



Lighting Survey Report

Boorley Green (Parcels B4 & C6)

Vistry Group PLC

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Basis of Report

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Executive Summary

This report is intended to provide evidence to satisfy the comments on lighting Condition 8a by the council's ecologist regarding the proposed development at Boorley Green Parcels B4 and C6.

Ecologist's response for Parcel **B4**

Condition 8a - Lighting

'As set out in my emails, as the lighting columns have already been installed, details of the shields/cowls necessary to ensure that the light spill onto the surrounding vegetation is reduced to no more than 1lux need to be provided, together with an amended lighting spill plan showing the new lighting lux level contours. I understand that you are currently arranging for this information to be provided.'

Ecologist's response for Parcel **C6**:

Condition 8a – Lighting

'As set out in my email dated 29.2.24 it is noted that the lighting lux levels plan 2201104 rev D shows that levels greater than 1lux would spill over onto the existing mature trees on the southern boundary adjacent to plots 284 and 387, having an impact on nesting birds and foraging bats. If the columns are already in place, then details of the shields/cowls necessary to ensure that the light spill onto the surrounding vegetation is reduced to no more than 1lux need to be provided, together with an amended lighting spill plan showing the new lighting lux level contours. Alternatively, if the lighting columns have not yet been installed then amendments are required to ensure the light spill onto surrounding vegetation does not exceed 1lux.'

The comments refer to potential light spill from the installed lighting to identified habitats at the periphery of the development.

The concern is that the light spill in specifically identified locations may be potentially adverse for nesting birds and commuting or foraging bats using the mature hedgerows and tree lines at the development edge.

To determine if there is any material light pollution from the installed lighting within the development, a Lighting Assessor undertook a 'Baseline Lighting Survey' to record photographic and photometric data at the identified locations.

The results of that survey are contained within this report and the impact assessment determines the degree of mitigation required to resolve the issue of light spill to sensitive habitat.

A mitigation strategy and evidence to demonstrate its effectiveness is provided in the attached Appendix A.



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Acronyms and Abbreviations

Contextual Darkness	Baseline ambient conditions without significant direct or indirect illumination from artificial light sources.
Natural Darkness	The absence of artificial illumination (may include natural sources of light such as moonlight or the ambient light reflected from sky glow).
AoS	Area of Study – The specific zone in question for investigation, mitigation or further information to be provided.



1.0 Site and Context

The site is defined 'Boorley Green' and the Area of Study (AoS) defined as the periphery of Parcels C6 and B4.

Figure A: Location of Areas of Study

The area highlighted in **Red** represents AoS1 which is the periphery of Parcel C6.

The area highlighted in **Blue** represents AoS2 which is the periphery of Parcel B4.



2.0 Baseline Survey

During the evening of Thursday 1st August 2024 a Lighting Assessor attended the site to undertake a photographic and photometric survey of the area AoS1 and AoS2.

Observations made were made and a photographic record is set out in the following sections.

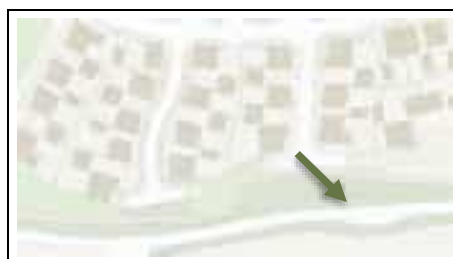
2.1 AoS1 South of Parcel C6

This part of the development is characterised by typical residential street setting with a hammerhead turning area at the periphery of each section of Oakland Road. There are two sections that are relevant to AoS1 referred to as AoS1E in the east and AoS1W in the west for identification purposes.

Oakland Road is lit by the solar street light column specified in the Prolectric lighting plan. The column is 6 metres in height with the luminaire tilted at 22° above horizontal. A number of low-level bollards are specified for the peripheral areas and parking bays.



Figure B: AoS1E East Tree line & Hedgerow South of Oakland Road



View looking southeast towards the tree line between the development edge and Maddoxford Lane beyond to the south. The tree line consists of a stand of tall mature trees with dense mature hedgerow beneath. This tree line is considered an ecological receptor and potential habitat for light sensitive species such as bats and nesting birds.

Figure C: AoS1W West Hedgerow South of Oakland Road



View looking east towards the tree line and low-level hedgerow between the development edge and Maddoxford Lane. The hedgerow in this area is minimal, no more than 1 metre in height. The tree line and mature hedgerow effectively terminates before the power line columns shown in the left of the image.



Figure D: AoS1E East Oakland Road Turning Area - Day



View looking northeast towards the development from the turning area. The street light column to the turning area is shown in the right of the image. The streetlight is angled upwards at 22° and is oriented towards the tree line at the boundary (marked).

Figure E: AoS1W West Oakland Road Turning Area - Day



View looking northeast towards the development from the turning area. One street light column is observed to be installed along this section of Oakland Road although it is not observed to be functional at the time of the survey. The other street light column to the turning area and bollard to the parking bays, both shown on the lighting plans are not installed at the time of the survey.



