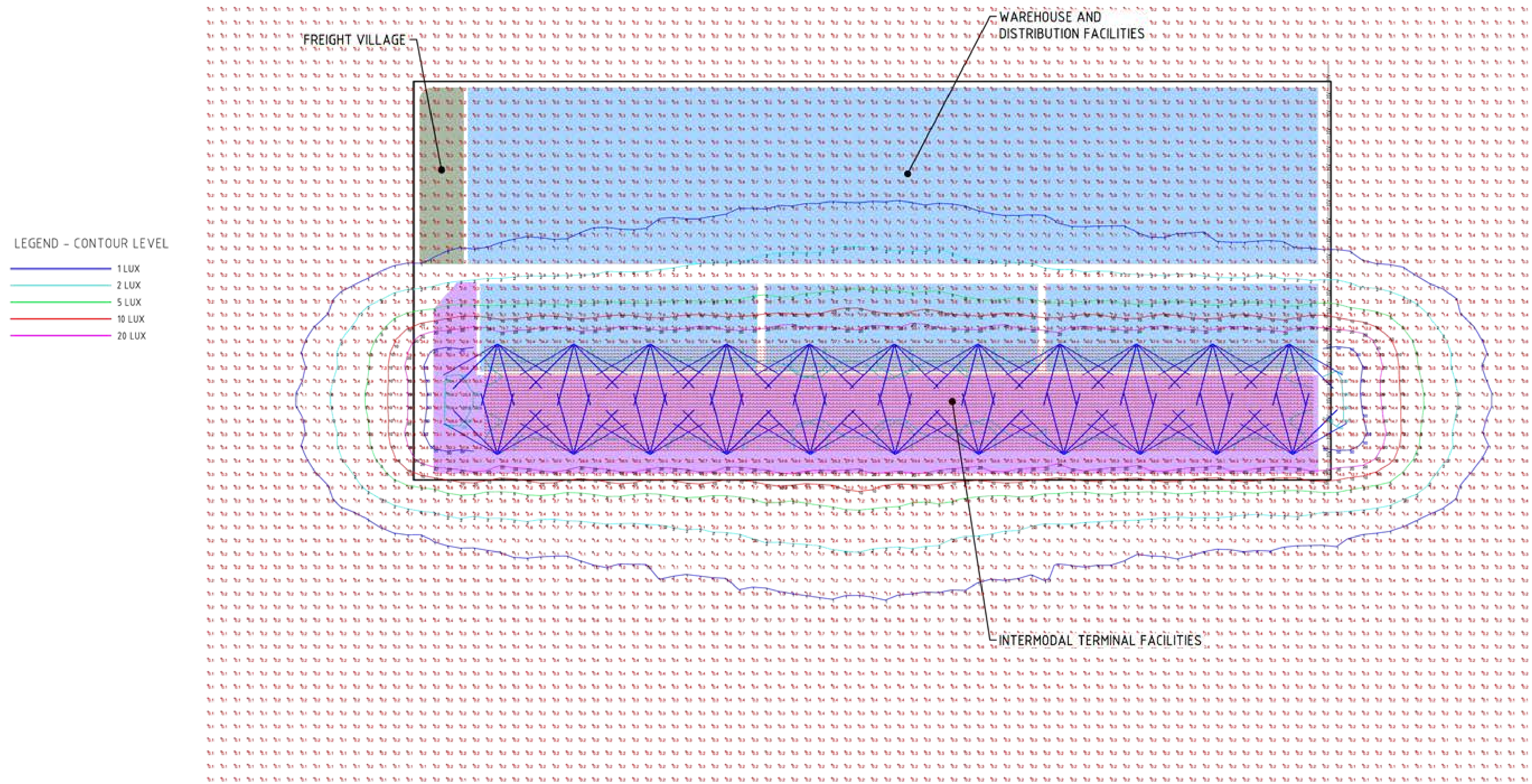
appendix C

SKC041 - Lighting Simulation Results



Issue	Description	Date
01	FOR INFORMATION	xx/xx/10

Client: SIMTA

Status: **PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

		Current Issue Signatures	
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Original Size	A1	Designed	DGM
Height Datum	AHD	Checked	DE
Grid	MGA	Approved	GI
Filename			

Project: SIMTA MOOREBANK INTERMODAL TERMINAL FACILITY

Title: LIGHTING SIMULATION RESULTS

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Drawing No.	Project No.	Issue
SKC041	AA003210	01

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appendix D

Copy of Light Spill Study Report
Hyder Consulting Engineers

Light Spill Study Report

SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Transitional Part 3A Concept Plan Application

