

MINTO WAREHOUSE AND LOGISTICS HUB

Light Spill Assessment

27 APRIL 2016

Incorporating



MINTO WAREHOUSE AND LOGISTICS HUB

Light Spill Assessment

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APPENDICES

APPENDIX A
Case Study Results – Moorebank Warehousing

1 INTRODUCTION

Qube is preparing a State Significant Development Application (SSDA) in relation to the proposed development of 5 and 9 Culverston Road, Minto, being legally described as Lot 3 in DP 817793 and Lot 400 in DP 875711 (the Site), for the purpose of a Warehouse and Logistics Hub (the Proposal).

Arcadis has been engaged to provide a Light Spill Analysis report relating to the proposal for the development of the Minto Warehouse and Logistics Hub as required by the Secretary's Environmental Assessment Requirements (SEAR) addressing a portion of the Urban Design and Visual elements requirement.

The objective of this report is to:

- Analyse spill limits and complete a high-level assessment of lighting requirements;
- Demonstrate that compliance can be achieved through design in accordance with:
 - Secretary's Environmental Assessment Requirements (SEARs) 11e; and
 - AA4282:1197 Control of the obtrusive effects of outdoor lighting;

1.1 Project Description

The Site is located in Minto and is bound by Airds Road, Rose Payten Drive and Main Southern Railway. Culverston Road crosses the development as outlined in Figure 1.1. The development is approximately 29.63 hectares in area and is planned to accommodate warehouses with the total building area of 112,000 m².

The existing site comprises an industrial area hardstand, shade structures and a warehouse building.



Figure 1.1 Site location

1.2 Proposed Development & Approval Conditions

This report has been prepared as part of a State Significant Development (SSD) Application and in accordance with the Secretary's Environmental Assessment Requirements (SEARs) (ref: SSD 7500, File: 16/03046 and dated 10/03/2016). The SEARs which are addressed in this report are presented in Table 1.

Table 1: Secretary's Environmental Assessment Requirements

SEARs Reference	Key Assessment Requirement	What is addressed
Urban Design and Visual	A detailed assessment (including photomontages and perspectives) of the facility (buildings and storage areas) including height, colour, scale, bulk, building materials and architectural treatments and finishes, signage, lighting and any retaining walls particularly from nearby public receivers and significant vantage points within the broader public domain.	A detailed assessment of the lighting for the facility, in particular the effects of light spill on the nearby public receivers.

2 LIGHT SPILL ASSESSMENT

2.1 Background

As part of the SEAR's key assessment requirement for the Urban Design and Visual aspects of the proposed development, an assessment on the effects of light spill on the nearby public receivers is required to ensure that compliance can be achieved with the relevant standards and the key assessment criteria.

The proposed development consists of the construction of four warehouse buildings, office buildings, external storage areas, car park facilities, and truck loading facilities.

