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Moorebank Precinct West (MPW) – Stage 2 Proposal

Visual Impact Assessment

SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 4, Division 4.1, State Significant Development

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Visual and Urban Design Assessment (Appendix D, MPW Concept Plan EIS)	Clouston Associates
Raw Viewpoint Photography	Reid Campbell
Lightspill Study Report	Arcadis
Landscape Planning	Ground Ink
Rail Access Report	AECOM

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contents

key terms

The following table provides a summary of the key terms which are included within this report.

Term	Definition
Moorebank Precinct West (MPW) Concept Plan Approval (Concept approval and Early Works)	MPW Concept Plan and Stage 1 Approval (SSD 5066) granted on 3 June 2016 for the development of the MPW Intermodal terminal facility at Moorebank and the undertaking of the Early Works. Granted under Part 4, Division 4.1 of the Environmental Planning and Assessment Act 1979. This reference also includes associated Conditions of Approval and Revised Environmental Management Measures, which form part of the documentation for the approval. N.B. Previously the MIC Concept Plan Approval
Moorebank Precinct West (MPW) EPBC Proposal	Commonwealth Approval (No. 2011/6086), granted in mid-2016 under the Environmental Biodiversity Protection Conservation Act 1999, for the impact of the MPW Project on listed threatened species and communities and impacts on the environment by a Commonwealth agency.
Moorebank Precinct West (MPW) Concept Plan EIS	The Environmental Impact Statement prepared to support the application for approval of the MPW Concept Plan and Early Works (Stage 1) under the Environment Protection and Biodiversity Conservation Act 1999 and the Environmental Planning and Assessment Act 1979. N.B. Previously the MIC Concept Plan EIS
Moorebank Precinct West (MPW) Planning Proposal	Planning Proposal (PP_2012_LPOOL_004_00) to rezone the MPW site from 'SP2- Defence to 'IN1- Light Industrial' and 'E3- Management', as part of an amendment to the Liverpool Local Environmental Plan 2008 (as amended). It is anticipated to be gazetted in late 2016.
Moorebank Precinct West (MPW) Project	The MPW Intermodal Terminal Facility as approved under the MPW Concept Plan Approval and the MPW EPBC Proposal. N.B. Previously the MPW Project
Moorebank Precinct West (MPW) site	The site which is the subject of the MPW Concept Plan Approval, MPW EPBC Proposal and MPW Planning Proposal (comprising Lot 1 DP1197707 and Lots 100, 101 DP1049508 and Lot 2 DP 1197707). The MPW site does not include the rail link as referenced in the MPW Concept Plan Approval or MPE Concept Plan Approval. N.B. Previously the MPW site
Early Works	Works approved under Stage 1 of the MPW Concept Plan Approval (SSD 5066), within the MPW site, including: establishment of construction compounds, building demolition, remediation, heritage impact mitigation works and establishment of the conservation area.
Early Works Approval	Approval for the Early Works (Stage 1) component of the MPW Project under the MPW Concept Plan Approval (SSD 5066) and the (yet to be granted) MPW EPBC Approval. Largely contained in Schedule 3 of the MPW Concept Plan Approval.
Early Works area	Includes the area of the MPW site subject to the Early works approved under the MPW Concept Plan Approval (SSD 5066).
Moorebank Precinct West (MPW) Stage 2 Proposal/the Proposal	Stage 2 of the MPW Concept Plan Approval (the subject of this EIS) including construction and operation of an IMT facility, warehouses, a Rail link connection and Moorebank Avenue/Anzac Road intersection works.

Term	Definition
Moorebank Precinct West (MPW) Stage 2 site/Proposal site	The subject of this PEA, the part of the MPW site which includes all areas to be disturbed by the MPW Stage 2 Proposal (including the operational area and construction area).
Moorebank Precinct West (MPW) Intermodal Terminal Facility/IMT facility	The Intermodal terminal facility on the MPW site, including truck processing, holding and loading areas, rail loading and container storage areas, nine rail sidings, loco shifter and an administration facility and workshop.
internal road	Main internal road through the MPW site which generally travels along the western perimeter of the site. Provides access between Moorebank Avenue and the IMT and warehouses.
Rail link connection	Rail connection located within the MPW Stage 2 site which connects to the Rail link included in the MPE Stage 1 Proposal (SSD 14-6766).
Proposal operational rail line	The section of the Rail link between the SSFL and the Rail link connection (included in the MPE Stage 1 Proposal) and the Rail link connection
construction area	Extent of construction works, namely areas to be disturbed during the construction of the MPW Stage 2 Proposal (the Proposal).
operational area	Extent of operational activities for the operation of the MPW Stage 2 Proposal (the Proposal).
Moorebank conservation area/conservation area	Vegetation exists along the western edge of the MPW site, with a riparian vegetation corridor (generally 25 metres wide) along the banks of the Georges River. This area has been defined as a conservation area as part of the MPW Concept Plan Approval (Moorebank Conservation Area).
Moorebank Precinct	Refers to the whole Moorebank intermodal precinct, i.e. the MPE site and the MPW site.
Moorebank Precinct East (MPE) Project	The Intermodal terminal facility on the MPE site as approved by the MPE Concept Plan Approval (MP 10_0913) and including the MPE Stage 1 Proposal (14-6766). N.B. Previously the SIMTA Concept Plan Approval
Moorebank Precinct East (MPE) site	The site which is the subject of the MPE Concept Plan Approval, and includes the site which is the subject of the MPE Stage 1 Approval. N.B. Previously the MPE site
Moorebank Precinct East (MPE) Stage 1 Proposal	MPE Stage 1 Proposal (14-6766) for the development of the Intermodal terminal facility at Moorebank. This reference also includes associated conditions of approval and environmental management measures which form part of the documentation for the approval. N.B. Previously the MPE Stage 1 Proposal
Revised Environmental Management Measures (REMMs)	The environmental management measures for the MPW Concept Plan Approval as presented within the MIC Supplementary Response to Submissions (SRtS) (PB, 2015) and approved under the MPW Concept Plan Approval.

Table 1 - Key Terms

executive summary

Reid Campbell, in conjunction with Arcadis, were appointed by SIMTA (Sydney Intermodal Terminal Alliance) to undertake a Visual Impact Assessment including a Light Spill Study of MPW Stage 2 Proposal (hereinafter referred to as the Proposal) which forms the second stage of the MPW Concept Plan and Stage 1 Approval (SSD 5066) granted on 3 June 2016.

This report has been compiled in accordance with the Secretary's Environmental Assessment Requirements (SEARS) issued under Section 78A(8A) of the Environmental Planning and Assessment Act 1979 dated 3 June 2016 (SSD 5066) specifically responding to Item 11; Visual Amenity, Urban Design and Landscaping under Key Issues of the Proposal.

This report seeks to identify and evaluate the visual impacts of the Proposal including an analysis of views from key vantage points and proposes management/mitigation measures to address the visual impact of the Proposal. The methodology used to identify key viewpoints and measure the visual impact of each view has been generally adopted from *Clouston Associates' Visual and Urban Design Assessment - Appendix D, MPW Concept Plan EIS (2015, Issue C)* for consistency in comparative analysis.

It should also be read in conjunction with the Landscape Drawings prepared by *Ground Ink Landscape Consultants*, which provides a design analysis and justification of the key built form elements of the Proposal.

This Visual Impact Assessment and Light Spill modelling are based on the MPW Stage 2 site (hereinafter referred to as the Proposal Site) as shown in Figure 1 which describes the maximum development envelope of built-form typologies within each land use zone on the site.

Adopting the siting, setback, height, landscaping and general design principles outlined in the MPW Concept Plan EIS for all built form, structure, urban and operating elements, a 3D massing model was generated to inform the likely maximum and realistic visual impact at key points identified by *Clouston Associates* via their *Visual and Urban Design Assessment.*

The Light Spill Study undertaken by Arcadis examines the potential lighting requirements for the operation of the Proposal Site and investigates through the modelling of a concept lighting design, its compliance with the Australian Standard AS4282 - 1997 Control of Obtrusive Effects of Outdoor Lighting.

The light spill modelling shows that the luminous intensity from lighting within the Proposal Site can be easily designed to be below the prescribed maximum value of 4 lux (for curfew hours: 11.00pm to 6.00am) at the windows of the nearest residential properties.

As such, the resultant findings of the Visual Impact Assessment and Light Spill Study are:

- the Proposal is consistent with the Concept Plan and Stage 1 Approval (SSD 5066);

- the Proposal is consistent with general industry practice and existing development in close proximity to the site and as such the visual amenity at these locations is generally unchanged;

- modelling suggests there is a limited visual impact to residential areas due to distance, existing visual barriers and undulating topography;

- in most instances it was found there was either no visual impact or no change to the general overall visual amenity at simulated view locations in residential areas;

- the most prominent views of the Proposal would be at localised site boundary points however the visual amenity at these locations is likely to be improved through mitigation measures such as significant and intensive landscaping, screening and architectural elements in order to shield the site operations;

- the impact of light spill to residential properties would be within the acceptable criteria as specified in Australian Standard AS4282 -1997 Control of Obtrusive Effects of Outdoor Lighting;

Table 2 summarises the findings of the visual impacts of the various viewpoints that are assessed in this report. Table 3 shows a summary of visual impact ratings for each stage of phasing for the MPW Stage 2 Proposal.

View Location Name	Area	Type	Visual Impact
View 01	Leacock Regional Park - South	Public space	Low/Moderate
View 02	Leacock Regional Park - North	Public space	Moderate
View 03	Casula	Public space	Moderate
View 04	Casula	Public space	Low/Moderate
View 05	Casula	Public space	N/A
View 06	Casula	Residential	Low/Moderate
View 07	Moorebank	Public road/Industrial	Low/Moderate
View 08	Moorebank	Public road/Industrial	Moderate

Table 2 - Viewpoint impact summary

View Location Name	Construction	Operations
View 01	Low	Low/Moderate
View 02	Moderate	Moderate
View 03	Moderate	Moderate
View 04	Low/Moderate	Low/Moderate
View 05	N/A	N/A
View 06	Moderate	Low/Moderate
View 07	Low/Moderate	Low/Moderate
View 08	Moderate	Moderate

Table 3 - Phasing stage visual impact summary

01 introduction

1.1 background

On the 3 June 2016 Concept Plan Approval (SSD 5066) was granted, under Part 4, Division 4.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act), to develop the Moorebank Precinct West Project (MPW Project) on the western side of Moorebank Avenue, Moorebank, in south-western Sydney (the MPW site).

The MPW Project involves the development of intermodal freight terminal facilities (IMT), linked to Port Botany, the interstate and intrastate freight rail network. The MPW Project includes associated commercial infrastructure (i.e. warehousing), a rail link connecting the MPW site to the Southern Sydney Freight Line (SSFL), and a road entry and exit point from Moorebank Avenue.

Under the Concept Plan Approval, the MPW Project is to be developed in four phases, being:

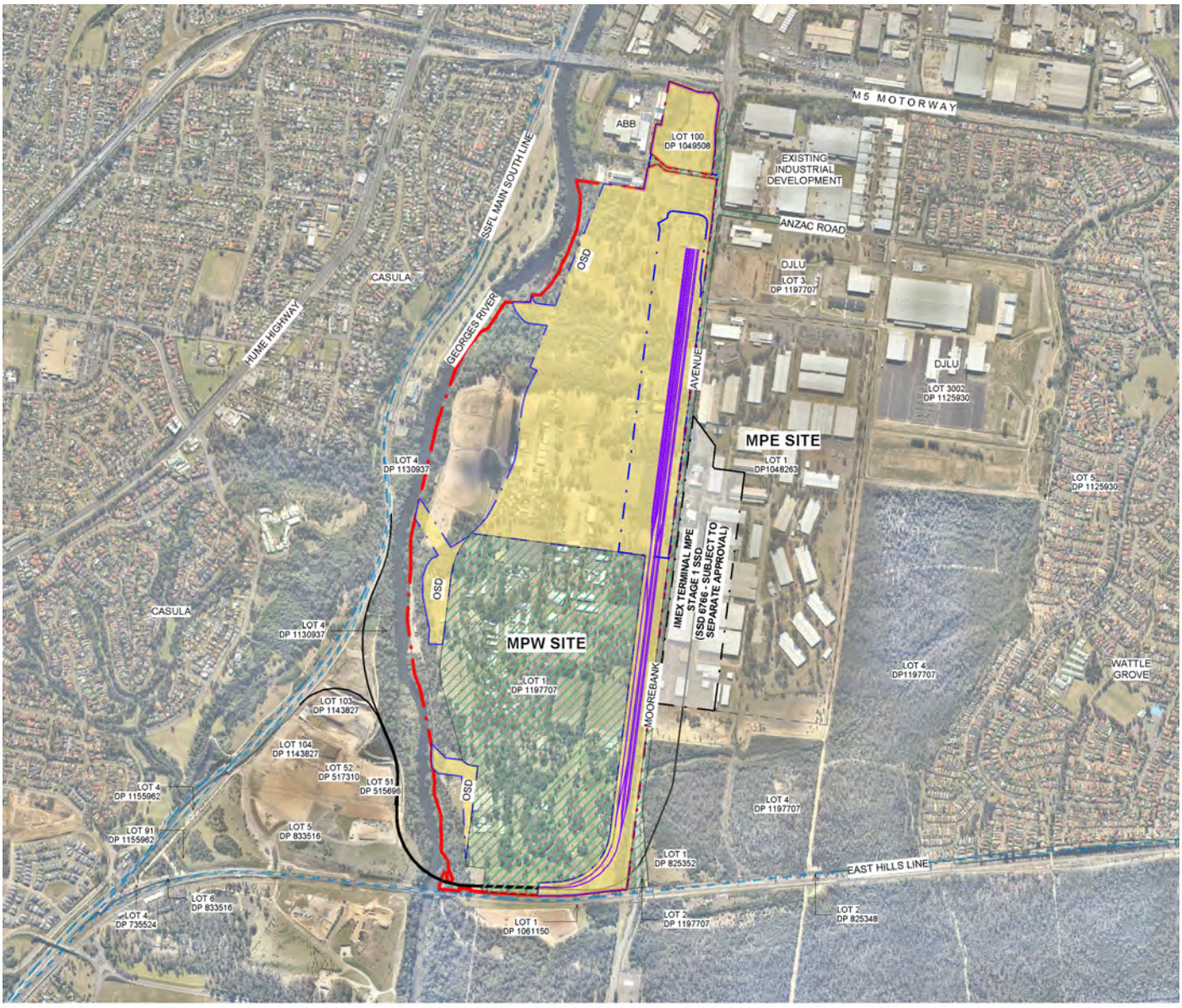
1. Early Works development phase, comprising:
- The demolition of existing buildings and structures
- Service utility terminations and diversion/relocation
- Removal of existing hardstand/roads/pavements and infrastructure associated with existing buildings
- Rehabilitation of the excavation/earthmoving training area (i.e. ‘dust bowl’)
- Remediation of contaminated land and hotspots, including areas known to contain asbestos, and the removal of:
    - Underground storage tanks (USTs)
    - Unexploded ordnance (UXO) and explosive ordnance waste (EOW) if found
    - Asbestos contaminated buildings
- Archaeological salvage of Aboriginal and European sites
- Establishment of a conservation area along the Georges River
- Establishment of construction facilities (which may include a construction laydown area, site offices, hygiene units, kitchen facilities, wheel wash and staff parking) and access, including site security
- Vegetation removal, including the relocation of hollow-bearing trees, as required for remediation and demolition purposes

