

Chapter 22

Visual and urban design



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22. Visual and urban design

This chapter describes the potential visual impacts of the Moorebank Intermodal Terminal (IMT) Project (the Project), including light spill, and the urban design principles underpinning the Project. A detailed visual impact assessment was prepared by Clouston Associates and is included as Technical Paper 12 – *Visual Impact Assessment* in Volume 8 of this Environmental Impact Statement (EIS). A detailed light spill assessment was prepared by AECOM and is included as Technical Paper 13 – *Light Spill Assessment* in Volume 9 of this EIS. Key findings of these assessments are summarised in this chapter.

This chapter also addresses the relevant Commonwealth Department of the Environment (DoE)'s EIS Guidelines and the Secretary for the NSW Department of Planning & Environment (NSW DP&E)'s Environmental Assessment Requirements (NSW SEARs) for the Project as shown in Table 22.1.

Table 22.1 Relevant Commonwealth EIS Guidelines and NSW SEARs

| Requirement | Where addressed |
|--|--|
| Commonwealth EIS Guidelines under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) | |
| <ul style="list-style-type: none"> Provide a discussion of the current light environment at the proposed site and surrounding areas. Identify the location of all sensitive receivers to light in the local area. | This chapter (section 22.5 and Figure 22.12). |
| <ul style="list-style-type: none"> Provide a description of the existing visual amenity of the proposed site including an analysis of views from key vantage points. Visual representations are required to address this section. | This chapter (sections 22.2.1 and 22.2.2). Visual representations are included in section 22.4. |
| <ul style="list-style-type: none"> Provide a detailed analysis and describe the change to visual amenity on the proposed site and surrounding areas resulting from construction and operation of the facility. | This chapter addresses the change to visual amenity on the proposed Project site and surrounding areas resulting from construction and operation of the facility (refer to sections 22.3 and 22.4). |
| <ul style="list-style-type: none"> Comprehensive monitoring of light spill. | This chapter (section 22.7.2). |
| NSW SEARs under the NSW <i>Environmental Planning and Assessment Act 1979</i> (EP&A Act) | |
| Visual and urban design – including but not limited to: | |
| <ul style="list-style-type: none"> identify and evaluate the visual impacts of the development including an analysis of views from key vantage points; a design analysis and justification of the key built form elements of the proposal; and analyse and describe the contribution and impacts of the proposed facility on light spill at the local scale and to sensitive receptors. | <p>This chapter addresses the visual and light spill impacts, as well as urban design principles of the Project, including an analysis of viewpoints (refer to section 22.4), light spill impacts (refer to section 22.5), and a design analysis and justification of key built form elements (refer to section 22.6).</p> <p>This chapter also proposes mitigation measures to address visual and light spill impacts of the Project (refer to section 22.7).</p> |

22.1 Assessment approach

22.1.1 Landscape character and visual impact assessment

This assessment adopted the methodology described in the NSW Roads and Maritime Services (RMS) *Guidelines for Landscape Character and Visual Impact Assessment* (RMS 2009). This assessment included the following key stages:

- site analysis and identification of landscape character zones;
- assessment of landscape character impacts and visibility of the Project;
- identification of key representative viewpoints to the development;
- assessment of potential visual impacts, in which the unmitigated impact of the Project on views from key representative viewpoints was assessed qualitatively, considering the sensitivity of the view and magnitude of the development in that view;
- assessment of the cumulative visual impact of other similar nearby developments and potential developments; and
- development of mitigation strategies to mitigate landscape character and visual impacts in the ongoing development of the design.

As outlined in Chapter 10 – *Impact assessment approach*, the visual assessment for the Project considered the impacts during each proposed development phase of the Project, including Early Works, the three development phases (Phases A, B and C) and the Full Build operational scenario (Full Build). This included consideration of potential construction and operational impacts within each phase.

For Phases A to C, impacts were examined in relation to parts of the Project that would already be operational at the conclusion of each phase. The Full Build scenario represents the long-term visual impact of the Project and is essentially the 'worst case' scenario in terms of operational impacts.