Figure F: AoS1E East Oakland Road Turning Area - Dusk

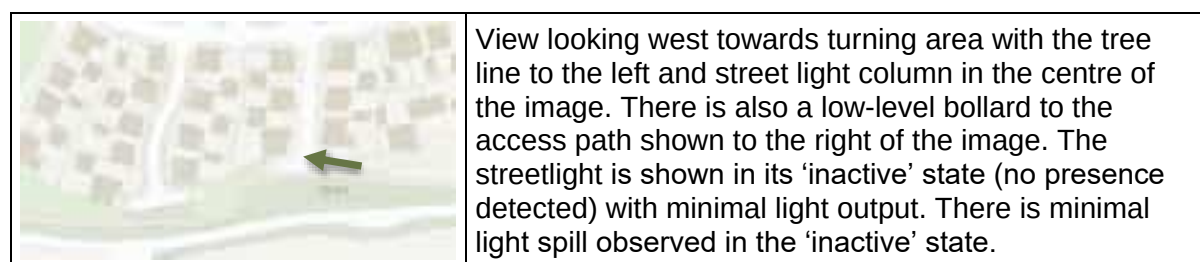


Figure G: AoS1E East Tree line & Hedgerow South of Oakland Road - Night

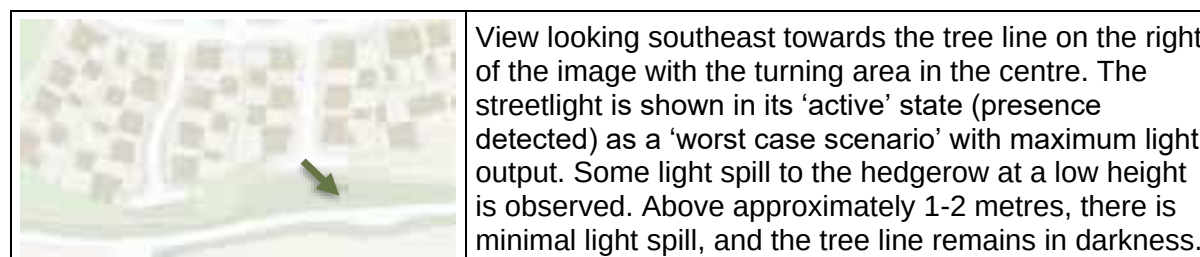
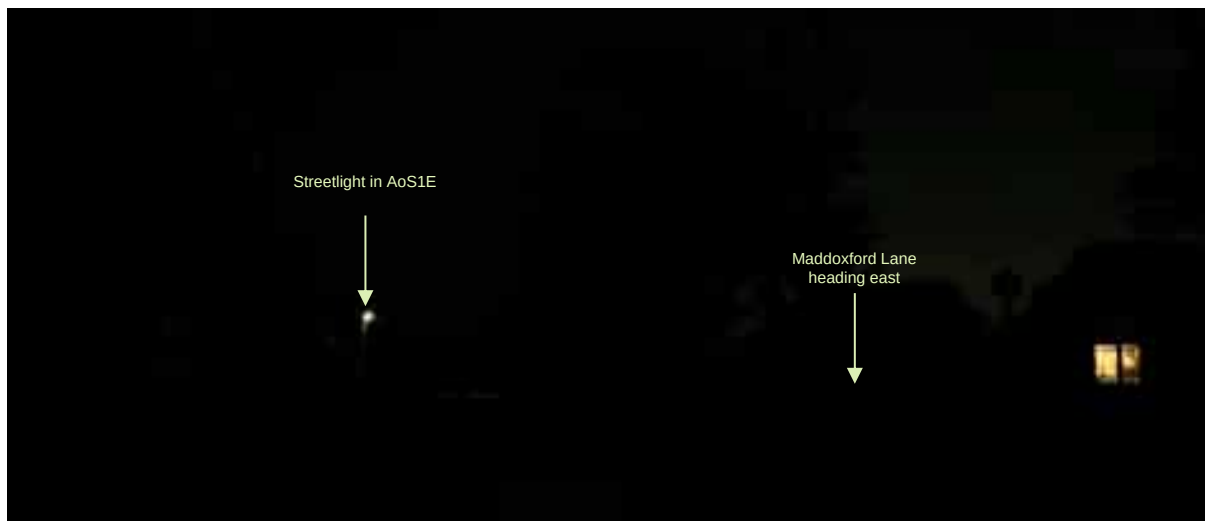


Figure H: AoS1W West Oakland Road Turning Area - Dusk



View looking northwest towards the development from the turning area. No street light column is observed to be installed to the turning area of Oakland Road. Beyond domestic interior and porch amenity lighting, there is no lighting to the turning area which remains in 'contextual darkness' beyond the minimal light egress from adjacent residential properties.

Figure I: AoS1W (West) Hedgerow South of Oakland Road - Night



View looking east towards the tree line and low-level hedgerow between the development edge and Maddoxford Lane. The hedgerow and tree line are in 'natural darkness' with no light spill from the development. The light column visible in the image to the left is associated with AoS1E (turning area) to the east.



Figure J: AoS1 - C6 - Potential Light Spill to Tree Line

Extract from the Proelectric street lighting design documentation with ISOLux contours. AoS to the south of Parcel C6 and north of Maddoxford Lane. Isolines show light spill to the mature tree line and hedgerow (approximate location highlighted in **Green**).



2.2 AoS1 Lux Level Survey

A number of lux level measurements were taken to validate the light modelling (ground level through the lit areas) and to establish as built readings for the for the identified habitat (vertical readings at the tree lines and hedgerows).

The survey was undertaken using a calibrated light metre with a resolution of 0.01 lux and results taken at 5 metre spacings.

During the survey it was observed that some of the columns and bollards specified were either not installed or not working.

Figure K: AoS1 Oakland Road Turning Areas East & West – Lux Survey Results



The results from the eastern turning area, where the lighting was installed and functional, show the horizontal illuminance is broadly in line with the modelling by Proelectric considering the Maintenance Factor was applied to the modelling, and differences in the exact spacing of measurement locations. The ISOlux contours do broadly represent the as built light distribution where the equipment is functional.

The vertical measurements do show increased levels of illumination above the required 1 lux limit imposed to protect the quality of habitats such as the mature tree line at the boundary.

The vertical illuminance levels recorded as part of the survey peak at 2.85 lux at 1.5 metres above ground level. It should be noted that this elevated light level is constrained to a very small area of the hedgerow (approximately 10 metres in length) and at relatively low height (below 2.5 metres in height).

Figure L: AoS1E East Oakland Road Turning Area – Lux Measurement Locations

Measurement locations are superimposed in approximate locations (5 metre spacing at 1.5 metres above FFL). Values in Lux / Illuminance Limit = Max <1lux.

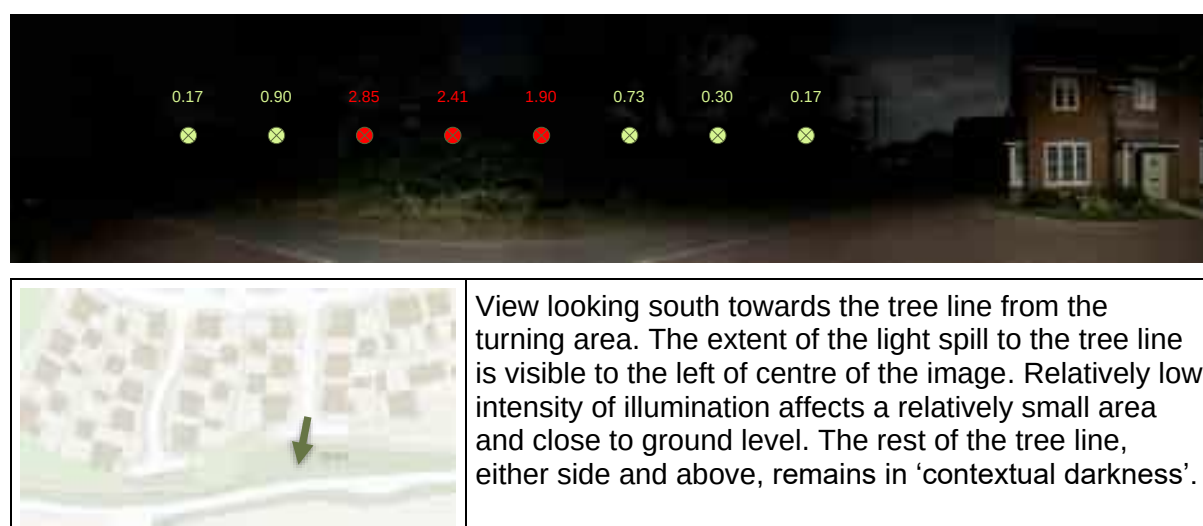
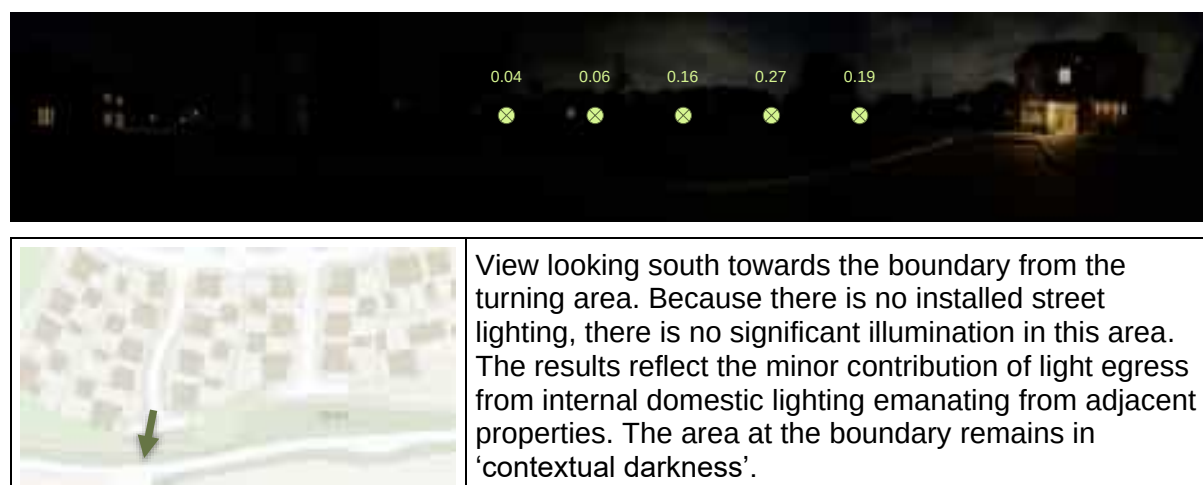


Figure M: AoS1W West Oakland Road Turning Area – Lux Measurement Locations

Measurement locations are superimposed in approximate locations (5 metre spacing at 1.5 metres above FFL). Values in Lux / Illuminance Limit = Max <1lux.



