21. Lighting

Purpose of the Assessment

21.1 Good lighting is critical for the safe and secure functioning of businesses where people work at night to service distribution networks. As these businesses work over 24hr periods, good quality night time illumination is a vital requirement which will ensure worker safety and business efficiency. However the lighting approach for such ventures must be mindful of being a 'good neighbour' especially when these are in rural, or semi-rural environments. It is critical to understand the possible lighting design impact at night between these equally important night time factors; operational safety and security and minimising light pollution. A baseline survey of the existing lit nightscape was carried out in order to establish the existing, lit, baseline condition. Then, given the fact that the exact design details of the site are not know at this stage, an 'Operational Lighting Parameters' lighting scheme was generated using a 'worst case scenario' approach. From this generic scheme an 'Illumination Impact Profile' (IIP) could then be generated which shows the potential impact on a range of ecological, heritage and human sensitive receptors. This qualifies the lit scheme at night so that a possible 'magnitudes of change' can be assessed. Finally, once the magnitudes are identified mitigation measures can also be set out so that, when a lighting design scheme is undertaken at the detailed design stage, any residual impact from the lit site can be minimised.

21.2 Badly-designed lighting schemes distribute light where it is not wanted, causing light pollution, while also wasting energy and creating poor visual environments. This needs to be avoided and indeed the National Policy Statement highlights this while the National Planning Policy Framework states that "By encouraging good design, planning policies and decisions should limit the effects of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation". Equally, carefully considered lighting solutions give a new dimension to the urban environment at night whilst respecting biodiversity and conservation interests.

21.3 In general, the key effects of poorly designed lighting which can, together, combine to create light pollution are as follows:

- Light Trespass/Encroachment: Poor indoor/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.

- Similarly, in terms of relevant ecological systems light trespass can disrupt existing bat roosts, foraging and commuting pathways.

- 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.

- 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.

21.4 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.

21.5 The ILP (Institute of Lighting Professionals) which publish considerable guidance on the subject of lighting at night concedes that, although the overall issue should be called 'Obtrusive Light', it is commonly referred to as Light Pollution and is referred to as this by other bodies such as The Department for Housing, Communities and Local Government.

21.6 This chapter considers the potential environmental effects of the Proposed Development in relation to temporary and permanent external lighting. It considers the following aspects of the development in isolation and as a whole:

- Main SRFI Site (including A43 access and all rail infrastructure);
- External lighting developments to J15a works;
- External lighting developments to all proposed development works (the above Proposed Developments as a whole).

21.7 A number of other off site minor highway works are proposed which have been excluded from this assessment for the reasons given below. Therefore, these junctions are not discussed further in this chapter. These are based on the available information at the time of writing and may be subject to change following further investigation.

1. Junction 1 – Junction 16 of the M1 – PL01. There are no residential receptors within 100 m of the proposed alterations where light fittings may need to be revised. At this stage no potential ecological receptors have been identified within 100 m of any existing or altered lighting.

2. Junction 3 – A4500/Upton Way/Tollgate roundabout - PL03. Existing housing is located on the cusp of the zone of influence at 100 m from potential altered light fittings. The widening of this junction to the north west is likely to result in some light fittings moving up to 5 m in a northerly direction. A desktop review of the current light fittings in this location would indicate that they appear to be of an older design and any new fittings would be far more efficient at lighting the road whilst minimising light spill. Therefore any change in lighting level experienced at these properties is likely to be negligible.

3. Junction 4 – the A5076/A5123/Upton Way - PL04. The physical amendments to this junction are limited to revised line markings. As the carriageways will not be getting wider the existing lighting is unlikely to need to be revised.

4. Junction 6 – A5076/Hunsbury Hill Road Roundabout - PL06. Whilst this junction is in close proximity to a number of existing dwellings the main area of highway widening is proposed on the eastbound approach of the A5076 to the junction. The lighting for this section of the junction is provided by lampposts mounted between the two carriageways and is unlikely to change as a result of the widening, assuming recommended illuminance levels can be achieved from these locations.

5. Junction 9 – A25/Brackmills roundabout - PL09. There are no physical changes to the highway that would necessitate the relocation or revision of the light fittings around this junction.

6. Junction 10 – Barnes Meadow Interchange - PL10. This junction is situated close to a nature reserve and a number of potential ecological light-sensitive receptors. An additional lane has been added to a section of the inside of the roundabout. The junction is lit in this area from the outside of the roundabout and therefore, would not need to be physically moved. If the current light fittings are not sufficient to illuminate the additional lane it will be replaced with a modern fitting that has the performance characteristics suitable for the widened highway. In such a case the modern fittings will be more efficient and would result in a reduction of light spill when compared to the existing older fittings.

7. Junction 14 – A43/A5 Tove – PL14. The southbound carriageway of the A5 on approach to the junction will be widened. The eastern kerb will largely remain in the same place, displacing the western kerb to account for the road widening. Therefore the light fittings on the western side of the A5 north will move in a westerly direction. There are industrial buildings and a children's day nursery with 100 m of the altered light fittings. However, none of these are light sensitive and therefore, this junction does not need to be considered.

8. Junction 15 – A43 Abthorpe – PL15. This junction was widened in 2016 to include an additional filter lane from the A43 southbound approach to the roundabout and a widening of the southern section of the roundabout itself. The road lighting was updated during these works. The highway improvements for the Proposed Development are in the same area as the 2016 works. It is considered unlikely that fittings will need to be moved or upgraded and therefore the lighting will not change and does not need to be assessed.

21.8 This chapter identifies the legislative and policy context for the assessment; summarises the extent of the Study Area; summarises relevant consultation; describes the baseline surveys and data, and baseline conditions; describes the methods used to assess the effects of the Proposed Development; identifies relevant embedded mitigation; provides an assessment of likely significant effects during construction, operation and decommissioning, and provides a cumulative assessment (inter and intra project). The chapter also identifies the mitigation measures required to prevent, reduce or offset any significant adverse effects and the likely residual effects after these measures have been adopted. Monitoring is identified where necessary, and a summary of the assumptions and limitations of the assessment is also provided.

21.9 This chapter is to be read in conjunction with:

- Appendix 21.1 – Baseline Survey;
- Appendix 21.1a – Baseline Survey – J15a
- Appendix 21.2a – Operational Lighting Parameters – J15a
- Appendix 21.3a – Illumination Impact Profile – J15a
- Appendix 21.2 – Operational Lighting Parameters;
- Appendix 21.3 – Illumination Impact Profile

Legislation, Policy and Best Practice

21.10 The assessment has been conducted with reference to the relevant legislation, planning policy and guidance, including:

Table 21.1: Summary of specialist topic relevant legislation, policy and guidance

Legislation / policy / guidance	Key provisions	Relevant section / paragraph
Clean Neighbourhoods and Environment Act (CNEA) 2005[21.1] **Part 9 section 102 and 103**	This 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, specifically, with – *'nuisance from artificial lighting and insect, and other issues affecting the local environment'*	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
Empowerment to Light Roads - The Highways Act 1980[21.2] **Section 97**	Section 97 empowers a Highway Authority to provide lighting for any highway or proposed highway for which they are or will be the Highway Authority. District Councils	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters;

	and many Parish or Town Councils also have the power to provide lighting as local lighting authorities.	Appendix 21.3 – Illumination Impact Profile
The National Network National Planning Policy Statement (NN NPS) 2014[21.3] **Health 4.79 to 4.82**	National road and rail networks and strategic rail freight interchanges have the potential to affect the health, well-being and quality of life of the population. Where the proposed project has likely significant environmental effects any environmental statement should identify and set out the assessment of any likely significant adverse health effects. The NN NPS advises that the applicant should identify measures to avoid, reduce or compensate for adverse health effects as appropriate.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
The National Planning Policy Framework (March 2012)[21.4] **Paragraph 125**	This Policy encourages good design with planning policies and decisions limiting the effect of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
Planning Practice Guidance (March 2014)[21.5] **Light Pollution** **Paragraphs 001 to 007**	This guidance advises on how to consider light within the planning system. It covers light pollution; relevant factors when considering where, when and how much light shines; and what factors are relevant when considering possible ecological effects.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
West Northamptonshire Joint Core Strategy Local Plan (Part 1) Adopted Dec 2014[21.6] **Policy BN9 – Planning for Pollution Control 10.65**	Advises that poor outdoor lighting is recognised as a source of pollution and can have an effect on dark skies. Developments that are likely to cause light pollution need to demonstrate that it has been minimised.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
SPG -South Northamptonshire Council - Light Pollution[21.7] **Whole publication**	This document sets out the Council's view on the common causes of light pollution and recommends how improvements can be made.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters;

		Appendix 21.3 – Illumination Impact Profile
SPG – Northampton County Council - Planning Out Crime In Northamptonshire 2003[21.8] **Section 11**	This document sets out the Council's view on lighting for the prevention of crime and how it needs to be taken into account at the planning stage of a development.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
ILP - PLG 04 – Guidance on Undertaking Environmental Lighting Impact Assessments[21.9] **Whole publication**	This document focuses on the lighting aspects of development applications, including design and assessment. The aim is to outline good practice in lighting design and provide practical guidance on production and assessment of lighting effects within new developments.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
Institute of Lighting Professionals – Guidance Notes for the Reduction of Obtrusive Light GN01:2011[21.10] **Whole publication**	This Guidance provides measurable design limits and recommendations to ascertain acceptability of obtrusive light levels at night.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
CIE – 150:2003 - Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations[21.11] **Whole publication**	The purpose of this Guide is to help formulate guidelines for assessing the environmental effects of outdoor lighting and to give recommended limits for relevant lighting parameters to contain the obtrusive effects of outdoor lighting within tolerable levels.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
CIE 126 (1997) Guidelines for Minimising Sky Glow[21.12] **Whole publication**	This Guide advises lighting designers and policy makers about the ways the interference by light of astronomical observations can be reduced or even avoided.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
CIE Technical Report Document 129 - 1998 Guide for lighting exterior work areas[21.13] **Whole publication**	This provides guidance for the design of lighting for exterior work areas. The objectives of lighting for exterior work areas are to ensure: efficient working conditions; safe movement and traffic; and safety and security of	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile

	people and property.	
BS5489-1: 2013 – Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas[21.14] **Whole publication**	This part of BS 5489 gives recommendations on the general principles of road lighting, and its aesthetic and technical aspects, and advises on operation and maintenance.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
BS EN 13201-2: 2015 – Road lighting – Part 2: Performance requirements[21.15] **Whole publication**	This part of this European Standard defines, according to photometric requirements, lighting classes for road lighting aiming at the visual needs of road users, and it considers environmental aspects of road lighting.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
BS EN 12464-2: 2014 – Lighting of Work Places – Part 2: Outdoor Work Places[21.16] **Whole publication**	This European standard specifies lighting requirements for outdoor work places, which meet the needs for visual comfort and performance. All usual visual tasks are considered.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
CIBSE LG1 – The Industrial Environment : 2012[1.17] **Whole publication**	This document provides guidance on lighting industrial environments. It has three objectives: to facilitate quick and accurate work; to contribute to the safety of those doing the work; and to create a good visual environment.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
Campaign to Protect Rural England (CPRE) Night Blight in the East Midlands[21.18] **Whole publication**	This document gives a broad brush indication of upwards light (sky glow) experienced within the UK. The interactive mapping tool allows specific areas and locations to be assessed with regards to a baseline condition.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
Bat Conservation Trust Bats and Lighting in the UK 2008[21.19] **Whole publication**	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 effects of lighting on bats and mitigation is suggested for various scenarios.	Appendix 21.1 – Baseline Survey; Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile
Bat Conservation Trust Artificial Lighting and Wildlife	This states that where lighting equipment utilises LED, a colour	Appendix 21.1 – Baseline Survey;

2014[21.20] **Whole publication**	correlated temperature (CCT) of lower than 4200K should be used. This spectral composition has reduced blue light and UV light content and is more in line with traditional recognised acceptable lamp sources.	Appendix 21.2 – Operational Lighting Parameters; Appendix 21.3 – Illumination Impact Profile

Licence or permit.