June 2013

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SIMTA

Moorebank Intermodal Terminal Facility

Light Spill Study

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This report has been prepared for SIMTA in accordance with the terms and conditions of appointment dated 17 August 2010. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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1 Introduction

The Sydney Intermodal Terminal Alliance (SIMTA) is a consortium of Qube Logistics and Aurizon. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC occupied site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access to Port Botany. Construction of the rail connection from the SIMTA site to the Southern Sydney Freight Line (SSFL) will be undertaken as part of the first stage of works for the SIMTA proposal.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 17 kilometres south of the Parramatta CBD, 5 kilometres east of the M5/M7 Interchange, 2 kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

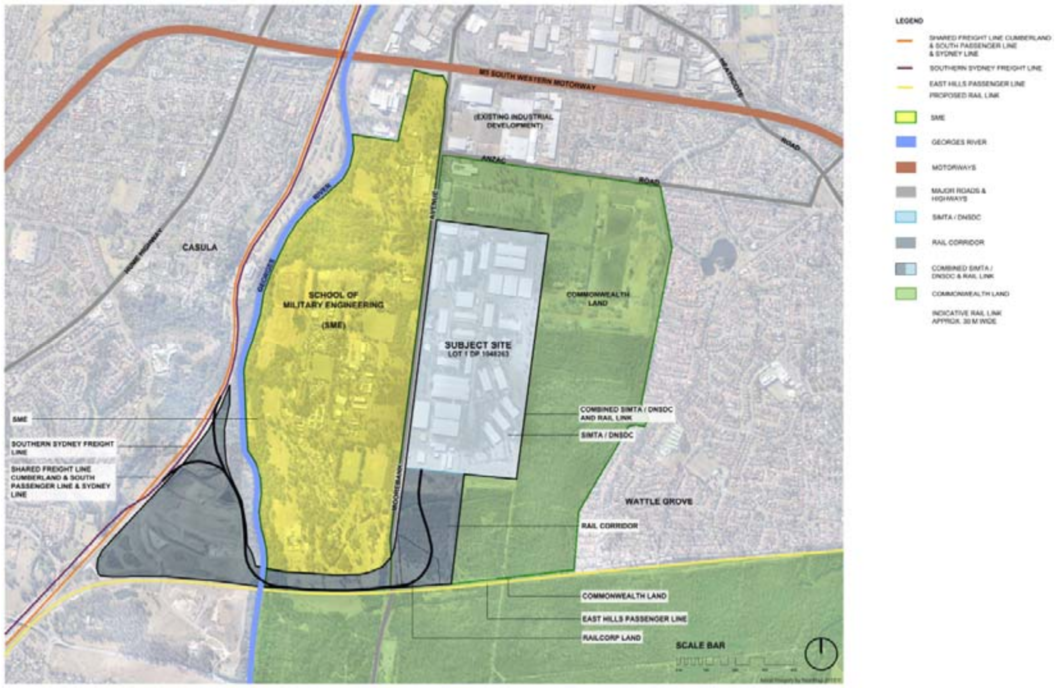
The SIMTA site, approximately 83 hectares in area, is currently operating as a Defence storage and distribution centre. The SIMTA site is legally identified as Lot 1 in DP1048263 and zoned as General Industrial under Liverpool City Council LEP 2008. The parcels of land to the south and south west that would be utilised for the proposed rail link are referred to as the rail corridor. The proposed rail corridor covers approximately 75 hectares and adjoins the Main Southern Railway to the north. The rail line is approximately 3.5 kilometres in length, 20 metres in width (variable width) and includes two connections to the SSFL, one south and one north.

The proposed rail corridor is owned by third parties, including the Commonwealth of Australia, RailCorp, private owners and Crown Land held by the Department of Primary Industries, and would link the SIMTA site with the Southern Sydney Freight Line. Existing uses include vacant land, existing rail corridors (East Hills Railway and Main Southern Railway), extractive industries, and a waste disposal facility. The rail corridor is intersected by Moorebank Ave, Georges River and Anzac Creek. Native vegetation cover includes woodland, forest and wetland communities in varying condition. The proposed rail corridor is zoned partly ‘SP2 Infrastructure (Defence and Railway)’ and partly ‘RE1 - Public Recreation’. The surrounding Commonwealth lands are zoned ‘SP2 Infrastructure (Defence)’.

The SIMTA proposal will be undertaken as a staged development. An annual operating capacity of one million TEU throughput is anticipated in the ultimate stage, when fully developed.