Landscape character matrix

The landscape character impacts of the Project were determined using a matrix based on a combination of magnitude and sensitivity, as shown in Table 22.2. 'Sensitivity' is defined as the degree to which a particular landscape can accommodate change arising from development, without detrimental effects on its character. 'Magnitude' is defined as the scale or degree of change to the landscape resource, including whether the change is temporary or permanent. The extent of the impacts was calculated based on a combination of magnitude and sensitivity ratings to give an overall landscape character impact rating.

Table 22.2 Landscape character and visual impact rating matrix

| Sensitivity | Magnitude | | | | | | |
|-------------|---------------|------------|--------------|---------------|---------------|---------------|---------------|
| | | Negligible | Low | Moderate–Low | Moderate | High–Moderate | High |
| | High | Negligible | Moderate | Moderate–High | Moderate–High | High | High |
| | High–Moderate | Negligible | Moderate | Moderate | Moderate–High | Moderate–High | High |
| | Moderate | Negligible | Moderate–Low | Moderate | Moderate | Moderate–High | Moderate–High |
| | Moderate–Low | Negligible | Moderate–Low | Moderate–Low | Moderate | Moderate | Moderate–High |
| | Low | Negligible | Low | Moderate–Low | Moderate–Low | Moderate | Moderate |
| | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |

Source: Technical Paper 12 – *Visual Impact Assessment*, Volume 8

Visual catchment analysis

As part of the visual impact assessment, a desktop study was conducted using aerial mapping to identify visual catchment zones and key receptors that may be visually affected by the Project. ‘Key receptors’ are the public or community who would have views of the Project site from their home, travel route and/or place of work. Eight receptor sites and associated viewpoints were identified. Each selected viewpoint represents a group of receptors within that immediate area. Photomontages were developed for selected viewpoints (see section 22.4), showing indicative views of the Project fully operational in Full Build, without mitigation such as screen planting. Impacts were assessed based on a composite of the sensitivity of the view and magnitude of the development in that view, before implementation of any mitigation strategy.

Visual impact rating

The overall visual impact rating for each viewpoint was determined based on a combination of the qualitative ratings for magnitude and sensitivity, using the matrix in Table 22.2.

22.1.2 Light spill assessment

The light spill assessment involved measurement of the existing environmental conditions with respect to light spill, calculation of the potential light spill from the indicative proposed lighting design for the Project, and assessment of the potential light spill impact in specific sensitive receptor areas. The detailed assessment in Technical Paper 13 – *Light Spill Assessment* (in Volume 9) focused on operational impacts during the Full Build (the worst case scenario); construction impacts are also discussed in this chapter.

Night-time surveys were carried out to measure existing lighting conditions. Illuminance (the quantity of light received at a specific point or at a property) was measured in lux using an illuminance meter. Photographs of the Project site were taken from various locations around the Project site, including Casula, Moorebank Avenue and Wattle Grove. These locations were selected based on observation and site analysis. The potential light spill from the Project was calculated using the industry standard lighting design software, AGI32 version 2.31. This software was used to calculate impacts based on a worst case impact scenario for light spill at Full Build operations (2030 onwards).

The impact of lighting on people is prescribed by *AS 4282-1997 Control of the obtrusive effects of outdoor lighting*. Road lighting proposed on Moorebank Avenue comprises public lighting, which is exempt from compliance with AS 4282. However, for the purpose of this assessment, light spill impacts along Moorebank Avenue were also assessed.

22.1.3 Urban design

Urban design principles were developed as part of the concept masterplanning work undertaken by Parsons Brinckerhoff and Sutera in 2012, and would be further considered in future design stages. A summary of the key urban design principles is provided in section 7.3 in Chapter 7 – *Project built form and operations* of this EIS.

22.1.4 Cumulative assessment

In accordance with the NSW SEARs, this EIS includes a cumulative assessment of the visual impacts of the Project in combination with development of the Sydney Intermodal Terminal Alliance (SIMTA) site and other planned developments within the surrounding region. The findings of the cumulative assessment are provided in Chapter 27 – *Cumulative impacts*.