21.11 There are no relevant licences or permits required to construct, operate and maintain the development with regards to artificial lighting at night.

Consultation

21.12 The scope and methodology for the obtrusive light assessment, relevant constraints and sensitive receptor types were summarised to inform the Scoping Report issued to the Competent Authority (South Northampton Council - SNC) and relevant Consultees.

21.13 **Table 21.2** summarises relevant specialist topic elements of the Scoping Opinion:

Table 21.2: Summary of Scoping Opinion

Scoping Opinion section / paragraph	Summary of issue raised	Relevant section / paragraph
Landscape and Visual 3.97	Agreement with South Northamptonshire Council that a lighting assessment should be provided within the ES.	Chapter 21
Appendix 1 **Presentation of the Environmental Statement, Flexibility**	The applicant should assess the maximum potential adverse impacts… Lighting proposals should also be described.	Appendix 21.2 – Operational Lighting Parameters
Appendix 3 **South Northamptonshire Council correspondence 7 January 2016**	States the inclusion of obtrusive light within the EIA process. Provides specific reference, assessment and outputs required in relation to the design, control and assessment for light trespass (horizontal and vertical) and glare.	Appendix 21.3 – Illumination Impact Profile

Table 21.3: Summary of consultations undertaken

Consultation and date	Summary of consultation	Relevant section / paragraph

13/07/2017	**Request for existing road/highways lighting layouts, traffic flow information and luminaire types and photometry. This was required so that the street lighting around the scope Junctions could be considered in accordance with the new, proposed, junction layouts.**	**Purpose of the Assessment.**

21.14 As part of the process, Applicant project team consultation was held to provide advice on the following:

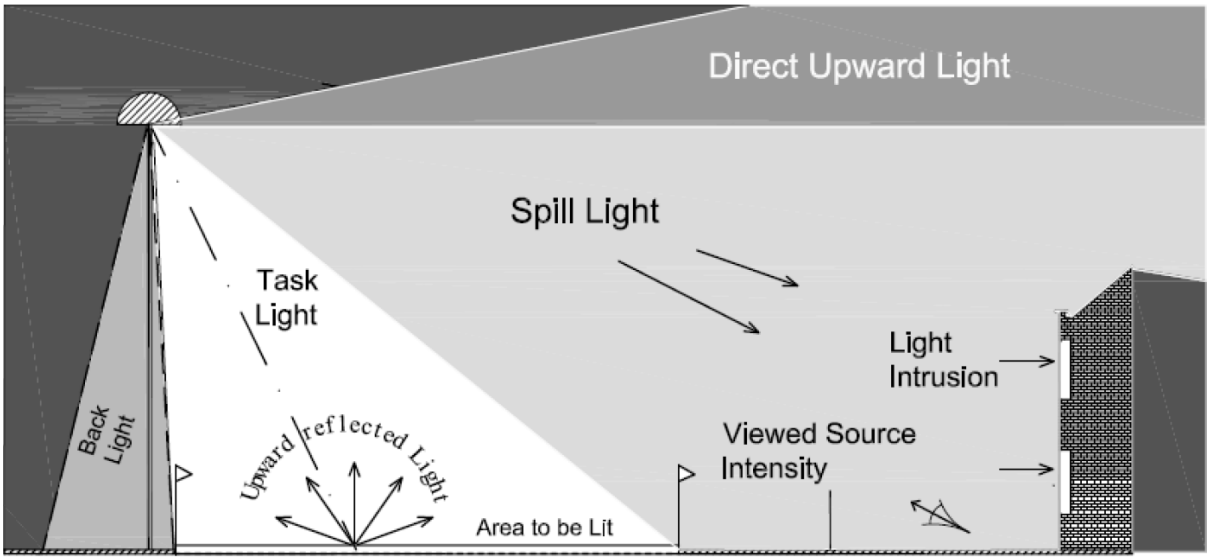
- Relevant specialist discipline constraints (ecology, landscape and heritage);
- Specific survey and assessment requirements (as part of the obtrusive light assessment) to inform the relevant associated disciplines;
- Initial overview of baseline conditions and obtrusive light effects; and
- Design evolution in relation to minimising potential obtrusive light impact in respect to the orientation and the positioning of buildings and artificially lit operations (where the demands for external lighting would be particularly concentrated).

Study Area

21.15 The Potential Development Area ('Order Limits') and nearby sensitive receptors have determined the extent of the study area for the baseline lighting survey. Based on professional judgement, the study area includes sensitive areas surrounding the Potential Development Area, such as Milton Malsorand adjacent to the Potential Development Area, that is, within 100 m of the scope boundary red line).

21.16 As discussed previously there are a number of different receptors around the site and the extent to which these are impacted by lighting at night is a function of the following –

- Distance from site
- Nature of luminaire position in relationship to receptor
- Type of luminaire, its' optical control and lamp type
- Its height above ground, mounting configuration (poll top / on a building, etc)
- Aiming angle (the ideal is that a luminaire is installed so that the area of light exit is parallel with the ground.



(Image 1 – ILP - Guidance Notes for the Reduction of Obtrusive Light GN01:2011)

21.17 Therefore the most critical sensitive receptors are those which may have a direct view towards the external lighting proposals and which may be affected during the construction and operation of the Proposed Developments.

Identification of Sensitive Receptors

21.18 The following identifies sensitive receptors which could be at risk of 'effect' from the external lighting of the Proposed Development including the upgrading of J15a.

1) Ecological (Appendix 21.1 Figure 1.2, Page 5)

- E1 to E25 – Ecological – Existing Bat Foraging and Commuting;
- C1 to C4 – Ecological – Waterbody (Grand Union Canal);
- C5 to C8 – Ecological – Waterbody (Northampton Arm).

2) Residential (Appendix 21.1, Figure 1.3, Page 6)

- R1 to R27 – Residential – Occupied Residential.

3) Heritage (Appendix **21.1 Figure 1.4, Page 7**)

- H1 to H4 – Heritage Receptors.

4) Heritage – J15a (Appendix 21a.1 Figure 1.4, Page 6)

- H5 to C11 – Heritage Receptors..

5) Rail and Highway

- T1 – Adjacent Rail - West Coast Mainline;
- T2 – Adjacent Rail – Northampton Loop;
- T3 – Adjacent Highway – A43 – Unlit;
- T4 – Adjacent Highway – Northampton Road – Partially Lit.

6) Natural

- SG1 – Natural – Direct Sky Glow.

21.19 A number of baseline sensitivity locations are identified as falling within the 'Order Limits' and being replaced / encroached upon. Therefore, the assessment of future effects is excluded for these locations.

21.20 These locations are identified as follows:

- R4 – Rathvilly Farm;
- R5 – Lodge Farm;
- R6 – Manor Farm;
- R7 – Nursery; and
- E6 to E17 – Ecology Locations

Exclusions

21.21 The closest SSSI, Roade Cutting, is approximately 0.5km south east from the Main SRFI Site and is a geological, not ecological, designation. Therefore, the SSSI is not considered further as part of this assessment.

21.22 Unless ecologically designated, Public Rights of Way (PRoW) are not considered to represent a sensitive receptor due to limited frequencies and durations of night time human use and activity. As such, human use of PRoWs are not included as part of the assessment.

21.23 Due to the expected type and nature of light effect, activity and periods of occupation existing commercial, industrial and employment developments are considered to have a negligible sensitivity and are therefore excluded from the assessment.

Baseline Surveys and Data

21.24 The approach and methodology used to assess the baseline lighting conditions within the Study Area involved a desk study and a baseline lighting survey.

21.25 **Appendix 21.1** and Appendix 21.1a (J15a) provide the detailed baseline survey information..

Lighting Survey Methodology

21.26 Light Readings (illuminance levels in Lux) were taken using a hand held Konica Minolta T-10A illuminance meter. As per industry standard methodology, all horizontal lux readings were taken on the ground and all vertical lux readings were taken at arm's length from a standing position; approximately 1.5m above ground.

21.27 Photographs were taken using a Canon 600D DSLR camera. Exposure times are variable.

Baseline Conditions

Main SRFI site

21.28 The area around the 'Order Limits' is, as in many rural areas (rural being defined in the ILP's guidance on light pollution as 'Village or relatively dark outer suburban locations'), lit at night with a variety of artificial luminaire types and lamp sources which have been installed over a number of years for a variety of reasons. Some are required, such as road lighting, while others are installed for work, safety or leisure reasons. Whatever the reason artificial light at night is part of any rural community's common experience of the road networks and commercial premises in their local area. This section, therefore, describes the results of the baseline lighting survey undertaken on 12th and 19th April 2016 and 26th and 27th May 2017 for J15a and includes information relating to the existing lighting on and surrounding the 'Order Limits' and the Junction and provides site specific data on existing illumination.

21.29 The detailed results and findings of the survey are included in **Appendix 21.1 and 21.1a**.

Overview of the Main SRFI Site and Adjacent Area

21.30 Much of the existing 'Order Limits' that define the Main SRFI Site is unlit and can be described as being rural with rural surroundings.

21.31 Although localised, existing lighting elements to the developed areas surrounding the 'Order Limits' are visible in the night scene and contribute to light trespass and sky glow which already characterises the area.