2. Development of the intermodal terminal (IMT) facility and initial warehousing facilities
3. ‘Ramp up’ of the IMT capacity and warehousing
4. Development of further warehousing.

Approval for the Early Works phase (MPW Concept Plan Approval) was granted as the first stage of the MPW Project within the Concept Plan Approval. Works, approved as part of this stage are anticipated to commence in the third quarter of 2016.

Commonwealth Approval (No. 2011/6086), under the Environmental Protection Biodiversity Conservation Act 1999 (EPBC Act), was also granted in mid 2016 (soon after the Concept Plan Approval) for the MPW Project. In addition to this, the Planning Proposal (PP_2012_LPOOL_004_00) which provided a rezoning of part of the MPW site, and surrounds, was gazetted on 24 June 2016 into the Liverpool Local Environmental Plan 2008 (Amendment No. 62).

On 5 December 2014, Moorebank Intermodal Terminal Company (MIC) and SIMTA announced their in-principle agreement to develop the Moorebank IMT Precinct on a whole of precinct basis. This agreement is subject to satisfying several conditions which both parties are currently working towards. SIMTA is therefore seeking approval to build and operate the IMT facility and warehousing under the MPW Project Concept Approval, known as the MPW Stage 2 Proposal (the Proposal).



LEGEND:

- MPW SITE BOUNDARY
- MPW STAGE 2 PROPOSAL SITE/SIMTA PROJE
- EXISTING RAIL LINE
- RAIL LINK CONNECTION
- MPE STAGE 1 APPROVAL RAIL LINK
- CONSTRUCTION AREA

Figure 1 - MPW Stage 2 Precinct Plan

1.2 report purpose

This report has been prepared to support the Environmental Impact Statement (EIS) for approval of the Proposal. A summary of the works included in the Proposal is provided below.

This report has been prepared as part of a State Significant Development (SSD) Application for which approval is sought under Part 4, Division 4.1 of the EP&A Act. This report has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) (ref: SSD 16-7709 and dated 14 July 2016) and revised environmental mitigation measures (REMMs) identified in the MPW Concept Plan Approval (SSD_5066).

Table 1 provides a summary of the SEARs and the REMMs from the MPW Concept Plan Approval, which are relevant to this report and the section where they have been addressed in this report.

1.3 SEARS

This report has been prepared in accordance with the secretary's environmental assessment requirements (SEARS) (ref: SSD 16-7709)

Section/Number	SEARs	Where addressed
11. Visual Amenity, Urban Design and Landscaping – including but not limited to: An assessment of visual impacts.	The assessment shall: a) include a description of the visual significance of the affected landscape including an analysis of views from key vantage points;	Section 07
	b) include artist's impressions of the development from key vantage points;	Section 07
	c) assess the visual impact of the project on the landscape character of the area, including built form (materials and finishes) and the urban design (height, bulk and scale) of the proposal including views to and from the site;	Section 07
	d) consider lighting impacts in the local area, analyse and describe the contribution and impacts of the proposed facility on light spill at the local scale and to sensitive receivers;	Section 08
	e) include details of hard and soft landscaping treatment and design (including details of suitable landscaping incorporating endemic species);	Section 07
	f) ensure the layout and design of the development has regard to the surrounding vehicular, pedestrian and cycling networks; and	Section 06 & 07
	g) propose management/mitigation measures to address the visual impact of the proposal.	Section 06

Table 4 - SEARS (SSD 16-7709) compliance table

1.4 Proposal overview

The MPW Stage 2 Proposal (the Proposal) involves the construction and operation of an Intermodal terminal (IMT) facility and associated warehousing.

The IMT facility would have the necessary infrastructure to support a container freight throughput volume of 500,000 twenty-foot equivalent units (TEUs) per annum. Specifically, the IMT facility within the Proposal site would include the following key components:

- Truck processing, holding and loading areas – with entrance and exit from Moorebank Avenue via an upgraded intersection and a round-about to distribute traffic between the warehousing precinct and the IMT
- Rail loading and container storage areas – installation of nine rail sidings, with an adjacent container storage area serviced by manual handling equipment
- Administration facility – office building with associated car parking and light vehicle access from Moorebank Avenue
- The Rail link connection – rail sidings within the IMT facility, which would be linked (to the south) to the Rail link (constructed as part of the MPE Project (SSD 14-6766)).

Also included within the Proposal are the following key components:

- Warehousing area – construction and operation of approximately 215,000 m² GFA of warehousing, with warehouses ranging in size from 4,000 m² to 71,000 m². Included within the warehousing area would be ancillary offices, truck and light vehicle parking, associated warehouse access roads.
- Freight village – construction and operation of approximately 800 m² of retail premises, with access from the internal road.
- Upgraded intersection on Moorebank Avenue and internal road – including works to Moorebank Avenue, Anzac Road to accommodate the proposed site entrance to Moorebank Avenue, and construction of an internal road.
- Ancillary works – including vegetation clearing, earth works, drainage and on-site detention, utilities installation/connection, signage and landscaping.

1.5 site description

The Proposal site is generally bounded by the Georges River to the west, Moorebank Avenue to the east, the East Hills Railway Line to the south and the M5 Motorway to the north. It is located on Moorebank Avenue, Moorebank and forms Lot 1 in Deposited Plan (DP) 1197707 . The Proposal site also contains Lots 100 and 101 DP1049508, which are located north of Bapaume Road and west of Moorebank Avenue. The Proposal site is located wholly within Commonwealth Land.

The Proposal would also require works to upgrade the intersection of the MPW site with Moorebank Avenue and would therefore be undertaken on the following parcels of land:

- Moorebank Avenue, owned by the Commonwealth Government, south of Anzac Road Lot 2, DP 1197707 (formerly part of Lot 3001, DP 1125930)
- Moorebank Avenue, owned by Roads and Maritime Services, north of Anzac Road
- A portion of Bapaume Road, a public road that is the responsibility of Liverpool City Council
- A portion of Anzac Road, owned by Liverpool City Council, to the east of Moorebank Avenue

The key existing features of the site are:

- Relatively flat topography, with the western edge flowing down towards the Georges River, which forms the western boundary to the MPW site
- A number of linked ponds in the south-west corner of the Proposal site, within the existing golf course, that link to Anzac Creek, which is an ephemeral tributary of the Georges River
- An existing stormwater system comprising pits, pipes and open channels
- Direct frontage to Moorebank Avenue, which is a publicly used private road, south of Anzac Road and a publicly owned and used road north of Anzac Road
- The majority of the site has been developed and comprises low-rise buildings (including warehouses, administrative offices, operative buildings and residential buildings), access roads, open areas and landscaped fields for the former School of Military Engineering (SME) and the Royal Australian Engineers (RAE) Golf Course and Club. Defence has since vacated and all buildings on the site are currently unoccupied and will be removed during the Early Works
- Native and exotic vegetation is scattered across the Proposal site
- The riparian area of the Georges River lies to the west of the Proposal site and contains a substantial corridor of native and introduced vegetation. The riparian vegetation corridor provides a wildlife corridor and a buffer for the protection of soil stability, water quality and aquatic habitats. This area has been defined as a conservation area as part of the MPW Concept Plan Approval
- As stated above, the majority of the Proposal site has been developed, however heritage and biodiversity values still remain on the site

- A strip of land (up to approximately 250 metres wide) along the western edge of the MPW site lies below the 1% annual exceedance probability (AEP) flood level

- The site is privately owned by the Commonwealth and leased by SIMTA.

A number of residential suburbs are located in proximity to the Proposal site, including:

- Wattle Grove, located approximately 1,000 m from the Proposal site and 1,000 m from the Rail link connection to the east. The Rail link, which will be used during operation of the Proposal is 1,260 m to the west of Wattle Grove at its closest point

- Moorebank, located approximately 630 m from the Proposal site and more than 1,400 m from the Rail link connection to the north. The Rail link is 2,500 m to the south of Moorebank at its closest point

- Casula, located approximately 330 m from the Proposal site and 1,200 m from the Rail link connection to the west. The Rail link is approximately 290 m to the east of Casula at the closest point

- Glenfield, located approximately 820 metres from the Proposal site and 1,100 metres from the Rail link connection to the south-west. The Rail link is approximately 750 m to the east of Glenfield at its closest point.

02 assessment methods

2.1 visual impact assessment

The following section describes the approach utilised in the assessment of the visual impact of the Proposal. The analysis combines the methodology used by Clouston Associates in the *'Landscape Character and Visual Impact Assessment'* report coupled with those recommended by Reid Campbell. The Viewpoints selected have been re-created to match those represented in the Clouston Associates report for consistency with the MPW Concept Plan EIS.

Selected Viewpoints include:

1. Southern section of Leacock Regional Park
2. Leacock Regional Park and associated residential heritage properties backing onto the Parklands.
3. Carroll Park and associated residential properties backing onto the park.
4. Casula Powerhouse Arts Centre
5. Georges River Casula Parklands
6. St. Andrews Park and associated residential properties surrounding the park, as well as properties that back onto the SSFL.
7. Junction of M5 South Western Motorway and Moorebank Avenue.
8. Moorebank Avenue heading south.

site inspection

Through site inspection and desktop review, Reid Campbell has visually evaluated the existing character of the area and specifically confirmed the relevance of locations identified in the Clouston Associates report that would potentially be subject to visual impacts from the Proposal. Photographs were taken by Reid Campbell from key viewpoints using a GPS Camera for later use in visual simulations of the development.

visualisation of the development

Based on the built form and urban design principles outlined in the MPW Concept Plan EIS *(SSD 5066)* in particular maximum height and scale), Reid Campbell created a digital 3D model using Autodesk REVIT which included the components of the development that would potentially be visible beyond the site. Computer generated views of the model matching the camera positions of photographs taken from the key viewpoints were created and combined with the photographs to create simulated massing montages of the Proposal from each of these key locations.

assessment of visual impact

The visual impact from the key viewpoints was then assessed qualitatively on the basis of the criteria described in Section 3. Views at a variety of distances from the site were considered however it is noted that the MPW site is primarily surrounded by vast amounts of vegetation to the west and the MPE site to the east (see Figure 2 & 6) providing an extensive buffer to local residential areas and other existing developments.

2.2 light spill assessment

A lighting concept for the Proposal was developed by Arcadis based on the operational requirements of SIMTA to be compliant with Australian Standard AS4282- 1997, ‘Control of Obtrusive Effects of Outdoor Lighting’ for the floodlighting system. The light spill was then modelled using agi32: version 2.02 and visual lighting design software, provided by light lab international software.

03 assessment criteria

3.1 visual impact assessment criteria

The visual impact of the selected viewpoints in this study have been evaluated on a qualitative basis. The visual impact of the Proposal has been assessed using a range of criteria against which the relative importance of each observer location can be described including; context, setting, site elements, site character, adjacent development, distance to view (foreground, middle ground and background), land use, visual prominence of the development, and potential changes to the view setting.

For each observer location these criteria have been addressed under three category headings; ‘visual adaptation’, ‘visual sensitivity’ and the resulting ‘visual impact’.

A comparative description of each category used in the visual impact evaluation process is summarised below.

visual adaptation

Visual adaptation describes any significant changes to the landscape and visual amenity that is likely to occur as a result of the Proposal from a particular view point including:

- the prominence of the Proposal and its individual components with regard to scale, form, colour and texture in contrast with the surrounding landscape; and
- the compatibility of the development within the context of the particular landscape zoning/primary use (such as residential, parklands and other non-industrial related uses) on the basis that integration of the proposed development is likely to incur a higher visual impact in those zones which are inhabited by non-industrial related activity. To this extent, ‘compatibility’ relates only to the specific viewpoint locations and not the degree to which the development can be seen as described under ‘prominence’ above.

visual sensitivity

Visual sensitivity refers to the likely duration of views and number of observers from a given viewpoint and is independent of the ‘prominence’ of the Proposal. In locations where visual amenity has a higher perceived importance and the duration of views and number of observers is greater than surrounding areas, the resulting visual sensitivity is regarded as being higher.