Hyder has prepared this light spill study to examine the potential lighting requirements for the operation of the SIMTA site and investigate through the modelling of a concept lighting design, its compliance with the Australian Standard – *AS4282- 1997, “Control of Obtrusive Effects of Outdoor Lighting”.*

The actual lighting design will be developed and detailed during ongoing design development of the stages of SIMTA. Each stage will require further analysis based upon the actual luminaires to be adopted to ensure their compliance with the above standard, and to mitigate any impact on the surrounding environment**Figure 1: Moorebank Intermodal Terminal Site**



2 Methodology

The scope of the light spill study is to predict:

- Light spill to residential boundaries in the form of a vertical illuminance/intensity calculation grid on a vertical plane at a height of 1.5m within the specified area, derived in the specified manner.
- Special criteria operation such as local airfields or astronomical observatories that could be affected from light spill.

The results of the modelling which depicts the alignment of the limiting illuminance is shown in Figure 4.

Software used for the illuminance modelling/calculation is the visual lighting design software *AGi32: version 2.02* provided by light lab international (www.lsa.com.au) and (www.visuallightingsoftware.com).

The assessment methodology has generally not included the beneficial effect of buildings, trees and bushes and can thus be considered conservative.

The extent or scale of values likely to be affected as a result of the SIMTA proposal are outlined further within this report. The extent or scale refers to areas within the SIMTA site and rail link construction footprint. Design information regarding the location of the rail link within the rail corridor is not available at this time. As a result, potential impacts within the rail corridor may be reviewed once design and siting studies are completed for the project application stages.

3 Australian Standards for Light Spill

In accordance with Table 2.1 of Australian Standard AS4282-1997 “Control of the Obtrusive Effect of Outdoor Lighting”, the following light levels have been adopted as the limiting values in the assessment of light spill:

<table>
<tr><th colspan="2" rowspan="2">Light Technical Parameter</th><th colspan="2">Residential Areas</th></tr>
<tr><th>Light Surrounds</th><th>Dark Surrounds</th></tr>
<tr><td rowspan="2">Illuminance in vertical plane</td><td>Pre-curfew hours</td><td>10 lux</td><td>10 lux</td></tr>
<tr><td>Curfew hours</td><td>2 lux</td><td>1 lux</td></tr>
<tr><td rowspan="2">Luminous Intensity Emitted by luminaires</td><td>Pre-curfew hours</td><td>100,000 cd

(for a large area with Level 1 control)</td><td>100,000 cd

(for a large area with Level 1 control)</td></tr>
<tr><td>Curfew hours</td><td>1,000 cd</td><td>500 cd</td></tr>
</table>

Table 1: Light Limiting Values in accordance with Table 2.1 - AS4282 - 1997

A copy of Table 2.1 – AS4282 – 1997 is located in Appendix A.

These limiting values are based upon the assumption that the criteria for curfew hours will apply, since the site lighting will be operational for 24 hours per day.

It should be noted that additional light spill can be accepted in an area where a lot of light already prevalent, whereas the same light spill will be seen as more obtrusive in dark residential areas.

4 Design Parameters and Assumptions

Site Description

The SIMTA site is divided into two main usages

- The rail transfer and container loading area, which is located on the western Moorebank Avenue frontage of the site.
- Warehousing area located on the eastern, Wattle Grove side of the site.

It is considered the location with the most potential for light spill is the rail transfer and container loading area.

The rail transfer and container loading area is an open area which will be lit by luminaires on high standards (assumed for the purposes of the modelling only as 40 metres), so as to provide relatively high levels of light in both horizontal/vertical planes. The level of light is intended to safely support operations of the intermodal terminal such as:

- Crane operations and positioning.
- Shared vehicular and pedestrian usage hazard.
- Container movement activities.

The warehousing is located on the eastern boundary and should be similar in operation to any large warehouse complex. The warehouses are expected to have their front of house entries facing the eastern boundary of the site, with loading and unloading of the buildings along the northern and southern building faces.

Operational Lighting Standards

There are no Australian Standards which specifically address minimum standards of lighting for an exterior work area with this type of application. In these instances, the international standard *Commission Internationale De L'eclairage (CIE) 129-1998 Guide for lighting exterior work areas* is generally adopted.

The CIE standard specifies 50 lux for "rough works" which includes continuous handling of large units and raw materials, loading and unloading of freight, lifting and deseeding location for cranes, open loading platforms.

The following design parameters have therefore been adopted for relevant calculations to analyse the effects of obtrusive light from the proposed lighting system;

- Maintained Average Horizontal Illuminance = 50 lux
- Light Loss Factor = 0.70
- Initial lamp output = 220,000 lumens/lamp
- Horizontal Illuminance based at ground level
- Calculation Grid Size over field = 5m x 5m

Luminaire Adopted for Modelling

For the purposes of modelling to satisfy AS4282 – 1997, the following lighting luminaire and standard have been adopted:

- Philips Optivision floodlight luminaires with 2,000 watt double ended short arc metal halide lamp.
- 40 metre high standards, located at approximately 120 metre centres.