21.32 The main contributors are outside of the 'Order Limits' and are due to highway lighting on the M1 motorway and surrounding highway junctions and roundabouts, Northampton, industrial complexes to the East of the M1, and localised lighting equipment to the village of Milton Malsor to the North and Blisworth to the South.

21.33 Within the 'Order Limits', the lit section of highway (Northampton/Towcester Road) intersects and runs North to South through the centre of the 'Order Limits'. Partial sections of the highway were observed as being unlit at the time of survey and is attributed to current engineering works being undertaken by the local lighting authority. Illuminated sections are notable in terms of visibility and obtrusive light to local and abutted areas and are considered to be the installed equivalent of an S2/S3 classification (subsidiary road with a typical speed of main user ≤ 30 mph - BS5489-1: 2013 – Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas).

21.34 **Table 21.4 below** provides a summary of the baseline conditions and the relationship to the 'Order Limits' for the Residential receptor locations.

21.35 Baseline conditions for the Ecological and Heritage receptor locations are provided within **Appendix 21.1.** It should be noted that Landscape viewpoints are not considered in this assessment as a 'view' towards a lit scene does not constitute light pollution. An example of this can be seen by the site picture entitled 'View from Milton Crossing Foot Bridge of PDA' on page 30 of Appendix 21.1.

21.36 In this night-time image artificially lit elements can be seen in the far distance but this does not mean that artificial light is 'encroaching' on the viewer. However the visual impact will need to be assessed and would be qualified by photometrically accurate LVIA's of the 'Proposed Development' at night based on the artificial lighting information in Appendix 21.2.

Table 21.4: Baseline Conditions - Residential Receptors

Sensitive Receptor	Peak Illuminance (Lux)	Environmental Zone Classification and ILP Threshold Limits	Conditions Relative to the Site	Existing Lighting Guidance Compliant
R1	Vertical @ 1.5m AFL – 0.25lux	E2 - (Village or relatively dark outer suburban locations). Light into Window - 5 lux pre curfew / 1 lux post curfew Source Intensity – 7500 cd pre curfew / 500 lux post curfew	<100m to the 'Order Limits' creates a degree of potential for light disturbance.	Yes
R2, R17, R8–R9, R11–R13, R21–R23	Vertical @ 1.5m AFL – 0.13lux			
R10	Vertical @ 1.5m AFL – 2.72lux			No, peak vertical illuminance 2.72lux. Associated with street lighting.
R3, R14–R16, R18–R20, R24–R27	Vertical @ 1.5m AFL – 0.13lux		>100m from the 'Order Limits' creates limited potential for light disturbance.	Yes
R4–R7	Vertical @ 1.5m AFL – 0.13lux	E2 - (Village or relatively dark outer suburban locations). Light into Window - 5 lux pre curfew / 1 lux post curfew Source Intensity – 7500 cd pre curfew / 500 lux post curfew	Within the 'Order Limits' and replaces sensitive receptor location, as such this is no longer considered as part of the assessment.	Yes

7) Natural – Direct Sky Glow

21.37 When considering direct sky glow, as a result of direct upwards light, there is the possibility of a site wide effect being visible from darker environments.

21.38 Direct sky glow cannot be measured. The baseline is assessed relative to visual baseline survey conditions and published CPRE – Night Blight data in the East Midlands.

21.39 Taken on a local scale, existing saturated sky glow is notable from major urban development within Northampton and its associated conurbation.

21.40 Under normal circumstances the sensitivity of the 'Order Limits' to direct upwards light, with similar conditions, would be considered to be Low. However, due to the presence of flying nocturnal species and the potential detrimental effect on predator evasion the sensitivity of the Site is considered to be moderate.

Environmental Zone

21.41 Assessment of the designation, use, habitat and external lighting condition dictates the classification of Environmental Zones across the Study Area.

21.42 The Environmental Zones prescribe limiting obtrusive light guidance values published by the Institute of Lighting Professionals ILP for obtrusive light (residential) - ILP Guidance Notes for the Reduction of Obtrusive Light (2011) [21.10].

21.43 Areas surrounding the 'Order Limits' are considered to be lit to the equivalent of an E2 Zone classification (Rural, low district brightness – Village or relatively dark outer suburban locations).

21.44 It is considered this is a fair representation of the existing Environmental Zone classifications and, should the proposed lighting requirements proceed within these parameters, the overall obtrusive light effect is regarded to be no greater than what is currently experienced across and around the 'Order Limits'.

Do Nothing Scenario

21.45 Should the Proposed Development not proceed there will be no change to the Environmental Zone Classifications.

Future Baseline Scenario

21.46 Before the 'Proposed Development' is built it is likely that there will be no change to the existing 2016/17 condition as the site is currently largely fields with a few small dwelling/light industrial areas. However there are a number of other development sites in the area, which are qualified later in this Chapter under the title 'Cumulative Assessment: Inter-Project Effects' and these sites may affect the future baseline scenario between the existing 2016/17 condition and the anticipated date of commencement of construction of the Proposed Development

21.47 If the 'Proposed Development' does proceed it is likely there will be a period, during construction, when there will be a minor/negative impact (although this could be reduced to negligible with the right mitigation measures) before the final scheme is installed.

Overview of J15a

21.48 The existing junction is lit with a variety of lighting products, installed over time as the road system and associated roundabouts, have been upgraded. A number of lit highways lighting conditions currently exist and can be seen in the site photographs in Appendix 21.1a which show a number of images of highways lighting on the M1 and the A43. The areas around the junction is mainly unlit and can be described as being rural with rural surroundings.

21.49 Although localised, existing lighting elements to the developed areas surrounding the 'Order Limits' are visible in the night scene and contribute to light trespass and sky glow which already characterises the area.

21.50 **Table 21.5 below** provides a summary of the baseline conditions and the relationship to J15a for the Ecological and Heritage receptor locations.

Table 21.5: Baseline Conditions – Ecological and Heritage Receptors

Sensitive Receptor	Peak Illuminance (Lux)	Environmental Zone Classification and ILP Threshold Limits	Conditions Relative to the Junction	Existing Lighting Guidance Compliant
C9-C10, C13-C15, C17-C18, C21-C33	Vertical @ 1.5m AFL– 0.1lux	E2 - (Village or relatively dark outer suburban locations).	<100m to the Junction creates a degree of potential for light disturbance.	Yes
C11-C12, C16, C19–C20	Vertical @ 1.5m AFL- 4.85lux			No, peak vertical illuminance 4.85lux. Associated with street lighting.
H5-H11	Vertical @ 1.5m AFL – 0.1lux			Yes

8) Natural – Direct Sky Glow

21.51 When considering direct sky glow, as a result of direct upwards light, there is the possibility of a site wide effect being visible from darker environments.

21.52 Direct sky glow cannot be measured. The baseline is assessed relative to visual baseline survey conditions and published CPRE – Night Blight data in the East Midlands.

21.53 Taken on a local scale, existing saturated sky glow is notable from major urban development within Northampton and its associated conurbation.

Environmental Zone

21.54 Assessment of the designation, use, habitat and external lighting condition dictates the classification of Environmental Zones across the Study Area.

21.55 The Environmental Zones prescribe limiting obtrusive light guidance values published by the Institute of Lighting Professionals ILP for obtrusive light (residential) - ILP Guidance Notes for the Reduction of Obtrusive Light (2011) [21.10].

21.56 Areas surrounding J15a are considered to be lit to the equivalent of an E2 Zone classification (Rural, low district brightness – Village or relatively dark outer suburban locations).

21.57 It is considered this is a fair representation of the existing Environmental Zone classifications and, should the proposed lighting requirements proceed within these parameters, the overall obtrusive light effect is regarded to be no greater than what is currently experienced across J15a.

Do Nothing Scenario

21.58 Should the Proposed Development not proceed there will be no change to the Environmental Zone Classifications.

Future Baseline Scenario

21.59 Before the upgrading of J15a commences due to the Proposed Development it is unlikely that the existing 2016/17 condition will change as there is no planned road configuration upgrade of this junction other than that relating to the Proposed Development however it is possible that some of the light fittings on the A5123 might be upgraded to LED sources.

21.60 If the upgrading of J15a does proceed it is likely there will be a period, during construction, when there will be a minor/negative impact (although this could be reduced to negligible with the right mitigation measures) before the final scheme is installed.

Climate Change

21.61 With respect to climate change it is not anticipated that the construction, operational and decommissioning phases will be adversely or significantly affected in terms of the provision of artificial light within the 'Order Limits'.

21.62 For a degree of protection against climate change the proposed use of LED (light emitting diodes) results in a reduction of power usage and increased life span (being typically 100,000 hours) over traditional high pressure sodium / metal halide technology (being typically 10,000 to 20,000 hours).

21.63 Similarly, the extinguishing of non-essential lighting operations will further reduce the power usage and frequency of replacement.

Method of Assessment

21.64 A desk study has been undertaken to identify relevant legislation, national planning policy, good practice guidance, local designations and relevant local planning policy in relation to lighting following the Institute of Lighting Professionals – Guidance Notes for the Reduction of Obtrusive Light GN01: 2011[21.10], CIE 150 (2003) [21.11] and CIE 126 (1997) [21.12] guidance.

Lighting Assessment Methodology

21.65 The objective of the study is to assess the Proposed Development and upgrade of J15a in terms of obtrusive light effects emitted from a generic Operational Lighting Parameters (Appendix 21.2 and 21.2a) but qualifying any light pollution issues through an Illumination Impact Profile (IIP) (Appendix 21.3 and 21.3a).

21.66 The assessment is in relation to published guidance limits, and the nature, use and sensitivity of the existing and retained receiving environment.

21.67 Where published guidance limits are available the following provides an overview in relation to the method of assessment for identified sensitivities.

Residential Receptors R1 to R27 - Environmental Zone and Guidance Values

21.68 For retained and occupied residential receptors the lighting assessment has followed the methodology outlined in CIE 126 (1997) [21.12] and CIE 150 (2003) [21.11] guidance. The criteria used to assess the magnitude and significance of the effects of installed lighting have been derived from CIE 150 (2003) [21.11], with consideration also given to the Institute of Lighting Professionals – Guidance Notes for the Reduction of Obtrusive Light GN01: 2011[21.10]. Here reference is made to the Environmental Zone Criteria for light nuisance into windows (measured in Lux) as defined as:

- E0: Protected surroundings, dark landscapes – UNESCO Starlight reserves, IDA Dark Sky Parks;
- E1: Natural surroundings, intrinsically dark landscapes - National Parks, Areas of Outstanding Natural Beauty etc.;
- **E2: Rural surroundings, low district brightness areas – Village or relatively dark outer suburban locations; - 'Order Limits' and J15a**
- E3: Suburban, moderate district brightness – small town centres or suburban locations; and
- E4: Urban, high district brightness – Town/city centres with high levels of night-time activity.

