

29.10.2021

Ref: SY191314-ER-1

JON HOWELL
DEVELOPMENT PROJECT MANAGER
JONATHAN@URBNSURF.COM

Dear Jon,

Re: URBNSURF SYDNEY - External Lighting Assessment

Background information

We have prepared lighting models and spill light calculations to demonstrate the impact of URBNSURF external and Lagoon lighting on nearby wetland.

Hill Road is located on the Western Boundary of the site and the wetland is in the North Side of Hill Road obstructed by a medium density tree plantation as shown on photo below.



Site and wetland along Hill Road north and south

The existing street lighting on Hills Road consists of Sylvania Street lighting luminaires, 150W metal halide lamps and aero screen flat glass. The pole heights are 10.5m high, outreach is 4.5m.

Upcast angle of the outreach arms is at 30degree, the road light luminaire upcast angle is 10degrees. There are luminaires on both sides of Hill Road at an average of 90m spacing in staggered formation.



Hill Road typical street lighting pole and luminaire

The wetland is on the northern side of Hill Road behind the tree line. There is a frog fence protecting the wetland along the full road boundary.



Wetland on northern side of Hill Road wildlife is protected by frog fence

Luminaire selection

External and basin lighting on URBNSURF site consists of the following:

- Lagoon Basin lighting – 30m high sports lighting masts with five (5) 1240W Sylvania Raptor LED floodlights. The floodlights have back and side shields as appropriate to control back spill and side spill light. All lagoon basin lighting is programmable DALI dimmable which allows for specific light settings during evening and night-time operation to minimise light spill impacts.
- Staff parking consists of 72W WeEf pole mounted luminaires on 7m high poles. Luminaires have two optics, side and forward throw. Selection of optics was determined on pole location. Luminaires are slightly tilted by 3 degrees above horizontal, but the light beams are restricted to 15 degree below horizontal hence no upward lighting applies.
- The external landscape, the pedestrian pathways and disabled car spaces are lit via a 31W Bega pole top luminaires on 5m high poles. Luminaires have two optics, side and forward throw. Selection of optics was determined on pole location. Luminaires aimed at 0 degree above horizontal to the ground to ensure the main light beam is facing down and no uplight applies.
- External lighting in front of the ground floor café/restaurant consists of 21W catenary mounted downlights with medium beam. The downlights are attached to the catenary wiring facing down at 90 degrees, meaning main light beam facing down towards the grass and no uplight applies.

Luminaires images



Sylvania Raptor – Lagoon Basin lighting on 30m high poles generally aimed between 6-10 degrees only



We-Ef Pole top luminaire - Staff parking lighting on 7m high poles generally aimed at 3 degrees only



Bega pole top luminaires - Event space, landscape and pathway lighting on 5m high poles aimed at 0 degree



Bega catenary mounted downlight at 3-4m height facing down to lawn area

Lighting calculation and model methodology

1. Northrop prepared a lighting model using AGi32 software.
2. For the obtrusive lighting calculation, we compliance test for both curfew (past 11pm) and pre-curfew hours as per AS/NZS 4282:2019.
3. The calculation grids were set up in 5mx5m grid.
4. Threshold increment has been calculated on the roadways. The maximum TI calculated is 14 based on the assumed roadway adaptation luminance of 1.0 cd/m².
5. We calculated the lighting levels internal and external to URBNSURF boundary.
6. We have calculated lighting levels on Hill Road and also within a **10 meter wide zone** behind the road into the wetland. (Refer Fig 1.)
7. We carried out obtrusive lighting calculations at the property boundary line of the wetland in a 30m high vertical plane.
8. The vegetation on Hill Road and the frog fence has been modelled into the calculations using 50% transmittance factor.
9. URBNSURF building has also been added to the model with the respective footprint and building height as per architectural plans. The building block was modelled with 0.47 reflectance factor applicable to a light colour concrete finish.

Three calculations were presented as follow:

- LC1 Calculation 1: Hill Road lighting on only, URBNSURF basin and external lighting off.
- LC2 Calculation 2: All lighting on (Hill Road lighting URBNSURF basin and external lighting)
- LC3 Calculation 3: Only URBNSURF external lighting on,

