

Illumination Impact Profile - RAIL CENTRAL

Appendix 21.3a – Junction 15a Illumination Impact Profile

APPENDIX 21.3a-DOC-1602403-20180301-Rail Central Junction 15a- DDM/SK-IIP 001-P3 March 2018



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### 0.0 Introduction



This Appendix of the PIER has been prepared by Hoare Lea to present quantitative information regarding pre and post development operational illuminance effects (Lux) for ecological / waterbody and heritage locations.

#### **IIP – Illumination Impact Profile**

The following provides an Illumination Impact Profile, in tandem with the DCO application, which gives assessment of the exterior lighting design proposal's impact on the surrounding Environmental Zone. With the passing into law of the 'Clean Neighbourhood and Environmental Act' 2005 this issue has now become a major deliverable for exterior lighting projects.

The intention of the Illumination Impact Profile package is to convey how the Proposed Developments will affect the illumination profile of the area and how that will comply with relevant legislation requirements and best practise Design Guidance.

In accordance with current CIE guidance and the ILP Guidance Notes for the Reduction of Obtrusive Light (2011) and in relation to the assessment, the following definitions are used in describing obtrusive lighting effects:

- Direct Sky glow: the direct upward spill of light into the sky, which can cause a glowing effect and is often seen above cities when viewed from a dark area.
- Light spill: the unwanted spillage of light onto adjacent areas and may affect sensitive receptors, particularly residential properties and ecological sites.
- 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.
- Light trespass (vertical and horizontal): the spilling of light beyond the boundary of a property, which may cause nuisance to others.

#### **Completed Development Lighting Parameters**

Appendix 22.??? 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).

#### Assessment Criteria for the Completed Development

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 relevant external lighting is operational simultaneously for the relevant pre or post curfew operational condition (i.e. a maximum adverse scenario);
- A unity Maintenance Factor 1.0 is applied to represent the maximum adverse condition from initial installation;
- As per standard industry practise existing and proposed landscape bunding and planting / trees have not been included within the assessment calculations.
- Reflected sky glow component should be taken into account where landscape surfaces are relatively light in colour and typically >30%. 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.</li>

### 0.0 Introduction

#### **Completed Development Lighting Parameters**

Appendix 21.2a provides the External Operational Lighting Parameters Plan for the typical lighting arrangements and their locations in relation to a major road junction. This scheme has been designed in accordance with the latest road lighting BS and sets clear parameters to inform the detailed lighting design stages (to be submitted for approval to South Northamptonshire Council).

#### Assessment Criteria for the Completed Development

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 relevant external lighting is operational simultaneously for the relevant pre or post curfew operational condition (i.e. a maximum adverse scenario);
- A unity Maintenance Factor 1.0 is applied to represent the maximum adverse condition from initial installation;
- As per standard industry practise existing and proposed landscape bunding and planting / trees have not been included within the assessment calculations.
- Reflected sky glow component should be taken into account where landscape surfaces are relatively light in colour and typically >30%. 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.

#### **Baseline Survey**

- The survey was undertaken between approximately 11.00pm and 03.00am, on Thursday 26<sup>th</sup> and Friday 27<sup>th</sup> May 2017.
- The weather was fairly humid and the sky clear during the night hours.
- The Moon was present in the sky, however was partially obscured by cloud when lighting measurements were taken.
- Unscreened Moonlight Condition measured as peak 0.01 Lux (Horizontal) and 0.02 Lux (Vertical).

#### Technical

- Light Readings (illuminance levels in Lux) were taken using a hand held Konica Minolta T-IOA illuminance meter.
- All horizontal lux readings were taken on the ground, all vertical lux readings were taken at arms length from a standing position; approximately 1.5m above ground.
- Photographs were taken using a Canon EOS 600D DSLR camera. Exposure times are variable.