21.69 The ILP guideline values for the Environmental Zones are outlined in **Table 21.6.**

Table 21.6: ILP Guidance Notes for the Reduction of Obtrusive Light (2011)

Environmental Zone	Sky Glow ULR (Max %) (1)	Light into Windows EV (2)		Source Intensity I (cd) (3)		Building Luminance (4) L (cd/m2)
		Pre Curfew	Post Curfew	Pre Curfew	Post Curfew	Ave. Pre Curfew
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	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

21.70 Notes to Table 21.6:

21.71 Where:

ULR (Upward Light Ratio) = 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

L = Luminance cd/m^2

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.

Natural – Direct Sky Glow Receptor SG1

21.72 As per Table 21.6, the ILP Guidance Notes for the Reduction of Obtrusive Light (2011) [21.10] provides limiting sky glow percentages relative to the Environmental Zone category (E0 to E4). This is assessed across the 'Order Limits' and J15a relative to the overarching Environmental Zone classification for intended and existing artificially lit areas. In the case of the 'Order Limits' and J15a this is a maximum Upward Light Ratio (ULR) of 2.5%. It should be noted that, from E2 Zones and above, there are limits which should not be exceeded rather than expecting an industrial development of this nature to have no upward light.

Railway Receptors

21.73 BS 5489-1:2013[21.14] provides guidance with respect to minimising light trespass and glare but does not state threshold limits. The following matters will influence the lighting strategy approach in the field of view of a train driver:

- Columns should be placed as far away as practicable from a rail bridge or the fence line of railway track;
- Glare should be minimized for the train driver by the use of luminaires conforming to an appropriate G class selected from BS EN 13201-2:2015[21.15] or shielding.
- Colours in a lighting scheme should not conflict or cause confusion with colours used for signal lights.

21.74 Professional judgement is used to assess the Operational Lighting Parameters and to inform detailed design requirements.

Highway Receptors

21.75 Direct glare from the Proposed Development should be controlled and design should provide for the appropriate G class luminaires selected from BS EN 13201-2:2015[21.15] to ensure adequate control of glare.

21.76 Professional judgement is used to assess the Operational Lighting Parameters and inform detailed design requirements.

Ecology Receptors E1 to E25 - Bat Activity, Waterbodies – Grand Union Canal (C1 – C4), Northampton Arm (C5 – C8) and Grand Union Canal / Northampton Arm (towpath) (C9 – C33)

21.77 The location of ecological sensitive receptors of relevance to this Chapter have been identified from consultation with the project team.

21.78

21.79 **Appendix 21.3 and 21.3a** presents information regarding baseline and post development operational illuminance effects for ecological and waterbody locations. This has informed the assessment presented within **Chapter 16: Ecology and Nature Conservation**.

21.80 A summary overview is provided within the Conclusion of the Non-Technical Summary.

Heritage Receptors H1 to H11

21.81 The location of heritage sensitive receptors of relevance to this Chapter have been identified from consultation with the project team.

21.82 **Appendix 21.3 and 21.3a** presents information regarding baseline and post development operational illuminance effects for heritage locations. This is provided to inform the assessment presented within **Chapter 12: Archaeology and Heritage.**

21.83 Where possible post-development light levels should be as close to the mean occurring light levels recorded at heritage locations on the site pre-development. Where this is not possible, a precautionary approach should be taken to keep light levels as low as possible.

21.84 Where **Table 21.7** provides the definition and criteria for the scale of sensitivities, in the absence of published policy and/or good practice this is based on professional judgement and derivation.

Table 21.7: Defining Sensitivity of Receptor

Sensitivity	Definition
High	The receptor has little ability to absorb change in artificial light conditions without fundamentally altering its present character, or is of international or national importance.
Moderate	The receptor has moderate capacity to absorb change in artificial light conditions without significantly altering its present character, or is of high importance.
Low	The receptor is tolerant of change in artificial light conditions without detriment to its character, or is of low or local importance.

21.85 Due to the expected type and nature of light effect, activity and periods of occupation existing commercial, industrial and employment developments are considered to have a nil sensitivity and are therefore excluded from the assessment.

Sensitivity of Receptor

21.86 Professional judgement has been used to apply receptor sensitivity for different types of use contained within the part of the Study Area that fall beyond the Potential Development Area. These are as follows:

- Existing Residential – High Sensitivity;
- Natural – Direct Sky Glow – Moderate Sensitivity.
- T1 – Adjacent Rail - West Coast Mainline – Moderate Sensitivity;
- T2 – Adjacent Rail – Northampton Loop – Moderate Sensitivity;
- T3 – Adjacent Highway – A43 – Unlit – Moderate Sensitivity;
- T4 – Adjacent Highway – Northampton Road – Partially Lit – Low Sensitivity.

21.87 Ecological and Heritage receptor sensitivities are determined within the corresponding Chapters.

Effect Duration

21.88 In determining the overall effect magnitude distinction is made between temporary and permanent effects based on the following timescale:

- Short Term – the effects from lighting would be of short duration and would not last more than 0 to 5 years from the commencement of the works;
- Medium Term – the effects from the lighting would take 5 to 10 years to be mitigated; and
- Long Term – the effects from the lighting would be reasonably mitigated over a long period of time (10 years or more) and includes permanent effects.

Magnitude of Effect

Evaluation Methodology

21.89 The assessment of potential effects, as a result of the future artificial lighting associated with the Proposed Development, will take into account both the construction / decommissioning and operational phases.

21.90 In the absence of published methodology for the evaluation of the Magnitude of Effect the following, derived by Hoare Lea, provides a basis for the evaluations:

- As defined within **Table 21.8** for the construction and decommissioning phases the Magnitude of Effect is assessed through professional judgement in relation to the distance of the receptor location from the 'Order Limits' and the precautionary construction lighting activity undertaken within the vicinity of the receptor location (principally based on a precautionary maximum adverse effect as a result of temporary (limited to activity periods) floodlighting).

- As defined within **Table 21.9** for the operational phase, the Magnitude of Effect is quantitatively assessed for each receptor location, relative to the nature and baseline condition of the sensitive receptor, the potential obtrusive light effect and guidance limitations for the relevant Environmental Zone as set out in **Table 21.1.**

- Similarly, where an effect is solely relative to design guidance recommendations (Rail and Highway Receptors), professional judgement of the embedded mitigation measures is given towards the Magnitude of Effect.

21.91 Where applicable and where measured baseline conditions are available (i.e. – measurable and accessible horizontal and vertical light conditions) the Magnitude of Effect relates to the percentage difference between measured baseline value to threshold guidance and resultant value to threshold guidance.

21.92 Where baseline conditions are not measurable (Direct Sky Glow and Glare) the Magnitude of Effect is determined by the calculated percentage increase (from the future artificial lighting developments) over threshold guidance for the relevant Environmental Zone as set out in **Table 21.1.**

21.93 In the absence of a published policy / methodology this definition and criteria for the Magnitude of Effect is based on the Hoare Lea definitions outlined within the following **Tables 21.7** and **21.8.**

Table 21.8: Defining Magnitude of Effect – Construction and Decommissioning

Magnitude of Effect	Definition of Magnitude
High	Construction and Decommissioning Obtrusive Light – Poorly aimed temporary floodlighting within 0m to 25m of receptor location.
Medium	Construction and Decommissioning Obtrusive Light – Poorly aimed temporary floodlighting within 25m to 50m of receptor location.
Low	Construction and Decommissioning Obtrusive Light – Poorly aimed temporary floodlighting within 50m to 75m of receptor location.
Negligible	Construction and Decommissioning Obtrusive Light – Poorly aimed temporary floodlighting within of 75m 100m from receptor location

Table 21.9: Defining Magnitude of Effect – Operation

Magnitude of Effect	Horizontal and Vertical Light Trespass (Lux)	Direct Sky Glow ULR%	Glare Luminaire Source intensity
	Percentage Change Between Baseline Value and Baseline Value + Development	Percentage increase over guidance limits for the Environmental Zone (Baseline value not available).	Percentage increase over guidance limits for the Environmental Zone. (Baseline value not available).
High	75 to 100%	75 to 100%	75 to 100%
Medium	45 to 75%	45 to 75%	45 to 75%
Low	10 to 45%	10 to 45%	10 to 45%
Negligible	0 to 10%	0 to 10 %	0 to 10 %

Significance Criteria

21.94 The significance of an environmental effect is determined by the interaction of the Magnitude of Effect and receptor sensitivity, whereby the effects can be beneficial or adverse.

21.95 The overall Significance of Effect at each receptor (of relevance to this chapter) is evaluated using the Hoare Lea defined Effect Significance Matrix as set out in **Table 21.10** and the factors below:

- The value of the resource (international, national, regional and local level importance);
- The effect magnitude;
- The duration involved; and
- The sensitivity of receptors.

Table 21.10: Effect Significance Matrix

Assessing Significance of Effects			
Magnitude of Effect	Sensitivity		
	High	Moderate	Low
High	Major Adverse / Beneficial	Moderate Adverse / Beneficial	Moderate Adverse / Beneficial

Medium	Moderate Adverse / Beneficial	Moderate Adverse / Beneficial	Minor Adverse / Beneficial
Low	Moderate Adverse / Beneficial	Minor Adverse / Beneficial	Negligible
Negligible	Negligible	Negligible	Negligible

21.96 The following provides a definition for varying degrees of significance:

- Major Beneficial: Major decrease in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor, resulting in a noticeable or major improvement in baseline conditions;
- Moderate Beneficial: Moderate decrease in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor, resulting in a moderate improvement in the current baseline conditions;
- Minor Beneficial: Minor decrease in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor, resulting in a minor perceptible improvement in baseline conditions;
- Negligible: Negligible or barely perceptible change in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor and would cause a negligible or barely discernible change to current baseline conditions;
- Minor Adverse: Minor increase in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor, would cause a minor perceptible change in baseline conditions;
- Moderate Adverse: Moderate increase in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor, and would result in a noticeable effect on baseline conditions; and
- Major Adverse: Major increase in the levels of obtrusive light onto surrounding areas and illuminance levels at the receptor, and would result in a major effect on baseline conditions.

21.97 While effects are considered to fall into one of four effect categories ranging from 'negligible', 'minor', 'moderate', 'major' in the effects matrix presented in **Table 21.10**, it is only those shaded effects that fall within the range of 'moderate' through to 'major' categories that are considered to be the significant environmental effects arising from the construction / decommissioning and operation phases of the Proposed Development.