Visual sensitivity is expressed in relative terms in this study with residential areas being of higher visual sensitivity and industrial areas having a lower sensitivity. Other areas of higher sensitivity include roads where, despite a short duration of views, there are large numbers of potential viewers and parks where the duration of views is not particularly long but where a high degree of importance is placed on visual amenity.

visual impact

The resulting visual impact is summarised on a qualitative basis against the above criteria. Table 5 that follows provides a matrix that breaks down visually how impact ratings are achieved.

Visual sensitivity \ Visual adaptation	**High**	**Moderate/High**	**Moderate**	**Low/Moderate**	**Low**	**Negligible**
High	High	High	Moderate/High	Moderate/High	Moderate	Negligible
Moderate/High	High	Moderate/High	Moderate/High	Moderate	Moderate	Negligible
Moderate	Moderate/High	Moderate/High	Moderate	Moderate	Low/Moderate	Negligible
Low/Moderate	Moderate/High	Moderate	Moderate	Low/Moderate	Low/Moderate	Negligible
Low	Moderate	Moderate	Low/Moderate	Low/Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Table 5 - Overall Impact Rating as a combination of Visual Sensitivity and Visual Adaptation

3.2 light spill assessment criteria

Light spill at the edge of the site has been digitally modelled by Arcadis and is expressed quantitatively in terms of light intensity.

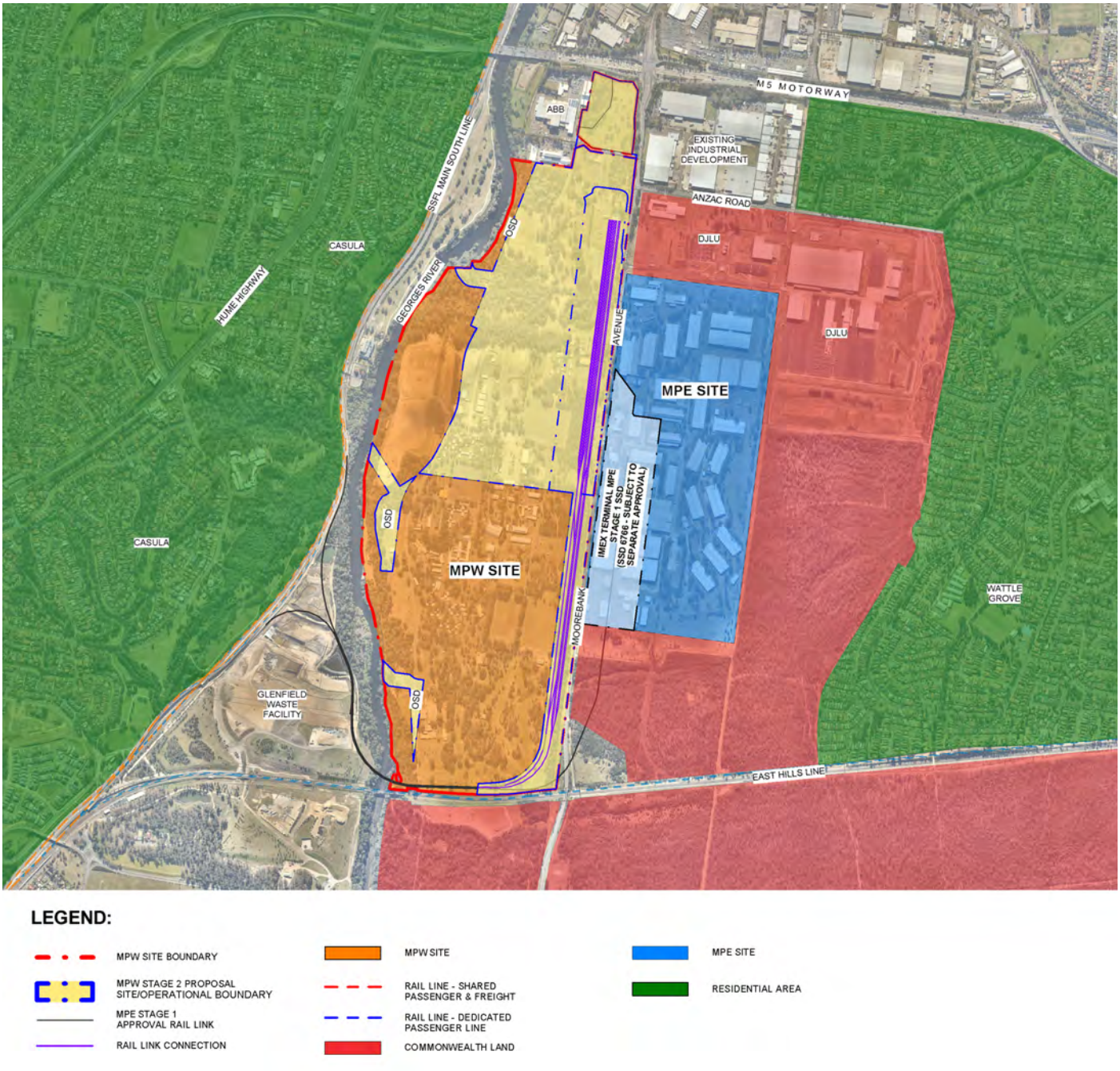


Figure 2 - Visual Character of the Surrounding Area

04 visual character of the surrounding area

The MPW site is surrounded by land owned by SIMTA, the Department of Defence and other industrial users. This includes the MPE site to the east, the DJLU, and further the Commonwealth of Australia Land to both the east and the south. The outer proximity toward the north-east includes existing Moorebank industrial developments known as 'Amiens and Yulong'. The residential suburb of Casula is located to the north-west and west. The Casula residential area is approximately 500m-1km west of the MPW site divided by the Georges River and the SSFL.

The MPW site is within relatively close proximity to the M5 Motorway, which intersects with Moorebank Avenue approximately 800 metres to the north of the north-east site boundary. Moorebank Avenue runs in a north-south direction and provides a direct connection between the Liverpool City Centre and the M5 Motorway on/off ramps to the north and the Glenfield/Macquarie Fields residential areas to the south.

Approximately 100m-200m west from the MPW site, the SSFL and passenger rail line run in a north-south direction and are bounded by the Casula residential area. To the south of the site, the existing East Hills Passenger Line (EHPL) runs in an east-west direction.

The outer area to the east and north of the site comprises of the Wattle Grove residential area (primarily low density), extensive commercial and industrial developments and major motor ways.

Surrounding natural elements include:

- Georges River which runs along the western boundary of the Proposal site;
- Leacock Regional Park, which is a publicly accessible recreation area and is located on the western side of the Georges River;
- Existing landscape and vegetation generally running along the western boundary following the banks of the Georges River. This bushland is primarily regenerated vegetation. The density of the bushland provides significant screening to much of the north-west and west surrounding areas; and
- The Glenfield Waste management facility which is located south west of the Proposal site, separated by the Georges River

The existing visual character of the site and surrounding area is shown in Figure 2.

The impact of the Proposal on visual character varies over the four different character zones depending on the landscape's sensitivity and the impact of the Proposal within the landscape.

05 visual character of the development

The Proposal involves the redevelopment of the MPW site. The existing site character consists of a number of buildings which made up the former school of military engineering. The existing topography is generally flat to gently undulating with adjoining slopes running down towards the Georges River. This is also the most prominent natural feature of the area being the riparian corridor that runs along the western boundary and the river itself.

Major visual elements of the Proposal:

Intermodal Terminal: The intermodal terminal would be located on the north eastern part of the site within the operational area adjacent to Moorebank Avenue. The total terminal area is approximately 20ha including the following key elements:

- Rail sidings including 4 marshalling and 1 working siding at approximately 1800m (within stage two) and an additional 4 sidings within the terminal at approximately 900m.
- Container hardstand to be used for container sorting and storage (up to 5 containers high or approximately 13m); and
- Administration offices and ancillary operational facilities.

The intermodal terminal is anticipated to operate 24 hours a day, 7 days a week. The terminal would include:

- A terminal management office of approximately 540m²;
- An engineering workshop of approximately 680m²;
- Modern container and secondary freight handling equipment;
- Ancillary facilities and amenities;
- Refuelling facilities.

Lighting: The visualisation carried out for this assessment assumes light pole heights varying between 13.5 to 21m. Poles would be galvanized steel.

Warehousing: Approximately 215,000m² GFA of warehousing is to be developed and located within the operational area situated to the west of the proposed Intermodal terminal on the northern end of the site. Major factors which contribute to the visual character of the warehousing component include the height, bulk and scale of each building. With a maximum height limit of 21m, warehouses will be visible from certain viewpoint locations particularly where elevated above the Proposal site.

Topography: The surface of the site is generally flat, undulating and sloping down towards the Georges River. The sites existing elevation sits between 12.5m and 16.0m above the Australian Height Datum (AHD). Figure 3 provides a visual of the greater topography. The proposed topography would have the site sitting approximately between 14.0m and 16.6m above the AHD, raising the majority of the site.

Vegetation: Vegetation across the site occurs both sporadically and in a long Riparian corridor that follows the banks of the Georges River. This serves as a visual buffer throughout the site to the surrounding area.

The vegetation on site ranges from endemic stands of mature native vegetation (15-25m tall) to mature introduced species planted in avenues or as features. Native vegetation communities found within the site include stands of:

- Alluvial Woodland (part of the River-Flat Eucalypt Forest on Coastal Floodplains);
- Riparian Forest (part of the River-Flat Eucalypt Forest on Coastal Floodplains);
- Castlereagh Swamp Woodland; and
- Castlereagh Scribbly Gum Woodland.

Most buildings are screened from view as a result of the existing vegetation's maturity and density with the exception of a few tall structures.

Figure 3 - Surrounding topography

06 measures to reduce visual impact

Appropriate measures to reduce the visual impact of the Proposal have been identified in parallel with the Concept Plan and Stage 1 Approval (SSD 5066). These measures would primarily comprise landscaping in key areas and visual buffers. Further detail can be found in the MPW Concept Plan Approval and its guidelines. An indicative Proposal site plan and landscape plan is shown at Figure 4 which demonstrates potential built form, facility and operations frontages in accordance with the MPW Concept Plan Approval. Figure 4 is indicative only and provides a representation of the potential maximum built-form impact for the purposes of conducting the Visual Assessment.

To mitigate and minimise any visual impacts, proposed landscaping will reinforce and extend the surrounding natural context. This is achieved through visual and physical connection to the existing landscape and vegetation in the area. The following general mitigation measures would be applied, where reasonable and feasible, for the landscaping of the Proposal:

- Use of species that are local to the area
- Use of trees to provide a uniform canopy cover within vegetated areas
- Use of local species as understory planting to support and enhance local habitat values
- Use of seeds collected within the local area for planting to reinforce the genetic integrity of the region, where possible.

The key nodal point along Moorebank Avenue is the primary entry point to the operational area of the Proposal. This access point would include additional features to enhance the arrival experience through the use of a series of selected native plants and recycled materials (where possible) in built-form to create visual interest. This area would also include entry signage for the precinct to help establish a sense of arrival and coherent address. Other directional signage would be located in proximity to assist way-finding throughout the proposed development

Where landscaping is clear of railway lines planting would consist of mixed tree planting used to create a natural feeling through landscape zones and mixed under-storey planting consisting of native shrubs and ground covers to form a virtually impenetrable barrier when mature.

Mitigation measures incorporated during the construction phases are discussed separately under section 7.1.

Where built form such as the warehousing and associated infrastructure presents the potential for significant visual impacts, mitigation is implemented through adaptive and considered design. Harmonious colour pallets and high quality finishes/materials allow for limited contrast, attractive design and longevity of amenity.

Overall, the proposed landscape and built form treatments would result in an improvement in the visual amenity of the entire site and would increase the current level of screening of the site. Urban design and planning principles help to breakdown the bulk and scale of the development as well as contributing to the creation of one cohesive address.