#### From the baseline survey we have assumed:

- Roads are representative of an M4 classification (BS 5489-1:2013): 0.75 cd m<sup>2</sup>, U0 0.4, UI 0.6.
- Conflict areas such as junctions and roundabouts are representative of C3 lighting class (BS 5489-1:2013): 15 Lux, Uo 0.4
- For the purposes of this IIP, calculations have used these parameters as a basis for our lighting calculations, should traffic flow assessments raise the classification of the roads/junction this IIP would require revision



### I.0 Results



#### Overview

#### Ecology - Waterbody - Grand Union Canal - Northampton Arm (C9- C33)

All existing sensitive receptors have been previously identified, and their baseline condition recorded in APPENDIX 21.1a-DOC-1602403-170721-Rail Central-CC-IIP 001-P1. Tabulated within **Table 1.2** of this document reference points C9 to C33 provide measured baseline conditions, peak / resultant horizontal and vertical light impacts (1.5m) at the respective ecology locations to inform the ecology assessment.

#### Heritage - H5 to H11

Alongside baseline data provided the following impact values (proposed development only) are provided to inform the heritage assessment. The data represented in **Table 1.4** is relevant to identified **Representative** Heritage Locations where pre and post curfew <u>vertical</u> illuminance to windows (as opposed to horizontal illuminance) are the recognised key indicators.

### I.0 Results

#### Natural Receptor - Direct Sky Glow (SGI)

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.

Direct Sky glow is assessed as a Site Wide impact and is based on a scenario where the most onerous of lighting impact is applied relative to the potential uses within each area.

In accordance with CIE 150 Section 5.5.2 the Upward Direct Light Ratio is calculated as follows:

The Direct ULR for the installation is calculated from the following equation:

ULR = Eup / (Edown + Eup)

Eup – Resultant average illuminance taken from a grid 1.0m above the highest luminaire

Edown – Resultant average illuminance taken from a grid 1.0m below the highest luminaire

For the purposes of direct sky glow assessment the majority of the Site is currently considered to be representative Environmental Zone classification of an E1: Intrinsically dark.

In maintaining a no change / improved environment the ILP Guidance Notes for the Reduction of Obtrusive Light (2011) provides a limiting sky glow percentage of 2.5%.

#### Notes

As we would assume new luminaires would be of a flat glass type, there would be no direct upward illumination.

ULR = Eup / (Edown + Eup)

ULR = 0 / (1.0 + 0)

ULR = 0.0% < 2.5%

Table 1.1 - Summary comparison of existing, calculated and resultant totals relating to obtrusive light for Site Wide Direct Sky Glow.

SENSITIVE RECEPTOR	SENSITIVITY	DIRECT SKY GLOW		
NATURAL - DIRECT SKYGLOW		Existing Condition	Sky Glow ULR (Max. %) (ILP Guidance Notes 2011) (cd)	Calculated Direct Sky Glow %
SGI – DIRECT SKYGLOW	MODERATE	Representative of an EI site wide night sky	0%	0
Magnitude of Change		classification		Negligible
SGI - Pre – Mitigation Significance of Effect				Negligible

Note:

- Pre Mitigation refers to assessment inclusive of the proposed good practise embedded mitigation.
- Pre Curfew All lighting on
- Post Curfew All lighting on
- As per standard industry practise, for worst case assessment, calculated results do not include for potential reduced impacts provided by natural screening.



## I.0 Results

Figure 1: Reference points from baseline survey, used as measurement points for IIP



Detail of all know existing sensitive receptors



## I.0 Results

#### Ecology C9 to C33 and heritage H5 to H11

From the baseline survey we have assumed:

- Roads are representative of an M4 classification (BS 5489-1:2013): 0.75 cd m<sup>2</sup>, U0 0.4, UI 0.6.
- Conflict areas such as junctions and roundabouts are representative of C3 lighting class (BS 5489-1:2013): 15 Lux, Uo 0.4
- For the purposes of this IIP, calculations have used these parameters as a basis for our lighting calculations, should traffic flow assessments raise the classification of the roads/junction this IIP would require revision
- The results overleaf highlighted in red show the 4 positions where the existing baseline condition recorded readings higher that background, natural (star/moon light), conditions
- Positions C9 to C17 and H5 & H6 are included for reference, unless there is a change in traffic flow resulting in a new road classification any changes will be minimal. No allowance for light spill from the motorway has been allowed for. The motorway is lit using a Twin-headed lantern mounted in the central reservation. The motorway is elevated approximately 6m above A43 and approximately 10m above the canal.