The Phillips Optivision luminaire has been specifically chosen for a number of reasons:

- It is commonly available in Australia and commonly adopted in similar uses such as external industrial sites and sports facilities.
- The Optivision luminaire uses an asymmetric reflector of very high efficiency.

Asymmetric reflectors in luminaires are used for down lighting in open industrial or sporting fixtures specifically to control light spill and limit glare and upward light leakage. Figure 2 shows how a light beam from an asymmetrical luminaire provides a more focussed light beam.

A brochure for the Optivision product is included in Appendix B and a copy of the lighting performance curves used for the modelling is shown in Figure 3.

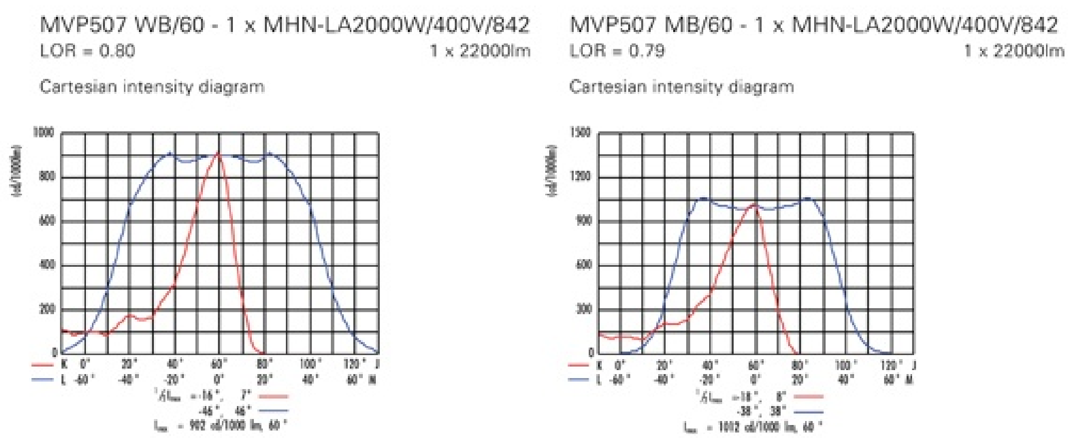
An asymmetric reflector means that the maximum beam intensity is emitted at an angle to the front of the glass so that spill is secured at a peak intensity at 60º and a sharp cut-off of light at 80º. The following photograph demonstrates the beam from an asymmetric reflector on a similar type of luminaire.

Figure 2: Example of Light Beam from an Asymmetic reflector

Standard luminaires with a symmetrical reflector need to be tilted to angles up to 75^0 to be able to achieve the spread and intensity of a beam over a wide area, whereas an asymmetrical reflector can achieve the same level with only a tilt of just 10º thus reducing risk of light spill to adjoining properties.

A combination of wide beam and medium beam reflectors would be used in the fittings to contain the lighting to a specific area without creating significant bright spots on site.

Philips Optivision 2000 watt Light Fitting



Photometric of the Light Fitting

Figure 3: Lighting Performance Diagram for Philips Optivision 2,000 watt

5 Results and Conclusion

The results of the modelling using Philips Optivision 2,000 watt luminaires mounted on 40 metre standards at approximately 120 metre centres are as follows:

- The most stringent requirement under Table 2.1 of AS4282 1997 of 1 lux in residential dark surrounds during curfew hours, is achieved approximately 150 metres from the light source as shown in Figure 4 following.
- Residential properties are approximately 400 metres from the eastern boundary and so will not be impacted by the light spill from the development.
- Along the eastern boundary where the uses are more consistent with a standard street in a commercial/industrial area, the light level is expected to be equivalent to a standard street level of lighting as per Australian Standard AS1158.3.1 “Lighting for roads and public spaces – Pedestrian area (Category P) lighting – Performance and design requirements”, category P3. Note that the requirements set for P3 is minimum 0.3 lux and hence unlikely to impact on the nearest residences.

The results of the modelling are shown on drawing SKC041 located in Appendix C.

The modelling shows that the luminous intensity from lighting within the SIMTA site can be easily designed to be below the prescribed maximum value of 500 cd (for curfew hours: 11.00pm to 6.00am) at the nearest residences.