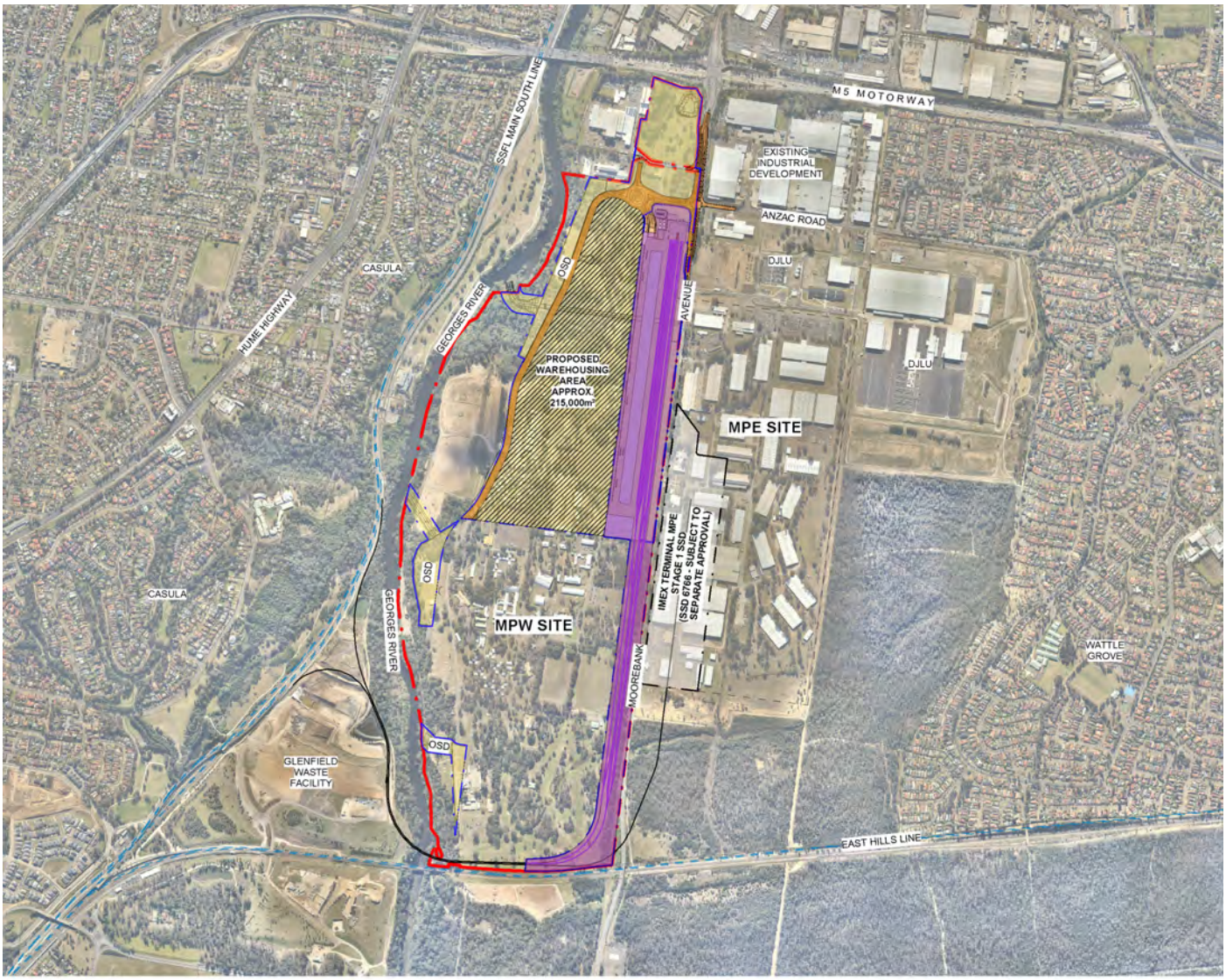


Figure 4 - Indicative MPW Stage 2 Proposal and Landscape Master Plan

07 visual impact of the development

The visual impact of the Proposal has been assessed by evaluating the views to the Proposal site from identified key viewpoints on the basis of the visual impact assessment criteria described in Section 3.

The extensive native bushland areas, DJLU facilities on neighbouring lands and the general pattern of industrial type development surrounding the MPW site screen the Proposal from much of the greater sensitive surrounding areas - primarily residential.

Potential viewpoints do occur along viewing corridors created by Moorebank Avenue and where topography provides some elevation above potential obstructions to views such as Casula area to the west.

The identified view points are all within 2km of the site. The Clouston Associates' *Visual and Urban Design Assessment* does not suggest that any significant further views of the Proposal exist. Sensitive receivers identified within the precinct are limited. Two heritage items are located in the area; Glenfield Farm and Kitchener House. However these remain relatively unaffected due to the existing surrounding conditions and proximity to the Proposal.

This section of the report assesses the visual impact from individual key viewpoints identified as part of MPW Concept Plan Approval analysis during daylight hours at which it is assumed would be consistent with peak operations.

Night time visual impacts are discussed in Section 8 as part of the light spill assessment. There would also be potential visual impacts during the construction of the Proposal. These are discussed at the end of this section.

Based on the their location and the works proposed, the visual impact during operations has been assessed for the following viewpoints:

View Location Name	Area	Type	Visual Adaptation	Visual Sensitivity	Visual Impact
View 01	Casula	Public space	Low	Low/Moderate	Low/Moderate
View 02	Casula	Public space	Low/Moderate	Moderate	Moderate
View 03	Casula	Public space	Moderate	Moderate	Moderate
View 04	Casula	Public space	Low	Moderate	Low/Moderate
View 05	Casula	Public space	N/A	Low/Moderate	N/A
View 06	Casula	Residential	Low	Moderate	Low/Moderate
View 07	Moorebank	Public road/ Industrial	Moderate	Low	Low/Moderate
View 08	Moorebank	Public road/ Industrial	High	Low	Moderate

Table 6 - Visual Impact during Operations

view locations

Figure 5 - View Locations

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view 01

Existing View

Simulated View

view 01

Viewing Location	Southern section of Leacock Regional Park
Visual Adaptation	
Approximate Viewing Distance	870m to site boundary (approx.)
Prominence of the Development	This view location has been taken in Leacock Regional Park, a public open space area. At this location the landscaped park slopes up from the street level toward a ridge which overlooks the Proposal site. Dense vegetation exists in the area limiting clear lines of sight beyond. The park is frequented by local residents. There are no residential properties within the park.
Landscape Compatibility	The view shown at this location is of primarily riparian vegetation that sits in the middleground with no view of any site buildings due to screening provided by the vegetation. In the foreground is the Southern Sydney Freight Line (SSFL) and the Glenfield landfill (not within the Proposal site). Distant vegetation is visible at the rear of the foreground treeline. There are trees in the foreground as well as large trees behind the residential dwellings that are highly prominent, suggesting a low level of visual adaptation.
Visual Sensitivity	Being a public open park that is frequented by locals with no residential properties within the park, the visual sensitivity would be low/moderate.
Visual Impact	There would be limited visibility from this viewpoint of the development due to screening provided by vegetation and the natural slope of the land. Tops of the warehouses, office buildings and light posts may be visible while partially screened by vegetation. The visual amenity would be relatively unchanged within this view corridor however, suggesting a low/moderate visual impact.

view 02

Existing View

Simulated View

view 02

Viewing Location	Leacock Regional Park looking east towards development site
Visual Adaptation	
Approximate Viewing Distance	470m to site boundary (approx.)
Prominence of the Development	This view location is taken from Leacock Regional Park looking east toward the Proposal site. The view is at an elevated location which sits above the Proposal site overlooking an assortment of vegetation in the foreground, the Georges River, and continued dense vegetation beyond. The vegetation that runs along the edge of Leacock Regional Park and the Georges River corridor is the most prominent feature of this view-point. Although the viewpoint is at a slightly higher elevation than that of the site, the vegetation in the foreground and background screens the majority of the Proposal.
Landscape Compatibility	The view of the existing landscape at this location shows scattered trees and shrubbery in the foreground with dense vegetation leading up to the horizon. The immediate existing landscape is highly compatible with the development and will require no alterations. Vegetation in the background will require some clearing where the development footprint is to be constructed.
Visual Sensitivity	The views shown from this viewpoint are taken from Leacock Regional Park, a dog-friendly park that is frequented by dog-walkers and pedes-trians. There are many walking tracks that run along the Georges River that link up with the Casula Powerhouse Arts Centre. Due to this, the visual sensitivity would be moderate. The heritage item listed Glenfield Farm is located within close proxim-ity to the view location and is identified as a sensitive receiver. Existing tree planning and vegetation in the area would however provide some screening of views to the proposed development and as such reduce the visual sensitivity.

view 02 (continued)

Visual Impact	Existing vegetation at this viewpoint obstructs some views of the proposed development particularly from existing buildings nearby. During the construction phase there would be clear views of tall construction equipment above the treeline. There may also be noticeable removal of vegetation from the MPW site. As such, due to the visual sensitivity of the location and elevation of the area, a moderate visual impact is suggested.

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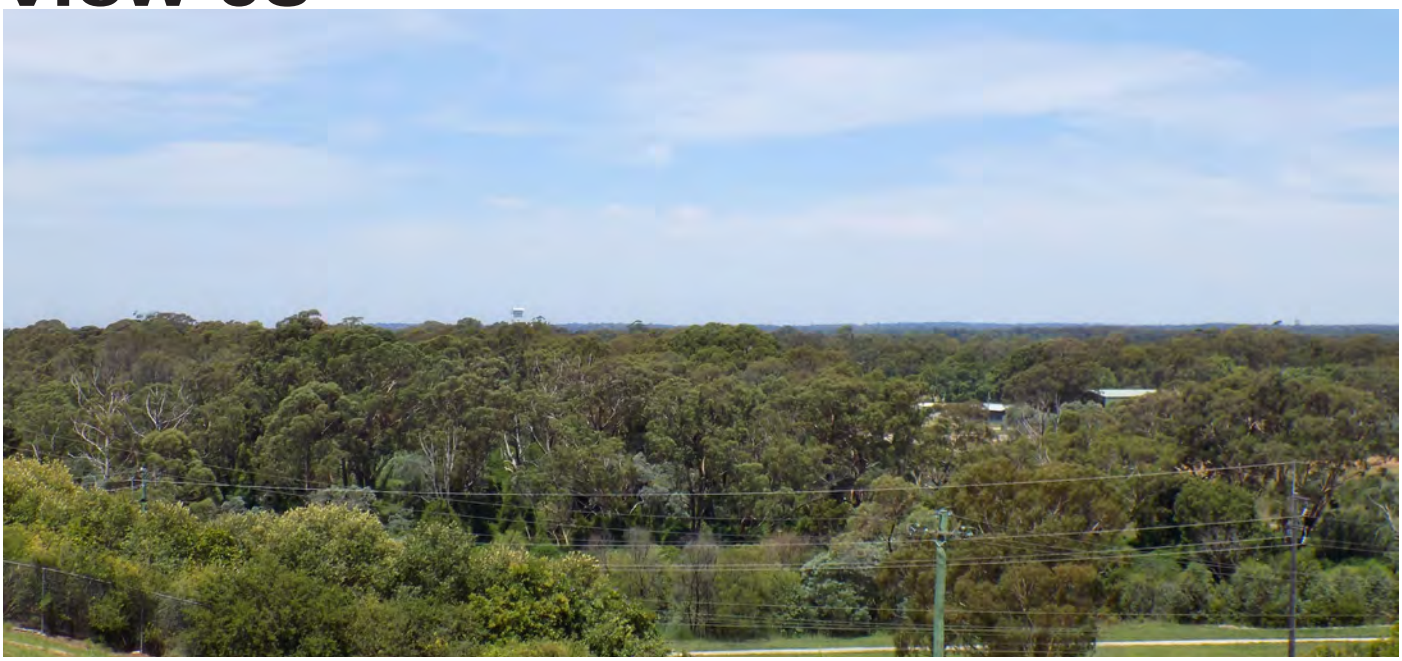
view 03



Existing View

Simulated View

view 03

Viewing Location	Carroll Park and neighboring residential properties
Visual Adaptation	
Approximate Viewing Distance	240m to site boundary (approx.)
Prominence of the Development	This view location is taken from an elevated point in Carroll Park in the West looking down toward the SSFL. The area has extensive views over the Proposal site.
Landscape Compatibility	The MPW site is densely populated with vegetation including tall trees and medium to small bushes that can be seen covering the majority of the Proposal site. As such, most of the development will be screened by existing vegetation in particular, that of the Conservation Area along the Georges River. The existing landscape is moderately compatible with the proposed development. There would be some clearance of vegetation on the Proposal site however.
Visual Sensitivity	Being a residential area the visual sensitivity would be relatively high. Several houses within the area and users of the park land would be able to see the development from this location with it being moderately prominent. Most views however would be of a short duration and therefore the visual amenity would be slightly diminished, suggesting a moderate sensitivity.
Visual Impact	There would be moderate visibility from this viewpoint east across the Georges River to the Proposal. The existing landscape amenity would change as a result of the development however retained and new vegetation would act sufficiently to screen the majority of the Proposal with only the tops of warehouses, light poles and some operational equipment being visible. As such there would be a moderate visual impact at this viewpoint location.

view 04

Existing View

Simulated View

view 04

Viewing Location	West of site, Casula Powerhouse Arts Centre
Visual Adaptation	
Approximate Viewing Distance	140m to site boundary (approx.)
Prominence of the Development	The viewpoint is taken outside of the Casula Powerhouse Arts Centre, located east of the Casula Railway Station. The view looks east towards the riparian vegetation zone that runs along the banks of the Georges River. All views of the Proposal site are heavily obscured by dense vegetation.
Landscape Compatibility	The location is situated on flat ground elevated above the banks of the Georges River looking towards dense vegetation comprised of tall trees and small to medium sized bushes. The existing landscape is highly compatible with the Proposal and would not require any alteration as a result of the development.
Visual Sensitivity	As the area is publicly accessible and offers some amenity to the community, the visual sensitivity is moderate in this location. Natural topography and existing vegetation heavily enclose the area limiting exposure to the east heavily screening the majority of the proposed development.
Visual Impact	Glimpses of the development may be visible from this location through the existing vegetation and above the tree line with the tops of warehouses and light poles potentially protruding. This, however would not likely be substantial enough to detract from the amenity of the area suggesting a relatively low/moderate visual impact.

view 05

Existing View

Simulated View

view 05

Viewing Location	West of site, Georges River Casula Parklands
Visual Adaptation	
Approximate Viewing Distance	150m to site boundary (approx.)
Prominence of the Development	This viewpoint is located to the west of the proposed development site looking north towards the bank of the Georges River and M5 motorway overpass. The Proposal will not be visible from this viewpoint. The SSFL and powerhouse access road are visible in the background to the west.
Landscape Compatibility	The Casula Parklands is a mix of maintained grassland, landscape and vegetation including trees and shrubs that heavily populate the riparian vegetation area that runs along the bank of the Georges River. As this provides a moderate buffer to the Proposal site and requires no clearing in this area, the landscape is highly compatible with the proposed development.
Visual Sensitivity	The Parklands offer an area of some amenity to the public with large open spans of landscaping accessible to the community. As such the visual sensitivity of the location would be moderate. This is however, lowered by the lack of upkeep and density of vegetation limiting users to designated pathways and roads with access points being restricted by the SSFL and Georges River.
Visual Impact	This viewpoint location has little to no visibility of the proposed site and development. Any proposed built form will be obstructed by dense riparian vegetation along the riparian corridor and Casula Parklands. The existing visual amenity therefore would have little to no change suggesting no visual impact.