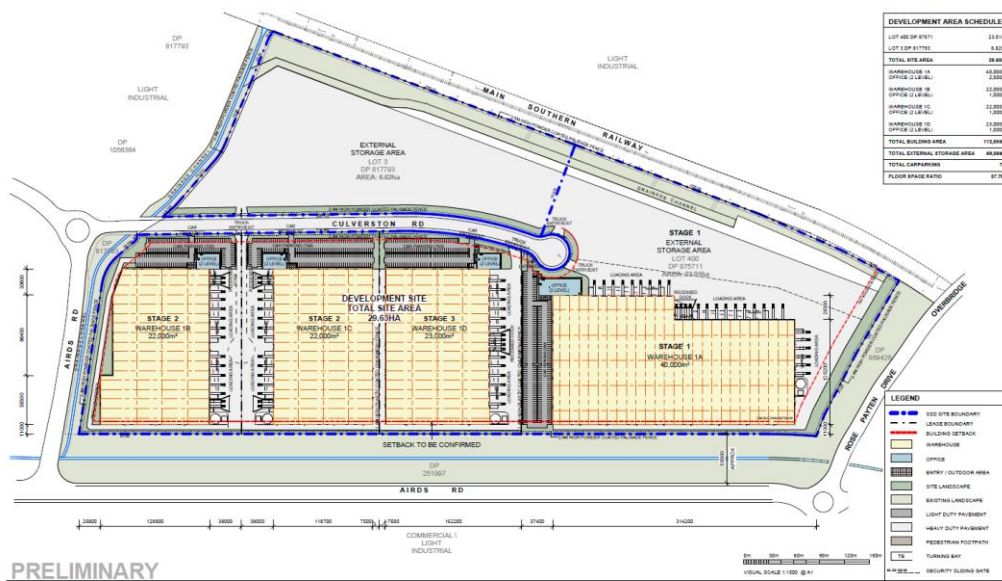


Figure 2.1 Proposed Development

The site is currently surrounded by industrial and commercial properties to the North and West, park land, industrial properties and a rail way to the East, and, car park and sporting facilities to the South. The nearest residential premises are located beyond the commercial and industrial facilities on the east and west sides of the development site.

This assessment focuses on the effects of the light spill on the residential areas.

Note: Any transitory lighting such as headlights of forklifts and trucks do not form part of the site lighting assessment.

2.2 Lighting Standards

The lighting design for the proposed development is to be completed in accordance with the following standards:

- AS/NZS 1680.5:2012 Australian and New Zealand Interior and workplace lighting, Part5: outdoor workplace lighting for the container yard lighting.
- AS/NZS 1158.0:2005 Australian and New Zealand Lighting for roads and public spaces, Part 3.1: Pedestrian area (Category P) lighting – Performance and design requirements – for roadways and carpark lighting
- AS 4282:1997 Control of the obtrusive effects of outdoor lighting.

The effects of light spill on nearby public receivers can be assessed by completing modelling to comply with AS4282:1997. Based on this standard the proposed

development site is categorised as a 'commercial area' for the purpose of light spill analysis and the illuminance and luminous intensity is to be calculated at neighbouring properties for the standard post curfew hours. The lighting levels to be achieved as outlined in the standard are described below:

- Boundary 1.0 – Residential area in dark surrounds – recommended maximum vertical illuminance of 1lx and a luminous intensity emitted by luminaires of 500cd.
- Boundary 2.0 – In commercial areas or at boundary of commercial and residential areas – recommended maximum vertical illuminance of 4lx and a luminous intensity emitted by luminaires of 2,500cd.

As part of the detailed lighting design process, the overall light spill can be assessed for compliance with the above requirements through calculation and modelling of the illuminance levels at the boundaries of neighbouring properties.

2.3 Assessment through Methodology

The effects of light spill on neighbouring properties will be minimised to meet the relevant standards through careful lighting design during the detailed design phase. The following methodologies will be adopted in the detailed design phase which will minimise the light spill. Through modelling and calculation using computation techniques, the results will confirm the compliance of the design in accordance with the relevant standards and criteria.

2.3.1 Site Assessment

As outlined in the relevant standards, an assessment procedure is used to determine compliance based on the criteria and recommended illuminance values at the relevant boundaries. The figure below identifies the applicable boundaries.



Figure 2.2 Spill Light Assessment Boundaries

From initial analysis the nearest point of the residential boundaries is greater than 250m from the development site boundary.

2.3.2 Calculation Techniques

Lighting calculations are to be completed in accordance with the techniques outlined in section 5 of AS4282:1997 using industry recognised software such as AGi32.

Through the calculation of the vertical illuminance at the relevant boundaries, the lighting will be designed to ensure compliance of the various criteria's as outlined in the standard.