22.2 Existing environment

22.2.1 Existing landscape character

With the exception of the proposed conservation area, the Project site is largely cleared and accommodates Defence buildings, ranging from single-storey dwellings to storage facilities for plant and machinery. The buildings are generally surrounded by open lawn areas and patches of remnant and planted vegetation, while training facilities (such as the plant and equipment training area, known as the ‘dust bowl’) do not contain any vegetation. At the southern end of the Project site is a golf course, which is largely open in character with stands of mature trees. To the north of the Project site is the ABB site and M5 Motorway, while the East Hills Rail Line borders the southern end of the Project site.

The landscape along Moorebank Avenue to the east of the Project site is well maintained, with many mature trees in good condition and well-kept lawns, and some footpaths.

Within the Project site, the vegetation ranges from stands of mature native vegetation (15–25 metres (m) tall) to mature introduced species planted in avenues or as features. The vegetation mainly obscures the current facilities from offsite viewpoints, but there are some filtered views of buildings, and some buildings can be seen above the tree canopy (refer photomontages in section 22.4).

On the western boundary of the Project site is the Georges River. The shoreline is heavily vegetated. Further west and south-west of the Project site is the passenger and freight (Southern Sydney Freight Line (SSFL)) rail corridor, which marks a transition to the low density residential suburbs of Casula and Glenfield and commercial properties along the Hume Highway.

As part of the landscape character assessment, four landscape character zones were defined for the Project site and surrounds, as shown in Figure 22.1. Table 22.3 provides further detail on the landscape character elements of each zone.

Table 22.3 Landscape character elements

| Elements | Zone 1 – Fragmented vegetation | Zone 2 – Riparian corridor | Zone 3 – Residential development | Zone 4 – Commercial/light industrial |
|---------------------------|--|---|---|---|
| Location | Mostly within the main IMT site and along a narrow strip of land west of the Georges River riparian corridor | Along the western boundary of the Project site (along the alignment of the Georges River) | East and west of the Project site, concentrated within the suburbs of Wattle Grove and Casula | North, east and on the Project site |
| Topography | Gently undulating landform | Mostly flat | Undulating landform | Flat landform |
| Hydrology | Natural gullies draining into riparian areas | Natural gullies draining into riparian areas, river corridor and creeks | Drainage networks | Drainage networks |
| Geology | No exposed features | No obvious or exposed geological features; Quaternary alluvial deposits | No obvious geological features | No obvious geological features |
| Ecology/vegetation | Fragmented remnant patches with some denser stands | Primary stands of vegetation with some understorey, cleared in locations | Disconnected and sparse tree cover | Disconnected and sparse tree cover |
| Land use | Military training | None | Semi-urban/residential | Commercial, light industrial, administration and training and some major infrastructure |
| Built form | No built form | No dwellings | Residential properties typified by single and double storey houses | Large multi-storey buildings of varying heights |
| Spatial | Primarily open in character with interrupted views | Primarily enclosed in character with more distant views from clearings | Primarily open in character with distant views from higher elevations | Primarily open in character with distant views from higher elevations |

Source: Based on various tables within Technical Paper 13 – *Visual Impact Assessment* (Volume 8)