view 06

Existing View

Simulated View

view 06

Viewing Location	West of site, St. Andrews Park along Buckland Road, St. Andrews Boulevard and Lakewood Crescent.
Visual Adaptation	
Approximate Viewing Distance	320m to site boundary (approx.)
Prominence of the Development	The view location is taken from St. Andrews Park looking east toward the Proposal site. There is a highly vegetated area obscuring any direct view of the site. The Proposal would therefore not likely be visible from this area and will be screened by a thick riparian corridor along the Georges River. The SSFL in the foreground runs within close proximity and is the prominent built feature from this viewpoint location.
Landscape Compatibility	In the foreground is an existing rail line with its associated service and access roads and power lines above. Directly beyond is the Georges River which has dense vegetation running along either side of its banks. This vegetation would require some clearance further east toward the proposed development, none of which would be visible from this location suggesting a highly compatible landscape.
Visual Sensitivity	Being a publicly accessible park in a residential area, the visual sensitivity in this location would be high. The existing infrastructure in the foreground lowers the visual sensitivity of the area to moderate.
Visual Impact	The development would not likely be visible from this area, however some built form features such as light poles may protrude above the tree line suggesting a low to moderate visual impact.

view 07

Existing View

Simulated View

view 07

Viewing Location	North-east of site, Junction of M5 Motorway and Moorebank Avenue
Visual Adaptation	
Approximate Viewing Distance	60m to site boundary (approx.)
Prominence of the Development	This viewpoint looks south down Moorebank Avenue showing existing industrial facilities on the east and industrially zoned land to the west. The road is lined with large trees on either side that provide some screening of the Proposal site. The primary areas for access and egress to the proposed development would be visible from this location.
Landscape Compatibility	The addition of new industrial elements to this landscape would be compatible with this landscape. The addition of road upgrades to the area would mean some clearing of vegetation however would not detract any further from landscape compatibility.
Visual Sensitivity	The existing industrial land-use would suggest a low visual sensitivity in this location. A sensitive receiver identified as Kitchener House, a heritage item, sits in the immediate foreground of this view location. This receiver is however currently in a primarily industrial area and as such visual sensitivity for the location would remain low, with the heritage item remaining relatively unaffected. As means of mitigation, implementation of strong urban design principles as part of the proposed landscape strategy would help to improve the existing landscape treatment of the area. As a result visible portions of the proposed development would improve visual sensitivity in the vicinity.
Visual Impact	The Proposal would be prominent from this location. However, the land-use compatibility creates a low visual sensitivity and therefore there would be a low to moderate visual impact from this viewpoint. Heritage items would be relatively unaffected due to the existing industrial nature of the area.

view 08

Existing View

Simulated View

view 08

Viewing Location	South-west of site, Moorebank Avenue
Visual Adaptation	
Approximate Viewing Distance	20m to site boundary (approx.)
Prominence of the Development	This portion of Moorebank Avenue consists of industrial facilities on either side of the road. The proposed development would be highly prominent from this location with relatively unobstructed views of the Proposal site. At this location, sections of the Rail Link connection would be visible in the middle ground with primary container yard in the background. For the purposes of creating a realistic assessment of the potential visual impact of the container yard and operating equipment, container heights have been staggered generally at maximum stacking height.
Landscape Compatibility	From this viewpoint, the proposed development would have a high impact on this existing landscape amenity, as it would require clearance of most existing vegetation. At this location operational equipment and containers yards would likely be of a larger scale than most elements in the immediate foreground and so would be visible. To increase compatibility, landscaping is proposed to help break down the prominence of any built form as part of the development. This would provide visual interest that would help reduce change to the existing landscape amenity and decrease prominence of the development.
Visual Sensitivity	The industrial land-use at this location creates a low visual sensitivity in general along the Moorebank Avenue corridor. This particular viewpoint does however have dense existing vegetation on the western side of the road which increases visual amenity. Most users of the area however would be travelling in vehicles most likely between existing industrial areas and for nominal durations. Therefore the overall visual sensitivity of the area is low.

view 08 (continued)

Visual Impact	The Proposal would be highly prominent at this location. However, the land-use compatibility and low visual sensitivity would mean that the proposed development may, through considered urban design principles, improve the amenity of the area. This suggests a moderate visual impact from this viewpoint location.

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07.1 visual impacts during construction

Subject to planning approval, construction of the Proposal is planned to commence in the first quarter of 2017.

The total period of construction works for the Proposal is anticipated to be approximately 36 months.

The following construction works are likely to be visible from surrounding areas and have been considered:

- Vegetation clearing and building demolition;
- Establishment and decommissioning of ancillary facilities including batch plant;
- Earthworks including stockpiling of material;
- Installation of drainage and utilities;
- Construction of rail sidings, locomotive shifter and refuelling area;
- Construction of access and egress points connecting to existing road network, including signage and truck processing gates;
- Construction of the administration office, engineering workshop and services; and
- Construction of warehousing precinct (including associated infrastructure and services).

During the above construction works the most visible elements are likely to be equipment such as cranes and piling rigs. These are likely to be visible from areas such as Moorebank Avenue, the nearby passenger rail lines and nearby residential areas of Casula and Wattle Grove. However, given the low rise nature of construction works, it is unlikely that these works would be overly intrusive and that any visual impacts would be localised and temporary in nature.

Other sources of visual impact during construction such as the establishment of hoardings and construction fencing would tend to create highly localised visual impacts primarily along Moorebank Avenue and also in areas visible to Casula.

Based on the their location and the works proposed, the visual impact during construction has been assessed for the following viewpoints:

View Location Name	Area	Type	Visual Adaptation	Visual Sensitivity	Visual Impact
View 01	Casula	Public space	Low	Low	Low
View 02	Casula	Public space	Low/Moderate	Moderate	Moderate
View 03	Casula	Public space	Moderate	Moderate	Moderate
View 04	Casula	Public space	Low	Moderate	Low/Moderate
View 05	Casula	Public space	N/A	Moderate	N/A
View 06	Casula	Residential	Low	Moderate/High	Moderate
View 07	Moorebank	Public road/ Industrial	Moderate	Low	Low/Moderate
View 08	Moorebank	Public road/ Industrial	High	Low	Moderate

Table 7 - Visual Impact during Construction

The following mitigation measures would be implemented to reduce the overall visual impact during construction phase:

- Existing vegetation around the perimeter of construction sites would be retained where feasible and reasonable;
- The early implementation of landscape planting would be recommended for consideration in order to provide visual screening during the construction of the Proposal;
- Elements within construction sites would be located to minimise visual impacts as far as feasible and reasonable, e.g. setting back large equipment from site boundaries;
- Construction lighting, on both ancillary facilities and plant and equipment, would be designed and located to minimise the effects of light spill on surrounding sensitive receivers, including residential areas and the proposed conservation area
- Design of site hoardings would consider the use of artwork or project information;
- Regular maintenance would be undertaken of site hoardings and perimeter areas including the prompt removal of graffiti;
- Re-vegetation/landscaping would be undertaken progressively; and
- Where required for construction works, cut-off and directed lighting would be used and lighting locations considered to ensure glare and light spill are minimised.

08 light spill assessment

8.1 Introduction

The external lighting at the Proposal site is provided by using metal halide lamps for the container yard and high pressure sodium (HPS) lamps for roadways and carparks. This proposed lamp technology will provide the development with high energy efficiency and light spectrum that has minimum visual impact on light spill.

8.2 Methodology

The light spill assessment has been undertaken with an understanding of the site's proposed work processes and usage. This is to ensure the site lighting provides safe work practice, avoids potential interference with equipment used on site and at the same time minimises light spill from the site. The pole positions, luminaire mounting heights, luminaire selection and luminaire aiming angles have been derived to provide an optimum result within the restrictions of the site.

The lighting design is provided in accordance with Australian Standards and has been modelled using industry lighting design software, AGi32 version 16.7.

The light spill assessment has been undertaken in AGi32 in accordance with the requirements set out in the Australian Standard AS 4282 – 1997. The model includes the pole positions, luminaire mounting heights, luminaire selection and luminaire aiming angles. The light spill has been modelled in accordance with the standards at relevant boundaries - Boundary 1.0 and 2.0 – refer Figure 8 and Figure 9.

The illuminance and luminous intensity have been assessed during post curfew hours as follows for both boundaries.

• Boundary 1.0 – Residential area in dark surrounds – recommended maximum vertical illuminance of 1lux (lx) and a luminous intensity emitted by luminaires of 500 candela (cd).
• 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.

An isolux plot was created for the area and the results show that the obtrusive light spill is less than 0.1 lux measured at the residential boundary– refer to Figure 8 and Figure 9.

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

8.3 Lighting Standards

The Proposal is lit in accordance with the following Australian 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.

8.4 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.

8.4.1 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 6.

The proposed 2,000 Watt (W) Sylvania A3 Maxi Metal Halide floodlight has asymmetric light distribution up to 66°, maximum up cast 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 6 - 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 7 - Sylvania Roadster

8.4.2 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 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 3 m to achieve an even light distribution across the carparks.

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Figure 8 - General site layout (North) showing light spill isolux curves both external and internal to the site

Figure 9 - General site layout (South) showing light spill isolux curves both external and internal to the site

8.5 Luminaire Schedule

The light spill assessment has been modelled based on the luminaires provided in Table 8 below.

Note: the luminaires outlined in Table 8 are limited to the container yard and perimeter lighting, carpark lighting is not included in the table below - refer Figure 8 and 9 on the previous page for location of luminaires.

Pole	Height (m)	Sylvania Roadster Aero 400W HPS	Sylvania A3 Maxi 200W HIS-TD Wide Beam Imax=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 Imax=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	

Table 8 - Luminaire schedule

8.6 Rail Access - Light Spill

The proposed rail spur line from the rail connection to the SSFL and the Intermodal runs parallel to Moorebank Avenue and is set at a level which is similar to the level of Moorebank Avenue.

There are no sensitive receivers along the route of the rail spur line apart from motorists on Moorebank Avenue travelling in the opposite direction to an operational locomotive and who may be impacted by headlight glare from the oncoming locomotive.

The impact of such headlight glare will be mitigated by the installation of appropriate screen planting within the buffer zone between the Moorebank Avenue road reserve and the rail spur corridor.

8.7 Results of Assessment

The lighting of the 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.

Regarding light spill from the Proposal the following mitigation measures would include:
• Lighting would be designed to minimise impacts on surrounding existing and future residents and the proposed conservation zone
• The use of shields on luminaire lighting to minimise brightness effects would be considered
• Asymmetric light distribution-type floodlights would be selected as part of the proposed lighting design (i.e. the light is directed specifically to the task with minimal direct light spill to the surrounding area)
• Low reflection pavement surfaces would be considered to reduce brightness
• The quantity of light and energy consumption in parts of the Proposal site that are not active would be minimised, while retaining safe operation.

09 conclusion

The Proposal is to be developed on a site that has been occupied by the Department of Defence (DoD) for many years and has been primarily utilised for training and education purposes serving as the former School of Military Engineering. Many of the facilities on the existing site are beyond their useful life and have been vacant following the relocation of the DoD.

Besides secure perimeter fencing, screening on the site is sporadic in nature and does not provide shield from views of internal operations particularly along Moorebank Avenue. Landscaping is present but similarly appears in clusters infrequently along the perimeter unsuccessfully creating a consistent buffer to surrounding users.

The site has prominent natural features along its western boundary including the Georges River and a riparian corridor that spans the entire site from north to south.

Beyond the river to the west is the SSFL followed by the closest residential areas, Casula and Wattle Grove. To the north-east and east are other industrial facilities. To the south is the EHPL and then beyond is dense vegetation on DoD land. These are all within 1km of the site boundaries.

The Proposal would generally be in keeping with the existing character of the area. Some relatively high and/ or bulky structures/ equipment will however increase the visibility of the site beyond its current levels with some limited and highly localised visual impacts on the east and varying levels of impacts to the west depending on location and elevation.

The pattern of development surrounding the site described above would help screen the development from much of the surrounding area. Potential views do occur along viewing corridors created by Moorebank Avenue, and where topography provides some elevation, above potential obstructions to views.

The anticipated visual impact of each viewpoint has been analysed using a range of qualitative criteria. Each viewpoint has been selected based on the MPW Concept Plan EIS for consistency of analysis. The methodology and techniques are a combination of those recommended by Reid Campbell and those used by *Clouston Associates* in their assessment during the MPW Concept Plan.

Given the nature of the Proposal and its consistency with general industry within the local area, higher visual impact locations would be primarily those in residential areas that have prominent views of the site and subsequently, proposed development. This study found that the development would incur a low to moderate visual impact to residential areas surrounding. However, these would be highly localised to only specific locations.

The limited visual impact to residential areas is mainly due to distance, existing visual barriers and undulating topography between the site and these residential zones.

The most prominent views of the development would occur at localised boundary points along Moorebank Avenue, however these impacts are regarded as relatively low because of their existing character being compatible with the Proposal.

A number of visual impact mitigation measures have been proposed including significant and intensive landscaping, planting, built-form screening, that would reduce the visibility of the development and improve the overall visual amenity of the site and area generally.