2.3.3 Design Methodology

To minimise the light spill effects on neighbouring properties, the lighting design will be carried out using the following techniques:

- Luminaire mounting height
Higher mounting heights allow for the possibility of lower aiming angles and the use of narrow flood light beams to ensure less spill and glare. Mounting heights of pole mounted fittings serving external storage areas will be between 10-20m. Warehouse mounted perimeter lighting will be mounted within 5m to ensure light can be effectively aimed to the desired areas.
- Luminaire positioning
The location of the external lighting has a big impact on the amount of spill light produced at adjoining properties. This is determined by the distance the light fittings are positioned from the relevant boundaries. Lighting will be positioned as far from the site perimeter as practical to ensure minimal spill light, while ensuring an efficient design. Where not possible, lighting at the perimeter will be aimed towards the sight to reduce the amount of obtrusive light and ensure compliance.
- Luminous flux output (per luminaire)
The selection of the light output of each luminaire is a key factor in the overall design and assessment of the criteria. Luminaires with higher output are generally more efficient however increase the overall lighting levels and consequently increase the amount of spill light. By modelling the specific luminaires at different mounting heights and positions, a solution will be determined which ensures the light spill levels are minimal.
- Luminaire beam type and distribution
By using light fittings that are specifically designed for the purpose of providing light for a commercial facility, the effects of light spill can be mitigated through careful consideration during modelling and calculation. Luminaires with low cut off angles (narrow beam) and specific reflecting techniques allow lighting to be directed to specific areas ensuring a more efficient design and minimal light spill. Examples include luminaires with aeroscreen visors to ensure lighting is concentrated downward, transverse cut off limiting the front and rear light spill, and reflectors or lenses (LED) which concentrate lighting to the desired areas.
- Vertical aiming angles
Lower vertical aiming angles reduces the possibility of spill light on adjoining properties. Through the design process, lighting will be selected and aimed to ensure that lighting is directed in the desired locations and light spill is minimised.

2.3.4 Obtrusive Lighting Assessment

Through the combination of luminaire selection, lighting positioning and aiming, lighting mounting height, and, by factoring in any external elements such as buildings and trees, the effects of light spill can be minimized during the detailed design phase to achieve compliance with the standards with respect to obtrusive lighting on nearby receivers.

2.4 Installation & Commissioning

During the detailed design process, measures can be taken to ensure that the construction documentation specifically outlines the contractor's responsibility to ensure lighting is installed as per the approved lighting design.

Additionally, as part of the commissioning phase of the project, the lighting installation should be checked to ensure the installed luminaires are of the correct type, in the correct locations, and aimed in accordance with the lighting design.

3 CASE STUDY

MOOREBANK WAREHOUSING

3.1 Background

A recent light spill study on a similar development was conducted for the Moorebank Warehousing facility. The development proposal is for the construction and operation of a warehousing facility with approximately 215,000 m² gross floor area (GFA).

The assessment with the relevant criteria included a high level analysis of the light spill on the neighbouring public receivers through modelling and calculation using techniques outlined in AS4282:1997.

3.2 Analysis and Results

The Moorebank site was analysed for spill lighting on nearby public receivers by completing a concept lighting design for the site and calculation of the vertical illuminance levels at the applicable boundaries as shown in the figure below.



Figure 3.1 Spill Light Assessment Boundaries

Results indicate that with the selected light fittings combined with suitable lighting design, compliance with the standard AS4282 is achieved.

Refer to Appendix A for a summary of the results and schedule of luminaires used.

4 CONCLUSION

The proposed Minto Warehouse and Logistic Hub has great similarity with Moorebank Warehousing development referenced in Section 3.

When comparing the two proposed developments, it is clear that both of the sites are similar in nature with neighbouring properties located at exceedingly far distance away from sensitive receivers. The nearest residential and commercial boundaries to the Minto Warehouses and Moorebank Warehouse are 290m and 390m respectively.

From the Moorebank Warehousing light spill modelling, it can be determined that the vertical illuminance level will be diminished to 0.1lx threshold at a distance of 50m away, using the luminaires and design strategies outlined in Section 2.

On this basis, the light spill from the proposed Minto Warehousing facility onto sensitive receivers at 290m away will be minimal and well below the limits stated in AS 4282:1997 – Control of the obtrusive effects of outdoor lighting.

APPENDIX A

Case Study Results – Moorebank Warehousing

1 LIGHT SPILL ASSESSMENT

1.1 Lighting Design

The lighting has been designed to minimise any direct light spill by selecting luminaires with a horizontal front glass for the warehouse yard and internal roads. The lighting along the proposed internal road along the Georges River will consist of traditional road lighting fixtures with side throw to maximise the light distribution along the site and minimise backwards light spill.