2.3 AoS1 C6 Impact Assessment

Area AoS1W West in the west has no installed street lighting and as such the area to the south of AoS1W remains in 'contextual darkness'. Without further mitigation this area has no adverse impact on light sensitive species such as bats or nesting birds utilising the adjacent habitats. The light levels recorded are below 1 lux peak and are observed to be consistent with baseline conditions in an absence of artificial illumination.

Area AoS1E East in the east has one streetlight installed and this has two modes of operation. Under its 'inactive state', there is little illumination to the tree line identified as potential light sensitive habitat. As this area is seldom used for local access to frontages only, this 'inactive' low level lighting state is expected to remain throughout the majority of the hours of darkness.

When in its 'active' state, which is only triggered temporarily by presence detection, the streetlight does cast light on to the tree line in a limited area above the prescribed illuminance limit of 1 lux. As such, without mitigation, the light does exceed the limits suggested by the ecologist.

It should be noted that the actual area affected is relatively small and low to the ground, leaving the majority of the tree line in 'contextual darkness'. Bats typically fly and forage above the height of the area affected by light spill and birds typically nest above this height.

2.3.1 Conclusion

Whilst light does exceed the value of 1 lux in the AoS1E East, it does so only for short and temporary durations ('active' state based on presence detection) and in a very limited area.

Should the lighting be left in its current condition without further mitigation, the likely effects on species would be assumed to be minimal in terms of severity (adverse impact) as well as both extent (affected area) and duration (time of exposure).

Should mitigation be deemed necessary, this may be applied to reduce the light spill to this specific area bring it down to below the 1 lux threshold on the vertical plane representing the tree line.

Suitable mitigation may include:

- The application of a front shield to the streetlight in AoS1E East to reduce the projection of light into the tree line at the boundary of the development.
- Adjusting the orientation and angle of tilt of the streetlight in AoS1E East to direct the light away from the tree line.
- Reducing the output of the streetlight in AoS1E East by removing the 'Active' state and using only the reduced output of the fixture by disabling presence detection.
- Removing the streetlight in AoS1E East altogether and leaving the turning area in 'contextual darkness'.

2.4 AoS2 Southeast of Parcel B4

This part of the development is characterised by typical residential street setting with a number of frontages at the periphery accessed via Merion Road. Merion Road loops around the perimeter of the development from the core.

Merion Road is lit by the solar street light column specified in the Prolectric lighting plan. The column is 6 metres in height with the luminaire tilted at 22° above horizontal orientated inwards towards the development from the boundary.



Figure N: AoS2 Merion Road - Day



View looking southwest towards the tree line south of the development area shown to the left of the image. The street light columns to the access road to frontages is shown to the right of the image. The streetlight is angled upwards at 22° and is oriented away from the tree line at the boundary (marked).

Figure O: AoS2 Merion Road - Dusk



View looking northeast towards the development shown to the left of the image and the tree line to the south of the development shown to the right of the image. The streetlight columns orientated towards the development and away from the tree line. Additional bollard lighting is observed to be installed and operational but not shown on the lighting plans.



Figure P: AoS2 Merion Road - Night



Figure Q: AoS2 – B4 - Potential Light Spill to Mature Tree Line

Extract from the Proelectric street lighting design documentation with ISOLux contours. AoS to the southeast of Parcel B4. Isolines show light spill to the land beyond the development to the south and east towards the mature tree lines (approximate area highlighted in **Green**).



2.5 AoS2 Lux Level Survey

A number of lux level measurements were taken to validate the light modelling (ground level through the lit areas) and to establish as built readings for the for the identified habitat (vertical readings at the tree lines and hedgerows).

An indicative sample area was chosen as the tree line is closest to the lit area representing a 'worst case scenario'. The areas to the north of parcel B4 were not accessible as they are currently under construction and no lighting is yet installed.

The survey was undertaken using a calibrated light metre with a resolution of 0.01 lux and results taken at 5 metre spacings.

During the survey it was observed that a number of additional low-level bollards are also installed below the light columns, which are not shown on the design drawings or ISOLux contour plans.

Figure R: AoS2 Merion Road – Lux Survey Results



The light levels recorded in the horizontal survey are consistent with the 'inactive' state although these measurements were recorded with human presence in the area. This may indicate the presence detection is deactivated or not working for these fixtures, and this affects the recorded results by showing a significantly lower level of illumination than that shown in the ISOLux contours provided by Prolectric.

Further evidence to demonstrate the extent of illumination under 'active' illumination is provided in **Appendix A** based on photometric modelling of the as built scheme. This is intended to provide reassurance that should the scheme be commissioned as per the original design, the level of light spill to the tree line is still below the stated illuminance limit.

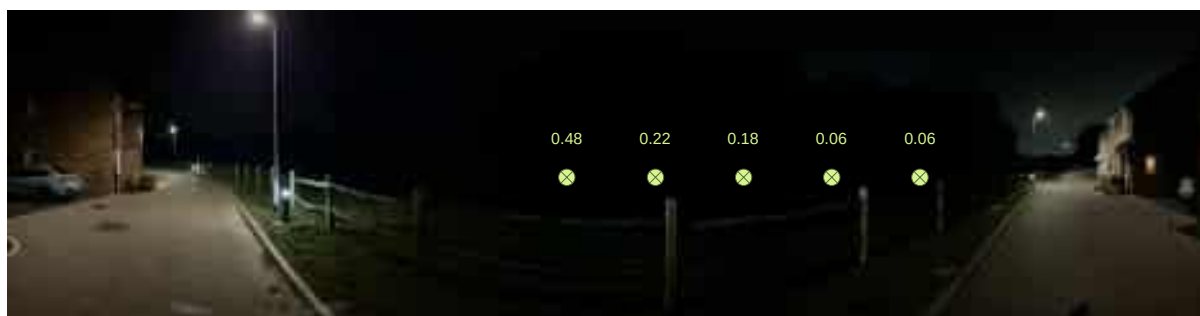
The vertical measurements taken at the tree line show minimal levels of illumination well below the required 1 lux limit imposed to protect the quality of habitats such as the mature tree line at the boundary.

The vertical illuminance levels recorded as part of the survey peak at 0.48 lux at 1.5 metres above ground level under the 'inactive' state. It should be noted that this tree line is topographically lower than the roadway due to a steep bank between. The 1.5 metres is above grade at the tree line, not above the roadway surface.



Figure S: AoS2 Merion Road Tree Line – Lux Measurement Locations

Measurement locations are superimposed in approximate locations (5 metre spacing at 1.5 metres above FFL). Values in Lux / Illuminance Limit = Max <1lux.



View looking southeast towards the tree line from the access road to frontages. The extent of the light spill to the tree line is minimal or at baseline for 'contextual darkness'. Due to the relatively low output of the street light fixtures, their optical control and orientation towards the core of the development, very little back light spill is observed.

2.6 AoS2 B4 Impact Assessment

The area to the south and east of the development in parcel B4 does have dense mature tree lines, hedgerow and woodland which are observed to be good potential habitat for bats and nesting birds. These areas are observed to remain in 'natural darkness' with very, little if any materially significant light pollution.