Calculation results

	Conclusion 1		Conclusion 2			Conclusion 3	
Calc reference	Street light on Current (Lux)	Street light on Seg1 Previous (Lux)	Basin, external and street light on Current(Lux)	Basin, external and street light on Previous	External on and street light off Current (Lux)	External and Street light on Current (Lux)	Default street lighting (Lux)
	Current	Previous (Gerard Lighting 2017)	Current	Previous (Gerard Lighting 2017)	Current	Current	Previous (Gerard Lighting 2017)
Drawing reference	LC1		LC2		LC3	Add results of LC1 and LC3	
Segment 1 Vertical lighting levels in 30m high zone	1.7	0.6	2.1	0.8	0	1.7	0.6
Segment 2 Vertical lighting levels in 30m high zone	0.3	0.4	1.6	0.5	0	0.3	0.4
Segment 3 Vertical lighting levels in 30m high zone	0.4	0.6	1.9	0.9	0	0.4	0.6
Segment 4 Vertical lighting levels in 30m high zone	4.2	0.6	7.0	1.1	0	4.2	0.6
Segment 5 Vertical lighting levels in 30m high zone	4.2	0.4	4.2	0.4	0	4.2	0.4
Average horizontal levels past Wetland boundary in 30m wide zone (Lux)	0.11		0.25		0	0.11	

Conclusions:

Conclusion 1 - Hill Road Street lighting – Refer to LC1 Calculation sheet

Our base point is the lighting levels and obtrusive lighting calculation results obtained for Hills Road street lighting. We have included street lighting poles on the entire URBNSURF Hills Road side as well as the first six street light luminaires on Holker Avenue.

As the street lighting is on from dusk to dawn only the difference and extra over values between street lighting and URBNSURF basin and external lighting needs to be evaluated.

Average horizontal lighting level past the Wetland boundary in a 30m zone is 0.11 lux

Conclusion 2 - URBNSURF basin and external lighting results added as well as Hills Road lighting - Refer to LC2 Calculation sheet

The additional lighting expected in each sensitive segment is summarised below:

1. $2.1 - 1.7 = 0.4$ Lux
2. $1.6 - 0.3 = 1.3$ Lux
3. $1.9 - 0.4 = 1.5$ Lux
4. $7 - 4.2 = 2.8$ Lux
5. $4.2 - 4.2 = 0$ Lux

Average horizontal lighting level past the Wetland boundary in a 30m zone is 0.25 lux and increase of just 0.14 lux over the street light horizontal level.

The net increase to the vertical and horizontal lux levels in this scenario are not perceivable without the use of sensitive measuring equipment.

It is likely that design development and specific light programming will allow even further reductions in spill light levels to align with spill lighting emitted from the street lighting.

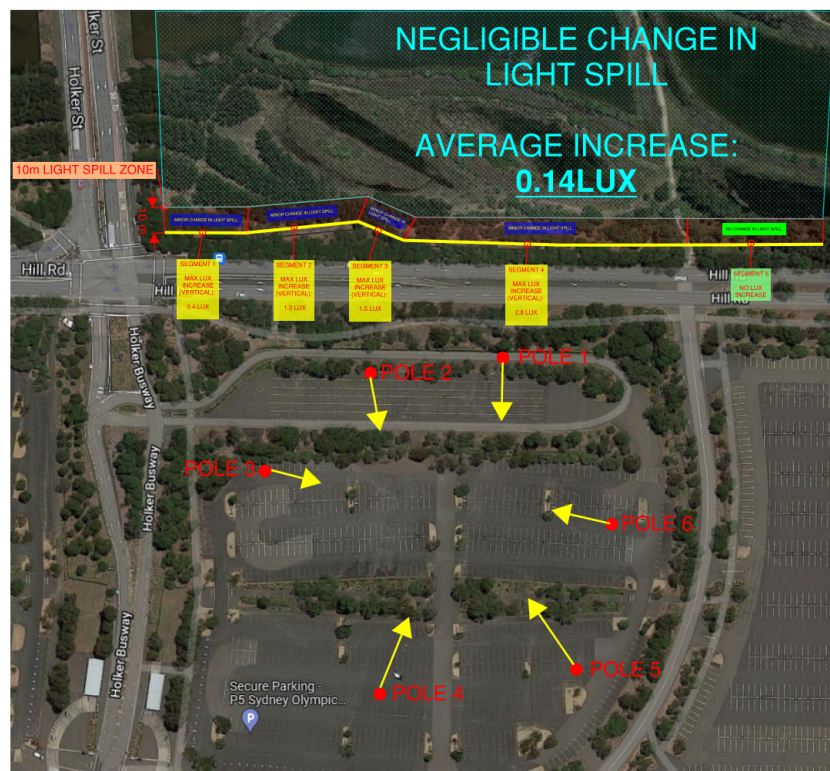


Figure 1 – URBNSURF light spill effect on Wetland (Also Refer Attached)

Conclusion 3 - URBNSURF - External Lighting only, no basin lighting – L3

This calculation resulted on net zero contribution of vertical horizontal levels over and above the street lighting generated vertical and horizontal illumination.

