARDS:

British Standards: www.bsi.org.uk	BS 5489-1: 2003 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 13201-3:2003 Road lighting – Part 3: Calculation of performance BS EN 13201-4:2003 Road lighting – Part 4: Methods of measuring lighting performance. BS EN 12193: 1999 Light and lighting – Sports lighting BS EN 12464-2: 2007 Lighting of work places – Outdoor work places
Countryside Commission/ DOE	Lighting in the Countryside: Towards good practice (1997) (<i>Out of Print but available on www.communities.gov.uk/index.asp?id=1144823</i>)
UK Government / Defra www.defra.gov.uk	Statutory Nuisance from Insects and Artificial Light – Guidance on Sections 101 to 103 of the Clean Neighbourhoods and Environment Act 2005 Road Lighting and the Environment (1993) (Out of Print)
CIBSE/SLL Publications: www.cibse.org	CoL Code for Lighting (2002) LG1 The Industrial Environment (1989) LG4 Sports (1990+Addendum 2000) LG6 The Exterior Environment (1992) FF7 Environmental Considerations for Exterior Lighting (2003)
CIE Publications: www.cie.co.at	01 Guidelines for minimizing Urban Sky Glow near Astronomical Observatories (1980) 83 Guide for the lighting of sports events for colour television and film systems (1989) 92 Guide for floodlighting (1992) 115 Recommendations for the lighting of roads for motor and pedestrian traffic – Second Edition (2010) 126 Guidelines for minimizing Sky glow (1997) 129 Guide for lighting exterior work areas (1998) 136 Guide to the lighting of urban areas (2000) 150 Guide on the limitations of the effect of obtrusive light from outdoor lighting installations (2003) 154 The Maintenance of outdoor lighting systems (2003)
ILP Publications: www.theilp.org.uk	TR 5 Brightness of Illuminated Advertisements (2001) TR24 A Practical Guide to the Development of a Public Lighting Policy for Local Authorities (1999) GN02 Domestic Security Lighting, Friend or Foe
ILP/CIBSE Joint Publications	Lighting the Environment - A guide to good urban lighting (1995)
ILP/CSS Publications	Joint Code of Practice for the installation, maintenance and removal of seasonal decorations. (2005)
ILP/CfDS Joint Publication www.dark-skies.org	Towards Understanding Sky glow. 2007
IESNA www.iesna.org	TM-15-07 (R) Luminaire Classification System for Outdoor Luminaires

NB: These notes are intended as guidance only and the application of the values given in Tables 2 & 3 should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced.

APPENDIX 1 - PROPOSED OUTDOOR LUMINAIRE CLASSIFICATION SYSTEM

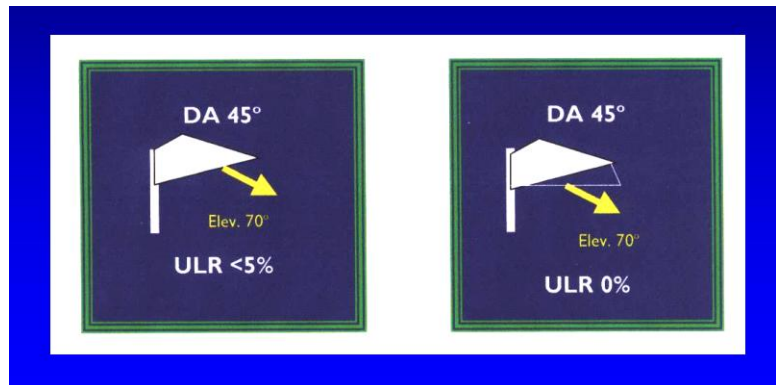
Variable Aim Luminaires – General Classifications:

➤ Type A	Symmetrical	
➤ Type B	Asymmetrical	
➤ Type C	Double-Asymmetrical	

Proposed labelling System:

Fixed Position luminaires

Variable Aim Luminaires
(Shown here for a 45° Double-Asymmetric luminaire aimed at 70° – with and without a cowl).