The relatively low output of the street light fixtures, their optical control and orientation towards the core of the development are observed to be effective at constraining the light to the development area with no back light spill above the 1 lux threshold on the vertical plane representing the tree line.

2.6.1 Conclusion

The street lighting as observed during the survey does not present any significant or adverse light pollution to the identified light sensitive habitats including the tree lines, woodland and mature hedgerows.

No further mitigation is required as the lighting scheme appears to comply with the objectives of preserving 'natural darkness' in these features for the benefit of ecology.





Appendix A Photometric Modelling Results

Lighting Survey Report

Boorley Green (Parcels B4 & C6)

Vistry Group PLC

SLR Project No.: 402.064830.00001

12 September 2024

A.1 Photometric Light Modelling

In order to test the viability of simple modifications to the existing lighting installation in AoS1E East to reduce light spill to the identified habitat of the mature tree line south of the development, a photometric light model was produced, to a reasonable degree of accuracy.

The photometric model uses photometric files provided by Prolectric for the luminaires used in the as built scheme. These files accurately model the light output and optical distribution of the beam emitted by the fixtures and are introduced to a scale 3D model of the site (AoS1E East and AoS2) allowing modelling that reproduces 'real world' effects.

The modelling including ISOlux contours and measurement data grids provided by Prolectric as part of the planning process were tested against the photometric model and the results were deemed to be accurate and repeatable within this model. These results were validated against the baseline survey measurements and found to be accurate against the as built installation. This proves accuracy and validates the original Prolectric modelling as well as this photometric model.

Vertical measurement planes were created in the model to represent the vertical face of the tree lines and hedgerows, and this provides an accurate method for testing the vertical illumination of this habitat feature from lighting within the scheme. Values on this surface should be less than 1lux in line with the ecologists recommended illuminance limit.

A horizontal measurement plane was created to represent the roadway surface for the purpose of testing the compliance of the roadway illumination against the design parameters used in the original design. An average value of between 3 to 5 lux is required which is in line with the Lighting Class P5.

A.1.1 Mitigation Strategy

A number of variations were tested to resolve issues with light spill in AoS1E, and a suitable mitigation was identified that satisfies the above criteria.

By removing the 22° tilt and having the luminaire mounted horizontally on the same column plus rotating the luminaire so its side throw optics align with the turning area is sufficient to eliminate any adverse contribution of light spill to the adjacent tree line. This arrangement also maintains the correct level of illumination to the roadway surface.

Evidence is provided in the following pages to demonstrate the output of the photometric model. Values are shown for both the 'As Built' (no mitigation) and 'Modified' (with mitigation) scheme with key values highlighted in **RED** where they exceed stated limits and **GREEN** where they are within the appropriate range.

The values for the vertical measurement plane 'VMP1' (representing the vertical face of the tree line) should be **below 1 lux** for the column **Emax** (See 'Calculation Objects') which is the data output from the model for the peak illuminance.

The values for 'Road Surface' (representing the horizontal roadway surface at ground level) should be **between 3 to 5 lux** for the column **E** (See 'Calculation Objects') which is the data output from the model for the average illuminance.

A.1.2 Conclusion

With the above mitigation undertaken, no other changes are necessary to satisfy the conditions as set out by the Council ecologist. The roadway illumination is maintained as originally designed and there is no materially significant illumination to the vertical face of the adjacent tree lines. With mitigation, no illumination is recorded in the model above the stated threshold of 1 lux on to the identified tree lines.

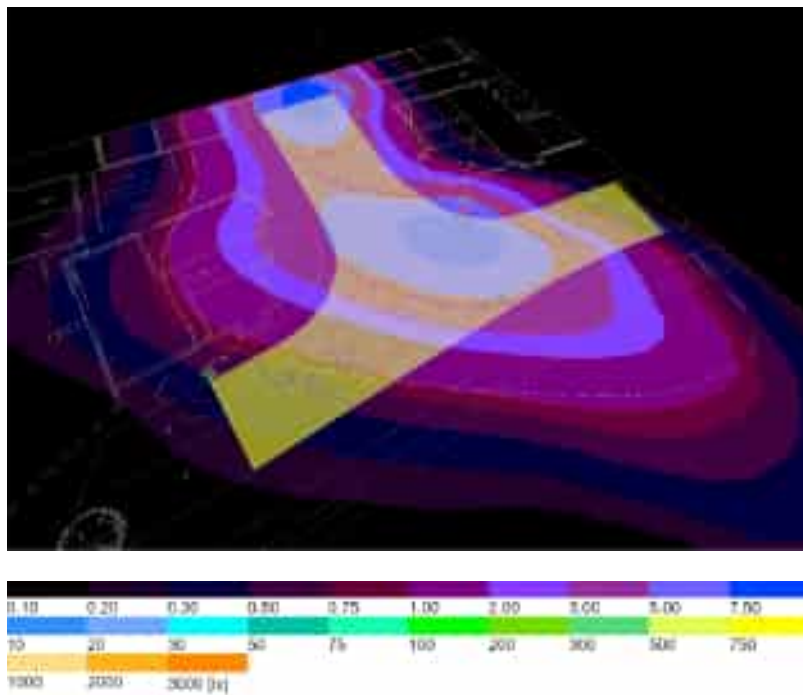


C6 AoS1E

Images

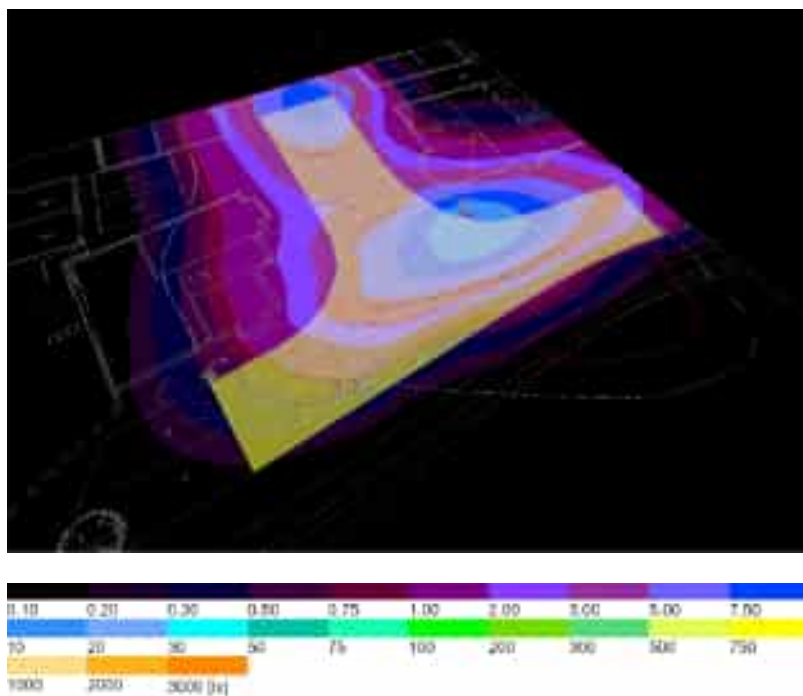
As Built False Colour Diagram

False colour diagram illustrating the extent of light spill into the tree line due to the upward tilt (22°) of the luminaire and the rotation of the fixture which orientates the optics to cast light laterally in to the tree line area.



Modified False Colour Diagram

False colour diagram illustrating the elimination of light spill into the tree line by removing the upward tilt of the luminaire to horizontal (0°) and the rotation of the fixture to align with the hammerhead turning area.