The calculation result indicates that the impact on wetland from the external lighting only with the lagoon basin lighting off have no impact to the sensitive wetland receivers as lighting levels (both vertical and horizontal) does not exceed the street lighting levels. Thus, the street lighting light level values are adopted to represent the baseline spill light entering the wetland in this scenario. The spill lighting from street lighting is maintained throughout the night.

Date	Rev	Issue	Author	Verifier
28.10.2021	1	Information	I.Kanalas	S.Parajuli

ATTACHMENTS

FIGURE 1 – URBNSURF LIGHT SPILL EFFECT ON WETLAND

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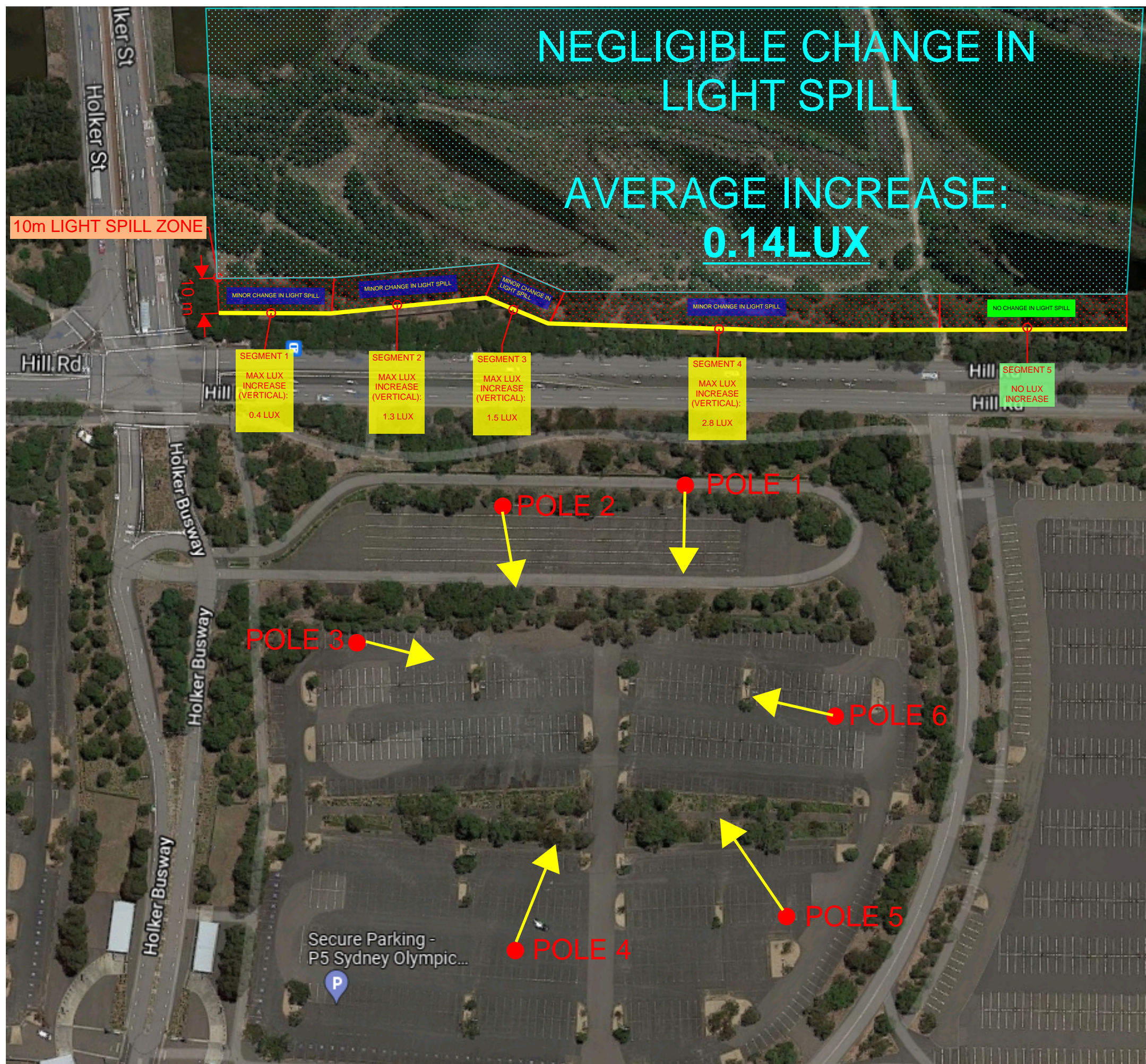


FIGURE 1 - URBNSURF Light Spill Effect on Wetland