APPENDIX 2 - ILLUSTRATIONS OF LUMINAIRE ACCESSORIES FOR LIMITING OBTRUSIVE LIGHT (images provided by Philips and Thorn)

Cowl (or Hood)



External Louvre



SHIELD



SHIELD "Barn Doors"



Double Asymmetric Luminaire



Simple Hood



Circular Louvre



Cowl & Louvre



Internal Louvre (horizontal)



Internal Louvre (vertical)



Appendix B

Survey Images

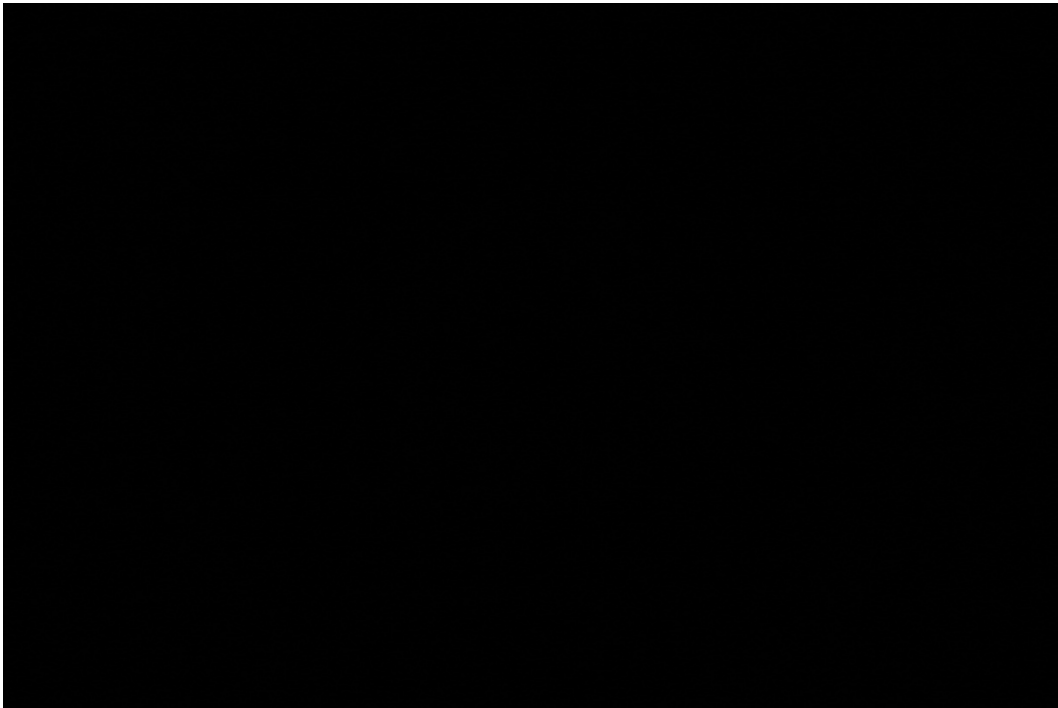
Contents