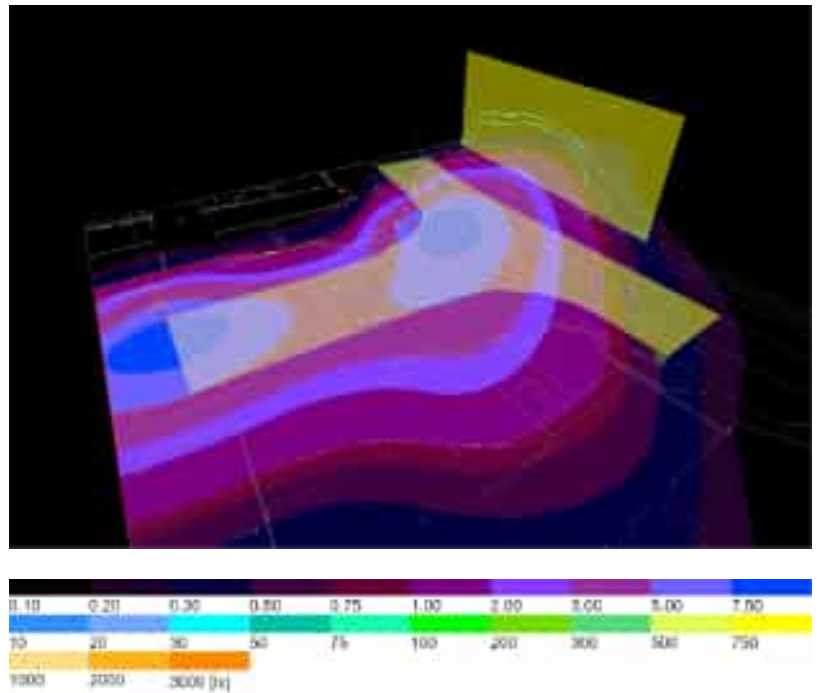


C6 AoS1E

Images

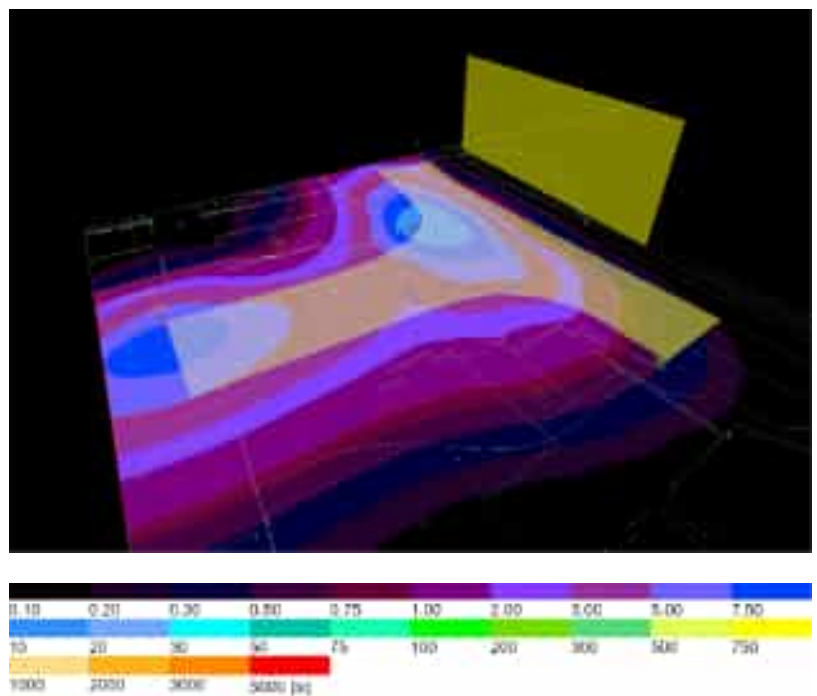
As Built Vertical False Colour Diagram

False colour diagram illustrating the position of the vertical measurement plane (VMP1) representing the vertical face of the tree line. Isolines on VMP1 indicate the vertical extent of light spill in the as built scenario. (See results for VMP1 As Built)



Modified Vertical False Colour Diagram

False colour diagram illustrating the position of the vertical measurement plane (VMP1) representing the vertical face of the tree line. Isolines on VMP1 indicate the vertical extent of light spill in the modified scenario. (See results for VMP1 Modified)



C6 AoS1E (As Built)

Calculation objects



C6 AoS1E (As Built)

Calculation objects

Calculation surfaces

Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP1 - Aos1E Tree Line Perpendicular illuminance Height: 4.000 m	0.88 lx	0.019 lx	4.36 lx	0.022	0.004	CG1
Road Surface Perpendicular illuminance Height: 0.000 m	4.21 lx	0.19 lx	9.59 lx	0.045	0.020	CG2
VMP2 - AoS1W Boundary Hedgerow Perpendicular illuminance Height: 4.000 m	0.006 lx	0.003 lx	0.010 lx	-	0.30	CG3
VMP3 - AoS2 Tree Line Perpendicular illuminance Height: 4.000 m	0.054 lx	0.020 lx	0.20 lx	0.37	0.100	CG4

Notes on planning:

Target for VMP1 <1 lux (E_{max})

Target for Roadway Surface 3-5 lux (E)

Target for VMP2 <1 lux (E_{max})

Target for VMP3 <1 lux (E_{max})

Notes:

ISOLines demonstrate the extent of the light on the horizontal plane at ground level.

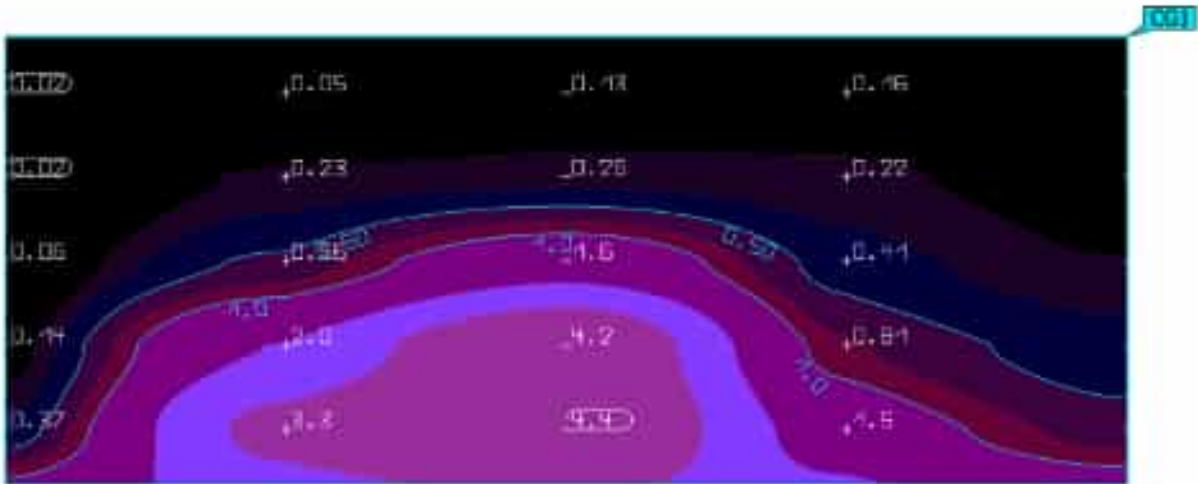
AoS1E - VMP1 shows illumination above the illuminance limit of 1 lux.

AoS1W - The streetlight that was observed to be installed but not working during the survey is omitted from the calculation to replicate the as built state observed during the survey.

AoS2 - The street lighting is set to 50% light output to replicate the 'inactive' state observed on site during the survey.

The equipment that has not been installed is omitted from the calculation and should not be installed.