The light spill assessment concludes that minimal effect on adjacent properties and on the environment can be achieved, through appropriate selection of light source, luminaire make and aiming as well as pole positions and height from static site lighting well within the limits stated in AS 4282 - 1997 Control of the obtrusive effects of outdoor lighting.

appendix A

Light Spill Study Report

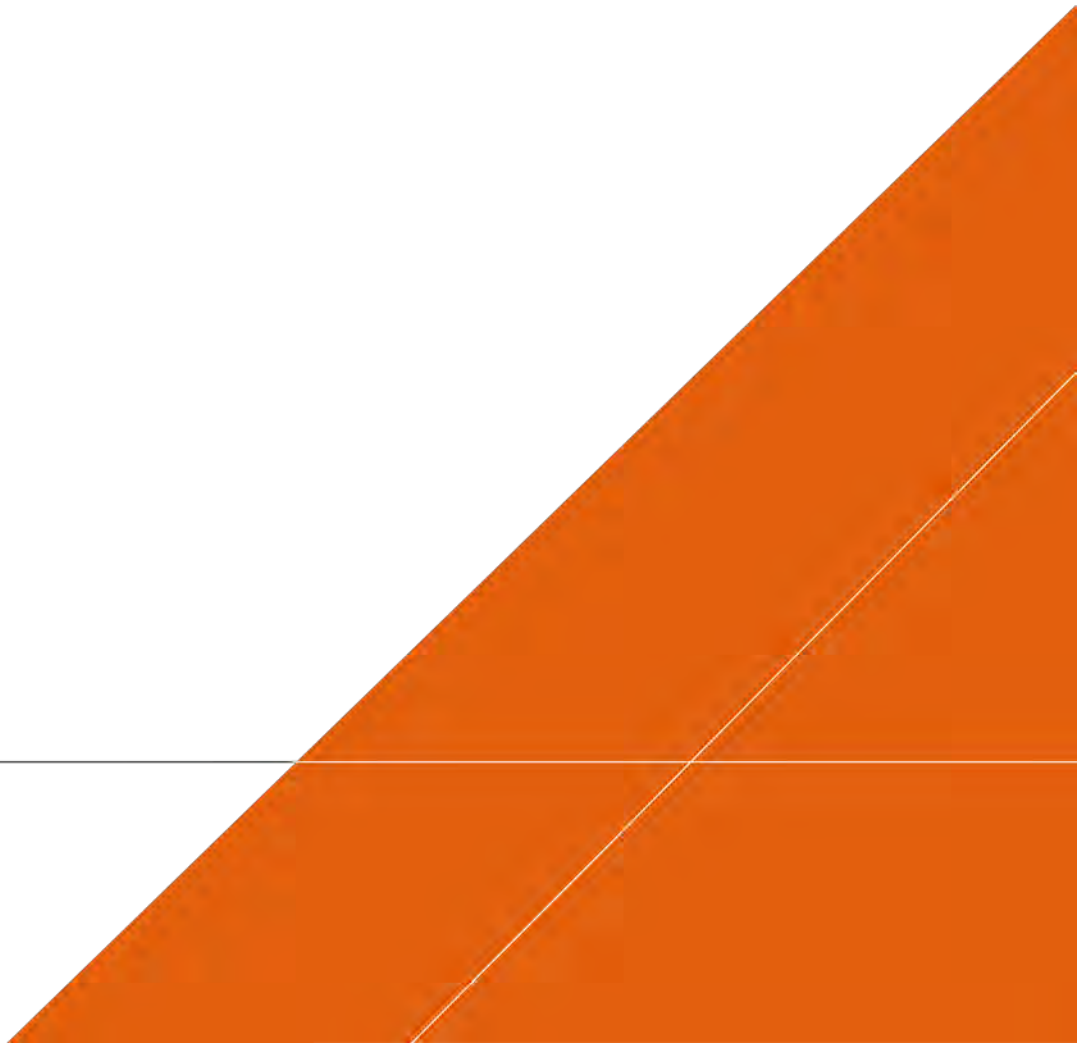
Arcadis

ARCADIS Design & Consultancy for natural and built assets

MOOREBANK INTERMODAL TERMINAL FACILITY: MPW STAGE 2 PROPOSAL

Light Spill Assessment

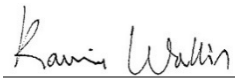
29 JULY 2016



Incorporating Hyder

MOOREBANK INTERMODAL TERMINAL FACILITY: MPW STAGE 2 PROPOSAL

Light Spill Assessment

Author	Karin Wallin	
Checker	Brent Tough	
Approver	Anna Zolotukhina	

Report No	R-0002-AA003760-AAR-P4
Date	29/07/2016
Revision Text	Revision P4

REVISIONS

Revision	Date	Description	Prepared by	Approved by
P1	08/03/2016	Draft Issue	KW	BT
P2	22/04/2016	For Information	KW	BT
P3	30/05/2016	Final	KW	BT
P4	29/07/2016	Update to reflect re-branding	KW	BT

CONTENTS

APPENDICES

1 INTRODUCTION

On the 3 June 2016 Concept Plan Approval (SSD 5066) was granted, under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), to develop the Moorebank Precinct West Project (MPW Project) on the western side of Moorebank Avenue, Moorebank, in south-western Sydney (the MPW site).

The MPW Project involves the development of intermodal freight terminal facilities (IMT), linked to Port Botany, the interstate and intrastate freight rail network. The MPW Project includes associated commercial infrastructure (i.e. warehousing), a rail link connecting the MPW site to the Southern Sydney Freight Line (SSFL), and a road entry and exit point from Moorebank Avenue.

Under the Concept Plan Approval, the MPW Project is to be developed in four phases, being:

- Early Works development phase, comprising:
    - The demolition of existing buildings and structures
    - Service utility terminations and diversion/relocation
    - Removal of existing hardstand/roads/pavements and infrastructure associated with existing buildings
    - Rehabilitation of the excavation/earthmoving training area (i.e. 'dust bowl')
    - Remediation of contaminated land and hotspots, including areas known to contain asbestos, and the removal of:
        - Underground storage tanks (USTs)
        - Unexploded ordnance (UXO) and explosive ordnance waste (EOW) if found
        - Asbestos contaminated buildings
    - Archaeological salvage of Aboriginal and European sites
    - Establishment of a conservation area along the Georges River
    - Establishment of construction facilities (which may include a construction laydown area, site offices, hygiene units, kitchen facilities, wheel wash and staff parking) and access, including site security
    - Vegetation removal, including the relocation of hollow-bearing trees, as required for remediation and demolition purposes
- Development of the intermodal terminal (IMT) facility and initial warehousing facilities
- 'Ramp up' of the IMT capacity and warehousing
- Development of further warehousing.

Approval for the Early Works phase (MPW Concept Plan Approval) was granted as the first stage of the MPW Project within the Concept Plan Approval. Works, approved as part of this stage are anticipated to commence in the third quarter of 2016.

Commonwealth Approval (No. 2011/6086), under the *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act), was also granted in mid 2016 (soon after the Concept Plan Approval) for the MPW Project. In addition to this, the Planning Proposal (PP_2012_LPOOL_004_00) which provided a rezoning of part of the MPW site, and surrounds, was gazetted on 24 June 2016 into the *Liverpool Local Environmental Plan 2008* (Amendment No. 62).

On 5 December 2014, Moorebank Intermodal Terminal Company (MIC) and SIMTA announced their in-principle agreement to develop the Moorebank IMT Precinct on a whole of precinct basis. This agreement is subject to satisfying several conditions which both parties are currently working towards. SIMTA is therefore seeking approval to build and operate the IMT facility and warehousing under the MPW Project Concept Approval, known as the MPW Stage 2 Proposal (the Proposal).

1.1 Report purpose

This report has been prepared to support the Environmental Impact Statement (EIS) for approval of the Proposal. A summary of the works included in the Proposal is provided below.

This report has been prepared as part of a State Significant Development (SSD) Application for which approval is sought under Part 4, Division 4.1 of the EP&A Act. This report has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) (ref: SSD 16-7709 and dated 14 July 2016) and revised environmental mitigation measures (REMMs) identified in the MPW Concept Plan Approval (SSD_5066). Table 1 provides a summary of the SEARs and the REMMs from the MPW Concept Plan Approval, which are relevant to this report and the section where they have been addressed in this report.

Table 1: Assessment requirements

Section / number	SEAR / REMM	Where addressed in this report
11.	**Visual Amenity, Design and Landscaping**	
d)	consider lighting impacts in the local area, analyse and describe the contribution and impacts of the proposed facility on light spill at the local scale and to sensitive receivers;	This report assess the light spill of Moorebank intermodal facility MPW Stage 2 Proposal. This report excludes headlight glare from trains, which is addressed in the Rail Access Report (Appendix F)

1.2 MPW Stage 2 Proposal Overview

The MPW Stage 2 Proposal (the Proposal) involves the construction and operation of an Intermodal terminal (IMT) facility and associated warehousing, as shown in Figure 1.

The IMT facility would have the necessary infrastructure to support a container freight throughput volume of 500,000 twenty-foot equivalent units (TEUs) per annum. Specifically, the IMT facility within the Proposal site would include the following key components:

- Truck processing, holding and loading areas – with entrance and exit from Moorebank Avenue via an upgraded intersection and a round-about to distribute traffic between the warehousing precinct and the IMT
- Rail loading and container storage areas – installation of nine rail sidings, with an adjacent container storage area serviced by manual handling equipment
- Administration facility – office building with associated car parking and light vehicle access from Moorebank Avenue
- The Rail link connection – rail sidings within the IMT facility, which would be linked (to the south) to the Rail link (constructed as part of the MPE Project (SSD 14-6766)).

Also included within the Proposal are the following key components:

- Warehousing area – construction and operation of approximately 215,000 m^2 GFA of warehousing, with warehouses ranging in size from 4,000 m^2 to 71,000 m^2. Included within the warehousing area would be ancillary offices, truck and light vehicle parking, associated warehouse access roads.
- Freight village – construction and operation of approximately 800 m^2 of retail premises, with access from the internal road.
- Upgraded intersection on Moorebank Avenue and internal road – including works to Moorebank Avenue, Anzac Road to accommodate the proposed site entrance to Moorebank Avenue, and construction of an internal road.
- Ancillary works – including vegetation clearing, earth works, drainage and on-site detention, utilities installation/connection, signage and landscaping.

1.2.1 Proposal components and key terms

Table 2 provides a summary of the key terms, which are included within this EIS.

Table 2: Summary of key terms used throughout this document

Term	Definition
Moorebank Precinct West (MPW) Concept Plan Approval (Concept approval and Early Works)	MPW Concept Plan and Stage 1 Approval (SSD 5066) granted on 3 June 2016 for the development of the MPW Intermodal terminal facility at Moorebank and the undertaking of the Early Works. Granted under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979*. This reference also includes associated Conditions of Approval and Revised Environmental Management Measures, which form part of the documentation for the approval. N.B. Previously the MIC Concept Plan Approval
Moorebank Precinct West (MPW) EPBC Approval	Commonwealth Approval (No. 2011/6086), granted in mid-2016, for the impact of the MPW Project on listed threatened species and communities and impacts on the environment by a Commonwealth agency. Anticipated to be granted under the *Environmental Biodiversity Protection Conservation Act 1999*.
Moorebank Precinct West (MPW) Concept Plan EIS	The Environmental Impact Statement prepared to support the application for approval of the MPW Concept Plan and Early Works (Stage 1) under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Environmental Planning and Assessment Act 1979*. N.B. Previously the MIC Concept Plan EIS
Revised Environmental Management Measures (REMMs)	The environmental management measures for the MPW Concept Plan Approval as presented within the MIC Supplementary Response to Submissions (SRtS) (PB, 2015) and approved under the MPW Concept Plan Approval.
Moorebank Precinct West (MPW) Planning Proposal	Planning Proposal (PP_2012_LPOOL_004_00) to rezone the MPW site from 'SP2- Defence to 'IN1- Light Industrial' and 'E3- Management', as part of an amendment to the *Liverpool Local Environmental Plan 2008* (as amended) gazetted on 24 June 2016.
Moorebank Precinct West (MPW) Project	The MPW Intermodal Terminal Facility as approved under the MPW Concept Plan Approval (5066) and the anticipated MPW EPBC Approval (2011/6086). N.B. Previously the MIC Project

Term	Definition
Moorebank Precinct West (MPW) site	The site which is the subject of the MPW Concept Plan Approval, MPW EPBC Proposal and MPW Planning Proposal (comprising Lot 1 DP1197707 and Lots 100, 101 DP1049508 and Lot 2 DP 1197707). The MPW site does not include the rail link as referenced in the MPW Concept Plan Approval or MPE Concept Plan Approval. N.B. Previously the MIC site.
Early Works	Works approved under Stage 1 of the MPW Concept Plan Approval (SSD 5066), within the MPW site, including: establishment of construction compounds, building demolition, remediation, heritage impact mitigation works and establishment of the conservation area.
Early Works Approval	Approval for the Early Works (Stage 1) component of the MPW Project under the MPW Concept Plan Approval (SSD 5066) and the (yet to be granted) MPW EPBC Approval. Largely contained in Schedule 3 of the MPW Concept Plan Approval.
Early Works area	Includes the area of the MPW site subject to the Early works approved under the MPW Concept Plan Approval (SSD 5066).
Proposal	MPW Stage 2 Proposal (the subject of this EIS), namely Stage 2 of the MPW Concept Plan Approval (SSD 5066) including construction and operation of an IMT facility, warehouses, a Rail link connection and Moorebank Avenue/Anzac Road intersection works.
Proposal site	The subject of this EIS, the part of the MPW site which includes all areas to be disturbed by the MPW Stage 2 Proposal (including the operational area and construction area).
IMT facility	The Intermodal terminal facility on the Proposal site, including truck processing, holding and loading areas, rail loading and container storage areas, nine rail sidings, loco shifter and an administration facility and workshop.
internal road	Main internal road through the Proposal site which generally travels along the western perimeter of the site. Provides access between Moorebank Avenue and the IMT and warehouses.
Rail link connection	Rail connection located within the Proposal site which connects to the Rail link included in the MPE Stage 1 Proposal (SSD 14-6766).
Proposal operational rail line	The section of the Rail link connection and Rail link between the SSFL and the Rail link connection (included in the MPE Stage 1 Proposal) to be utilised for the operation of the Proposal.
construction area	Extent of construction works, namely areas to be disturbed during the construction of the Proposal.
operational area	Extent of operational activities for the operation of the Proposal.
Moorebank conservation area/conservation area	Vegetated area to remain to the west of the Georges River, to be subject to biodiversity offset, as part of the MPW Project.
Moorebank Precinct (MP)	Refers to the whole Moorebank intermodal precinct, i.e. the MPE site and the MPW site.