1.1.1 Luminaire Selection

The luminaire selections include the Sylvania A3 Maxi 2000W metal halide floodlight and Sylvania Roadster 400W high pressure sodium.

Minimisation of any direct light spill requires selection of a luminaire that has a horizontal front glass when aimed and fixed in position. This typically requires a floodlight with an asymmetric distribution.

The A3 Maxi is an asymmetric high performance floodlight designed for use in industrial facilities, airport apron lighting, logistics terminals and port facilities – refer Figure 1.

The proposed 2,000 Watt (W) Sylvania A3 Maxi Metal Halide floodlight has asymmetric light distribution up to 66°, maximum upcast range of 85° with adjustment in 5° steps and comes in a wide beam option. This fitting will minimise light spill and provide the space with good quality light with high colour rendering.



Figure 1 Sylvania A3 Maxi

The road lighting luminaires proposed are Sylvania Roadster 400W High Pressure Sodium with a side throw distribution to ensure maximum light distribution across the internal road and warehouse access roads.



Figure 2 Sylvania Roadster

1.1.2 Luminaire Position and Mounting Height

The position and mounting height of the luminaire is important to ensure adequate outdoor lighting is provided while ensuring the light spill is kept to a minimum.

The site's pole height has been limited to two different heights at 21 and 13.5 metres (m) to provide consistent lighting throughout. The maximum pole height of 21m provides consistency with the adjacent, approved, SIMTA Stage 1 lighting design and provides an even lighting spread across the container yard area.

The internal road and warehouse access road luminaires are fitted on 13.5 m poles. These luminaires are placed on an outreach arm of 1 m to maximise the spacing.

There are 11 poles (P25-P42) in the container yard, each with 4 x 2,000W Metal Halide lamps mounted at 21 m. The luminaires will provide equal amount of light in each direction and ensure uniform lighting across the yard.

The perimeter of the container yard is designed with 34 x 21 m poles fitted with 2,000W Metal Halide lamps in order to provide good colour rendering and light quality across the working area.

The carpark lighting is proposed to be Sylvania Roadster 400W HPS side throw lamps mounted on 13.5 m poles. The luminaires are placed on an outreach arm of 3m to achieve an even light distribution across the carparks.

1.2 Compliance with AS 4282-1997 Control of the obtrusive effects of outdoor lighting

In accordance with AS4282-1198, the Proposal is defined as a 'commercial area'. The illuminance and luminous intensity have been assessed as specified by the standard post curfew hours:

- Boundary 1.0 – Residential area in dark surrounds – recommended maximum vertical illuminance of 1lx and a luminous intensity emitted by luminaires of 500cd.
- Boundary 2.0 – In commercial areas or at boundary of commercial and residential areas – recommended maximum vertical illuminance of 4lx and a luminous intensity emitted by luminaires of 2,500cd.

The result of the assessment is represented in Figure 3 and shows that the combination of the lighting design, luminaire selection, positioning and aiming produce results that are well within the requirements of AS4282-1997 – refer Appendix A for further details.

Note: transitory lighting such as headlights of forklifts and trucks do not form part of the site lighting assessment.

1.2.1 Mobile and Transitory Lighting

Lighting associated with forklifts and vehicles will not generally be of concern since it has a fixed downward aiming light beam and the loading/unloading activities are within the container yard, which is not in close proximity to the site boundary.

The output from mobile and transitory lighting is insignificant in comparison to the fixed permanent site wide lighting which easily complies with AS 4282 Obtrusive Lighting.

Mobile and transitory lighting effects from forklifts and trucks are therefore not included in the permanent site lighting spill light calculations.