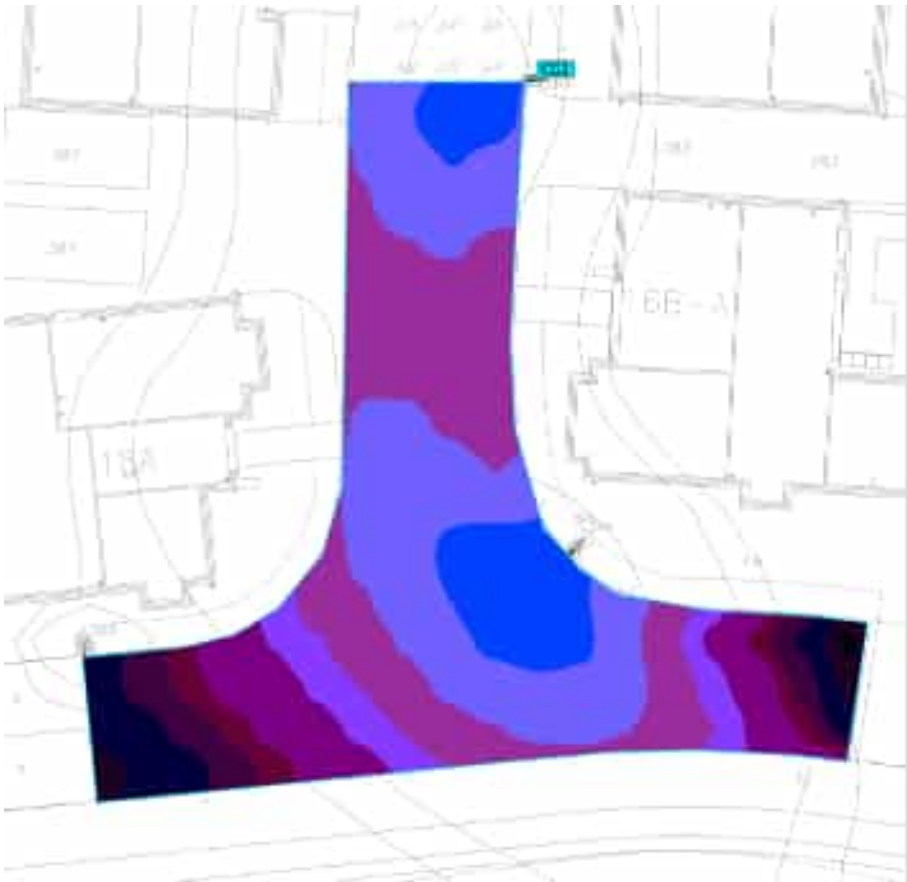
C6 AoS1E (As Built)
VMP1 - Aos1E Tree Line



Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP1 - Aos1E Tree Line Perpendicular illuminance Height: 4.000 m	0.88 lx	0.019 lx	4.36 lx	0.022	0.004	CG1

Notes on planning:
Target for VMP1 <1 lux (E_{max})
VMP1 shows illumination above the illuminance limit of 1 lux.

C6 AoS1E (As Built)
Road Surface

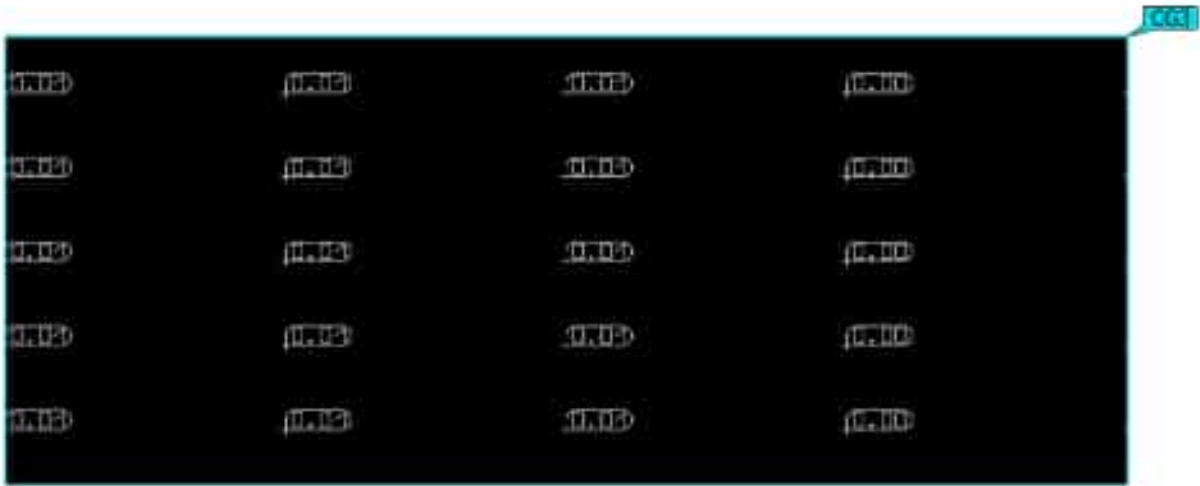


Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
Road Surface Perpendicular illuminance Height: 0.000 m	4.21 lx	0.19 lx	9.59 lx	0.045	0.020	CG2

Notes on planning:
Target for Roadway Surface 3-5 lux (E)

C6 AoS1E (As Built)

VMP2 - AoS1W Boundary Hedgerow

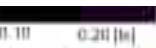
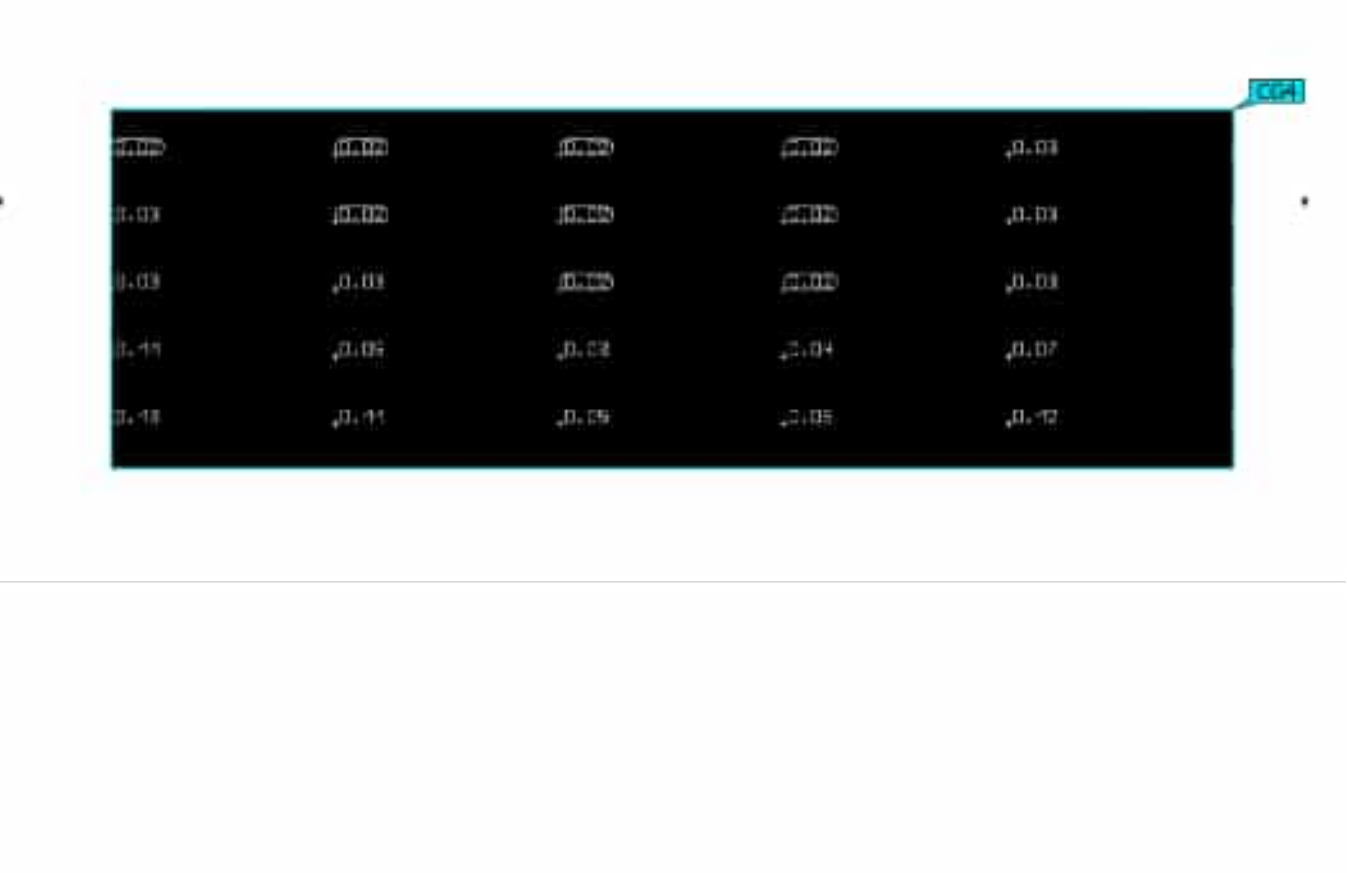


Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP2 - AoS1W Boundary Hedgerow Perpendicular illuminance Height: 4.000 m	0.006 lx	0.003 lx	0.010 lx	-	0.30	CG3

Notes on planning:
Target for VMP2 <1 lux (E_{max})

C6 AoS1E (As Built)

VMP3 - AoS2 Tree Line



Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP3 - AoS2 Tree Line Perpendicular illuminance Height: 4.000 m	0.054 lx	0.020 lx	0.20 lx	0.37	0.100	CG4

Notes on planning:
Target for VMP2 <1 lux (E_{max})

C6 AoS1E (Modified)

Calculation objects



C6 AoS1E (Modified)

Calculation objects

Calculation surfaces

Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP1 - AoS1E Tree Line Perpendicular illuminance Height: 4.000 m	0.094 lx	0.027 lx	0.19 lx	0.29	0.14	CG1
Road Surface Perpendicular illuminance Height: 0.000 m	4.43 lx	0.26 lx	12.8 lx	0.059	0.020	CG2
VMP2 - AoS1W Boundary Hedgerow Perpendicular illuminance Height: 4.000 m	0.017 lx	0.005 lx	0.065 lx	0.29	0.077	CG3
VMP3 - AoS2 Tree Line Perpendicular illuminance Height: 4.000 m	0.11 lx	0.041 lx	0.39 lx	0.37	0.11	CG4

Notes on planning:

Target for VMP1 <1 lux (E_{max})

Target for Roadway Surface 3-5 lux (E)

Target for VMP2 <1 lux (E_{max})

Target for VMP3 <1 lux (E_{max})

Notes:

ISOLines demonstrate the extent of the light on the horizontal plane at ground level.

AoS1E - With mitigation, vertical illuminance is recorded on VMP1 below the illuminance limit of 1 lux with the installed streetlighting in the 'active' state.

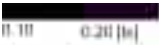
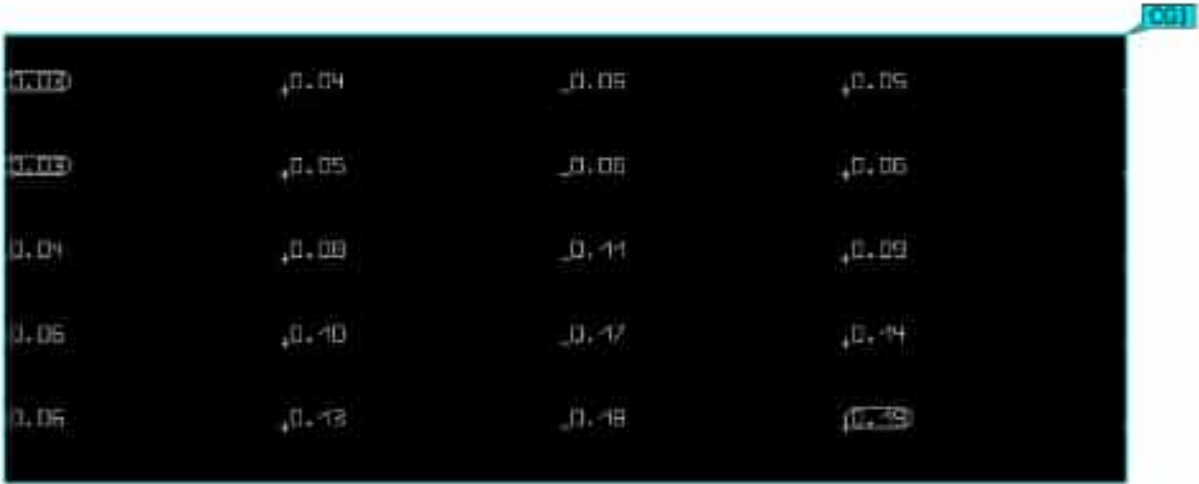
AoS1W - The streetlight that was observed to be installed but not working during the survey is included in the calculation to ensure the target values on VMP2 are not exceeded with this equipment commissioned as designed.

Vertical illuminance is recorded on VMP2 below the illuminance limit of 1 lux with the installed streetlighting in the 'active' state.

AoS2 - The street lighting is set to 100% to replicate the 'active' state triggered by presence detection as designed but not observed during the survey.

The equipment that has not been installed is omitted from the calculation and should not be installed.

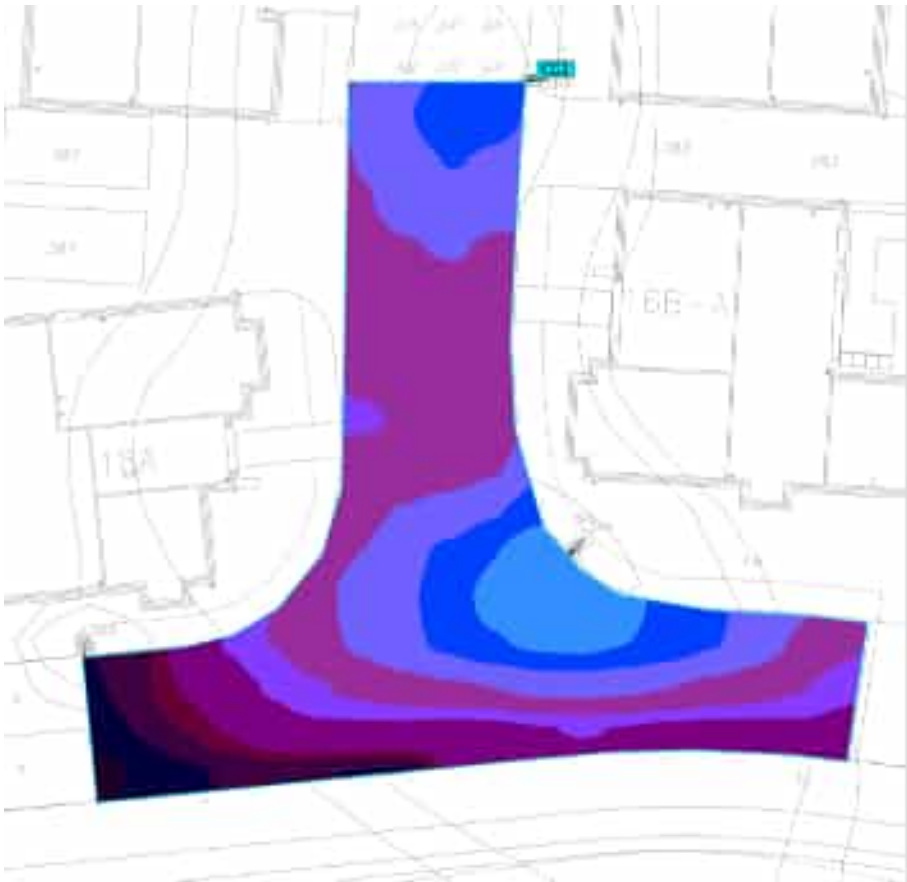
C6 AoS1E (Modified)
VMP1 - Aos1E Tree Line



Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP1 - Aos1E Tree Line Perpendicular illuminance Height: 4.000 m	0.094 lx	0.027 lx	0.19 lx	0.29	0.14	CG1

Notes on planning:
Target for VMP1 <1 lux (E_{max})

C6 AoS1E (Modified)
Road Surface

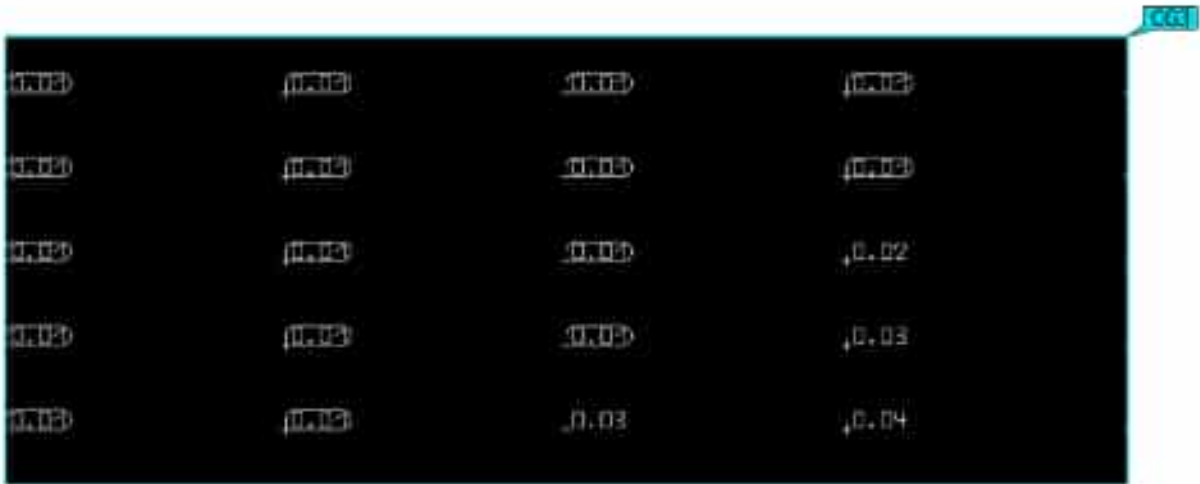


Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
Road Surface Perpendicular illuminance Height: 0.000 m	4.43 lx	0.26 lx	12.8 lx	0.059	0.020	CG2

Notes on planning:
Target for Roadway Surface 3-5 lux (E)

C6 AoS1E (Modified)

VMP2 - AoS1W Boundary Hedgerow



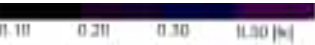
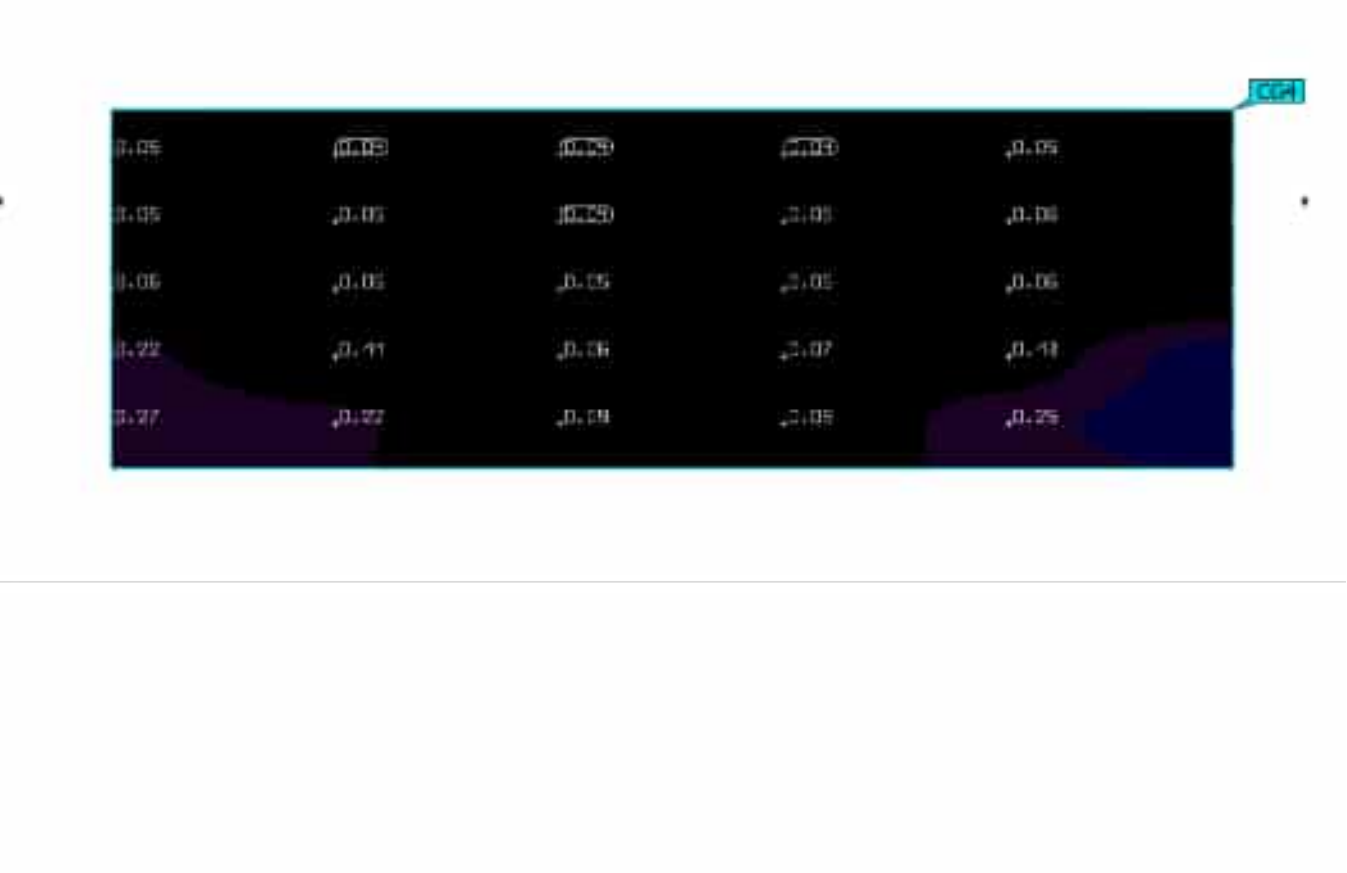
0.017 lx

Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP2 - AoS1W Boundary Hedgerow Perpendicular illuminance Height: 4.000 m	0.017 lx	0.005 lx	0.065 lx	0.29	0.077	CG3

Notes on planning:
Target for VMP2 <1 lux (E_{max})

C6 AoS1E (Modified)

VMP3 - AoS2 Tree Line



Properties	$\bar{E}$	E_{min}	E_{max}	$U_o (g_1)$	g_2	Index
VMP3 - AoS2 Tree Line Perpendicular illuminance Height: 4.000 m	0.11 lx	0.041 lx	0.39 lx	0.37	0.11	CG4

Notes on planning:
Target for VMP3 <1 lux (E_{max})