## I.0 Results

**Overview:** Ecology, Positions C9 to C33 Heritage Positions H5 to H11

Table I.2

	JGHT TRESPASS										
WATERBODY LOCATIONS	Baseline Existing Horizontal Illuminance (Lux) (Ground)	Baseline Existing Vertical Illuminance (Lux) (@ I.5m AFL)	Baseline Existing Environmental zone	<b>Impact</b> Max. Horizontal Illuminance (Lux) (Ground)	Impact Max. Vertical Illuminance (Lux) (@ I.5m AFL	<b>Resultant</b> Max. Horizontal Illuminance (Lux) (Ground)	<b>Resultant</b> Max. Vertical Illuminance (Lux) (@ I.5m AFL)	Assessing significance of Magnitude of effect (Table 0.9)	Comments	Possible mitigation	
C9/H5 - Northampton Arm	0.10	0.10	EI	Neutral. See note I	Neutral. See note I	Neutral. See note 1	Neutral. See note I	Neutral. See note I			
C10 - Northampton Arm	0.17	0.06	EI	Neutral. See note I	Neutral. See note I	Neutral. See note I	Neutral. See note I	Neutral. See note I			
CII - Northampton Arm	2.63	3.14	EI	Neutral. See note 1	Neutral. See note I	Neutral. See note I	Neutral. See note I	Neutral. See note I			
C12 - Northampton Arm	4.85	5.98	EI	Neutral. See note 1	Neutral. See note I	Neutral. See note I	Neutral. See note I	Neutral. See note I			
C13 - Northampton Arm	0.19	0.03	EI	Neutral. See note 1	Neutral. See note 1	Neutral. See note I	Neutral. See note I	Neutral. See note I			
C14 - Northampton Arm	0.09	0.02	EI	Neutral. See note 1	Neutral. See note 1	Neutral. See note I	Neutral. See note I	Neutral. See note I			
C15/H6 - Northampton Arm	0.03	0.03	EI	Neutral. See note 1	Neutral. See note 1	Neutral. See note I	Neutral. See note I	Neutral. See note I			
C16 - Northampton Arm	0.56	0.29	EI	Neutral. See note I	Neutral. See note I	Neutral. See note I	Neutral. See note I	Neutral. See note I			
C17 - Northampton Arm	0.03	0.02	EI	Neutral. See note 1	Neutral. See note 1	Neutral. See note I	Neutral. See note I	Neutral. See note 1			
C18 - Northampton Arm	0.12	0.07	EI	7.10	8.00	7.22	8.07	Major	Increased light levels due to revised road layout.	Natural landscaping/Bridge design	