Term	Definition
Moorebank Precinct East (MPE) Project	The Intermodal terminal facility on the MPE site as approved by the MPE Concept Plan Approval (MP 10_0913) and including the MPE Stage 1 Proposal (14-6766). N.B. Previously the SIMTA Concept Plan Approval
Moorebank Precinct East (MPE) site	The site which is the subject of the MPE Concept Plan Approval, and includes the site which is the subject of the MPE Stage 1 Approval. N.B. Previously the SIMTA site
Moorebank Precinct East (MPE) Stage 1 Proposal	MPE Stage 1 Proposal (14-6766) for the development of the Intermodal terminal facility at Moorebank. This reference also includes associated conditions of approval and environmental management measures which form part of the documentation for the approval. N.B. Previously the SIMTA Stage 1 Proposal
Rail link	Part of the MPE Stage 1 Proposal (14-6766), connecting the MPE site to the SSFL. The Rail link (as discussed above) is to be utilised for the operation of the Proposal.

2 SITE DESCRIPTION

The Proposal site is generally bounded by the Georges River to the west, Moorebank Avenue to the east, the East Hills Railway Line to the south and the M5 Motorway to the north. It is located on Moorebank Avenue, Moorebank and forms Lot 1 in Deposited Plan (DP) 1197707[1]. The Proposal site also contains Lots 100 and 101 DP1049508, which are located north of Bapaume Road and west of Moorebank Avenue. The Proposal site is located wholly within Commonwealth Land.

The Proposal would also require works to upgrade the intersection of the MPW site with Moorebank Avenue and would therefore be undertaken on the following parcels of land:

- Moorebank Avenue, owned by the Commonwealth Government, south of Anzac Road Lot 2, DP 1197707 (formerly part of Lot 3001, DP 1125930)
- Moorebank Avenue, owned by Roads and Maritime Services, north of Anzac Road
- A portion of Bapaume Road, a public road that is the responsibility of Liverpool City Council
- A portion of Anzac Road, owned by Liverpool City Council, to the east of Moorebank Avenue

The key existing features of the site are:

- Relatively flat topography, with the western edge flowing down towards the Georges River, which forms the western boundary to the MPW site
- A number of linked ponds in the south-west corner of the Proposal site, within the existing golf course, that link to Anzac Creek, which is an ephemeral tributary of the Georges River
- An existing stormwater system comprising pits, pipes and open channels
- Direct frontage to Moorebank Avenue, which is a publicly used private road, south of Anzac Road and a publicly owned and used road north of Anzac Road
- The majority of the site has been developed and comprises low-rise buildings (including warehouses, administrative offices, operative buildings and residential buildings), access roads, open areas and landscaped fields for the former School of Military Engineering (SME) and the Royal Australian Engineers (RAE) Golf Course and Club. Defence has since vacated and all buildings on the site are currently unoccupied and will be removed during the Early Works
- Native and exotic vegetation is scattered across the Proposal site
- The riparian area of the Georges River lies to the west of the Proposal site and contains a substantial corridor of native and introduced vegetation. The riparian vegetation corridor provides a wildlife corridor and a buffer for the protection of soil stability, water quality and aquatic habitats. This area has been defined as a conservation area as part of the MPW Concept Plan Approval
- As stated above, the majority of the Proposal site has been developed, however heritage and biodiversity values still remain on the site
- A strip of land (up to approximately 250 metres wide) along the western edge of the MPW site lies below the 1% annual exceedance probability (AEP) flood level
- The site is privately owned by the Commonwealth and leased by SIMTA.

A number of residential suburbs are located in proximity to the Proposal site, including:

[1] Previously legally described as “Lot 3001, DP 1125930” in the MPW Concept Plan Approval (SSD 5066), however has since been subdivided.

- Wattle Grove, located approximately 1,000 m from the Proposal site and 1,000 m from the Rail link connection to the east. The Rail link, which will be used during operation of the Proposal is 1,260 m to the west of Wattle Grove at its closest point
- Moorebank, located approximately 630 m from the Proposal site and more than 1,400 m from the Rail link connection to the north. The Rail link is 2,500 m to the south of Moorebank at its closest point
- Casula, located approximately 330 m from the Proposal site and 1,200 m from the Rail link connection to the west. The Rail link is approximately 290 m to the east of Casula at the closest point
- Glenfield, located approximately 820 m from the Proposal site and 1,100 m from the Rail link connection to the south-west. The Rail link is approximately 750 m to the east of Glenfield at its closest point.

3 REPORT OVERVIEW

Arcadis has been engaged to provide a Light Spill Analysis and report relating to the MPW Stage 2 Proposal operational area for the State Significant Development (SSD) Application for the Proposal.

This technical report has been provided to analyse and document any potential light spill from the 2 Proposal operational area.

The information used in this report is based on:

- “Warehousing – Master Plan” drawing by Reid Campbell from 22/02/2016;
- Lighting selection, mounting heights and distance based on the concept outlines in the Building Services Strategy Brief (Arcadis, 8 March 2016).

The objective of this report is to

- Analyse spill limits and complete a high-level assessment of lighting requirements;
- Preliminary external lighting design for container yard, internal roadways warehouses and carparks;
- Assess the results of the software modelling to demonstrate compliance in accordance with the:
  - Secretary’s Environmental Assessment Requirement (SEAR) 11e; and
  - ‘AA4282-1197 Control of the obtrusive effects of outdoor lighting’.

4 OPERATIONAL AREA

The Proposal operational area is located predominantly at the northern end of the MPW site, with the associated Rail link connecting the site to the SSFL in the south eastern part of the MPW site as indicated in Figure 1.

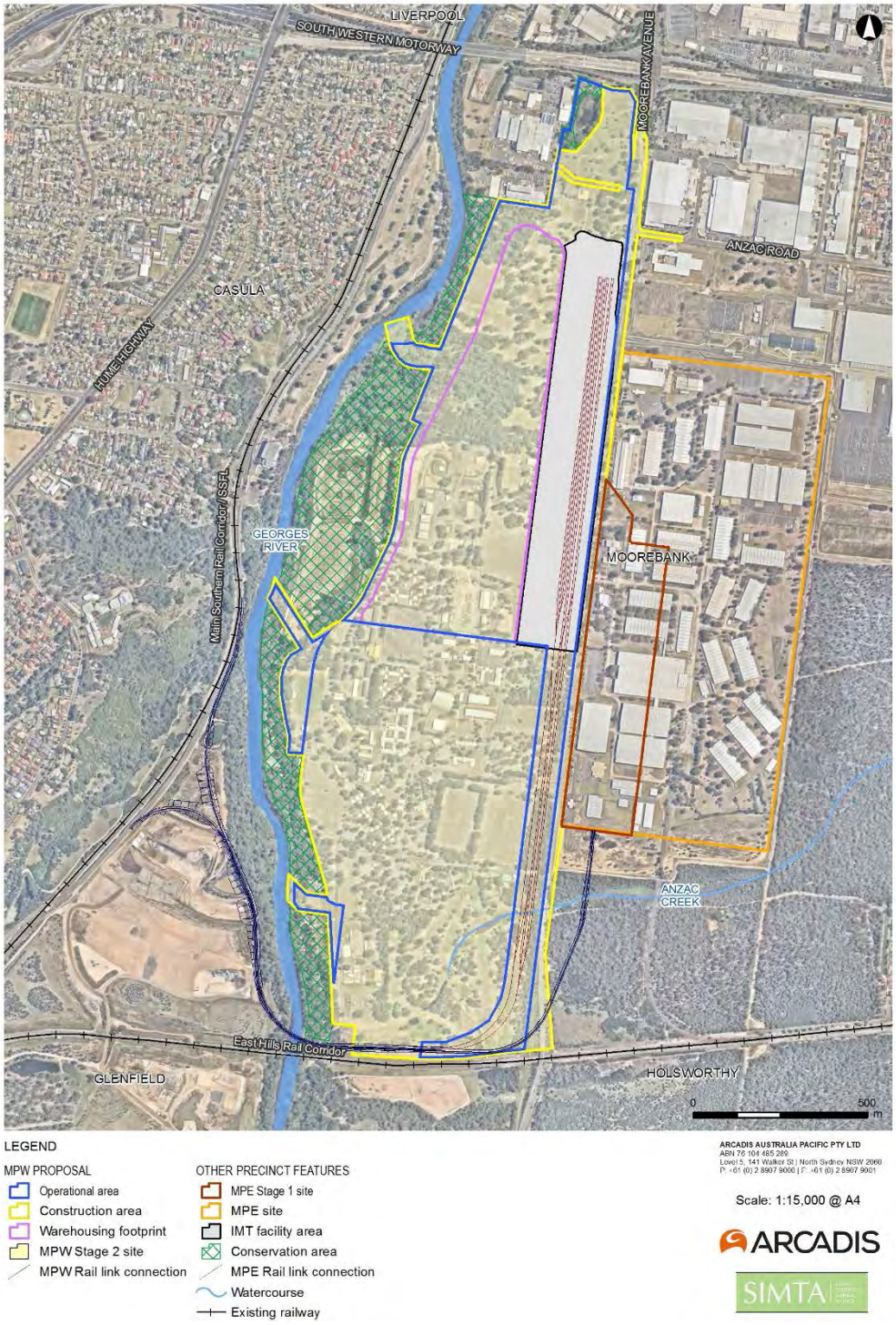


Figure 1 Proposal operational area

5 LIGHT SPILL ASSESSMENT

5.1 Background

The external lighting at the Proposal site is provided by using metal halide lamps for the container yard and high pressure sodium (HPS) lamps for roadways and carparks. This proposed lamp technology will provide the development with high energy efficiency and light spectrum that has minimum visual impact on light spill.

5.2 Methodology

The light spill assessment has been undertaken with an understanding of the site's proposed work processes and usage. This is to ensure the site lighting provides safe work practice, avoids potential interference with equipment used on site and at the same time minimises light spill from the site. The pole positions, luminaire mounting heights, luminaire selection and luminaire aiming angles have been derived to provide an optimum result within the restrictions of the site.

The lighting design is provided in accordance with Australian Standards and has been modelled using industry lighting design software, AGi32 version 16.7.

The light spill assessment has been undertaken in AGi32 in accordance with the requirements set out in the Australian Standard AS 4282 – 1997. The model includes the pole positions, luminaire mounting heights, luminaire selection and luminaire aiming angles. The light spill has been modelled in accordance with the standards at relevant boundaries - Boundary 1.0 and 2.0 – refer Figure 5 and Figure 6.

The illuminance and luminous intensity have been assessed during post curfew hours as follows for both boundaries.

- Boundary 1.0 – Residential area in dark surrounds – recommended maximum vertical illuminance of 1lux (lx) and a luminous intensity emitted by luminaires of 500 candela (cd).
- 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.

An isolux plot was created for the area and the results show that the obtrusive light spill is less than $0.1Lux$ measured at the residential boundary– refer to Figure 5 and Figure 6.