Embedded Mitigation

Main SRFI site & J15a Works

Construction, Operational and Decommissioning Phases

21.98 In order to reduce the effects of lighting during the construction and decommissioning phases on the sensitive receptors, best practise measures as recommended by the CIE, ILP, CIRIA and Health and Safety Executive (HSE) will be implemented as part of a Construction Environmental Management Plan (CEMP).

21.99 For the operational phase care should be taken to minimise light spill and glare from any lighting installed by ensuring the correct luminaire is selected and installed correctly in line with the following recommendations within CIE 150 (2003)[21.11] and ILP Guidance Notes for the Reduction of Light Pollution 2011[21.10]. Mitigation measures for each phase are as follows

Table 21.11: Embedded Mitigation Measures

Potential effect Construction	Proposed mitigation	Means of implementation	Mechanism for securing mitigation and DCO reference (where applicable)
Light Pollution emissions impacting off-site residential and commercial / industrial site users and members of the public	All luminaires used around the perimeter of the 'Order Limits' should be mounted within the 'Order Limits', so that the main photometric distribution of the luminaire will be towards site works, keeping all light within the boundary and preventing artificial light spilling outside of this; Wherever possible consideration should be given to minimise the need for lighting in areas of ecology habitat or in areas situated directly adjacent to ecology habitat. Should H&S require artificial lighting to these areas all luminaires should be directed away from the habitat area; Wherever possible and subject to landscape design, natural and solid screen perimeters should be included to reduce obtrusive light to adjacent sensitive areas and light should be extinguished when not in use;	Implementation of CEMP	A Lighting Management Plan should be prepared which includes periodic monitoring and makes provision for necessary remedial works, and deals with the control of lighting associated with night-time construction activities.

	Wherever possible, all artificial lighting used during the construction phase should be directed below the horizontal to prevent unwanted upward light; When not in use all artificial lighting used for construction should be extinguished. Modern, high efficiency lamps and luminaires should be employed throughout the 'Order Limits' to be as energy efficient as possible; Illuminance levels should be designed in accordance with BS EN 12464-2: 2014 and CIE 129; the areas should not be over lit;		
Operation			
Light Pollution emissions impacting off-site residential and commercial / industrial site users and members of the public	Detailed design to ensure the use of controlled light distribution, optimised optics (flat glass - controlled light distribution below the horizontal) and considered luminaire positioning are employed; All luminaires used around the perimeter of the 'Order Limits' should be mounted within the 'Order Limits', so that the main photometric distribution of the luminaire will be towards the task area, keeping all light within the boundary; To minimise potential obtrusive light trespass, glare and visual effect it is recommended that minimal column heights are considered in all applicable locations; Modern, LED luminaires should be employed to minimise the obtrusive light spill footprint and be as energy	Submission of Detail Design and Construction (RIBA Stage 4 to 6) for the proposed lighting design to the appropriate authorities	Final luminaire types and positions together with a full IIP which qualifies the light pollution impact on sensitive receptors is in accordance with this submission which may include a post installation day and night-time survey to ensure compliance

efficient as possible;

Operational light levels to be designed to a minimum required for H&S and not to over light. This is to be achieved by employing a colour rendering of Ra > 60 and an S/P ratio > 1.2;

To minimise disruption to bats, light sources utilised should employ lamps with minimal or zero ultra violet (UV) emission (insects are attracted to UV). Hence, it may be applicable to consider LED light sources (which have limited / zero UV content) rather than ceramic metal halide and other 'white light' discharge lamps. Recent BCT Interim guidance 2014 states that LED with a CCT of lower than 4200K should be used;

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 switched off or, wherever possible, dimmed at a pre-determined curfew time (suggested as 23:00 in accordance with ILP Guidance Notes);

It is not advised that movement detectors are used as a control of operation as this often causes greater adverse visual effect (on / off / on patterns) due to ecology and other external factors affecting the sensors. Control of operation for future development should be based on automated methodologies set out within the design process;

Where applicable, glare controlling louvres and light shields to be applied post installation;

	Column and luminaires to be of a colour and finish to 'blend' in to the day time landscape		
Decommissioning			
Light Pollution emissions impacting off-site residential and commercial / industrial site users and members of the public	As per Construction	As per Construction	As per Construction
Cumulative			
Light Pollution emissions impacting off-site residential and commercial / industrial site users and members of the public	N/A	N/A	N/A

21.100 Standard, good practise industry design measures have been embedded within the operational assessment design process, these include:

- Wherever possible, ensuring the use of controlled light distribution, optimised optics (flat glass - controlled light distribution below the horizontal) and considered luminaire positioning / minimal heights and tilting angles are employed;
- Luminaire selection based on inherent glare control to an appropriate G class ranging between 4 and 6;
- Modern, LED luminaires to minimise the obtrusive light spill footprint and be as energy efficient as possible;

- All luminaires used around the perimeter of the 'Order Limits' are mounted within the site, so that the main photometric distribution of the luminaire will be towards the task area only;

- Wherever possible, adopting a light quality that minimises disruption to existing ecological systems in the form of 'LED' light sources (<4200K) which emit minimal UV and blue light.

- Columns are placed as far away as practicable from a rail bridge or the fence line of railway track; and

- Use of warm / neutral white light avoids conflict with rail signal lights being green, yellow and red); and

- Design evolution (during consultation) in relation to minimising potential obtrusive light impact in respect to the orientation and the positioning of buildings and artificially lit operations (where the demands for external lighting would be particularly concentrated).

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21.101 Standard, good practise industry design measures have been embedded within the operational assessment design process, these include:

- Wherever possible, ensuring the use of controlled light distribution, optimised optics (flat glass - controlled light distribution below the horizontal) and considered luminaire positioning / minimal heights and tilting angles are employed;

- Luminaire selection based on inherent glare control to an appropriate G class ranging between 4 and 6;

- Modern, LED luminaires to minimise the obtrusive light spill footprint and be as energy efficient as possible;

- Wherever possible, adopting a light quality that minimises disruption to existing ecological systems in the form of 'LED' light sources (<4200K) which emit minimal UV and blue light; and

- Use of warm / neutral white light avoids conflict with rail signal lights being green, yellow and red).

Assessment of Construction and Decommissioning Phase Effects

Main SRFI site

21.102 The CIE Technical Report Document 129 - 1998[21.13] Guide for lighting exterior work areas states that lighting on construction sites is typically required as part of on-site security and

health and safety requirements. This publication also provides guidance relating to illuminance criteria, glare control and environmental aspects.

21.103 The construction phasing period is proposed to run from 2019 until 2029 (with first operation in 2021).During these construction operations, it is expected that there will be a degree of night-time working and associated floodlighting.

21.104 Depending on the intensity and location of the activities it is considered that effects are likely to be temporary (limited to activity periods) and, given the construction period, long term in duration at any given receptor.

21.105 The following provides a description of the potential construction phase impacts (pre mitigation) for the following sensitive receptors:

- Residential (not replaced by the 'Order Limits');
- Natural - Direct sky glow;
- Rail; and
- Highway

21.106 As defined within **Table 21.8** the Magnitude of Effect is assessed through professional judgement in relation to the distance of the receptor location from the 'Order Limits' and the precautionary construction lighting activity undertaken within the vicinity of the receptor location (principally based on a precautionary maximum adverse effect as a result of temporary (limited to activity periods) floodlighting). Any construction lighting will follow the phasing of the project which given the nature of the development will, in turn, be driven by economic factors. It is therefore not possible to qualify an overall Magnitude of Effect from construction.

21.107 Regarding ecological / waterbody and heritage receptors the significance of effect as a result of construction lighting is assessed within the relevant Chapters.

Potential Effect on Residential Receptors

21.108 Where an occupied residential location is outside of a professionally judged and precautionary 100m zone (**Table 21.8**), from the 'Order Limits', it is considered unlikely that obtrusive light conditions will cause an adverse effect and are therefore scoped out from this assessment.

21.109 As a result, pre-mitigation effects on the following residential receptors (that fall within a 100m zone and which may receive an equal or exceed a negligible magnitude of effect) are assessed.

9) Residential R1, R8, R10 and R13

21.110 These receptors are within 25m from the 'Order Limits' boundary and potential obtrusive light from poorly controlled temporary floodlights could give rise to an adverse effect compared with the existing baseline during the hours of darkness.

- R1: Properties on Barn Lane
- R8: Gaytonway / Spring Gardens / Parley Pole / Woodbury
- R10: Property adjacent to James King Plant
- R13: Terraced properties

21.111 Based on professional judgement, the magnitude of effect is likely to be **high** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **major adverse** effect.

10) Residential R9, R11, R12 and R22

21.112 These receptors are within the range of 25m to 50m from the 'Order Limits' boundary and potential obtrusive light from poorly controlled temporary floodlights could give rise to an adverse effect compared with the existing baseline during the hours of darkness.

- R9: Deveron House
- R11: Property adjacent to J B J Business Park
- R12: Property within Youngs Nursery
- R21: Properties adjacent to The Old Toll House – Blisworth Arm

21.113 Based on professional judgement, the magnitude of effect is likely to be **medium** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **moderate adverse** effect.

11) Residential R2, R17, R21 and R23

21.114 These receptors are within the range of 50m to 75m from the 'Order Limits' boundary and potential obtrusive light from poorly controlled temporary floodlights could give rise to an adverse effect compared with the existing baseline during the hours of darkness.

- R2: Properties on Rectory Lane
- R17: Properties on Station Road
- R21: Blisworth Marina

- R23: Gayton Marina

21.115 Based on professional judgement, the magnitude of effect is likely to be **low** (prior to mitigation), due to their location within an E2 zone, which would result in a direct, temporary (limited to activity periods), short to medium term and local **minor adverse** effect, which is not significant.

Potential Effect on Natural Receptors – Direct Sky Glow

12) Sensitive Receptor SG1 – Direct Sky Glow

21.116 Poorly aimed temporary floodlights and unshielded security lighting could emit direct upwards light creating an increase in direct sky glow for the 'Order Limits'.

21.117 Based on professional judgement, the magnitude of effect is likely to be **low** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and district **minor adverse** effect as a result of uncontrolled upwards light spill, which is not significant

Potential Effect on Rail and Highway Receptors

13) Potential Effect on Rail (T1 and T2)

14) The West Coast Mainline (T1)

21.118 The West Coast Mainline runs directly adjacent to and partially within the southern edge of the 'Order Limits' boundary.

21.119 The notable location where potential activities could give rise to an adverse effect compared with the existing baseline during the hours of darkness of track use relate to the potential express freight cross-dock platform.

21.120 Although light colours will not conflict with rail operations (warm / neutral white only), based on professional judgement the magnitude of effect is likely to be **high** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **moderate adverse** effect as a result of potential light trespass and glare.