B1	Survey Photos	1
B2	HDR Images	10
B3	Survey Map	16

B1 Survey Photos



VP 1



VP 2



VP 3



VP 4



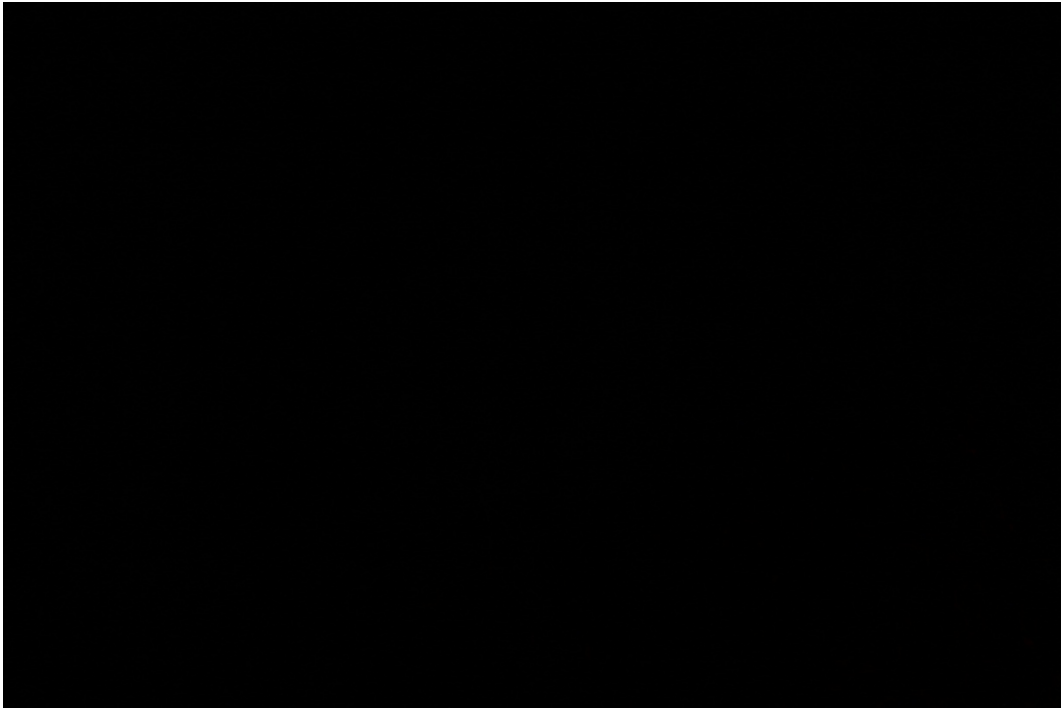
VP 5



VP 6



VP 9



VP 10



VP 12



VP 13