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

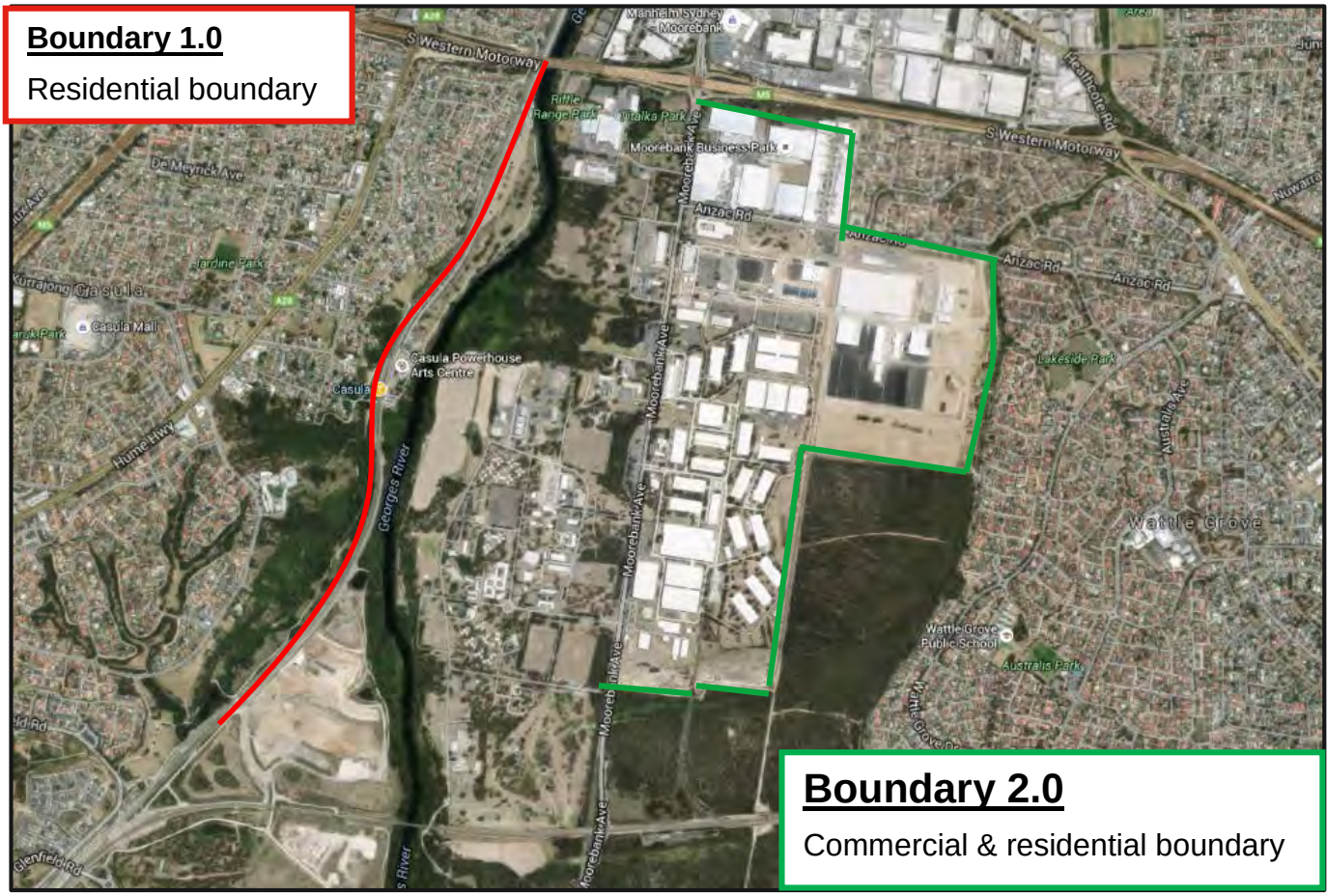


Figure 2 Site context and relevant boundary

5.3 Lighting Standards

The Proposal is lit in accordance with the following Australian 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.

5.4 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.

5.4.1 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 3.

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 3 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 4 Sylvania Roadster

5.4.2 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 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.

5.5 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 5 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.

5.5.1 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.

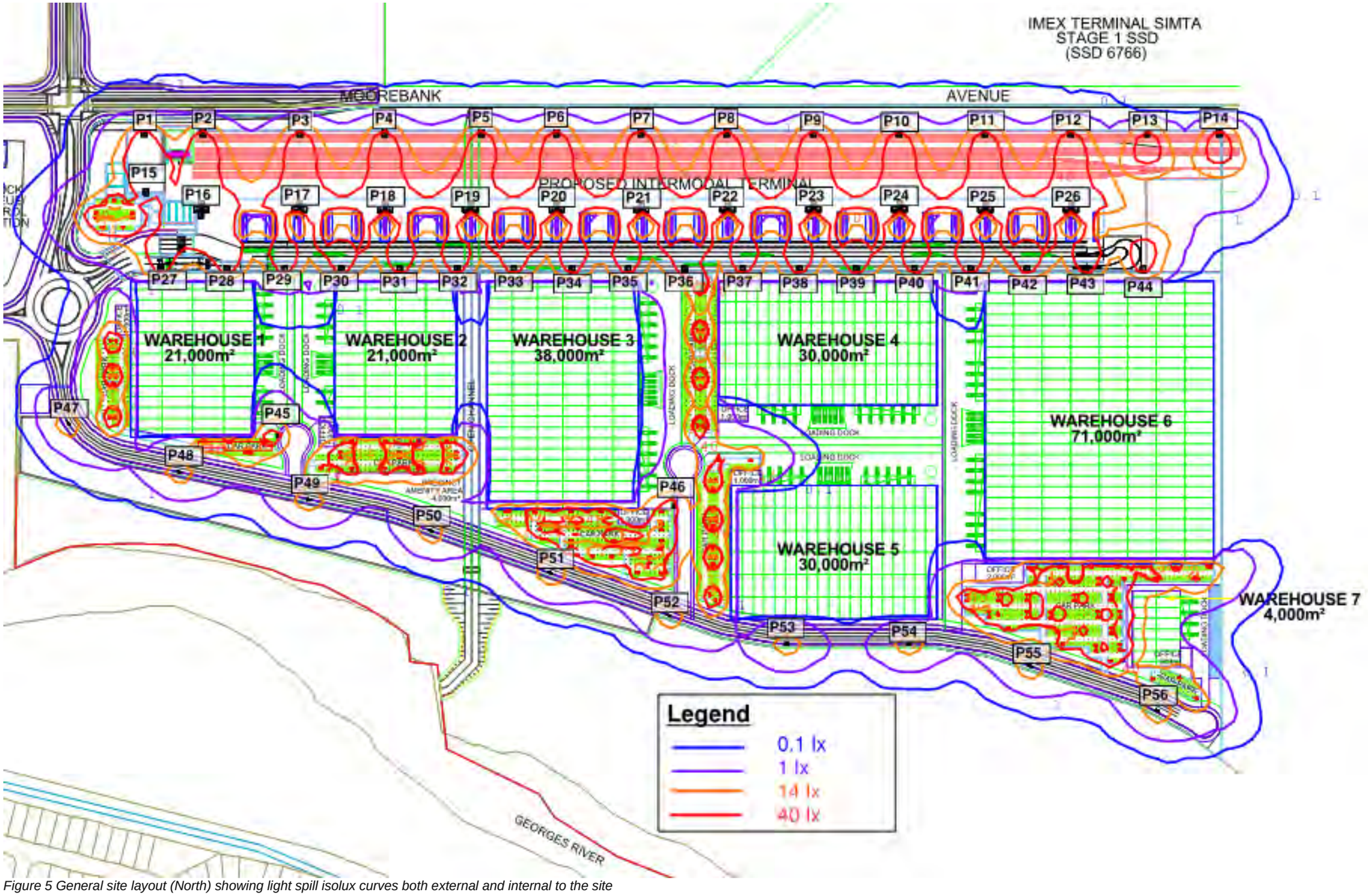


Figure 5 General site layout (North) showing light spill isolux curves both external and internal to the site

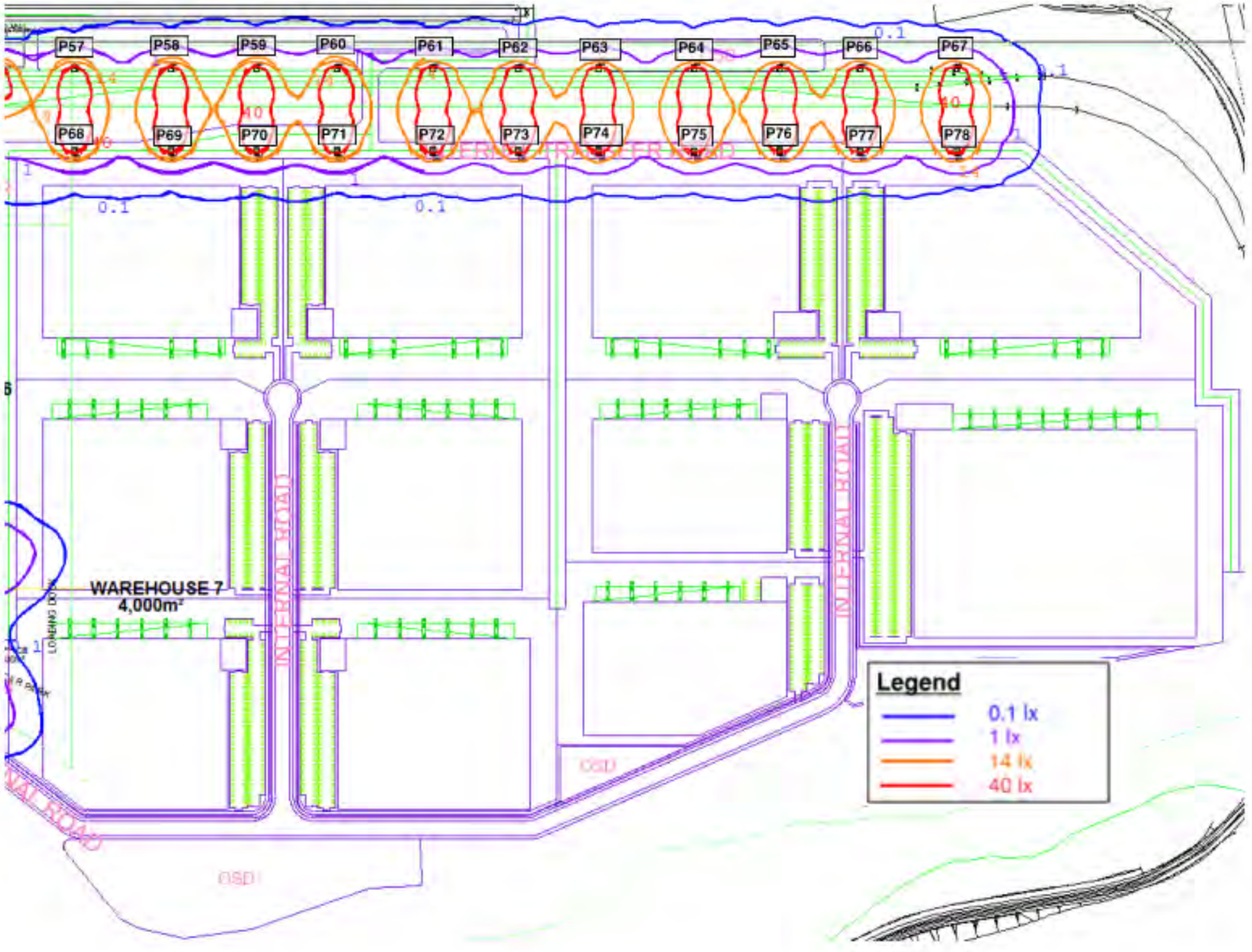


Figure 6 General site layout (South) showing light spill isolux curves both external and internal to the site

5.6 Luminaire schedule

The light spill assessment has been modelled based on the luminaires provided in Table 3 below.

Note: the luminaires outlined in Table 3 are limited to the container yard and perimeter lighting, carpark lighting is not included in the table below - refer Figure 5 and 6 on the previous page for location of luminaires.

Table 3 Luminaire Schedule

Pole	Height (m)	Sylvania Roadster Aero 400W HPS	Sylvania A3 Maxi 200W HIS-TD Wide Beam Imax=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 Imax=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	
P57	21		1
P58	21		1
P59	21		1
P60	21		1
P61	21		1
P62	21		1
P63	21		1
P64	21		1
P65	21		1
P66	21		1
P67	21		1
P68	21		1
P69	21		1
P70	21		1
P71	21		1
P72	21		1
P73	21		1
P74	21		1

Pole	Height (m)	Sylvania Roadster Aero 400W HPS	Sylvania A3 Maxi 200W HIS-TD Wide Beam Imax=60 deg
P75	21		1
P76	21		1
P77	21		1
P78	21		1

6 ASSESSMENT RESULT

The lighting of the 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.

APPENDIX A

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 Intermodal External Lighting v2 includes southern rail
30/05/2016 3:04:52 PM

Illuminance

Maximum Allowable Value: 1 Lux

Calculations Tested (3):

Calculation Label	Test Results	Max. Illum.
ObtrusiveLight=Resi-West-Ext_Ill_Seg1	PASS	0.0
ObtrusiveLight=Resi-West-Ext_Ill_Seg2	PASS	0.0
ObtrusiveLight=Resi-West-Ext_Ill_Seg3	PASS	0.0

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value: 500 Cd

Calculations Tested (3):

Calculation Label	Test Results
ObtrusiveLight=Resi-West-Ext_Cd_Seg1	PASS
ObtrusiveLight=Resi-West-Ext_Cd_Seg2	PASS
ObtrusiveLight=Resi-West-Ext_Cd_Seg3	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 Intermodal External Lighting v2 includes southern rail
30/05/2016 2:38:52 PM

Illuminance

Maximum Allowable Value: 4 Lux

Calculations Tested (8):

Calculation Label	Test Results	Max. Illum.
ObtrusiveLight-Comm Boundary_Ill_Seg1	PASS	0.0
ObtrusiveLight-Comm Boundary_Ill_Seg2	PASS	0.0
ObtrusiveLight-Comm Boundary_Ill_Seg3	PASS	0.0
ObtrusiveLight=Comm-Resi-East_Ill_Seg1	PASS	0.0
ObtrusiveLight=Comm-Resi-East_Ill_Seg2	PASS	0.0
ObtrusiveLight=Comm-Resi-East_Ill_Seg3	PASS	0.0
ObtrusiveLight=Comm-Resi-East_Ill_Seg4	PASS	0.0
ObtrusiveLight=Comm-Resi-East_Ill_Seg5	PASS	0.0

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value: 2500 Cd

Calculations Tested (8):

Calculation Label	Test Results
ObtrusiveLight-Comm Boundary_Cd_Seg1	PASS
ObtrusiveLight-Comm Boundary_Cd_Seg2	PASS
ObtrusiveLight-Comm Boundary_Cd_Seg3	PASS
ObtrusiveLight=Comm-Resi-East_Cd_Seg1	PASS
ObtrusiveLight=Comm-Resi-East_Cd_Seg2	PASS
ObtrusiveLight=Comm-Resi-East_Cd_Seg3	PASS
ObtrusiveLight=Comm-Resi-East_Cd_Seg4	PASS
ObtrusiveLight=Comm-Resi-East_Cd_Seg5	PASS

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