15) Northampton Loop (T2)

21.121 The Northampton Loop runs within the eastern edge boundary of the 'Order Limits' and due to the immediate vicinity of activities (in relation to the proposed Intermodal Terminal) light trespass and glare could give rise to an adverse effect compared with the existing baseline during the hours of darkness of track use.

21.122 Although light colours will not conflict with rail operations (warm / neutral white only), based on professional judgement the magnitude of effect is likely to be **high** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **moderate adverse** effect as a result of potential light trespass and glare.

16) Potential Effect on Highway (T3 and T4)

17) A43 Highway (T3)

21.123 The currently unlit A43 highway falls within the western 'Order Limits' boundary, where proposed developments within the Order Limits, include a new access roundabout junction and associated slip roads for the 'Order Limits' access.

21.124 Illuminated construction activities would likely be limited and based on localised temporary (limited to activity period) floodlights, which if poorly aimed and controlled could become a cause of glare to the currently unlit highway.

21.125 Based on professional judgement, the magnitude of effect is likely to be **high** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **moderate adverse** effect as a result of potential glare.

18) Northampton Road (T4)

21.126 Being partially lit (at the time of survey) the Northampton Road runs north to south through the 'Order Limits'.

21.127 The notable locations would be construction activities in relation to the proposed emergency vehicular access and pedestrian / cyclist access route provision between 'Order Limits' main access roadway and the Northampton Road. Where, artificially lit activities would likely be based on localised temporary (limited to activity periods) floodlights, which if poorly aimed and controlled could become a cause of glare to the currently unlit / partially lit highway.

21.128 Based on professional judgement, the magnitude of effect is likely to be **high** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **minor adverse** effect as a result of potential glare, which is not significant.

21.129 **Table 21.10** provides an overview of the pre-mitigation effects for the identified sensitive receptors (of relevance to this chapter) where a pre mitigation effect has been identified to exceed negligible.

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21.130 During the construction operations, it is expected that there will be a degree of night-time working and associated floodlighting.

21.131 Depending on the intensity and location of the activities it is considered that effects are likely to be temporary (limited to activity periods) and short to medium term in duration at any given receptor.

21.132 The following provides a description of the potential construction phase impacts (pre mitigation) for the following sensitive receptors:

- Residential;

- Natural - Direct sky glow; and
- Highway

21.133 As defined within **Table 21.8** the Magnitude of Effect is assessed through professional judgement in relation to the distance of the receptor location from the site boundary for the highway works and the precautionary construction lighting activity undertaken within the vicinity of the receptor location (principally based on a precautionary maximum adverse effect as a result of temporary (limited to activity periods) floodlighting).

21.134 Regarding ecological / waterbody and heritage receptors the significance of effect as a result of construction lighting is assessed within the relevant Chapters.

Potential Effect on Residential Receptors

21.135 No occupied residential locations are noted be inside of a professionally judged and precautionary 100m zone (**Table 21.7**), from the highway site works boundary. Therefore, it is considered unlikely that obtrusive light conditions will cause an adverse effect on any residential receptors.

Potential Effect on Natural Receptors – Direct Sky Glow

19) Sensitive Receptor SG1 – Direct Sky Glow

21.136 Poorly aimed temporary floodlights and unshielded security lighting could emit direct upwards light creating an increase in direct sky glow for the 'Order Limits'.

21.137 Based on professional judgement, the magnitude of effect is likely to be **low** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and district **minor adverse** effect as a result of uncontrolled upwards light spill, which is not significant.

Potential Effect on Highway Receptors

20) Potential Effect on Highway (T5 and T6)

21.138 The A43 and A5123 highways are currently partially lit near the existing M1 Junction15a access roundabouts.

21.139 Any illuminated highway construction activities will be carried out by a specialist construction contractor who is familiar with the requirements of providing suitable temporary lighting that minimises glare to existing road users.

21.140 Based on professional judgement and the provision of suitable lighting, the magnitude of effect is likely to be **negligible** (prior to mitigation) which would result in a direct, temporary (limited to activity periods), short to medium term and local **negligible** effect as a result of potential glare.

21.141 **Table 21.10** provides an overview of the pre-mitigation effects for the identified sensitive receptors (of relevance to this chapter) where a pre mitigation effect has been identified to exceed negligible.

Assessment of Operational Phase Effects

Main SRFI site

21.142 The following provides a description of the potential completed development phase impacts (pre mitigation) for the following sensitive receptors:

- Residential (not replaced by the 'Order Limits');
- Natural - Direct Sky Glow;
- Rail; and
- Highway

21.143 As defined within **Table 21.9** the operational Magnitude of Effect is modelled and quantitatively assessed for each receptor location, relative to the nature and baseline condition of the sensitive receptor, the potential obtrusive light effect and guidance limitations for the relevant Environmental Zone as set out in **Table 21.1**.

21.144 Similarly, where an effect is solely relative to design guidance recommendations (Rail and Highway Receptors), professional judgement of the embedded mitigation measures is given towards the Magnitude of Effect.

21.145 Regarding ecological / waterbody and heritage receptors the significance of effect as a result of operational lighting is assessed in the relevant Chapters.

21.146 In support of this assessment and to inform the other specialist disciplines the following are appended:

- **Appendix 21.2** provides the External Operational Lighting Parameters for the typical lighting arrangements and their locations in relation to the proposed uses within the 'Order Limits'. This includes for the modelling of precautionary external lighting parameters throughout the 'Order Limits' and sets clear parameters to inform the detailed lighting design stages (to be submitted for approval to South Northamptonshire Council) pursuant to a requirement to be included in the DCO.
- **Appendix 21.2a** provides the External Operational Lighting Parameters Plan for the typical lighting arrangements and their locations in relation to the proposed highway changes to J15a. This includes for the modelling of precautionary external lighting parameters throughout J15a and sets clear parameters to inform the detailed lighting design stages (to be submitted for approval to South

Northamptonshire Council) pursuant to a requirement to be included in the DCO.

- **Appendix 21.3** presents quantitative information regarding pre and post development operational illuminance effects (Lux) for residential, ecological / waterbody and heritage locations for the lighting within the 'Order Limit'.

- **Appendix 21.3a** presents quantitative information regarding pre and post development operational illuminance effects (Lux) for ecological and heritage locations for the lighting of J15a.

Potential Effect on Residential Receptors

21.147 Residential receptors are quantitatively assessed with respect to potential glare and vertical light trespass emitted from the 'Order Limits'.

21.148 Due to good practise industry design measures embedded within the lighting parameters, all residential receptor locations are likely to receive a pre mitigation, pre curfew no significant effect. Where, the resultant obtrusive light values received comply with pre curfew guidance limits.

21.149 However, due to the operation of the Proposed Development being proposed as 24 hour operational, as a worst-case, it should be noted that a number of these residential receptors will receive an obtrusive light magnitude of effect that exceeds negligible during post curfew periods (curfew is recognised as being after 23:00 and where lower threshold limits are prescribed by guidance).

21) Residential R1 to R3 and R8 to R14

- R1: Properties on Barn Lane
- R2: Properties on Rectory Lane
- R3: Mortimers / The Old Rectory
- R8: Gaytonway / Spring Gardens / Parley Pole / Woodbury
- R9: Deveron House
- R10: Property adjacent to James King Plant
- R11: Property adjacent to J B J Business Park
- R12: Property within Youngs Nursery
- R13: Terraced properties
- R14: Properties on Station Road

21.150 During post curfew operation, the magnitude of effect at these receptors is likely to be **low** (prior to mitigation) which would result in a post curfew **minor adverse** effect over the existing baseline as a result of potential glare (although compliant to guidance) from visible light points within the 'Order Limits'. This is not significant as all receptors are located in the E2 zone and none receive light which exceed recommended limits for the zone.

21.151 Note: With regards to Receptor Location 10 (Property adjacent to James King Plant), the current baseline condition exceeds post curfew guidance (1 Lux). However, as a result of a negligible change in condition due to the artificial lighting associated with the 'Order Limits', this receptor is maintained as receiving a negligible significance of effect.

Potential Effect on Natural Receptors – Direct Sky Glow

22) Sensitive Receptor SG1 – Direct Sky Glow

21.152 The embedded measures include for all luminaires to be full cut-off (zero light output above the horizontal) resulting in a pre-mitigation **negligible** effect for both the 'Order Limits' and J15a where, the calculated % ULR for the whole 'Order Limits' and J15a complies with guidance limits.

Potential Effect on Rail and Highway Receptors

23) Railway Receptors (T1 and T2)

- T1: West Coast Mainline
- T2: Northampton Loop

21.153 BS 5489-1:2013[21.14] provides guidance with respect to minimising light trespass and glare but does not state threshold limits. Therefore, as described within this guidance, the following have been considered against the external lighting parameters and embedded measures:

- Columns should be placed as far away as practicable from a rail bridge or the fence line of railway track;
- Glare should be minimized towards the train driver by the use of luminaires conforming to an appropriate G class selected from BS EN 13201-2:2015[21.15], Table A.1.; and
- Light colours should not conflict or cause confusion with colours used for signal lights.

21.154 It is judged that as a result of the following embedded measures, the railway receptor locations are likely to receive a pre mitigation, negligible magnitude of effect and significance of effect:

- Columns are placed as far away as practicable from a rail bridge or the fence line of railway track;

- Flat glass, controlled glare, minimal mounting height / tilt and the expected luminaire types predominately being highway and associated area lighting (inherent glare control to an appropriate G class ranging between 4 and 6) creates minimal / negligible potential glare to the train driver; and

- Use of warm / neutral white light avoids conflict with rail signal lights being green, yellow and red).

24) Highway Receptors (T3 and T4)

- T3: A43 – Unlit

- T4: Northampton Road – Partially Lit

21.155 The embedded measures include for all luminaires to be full cut-off (zero light output above the horizontal) and to be an appropriate G class (ranging between 4 and 6).

21.156 This creates **not significant** potential glare to vehicle users and is judged that the highway receptor locations will receive a pre mitigation, **not significant** magnitude and significance of effect.

21.157 **Table 21.12** provides an overview of the pre-mitigation effects for the identified sensitive receptors (of relevance to this chapter) where a pre mitigation effect has been identified to exceed negligible.

J15a works

21.158 The following provides a description of the potential completed development phase impacts (pre mitigation) for the following sensitive receptors:

- Natural - Direct Sky Glow;

- Highway

21.159 As defined within **Table 21.8** the operational Magnitude of Effect is modelled and quantitatively assessed for each receptor location, relative to the nature and baseline condition of the sensitive receptor, the potential obtrusive light effect and guidance limitations for the relevant Environmental Zone as set out in **Table 21.1**.