VP 14



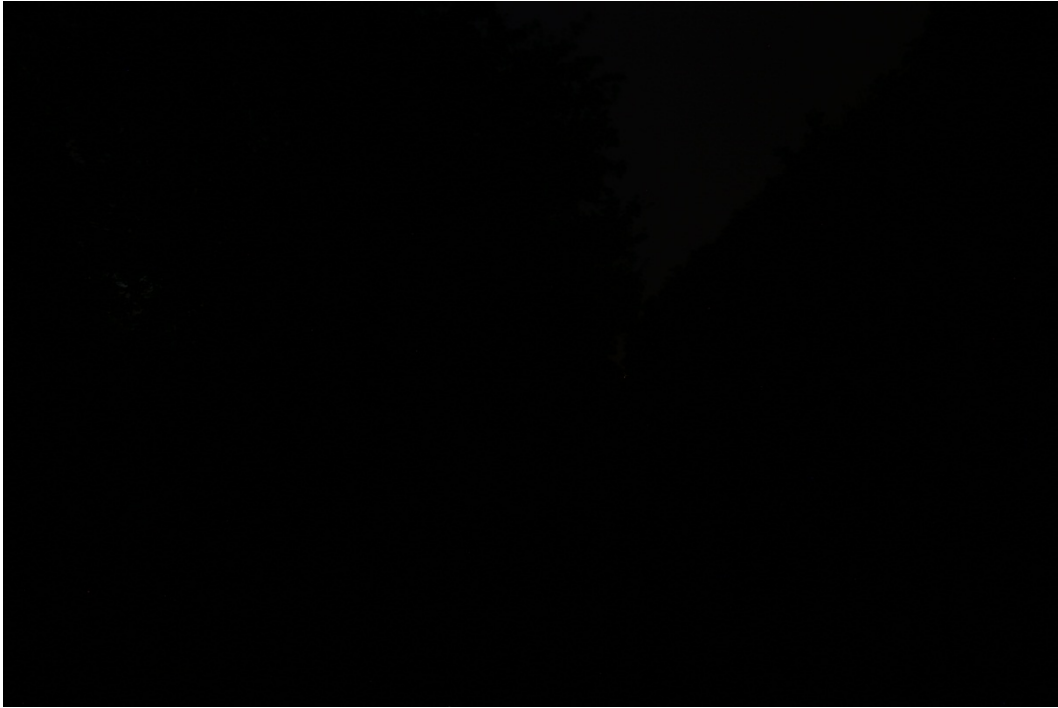
VP 15



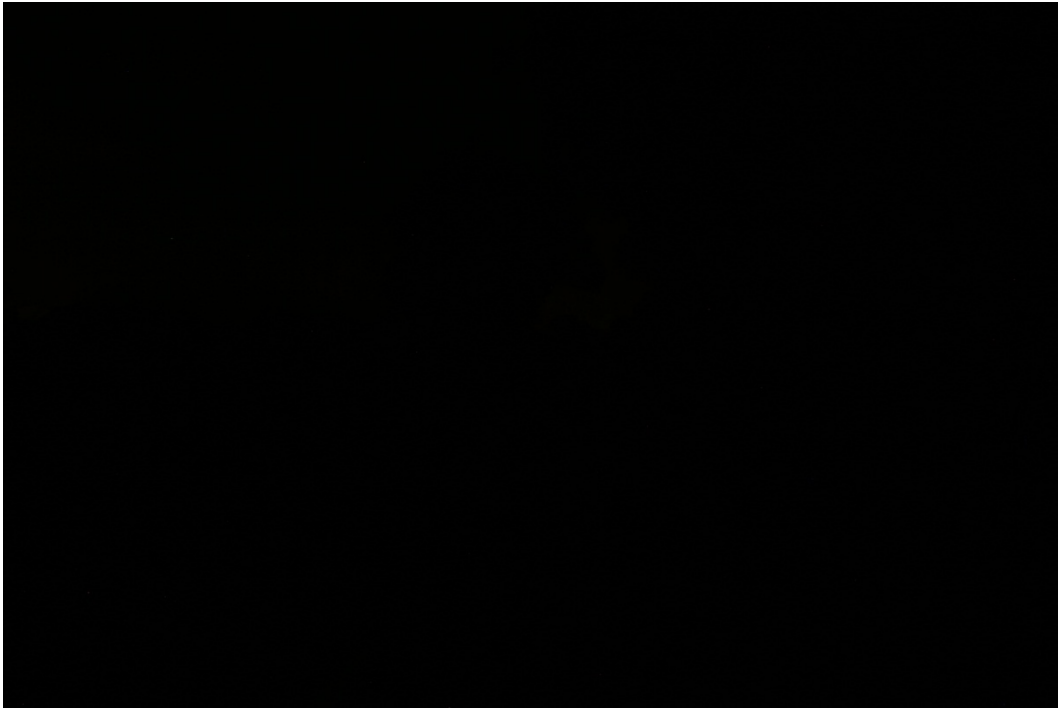
VP 16



VP 17



VP 18

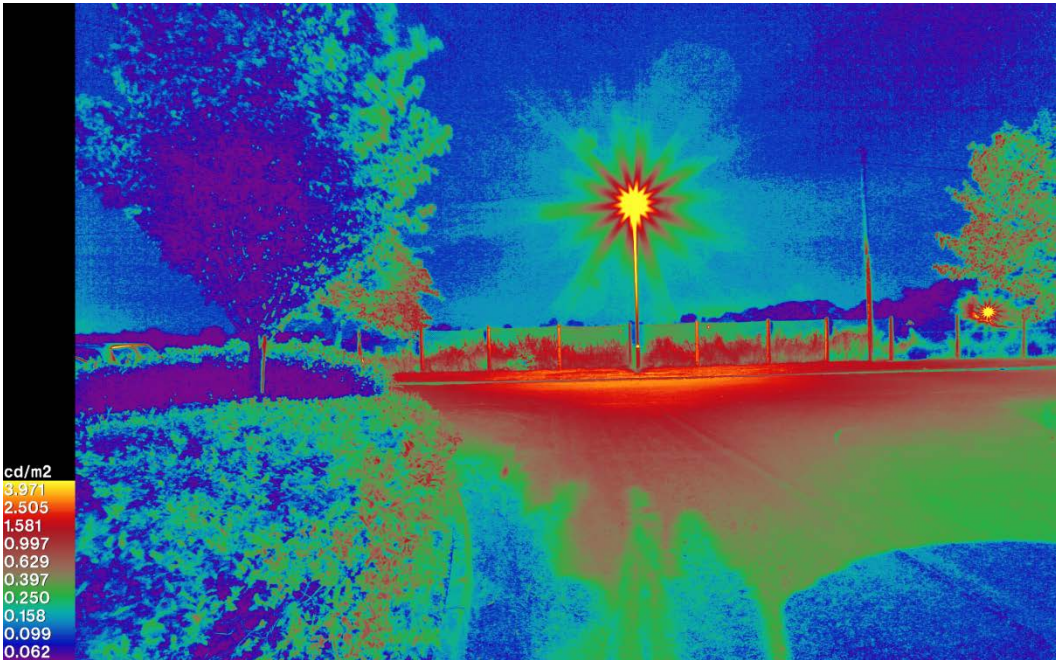


VP 19

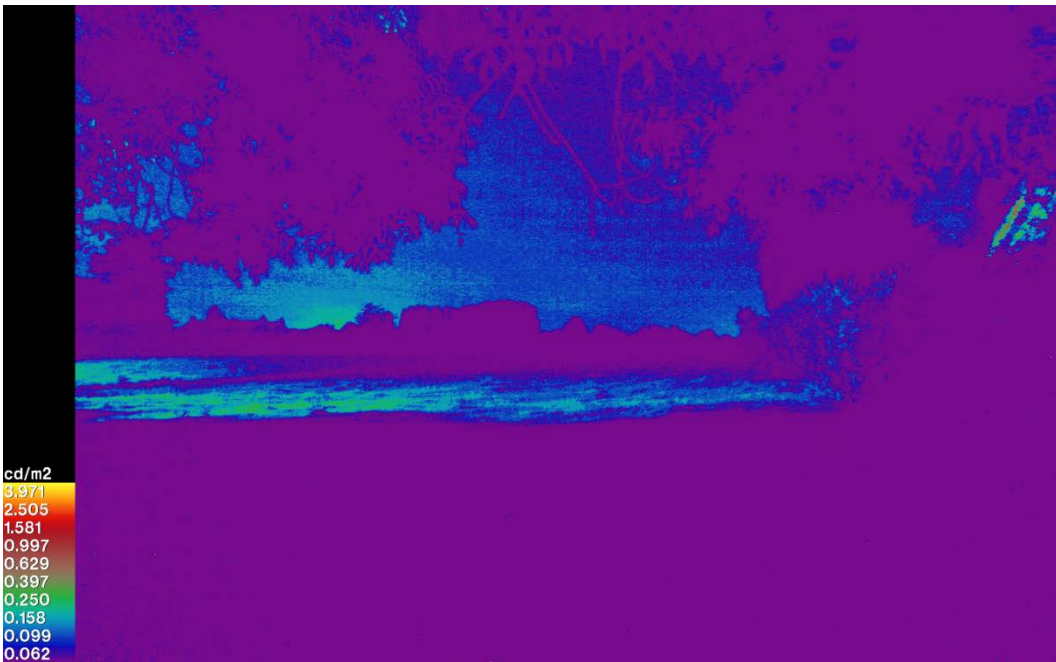