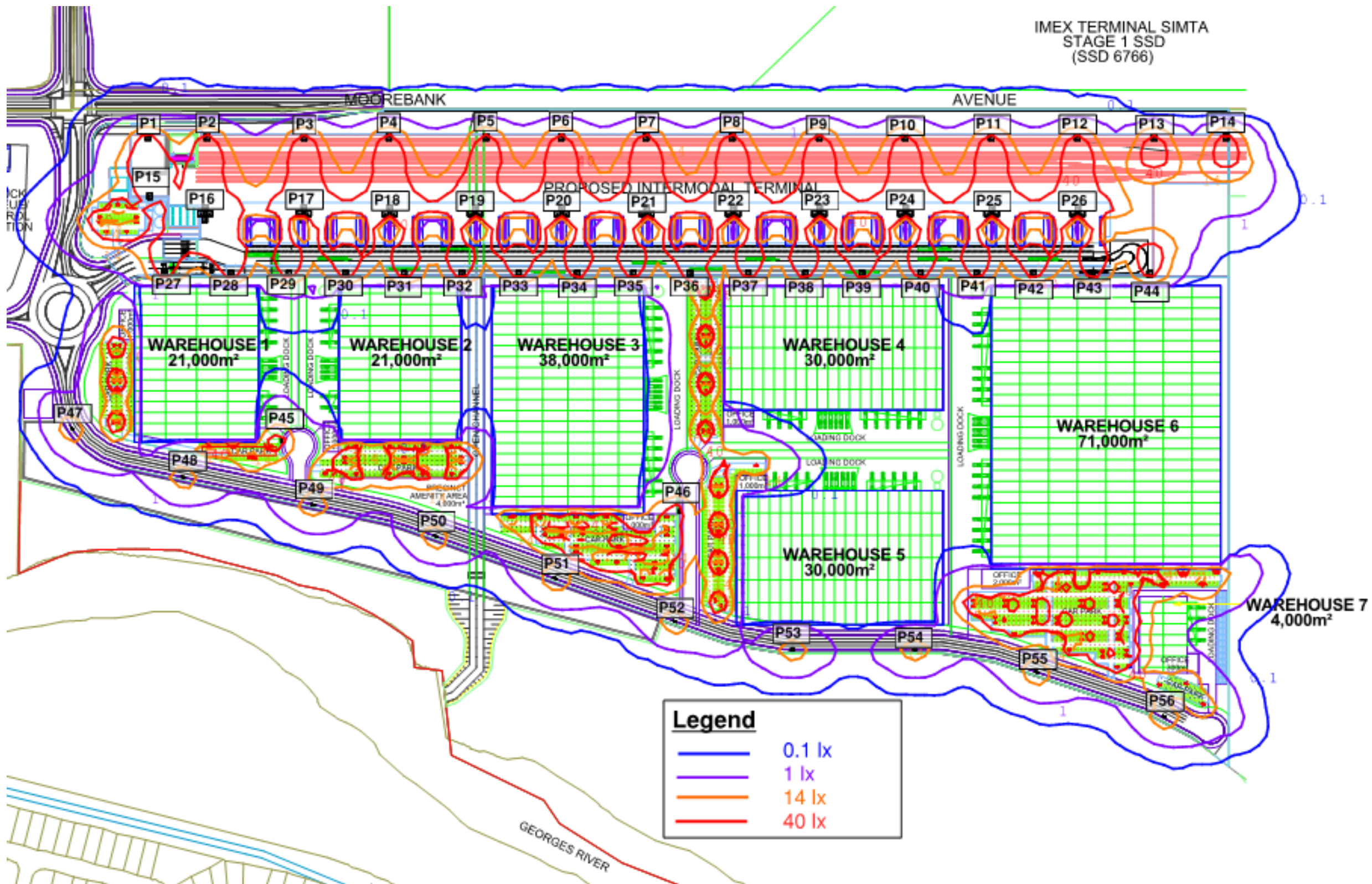


Figure 3 General site layout showing light spill isolux curves both external and internal to the site

1.3 Luminaire schedule

The light spill assessment has been modelled based on the luminaires provided in Table 1 below.

Note: the luminaires outlined in Table 1 are limited to the container yard and perimeter lighting, carpark lighting is not included in the table below. Refer to Figure 3 General site layout showing light spill isolux curves both external and internal to the Figure 3 for location of luminaires.