Therefore the impact of light spill to the residential properties will be well within the required criteria as specified in Australian Standard AS4282-1997 “Control of the Obtrusive Effect of Outdoor Lighting”:

Further detailed lighting design development of the terminal will aim to reduce the proposed 40 metre standards to a lesser height (less than the proposed height of the warehouses) whilst maintaining the 50 Lux levels required for terminal operations and any occupational health and safety requirements. The reduced standard height (and increased standard frequency) may further reduce the surrounding light spill Isolux levels indicated in Figure 4 and the impact on the surrounding residential areas; however the full extent of this reduction will not be fully recognised until further detailed design modelling is undertaken.

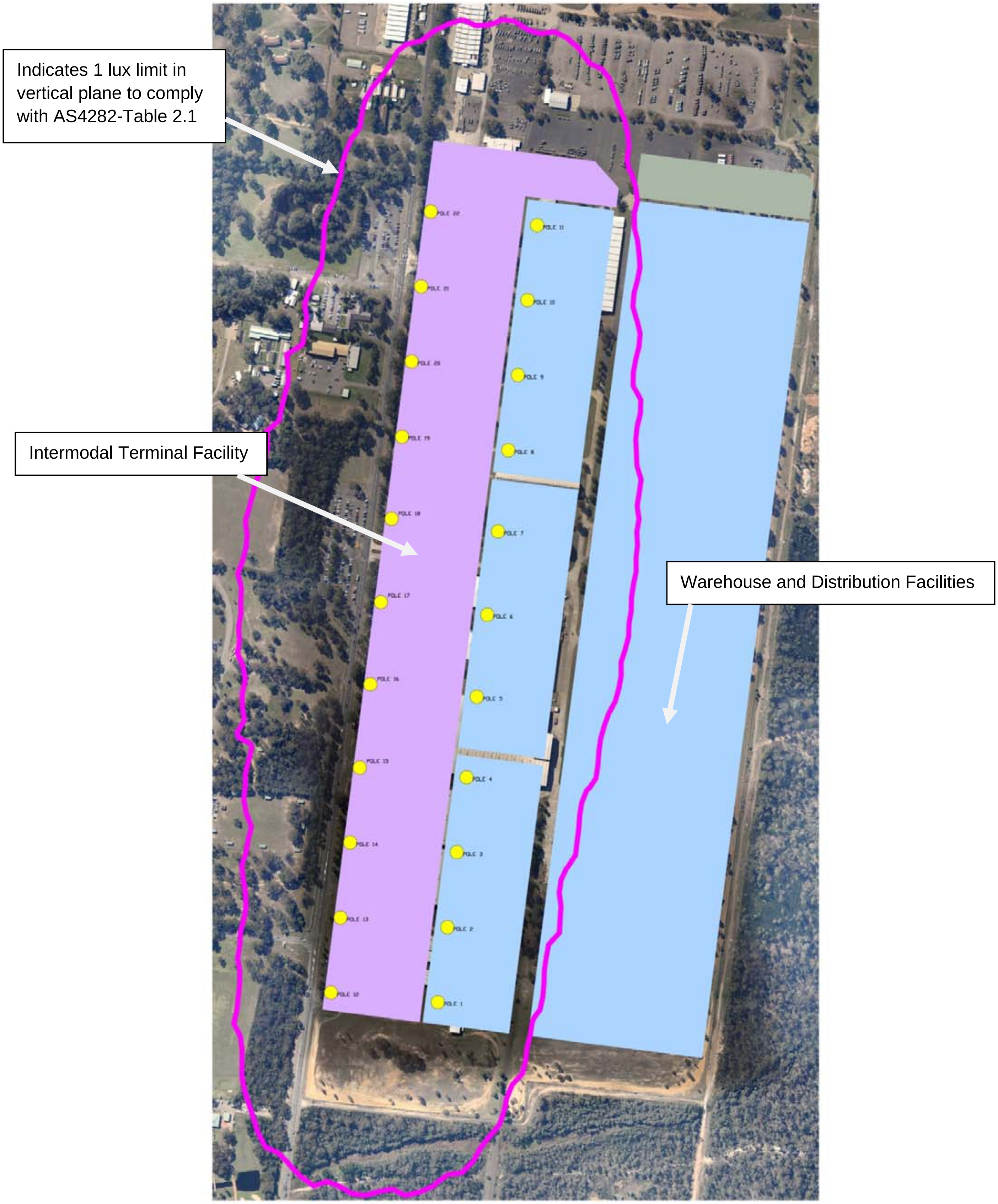


Figure 4: Isolux result (Vertical Illuminance at 1.5 m Above Ground)

Appendix A

Table 2.1 – AS4282 - 1997

Appendix B

Phillips Optivision Brochure

Appendix C

SKC041 – Lighting Simulation Results

REIDCAMPBELL