21.160 Similarly, where an effect is solely relative to design guidance recommendations (Highway Receptors), professional judgement of the embedded mitigation measures is given towards the Magnitude of Effect.

21.161 Regarding ecological / waterbody and heritage receptors, the significance of effect, at locations C18 through to C23 and H5 to H11, Appendix 21.3a Table 1.2, as a result of operational lighting is assessed in the relevant Chapters.

Potential Effect on Natural Receptors – Direct Sky Glow

25) Sensitive Receptor SG1 – Direct Sky Glow

21.162 The embedded measures include for all luminaires to be full cut-off (zero light output above the horizontal) resulting in a pre-mitigation **negligible** effect.

Potential Highway Receptors

26) Highway Receptors (T5 and T6)

- T5: A43 – Lit
- T6: B5123 - Lit

21.163 The embedded measures include for all luminaires to be full cut-off (zero light output above the horizontal) and to be an appropriate G class (ranging between 4 and 6).

21.164 This creates **negligible** potential glare to vehicle users and is judged that the highway receptor locations will receive a pre mitigation, **negligible** magnitude of effect and **negligible** significance of effect.

21.165 *Table 21.12* ***provides an overview of the pre-mitigation effects for the identified sensitive receptors (of relevance to this chapter) where a pre mitigation effect has been identified to exceed negligible.***

Assessment of Decommissioning Phase Effects

21.166 It is not known when there will no longer be a need for the Proposed Development and many elements of the development are unlikely to be decommissioned at all. The design life of the warehousing buildings will be in the order of 60+ years (approximately), and the rail infrastructure and civil engineering works will be significantly longer than this. Once the warehouses reach their design life, it is entirely feasible that they will be re-provided in a modern form. Should that occur it would be subject to its own assessment of effects at the relevant time.

21.167 It is anticipated that, during the decommissioning, which may include activities during the winter months and therefore some working in the hours of darkness, the key sources of artificial lighting are likely to include: security lighting associated with the construction (demolition) compounds and site perimeter security; lighting associated with vehicles, machinery and any agreed on-going working areas and lighting arising from any temporary car parking areas or office units. These sources of light will therefore be predominant during activities that fall within the hours of darkness and is also anticipated that low output security lighting may be required at all times.

21.168 In regards to decommissioning phase effects, these are addressed as part of the assessment of Operational Phase Effects section.

Cumulative Effects

Cumulative Assessment: Intra-Project Effects

21.169 There is the potential for intra-project effects in relation to ecology LVIA, and heritage. Ecological systems can be considerably affected by obtrusive light through light trespass and sky glow. It is known that species activity can be adversely affected to the point where a species migrates or avoids foraging or roosting in a previously occupied area.

21.170 The change in night time view is a subjective consideration and forms part of the LVIA. The lighting system employed is a key component of the night view in terms of form and texture response to light and obtrusive light trespass and glare to the surrounding environment. This can create a negative response to the visual change in view of the local environment to distant views where a change in the sky glow may be notable. Both of these conditions can detract from the nature of the surroundings and if unchecked can act as a negative precedent in future local development.

Cumulative Assessment: Inter-Project Effects

21.171 The full list of cumulative sites are provided in Chapter 7 and those that fall within a precautionary 200m zone from the Order Limits (based on a 100m obtrusive light zone of influence for each Site including the Order Limits) are listed below:

- CI.2 Northampton Gateway. This has the potential for inter-project cumulative effects and is discussed separately below.
- CI.24 Engineering works 100 m away. It was refused and the appeal was dismissed in 2013 with no resubmission. Therefore this has been excluded from the cumulative assessment.
- CI.26 is a dwelling which is noted to be built. There would be no cumulative effects with dwellings
- CI.29 is another dwelling which was refused and never appealed therefore can also be discounted
- CI.31 dismantling of overhead electricity lines – no lighting implications and can be discounted
- CI.32 change of use from an old sewage treatment works to a storage and transfer of hardcore and waste recycling aggregates. Paragraph 5.14 of the planning statement for this development confirms that no external lighting will be fitted to this development. Therefore there will not be any cumulative lighting impacts.
- C.34 change of use from a house to a small (up to six people) care home. No significant lighting beyond those associated with domestic use is likely to be

installed for this development and therefore need not be considered in the cumulative assessment.

- CI.81 sand extraction site adjacent to the M1 motorway. This site is approximately 400m from the nearest residential receptor and therefore would not be contributing to light spill or glare at these receptors. Therefore it should be excluded from the cumulative lighting assessment.

21.172 Where possible, available planning information for the above named sites, has been assessed or, where information has been minimal, professional judgment has been applied to the type of lighting that might be in place based on the type of development or industrial activity.

***Northampton** Gateway*

Potential Cumulative Effect on Residential Receptors

21.173 The operation of the proposed Northampton Gateway development would be 24 hour, as a worst-case. Therefore, a number of residential receptors considered in this assessment have the potential to receive a cumulative obtrusive light magnitude of effect that exceeds negligible. However, the closest residential receptor, R1: Properties on Barn Lane, is approximately 350m from the boundary of the Northampton Gateway development. This is far in excess of the precautionary 100m zone and therefore it is considered that any lighting which is compliant with modern standards would be of **negligible** magnitude of effect which would result in a **negligible** cumulative effect.

Potential Cumulative Effect on Natural Receptors – Direct Sky Glow

27) Sensitive Receptor SG1 – Direct Sky Glow

21.174 As with the Proposed Development it is anticipated that the embedded measures for Northampton Gateway would include for all luminaires to be full cut-off (zero light output above the horizontal) resulting in a pre-mitigation **negligible** cumulative effect.

Potential Cumulative Effect on Rail and Highway Receptors

28) Railway Receptors (T1 and T2)

- T1: West Coast Mainline
- T2: Northampton Loop

21.175 The Proposed Development would have a **negligible** magnitude of effect, resulting in a **negligible** significant effect on railway receptors T1 and T2. Based on the assumption that the Northampton Gateway project would be designed to similar standards and would be situated similar distances from these receptors it too would be expected to have a **negligible** magnitude of effect, resulting in a **negligible** significant effect on railway receptors T1 and T2. Therefore resulting in a **negligible** cumulative effect.

29) Highway Receptors (T3 and T4)

- T3: A43 – Unlit
- T4: Northampton Road – Partially Lit

21.176 A **negligible** potential glare to vehicle users and a **negligible** magnitude of effect to highway receptors is reported above for the Proposed Development. Given the proximity to these highways it is anticipated that the proposed Northampton Gateway project would not cumulatively add to this. Therefore, there would be a **negligible** cumulative effect on highway receptors T3 and T4.

Residual Effects

21.177 A comparison of effects between pre and post mitigation on a range of receptors can be found in a Summary of Residual Effects in Table 21.12. The embedded mitigation methods, for both construction and operational, can be found in Table 21.11 and it will be the application of some or all of the embedded mitigation methods listed in the table that will ensure the post mitigation effects stated below.

Main SRFI site

Construction and Decommissioning Phase

21.178 The assessment and analysis has demonstrated that through the implementation of mitigation a reduction in effects can be achieved. In particular, this would be achieved through the use of controlled lighting (shielded and downlight only), considered positioning / aiming and limiting the periods and frequencies of operation (i.e. - essential lighting health and safety and security lighting only during the hours of darkness).

21.179 The following provides a description of the residual effects (post mitigation) for identified sensitive receptors where an initial pre mitigation significance of effect has been judged to exceed negligible.

Potential Effect on Residential Receptors

Residential R1, R8, R10 and R13

- R1: Properties on Barn Lane
- R8: Gaytonway / Spring Gardens / Parley Pole / Woodbury
- R10: Property adjacent to James King Plant
- R13: Terraced properties

21.180 As a result of the implementation of the embedded mitigation methods, based on professional judgement it is expected that the magnitude of effect will reduce from high to low, resulting in a **minor adverse** residual effect.

21.181 *Residential R9, R11, R12 and R21*

- R9: Deveron House
- R11: Property adjacent to J B J Business Park
- R12: Property within Youngs Nursery
- R21: Properties adjacent to The Old Toll House – Blisworth Arm

21.182 As a result of the implementation of the embedded mitigation methods, based on professional judgement it is expected that the magnitude of effect will reduce from medium to negligible, resulting in a **negligible** residual effect.

21.183 *Residential R2, R17, R21 and R23*

- R2: Properties on Rectory Lane
- R17: Properties on Station Road
- R21: Blisworth Marina
- R23: Gayton Marina

21.184 As a result of the implementation of the embedded mitigation methods, based on professional judgement it is expected that the magnitude of effect will reduce from low to negligible, resulting in a **negligible** residual effect.

Potential Effect on Natural Receptors – Direct Sky Glow

30) Sensitive Receptor SG1 – Direct Sky Glow

21.185 Based on professional judgement, the magnitude of effect is likely to reduce from low to negligible (post mitigation) which would result in a **negligible** residual effect compared with the existing baseline.

Potential Effect on Rail and Highway Receptors

31) Potential Effect on Rail (T1 and T2)

32) Railway Receptors (T1 and T2)

- T1: West Coast Mainline
- T2: Northampton Loop

21.186 It is judged that a pre mitigation adverse significant effect during the hours of darkness is possible (based on glare and light trespass from potential activities relating to the proposed express freight cross-dock platform and Intermodal Terminal) but is limited in periods and frequency and is solely during the darkness hours of track use.

21.187 However, as a result of the implementation of the embedded mitigation methods (predominately luminaire shielding and considered aiming), it is expected that the magnitude of effect will reduce from high to low, resulting in a **minor adverse** residual effect.

33) Potential Effect on Highway (T3 and T4)

21.188 It is judged that a pre mitigation adverse effect during the hours of darkness is possible (based on glare from potential activities relating to the proposed new access roundabout junction and emergency vehicular access and pedestrian / cyclist access route provision) but is likely to be limited in periods and frequency.

- T3: A43 Highway

21.189 As a result of the implementation of the embedded mitigation methods (predominately luminaire shielding and considered aiming), it is expected that the magnitude of effect will reduce from high to low resulting in a **minor adverse** residual effect.

- T4: Northampton Road

21.190 As a result of the implementation of the embedded mitigation methods (predominately luminaire shielding and considered aiming), it is expected that the magnitude of effect will reduce from high to low resulting in a **negligible** residual effect.

21.191 **21.12** provides an overview of the pre and post mitigation (residual) effects for the identified sensitive receptors (of relevance to this chapter) where a pre mitigation effect has been identified to exceed negligible.