Table 1 Luminaire Schedule

Pole	Height (m)	Sylvania Roadster Aero 400W HPS	Sylvania A3 Maxi 200W HIS-TD Wide Beam I _{max} =60 deg
P1	21		1
P2	21		1
P3	21		1
P4	21		1
P5	21		1
P6	21		1
P7	21		1
P8	21		1
P9	21		1
P10	21		1
P11	21		1
P12	21		1
P13	21		1
P14	21		1
P15	21		1
P16	21		4
P17	21		4
P18	21		4
P19	21		4
P20	21		4
P21	21		4
P22	21		4

Pole	Height (m)	Sylvania Roadster Aero 400W HPS	Sylvania A3 Maxi 200W HIS-TD Wide Beam Imax=60 deg
P23	21		4
P24	21		4
P25	21		4
P26	21		4
P27	21		1
P28	21		1
P29	21		1
P30	21		1
P31	21		1
P32	21		1
P33	21		1
P34	21		1
P35	21		1
P36	21		1
P37	21		1
P38	21		1
P39	21		1
P40	21		1
P41	21		1
P42	21		1
P43	21		1
P44	21		1
P45	13.5	1	
P46	13.5	1	
P47	13.5	1	
P48	13.5	1	
P49	13.5	1	

Pole	Height (m)	Sylvania Roadster Aero 400W HPS	Sylvania A3 Maxi 200W HIS-TD Wide Beam I _{max} =60 deg
P50	13.5	1	
P51	13.5	1	
P52	13.5	1	
P53	13.5	1	
P54	13.5	1	
P55	13.5	1	
P56	13.5	1	

2 ASSESSMENT RESULT

The lighting of the MIC 2 Proposal is within acceptable limits of AS4282 and will have a minimal effect on the surrounding environment.

The site complies with 'AS4282- 1997 Control of the obtrusive effects of outdoor lighting' – refer Appendix A for more details.

Light spill result Boundary 1.0

The result of the maximum illuminance and luminous intensity at vertical planes at Boundary 1.0.

Obtrusive Light - Compliance Report

AS 4282-1997, Post-Curfew, Residential - Dark Surrounds

Filename: Moorebank

External Lighting

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Illuminance

Maximum Allowable Value: 1 Lux

Calculations Tested (4):

Calculation Label	Test Results	Max. Illum.
ObtrusiveLight-Resi-East_Ill_Seg1	PASS	0.0
ObtrusiveLight-Resi-East_Ill_Seg2	PASS	0.0
ObtrusiveLight-Resi-East_Ill_Seg3	PASS	0.0
ObtrusiveLight-Resi-East_Ill_Seg4	PASS	0.0

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value: 500 Cd

Calculations Tested (4):

Calculation Label	Test Results
ObtrusiveLight-Resi-East_Cd_Seg1	PASS
ObtrusiveLight-Resi-East_Cd_Seg2	PASS
ObtrusiveLight-Resi-East_Cd_Seg3	PASS
ObtrusiveLight-Resi-East_Cd_Seg4	PASS

Light spill result Boundary 2.0

The result of the maximum illuminance and luminous intensity at vertical planes at Boundary 2.0.

Obtrusive Light - Compliance Report

AS 4282-1997, Post-Curfew, Commercial

Filename: Moorebank External Lighting

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Illuminance

Maximum Allowable Value: 4 Lux

Calculations Tested (3):

<u>Calculation Label</u>	<u>Test Results</u>	<u>Max. Illum.</u>
ObtrusiveLight-Comm Boundary_Ill_Seg1	PASS	0.0
ObtrusiveLight-Comm Boundary_Ill_Seg2	PASS	0.0
ObtrusiveLight-Comm Boundary_Ill_Seg3	PASS	0.0

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value: 2500 Cd

Calculations Tested (3):

<u>Calculation Label</u>	<u>Test Results</u>
ObtrusiveLight-Comm Boundary_Cd_Seg1	PASS
ObtrusiveLight-Comm Boundary_Cd_Seg2	PASS
ObtrusiveLight-Comm Boundary_Cd_Seg3	PASS