VP 20

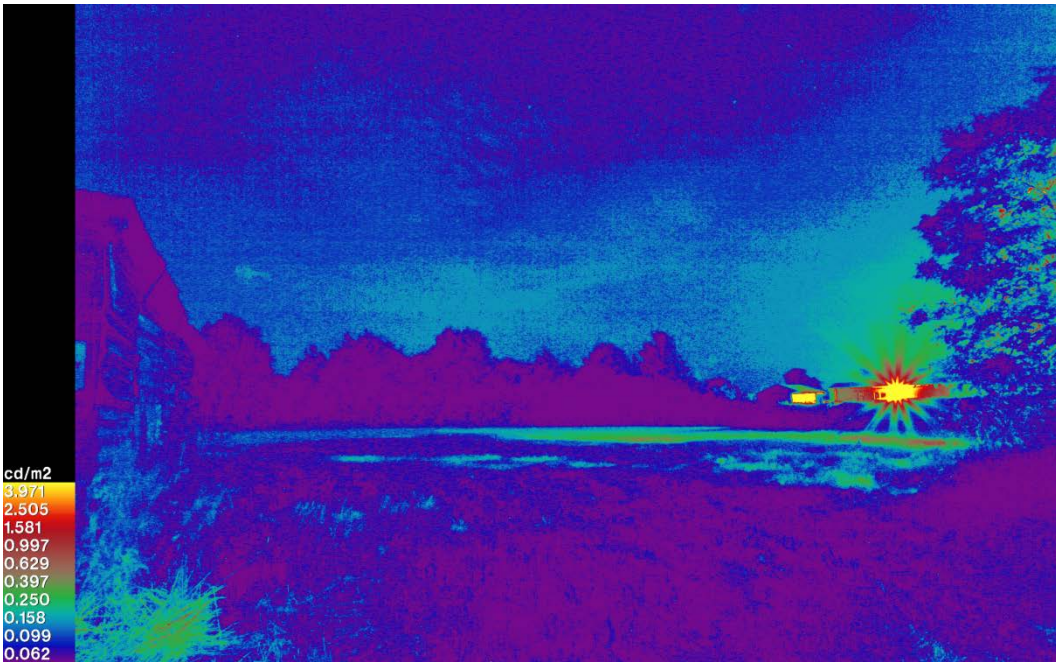
B2 HDR Images



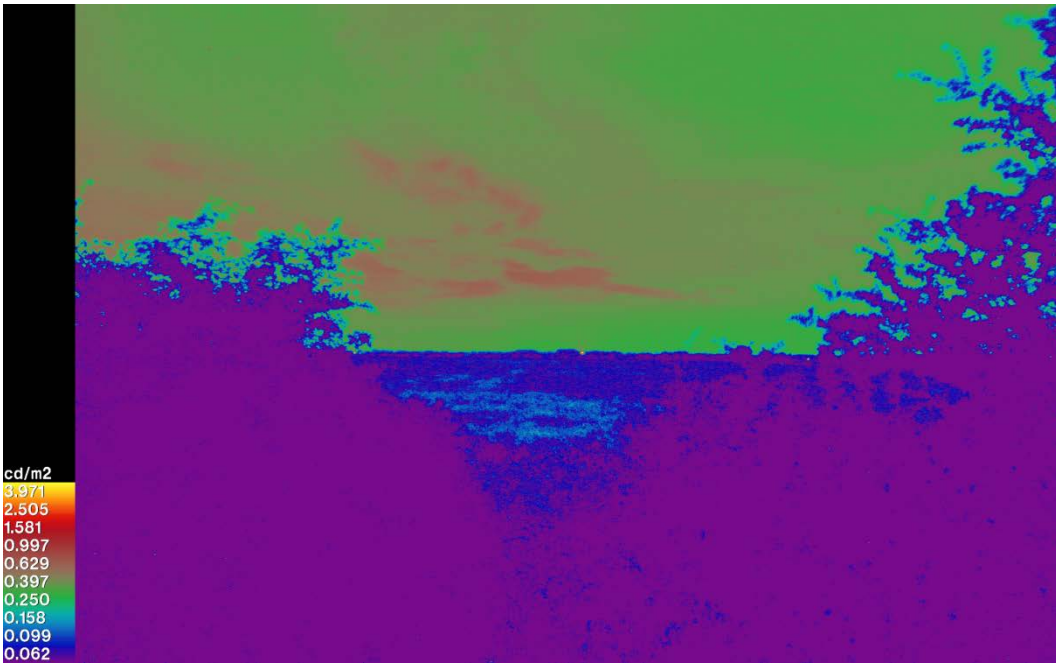
VP 1



VP 3



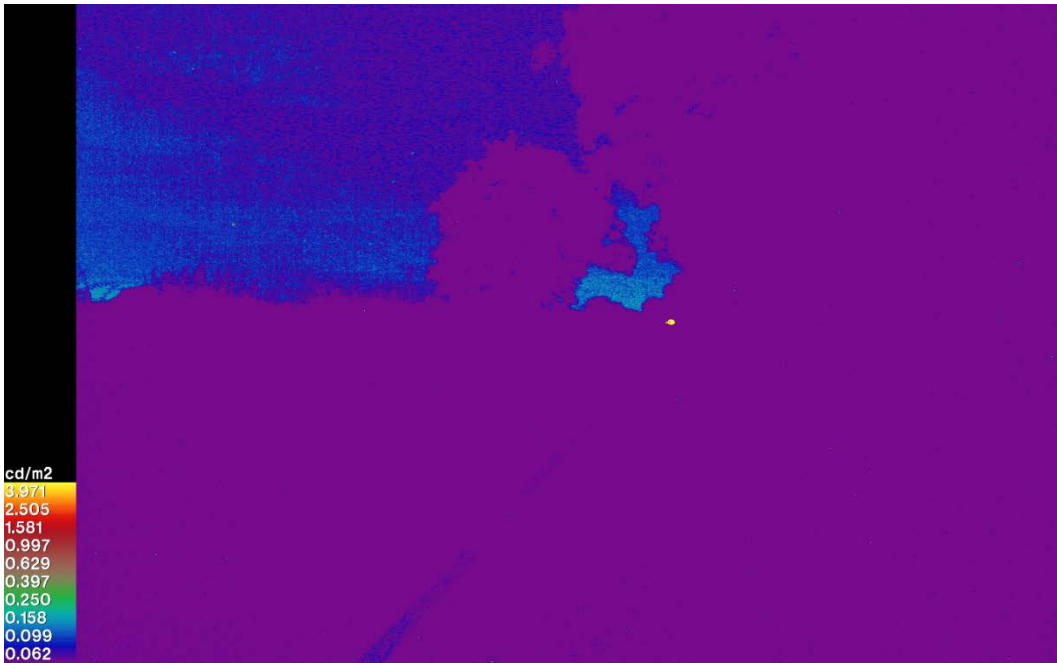
VP 4



VP 13



VP 15



VP 19