## I.0 Results

Overview: Ecology, Positions C9 to C33 Heritage Positions H5 to H11

Table 1.2

	LIGHT TRESPASS									
WATERBODY LOCATIONS	Baseline Existing Horizontal Illuminance (Lux) (Ground)	Baseline Existing Vertical Illuminance (Lux) (@ I.5m AFL)	Baseline Existing Environmental zone	<b>Impact</b> Max. Horizontal Illuminance (Lux) (Ground)	Impact Max. Vertical Illuminance (Lux) (@ I.5m AFL	<b>Resultant</b> Max. Horizontal Illuminance (Lux) (Ground)	<b>Resultant</b> Max. Vertical Illuminance (Lux) (@ I.5m AFL)	Assessing significance of Magnitude of effect (Table 0.9)	Comments	Possible mitigation
C19 - Northampton Arm	0.45	0.02	EI	10.80	1.80	11.25	1.82	Major	Increased light levels due to revised road layout.	Natural landscaping/Bridge design
C20/H7 - Northampton Arm	0.25	0.25	EI	2.30	2.60	2.55	2.85	Major	Increased light levels due to revised road layout.	Natural landscaping/Bridge design
C2I - Northampton Arm	0.03	0.01	EI	0.30	0.50	0.33	0.51	Minor	Increased light levels due to revised road layout.	Natural landscaping
C22 - Northampton Arm	0.03	0.00	EI	0.20	0.40	0.23	0.40	Minor	Increased light levels due to revised road layout.	Natural landscaping
C23 - Northampton Arm	0.03	0.01	EI	0.10	0.20	0.13	0.21	Minor	Increased light levels due to revised road layout.	Natural landscaping
C24 - Northampton Arm	0.04	0.02	EI	0.00	0.10	0.04	0.12	Neutral		
C25/H8 - Northampton Arm	0.04	0.04	EI	0.00	0.00	0.04	0.04	Neutral		
C26 - Northampton Arm	0.04	0.02	EI	0.00	0.00	0.04	0.02	Neutral		
C27 - Northampton Arm	0.02	0.01	EI	0.00	0.10	0.02	0.11	Neutral		
C28 - Northampton Arm	0.02	0.02	EI	0.00	0.00	0.02	0.02	Neutral		



### I.0 Results

Overview: Ecology, Positions C9 to C33 Heritage Positions H5 to H11

Table 1.2

	LIGHT TRESPASS									
WATERBODY LOCATIONS	Baseline Existing Horizontal Illuminance (Lux) (Ground)	Baseline Existing Vertical Illuminance (Lux) (@ I.5m AFL)	<b>Baseline</b> Existing Environmental zone	<b>Impact</b> Max. Horizontal Illuminance (Lux) (Ground)	Impact Max. Vertical Illuminance (Lux) (@ I.5m AFL	<b>Resultant</b> Max. Horizontal Illuminance (Lux) (Ground)	<b>Resultant</b> Max. Vertical Illuminance (Lux) (@ I.5m AFL)	Assessing significance of Magnitude of effect (Table 0.9)	Comments	Possible mitigation
C29/H9 - Northampton Arm	0.02	0.02	EI	0.00	0.00	0.02	0.02	Neutral		
C30 - Northampton Arm	0.02	0.01	EI	0.00	0.00	0.02	0.01	Neutral		
C31/H10 - Northampton Arm	0.02	0.02	EI	0.00	0.00	0.02	0.02	Neutral		
C32 - Northampton Arm	0.02	0.01	EI	0.00	0.00	0.02	0.01	Neutral		
C33/H11 - Northampton Arm	0.02	0.02	EI	0.00	0.00	0.02	0.02	Neutral		

#### Notes:

I. No change or minimal change to existing lighting layout at these locations. Therefore no change in impact.



## 2.0 Summary of Adversities, Further Mitigation and Residual Effect

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The previous tables provide the pre mitigation significance of effect of operational condition. Where, cause and mitigation measures are outlined.

While effects are considered to fall into one of four effect categories ranging from 'negligible', 'minor', 'moderate', 'major' it is only those effects that fall within the range of 'moderate to minor' to 'major' categories that are considered to be the significant environmental effects arising from the operation of the Proposed Development.

The notable pre mitigation significance of effects vary between negligible to major adverse. For the most adverse cases it is also likely that ILP guidance limits are exceeded

However, from the implementation at design and installation stages the following further mitigation measures should be applied to reduce this effect, including:

- Considered luminaire positions and orientation;
- Potential application of post installation luminaires shields; and
- Part retention and proposed foliage

#### Note:

With respect to ecology and heritage locations, Section 1.0 of this report provides baseline, operational illuminance levels and resultant values to inform and support the relevant assessments.

Audit Sheet



Rev.	Description	Prepared and checked by	Reviewed by	Date by
PI	IIP - Review Issue	SK	DDM	02.02.18
P2	IIP - Review Issue – Minor Amendments	SK	DDM	05.02.18
P3	Final Issue	SK	DDM	01.03.18

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