Operational Phase

21.192 In general, it can be expected that from the implementation of the embedded mitigation methods, during design and installation phases, a reduction in effect can be achieved. In particular, through the consistent use of flat glass luminaires, considered heights / aiming and luminaire shields.

21.193 The following provides a description of the potential completed development phase residual effects (post mitigation) for the relevant identified sensitive receptors where an initial pre mitigation significance of effect has been assessed as exceeding negligible.

21.194 In all cases, these effects relate to potential post curfew glare (although compliant, where applicable, to guidance) received from visible light points within the 'Order Limits'.

34) Residual Effect on Residential Receptor Locations

21.195 From the implementation of the embedded mitigation methods, during design and installation stages, it is expected that the post curfew magnitude of effect (glare), for all residential receptor locations, will reduce to negligible resulting in a **negligible** post curfew and guidance compliant residual effect.

21.196 Note: With respect to light trespass, it is assessed that the majority of residential receptors will be guidance compliant. The exception being at R10 (Property adjacent to James King

Plant) where the baseline post curfew condition currently exceeds guidance due to the existing highway lighting to Northampton / Towcester Road.

21.197 Any further contribution to this condition (as a result of the 'Order Limits) is considered to be **negligible** (0.13 Lux).

21.198 **Table 21.12** provides an overview of the pre and post mitigation (residual) effects for the identified sensitive receptors (of relevance to this chapter) where a pre mitigation effect has been identified to exceed **negligible**.

J15a works

Construction and Decommissioning Phase

21.199 In general, it can be expected that through the implementation of the embedded mitigation methods a reduction in effects can be achieved. In particular, this would be achieved through the use of controlled lighting (shielded and downlight only), considered positioning / aiming and limiting the periods and frequencies of operation (i.e. - essential lighting health and safety and security lighting only during the hours of darkness).

21.200 The following provides a description of the residual effects (post mitigation) for identified sensitive receptors where an initial pre mitigation significance of effect has been judged to exceed negligible.

Potential Effect on Natural Receptors – Direct Sky Glow

35) Sensitive Receptor SG1 – Direct Sky Glow

21.201 Based on professional judgement, the magnitude of effect is likely to reduce from low to negligible (post mitigation) which would result in a **negligible** residual effect compared with the existing baseline.

Operational Phase

21.202 All impacts (pre mitigation) identified at the operational phase are **negligible** and therefore mitigation and residual effects need not be discussed however the robustness of the assessment and the assumed nature of lighting on site underpins this assurance.

Table 21.12: Summary of Residual Effects

Sensitive Receptor	Description of Effect	Pre Mitigation Significance	Mitigation	Residual Effect
CONSTRUCTION AND DECOMMISSIONING				
Residential				
R1: Properties on Barn Lane	T, D, ST to MT & LL	**Major Adverse**	Implementation of best practice construction lighting mitigation measures	**Minor Adverse**
R8: Gaytonway / Spring Gardens /	Potential light			

Parley Pole / Woodbury **R10: Property adjacent to James King Plant** **R13: Terraced properties**	trespass and glare from poorly aimed floodlighting		as part of the Construction Environmental Management Plan (CEMP).	
R9: Deveron House **R11: Property adjacent to J B J Business Park** **R12: Property within Youngs Nursery** **R21: Properties adjacent to The Old Toll House – Blisworth Arm**	T, D, ST to MT & LL Potential glare from poorly aimed floodlighting	**Moderate Adverse**	As above	**Negligible Adverse**
R2: Properties on Rectory Lane **R17: Properties on Rectory Lane** **R21: Blisworth Marina** **R23: Gayton Marina**	T, D, ST to MT & LL Potential glare from poorly aimed floodlighting	**Minor Adverse**	As above	**Negligible Adverse**
Natural – Direct Sky Glow				
SG1: Direct Sky Glow	T, D, ST to MT & LL Potential direct upwards light spill from poorly aimed floodlighting	**Minor Adverse**	As above	**Negligible Adverse**
Rail				
T1: The West Coast Mainline **T2: Northampton Loop**	T, D, ST to MT & LL Potential light trespass and glare and from poorly aimed floodlighting	**Moderate Adverse**	As above	**Minor Adverse**
Highway				
T3: A43 Highway	T, D, ST to MT & LL Potential glare from poorly aimed floodlighting	**Moderate Adverse**	As above	**Minor Adverse**

T4: Northampton Road	T, D, ST to MT & LL Potential glare from poorly aimed floodlighting	**Minor Adverse**	As above	**Negligible Adverse**
COMPLETED DEVELOPMENT – OPERATIONAL **Residential – Post Curfew**				
R1: Properties on Barn Lane **R2: Properties on Rectory Lane** **R3: Mortimers / The Old Rectory** **R8: Gaytonway / Spring Gardens / Parley Pole / Woodbury** **R9: Deveron House** **R10: Property adjacent to James King Plant** **R11: Property adjacent to J B J Business Park** **R12: Property within Youngs Nursery** **R13: Terraced properties** **R14: Properties on Station Road**	**P, D, LT & LL** **An increase in potential glare but compliant to post curfew limits.**	**Minor Adverse**	**Detailed design consideration for considered luminaire positions, heights, orientation, shielding and distribution.**	**Negligible Adverse**

Notes to **Table 21.12**:

P/T/R = Permanent/Temporary/Reversible, D / I = Direct / Indirect, ST/MT/LT = Short Term / Medium Term / Long Term

LL = Local level (on site or neighbouring sites), DL = District level, RL = Regional level

NL = National level (UK), IL = International level

21.203 Regarding specific wildlife and ecology receptors the pre mitigation and residual effects are not included within this assessment. Further information is provided in Chapter 16 – Ecology and Nature Conservation.

21.204 Regarding heritage receptors the pre mitigation and residual effects are not included within this assessment. Further information is provided in Chapter 11 – Archaeology and Chapter 12 – Heritage.

21.205 Excludes baseline sensitivity locations situated within the 'Order Limits' boundary which will be replaced by the development proposals. Therefore, future effects on these locations have not been assessed.

- R4 – Rathvilly Farm;
- R5 – Lodge Farm;
- R6 – Manor Farm; and
- R7 – Nursery.

Monitoring

21.206 The monitoring of aspects of the mitigation associated with the Proposed Development will be necessary in order that the residual effects can be judged. This also allows adjustments to be made, where necessary.

21.207 Any monitoring or surveys that are programmed to take place during construction that will not be continued through to the operational phase are covered within the Construction Environmental Management Plan (CEMP).

21.208 As part of the CEMP a Lighting Management Plan will be prepared which includes periodic monitoring and makes provision for necessary remedial works, and deals with the control of lighting associated with night-time construction activities.

21.209 The monitoring will assess the effectiveness of the implemented mitigation measures and will be based upon:

- Horizontal and Light Trespass, based on measured conditions; and
- Glare and Direct Sky Glow, based on visually assessment.

21.210 Monitoring criteria will be assessed against all of the embedded mitigation measures which will be implemented throughout the phases of the Proposed Development.

Limitations and Assumptions

Assessment Criteria for the Completed Development

21.211 For the purposes of demonstrating a robust assessment, the following standard industry precautionary measures are applied to the assessment calculation:

- It has been assumed that all external lighting is operational simultaneously (i.e. a maximum adverse scenario); Accordingly all lighting is positioned to comply with the lighting levels required by the codes and standards for particular site

activities (road use, loading/unloading) and all lumen packages for all luminaires have been set to maximum output with no maintenance factor.

- As per standard industry practise existing and proposed landscape bunding and planting / trees have not been included within the assessment calculations.

Reflective Properties of Illuminated Surfaces

21.212 Guidance is expressed in terms of the direct illuminance component. However, where the surface is relatively light in colour and typically >30% the reflected light component should be taken into account. In the case of this assessment it is assumed that the typical landscape reflectance value is <30% and will not provide significant contribution, by reflection, to the illuminance at the measured point.

References

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21.3 The National Network Planning - Policy Statement Guidance (NN NPS) 2015

21.4 Department for Communities and Local Government (2012) National Planning Policy Framework, HMSO, London

21.5 Department for Communities and Local Government (2014) National Planning Practice Guidance 2014 – Light Pollution, http://planningguidance.planningportal.gov.uk/blog/guidance/light-pollution.

21.6 West Northamptonshire Joint Core Strategy Local Plan (Part 1) – Adopted 2014

21.7 South Northamptonshire Council (undated) Supplementary Planning Guidance – Light Pollution

21.8 South Northamptonshire Council (2003) Supplementary Planning Guidance – Planning out Crime in Northamptonshire

21.9 Institute of Lighting Professionals (2011) Guidance on Undertaking Environmental Lighting Effect Assessments PLG04, ILP, Rugby

21.10 Institute of Lighting Professionals (2011) Guidance Notes for the Reduction of Obtrusive Light GN01, ILP, Rugby

21.11 CIE International Commission on Illumination (2003) CIE 150 - Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations, Commission Internationale De L'Eclairage, Vienna.

21.12 CIE International Commission on Illumination (1997) CIE 126 - Guidelines for Minimising Sky Glow, Commission Internationale De L'Eclairage, Vienna.

21.13 CIE International Commission on Illumination (1998) CIE Technical Report 129 - Guide for lighting exterior work areas, Commission Internationale De L'Eclairage, Vienna.

21.14 The British Standards Institution (7th Edition, 2012) BS 5489-1: 2013 – Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas, BSI Standards, London.

21.15 The British Standards Institution / CEN (2015) BS EN 13201-2: 2015 – Road lighting – Part 2: Performance requirements, BSI Standards, London.

21.16 The British Standards Institution / CEN (2007) BS EN 12464-2:2014 – Lighting of Work Places – Part 2: Outdoor work places, BSI Standards, London.

21.17 The Chartered Institution of Building Services Engineers (CIBSE) (2012) Lighting Guide – The Industrial Environment, CIBSE, London

21.18 Campaign to Protect Rural England (CPRE) (2000) Night Blight in the North West, CPRE, London

21.19 Bat Conservation Trust / ILE (Version 3) Bats and Lighting in the UK (2009) Bat Conservation Trust, London.

21.20 Bat Conservation Trust Artificial Lighting and Wildlife (2014) Bat Conservation Trust, London.

Glossary

Illuminance – The total luminous flux incident on a surface, per unit area (SI unit – Lux).

Luminance – Photometric measure of the luminous intensity per unit area of light travelling in a given direction (SI unit cd/m^2).

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

Sky Glow – 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.

Glare – The uncomfortable brightness of the light source against a dark background which results in dazzling the observer, which may cause nuisance to residents and a hazard to road users;

Horizontal and Vertical Light Trespass – The spilling of light beyond the boundary of a property, which may cause nuisance to others.

Tables

Figures

Appendices