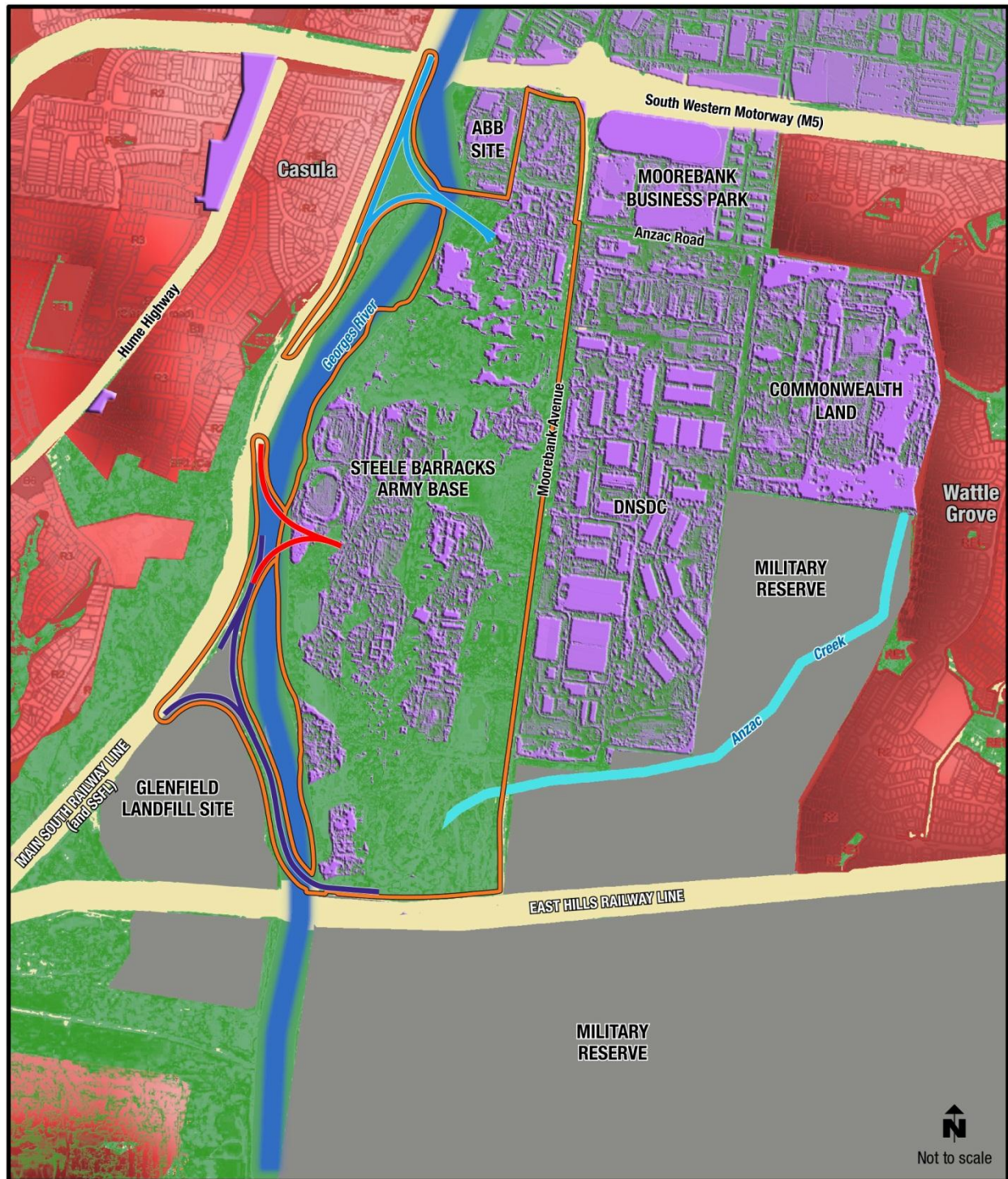


Figure 22.1 Landscape character zones

- Project site boundary
- Northern rail access option
- Central rail access option
- Southern rail access option
- Transport corridor
- Creek
- Other land use
- Landscape Character Zone 1 - Fragmented vegetation
- Landscape Character Zone 2 - Riparian corridor
- Landscape Character Zone 3 - Residential development
- Landscape Character Zone 4 - Commercial/light industrial development

22.2.2 Visual catchment analysis and existing key viewpoints

Figure 22.2 shows the visual catchment analysis of the existing Project site and surrounds, as well as identified key viewpoints. This assessment did not consider the placement of individual built elements within the indicative layouts for the Project.

In terms of private domain, the Project site is principally visible from a number of residential properties backing onto Leacock Regional Park, Carroll Park, St Andrews Park and the Main South Rail Line (and the SSFL) near Lakewood Crescent. Views towards the Project site from other properties within Casula are blocked by a combination of built form and topography.

In regard to public domain, the Project site is principally visible from high points along the M5 Motorway and along the length of Moorebank Avenue. It is also visible from parts of minor local roads (such as Marsh Parade, Lakewood Crescent, St Andrews Boulevard and Leacocks Lane) and parks (such as Carroll Park, St Andrews Park and Leacock Regional Park to the west). Direct views northwards into the Project site are also available from the East Hills Rail Line corridor to the south.

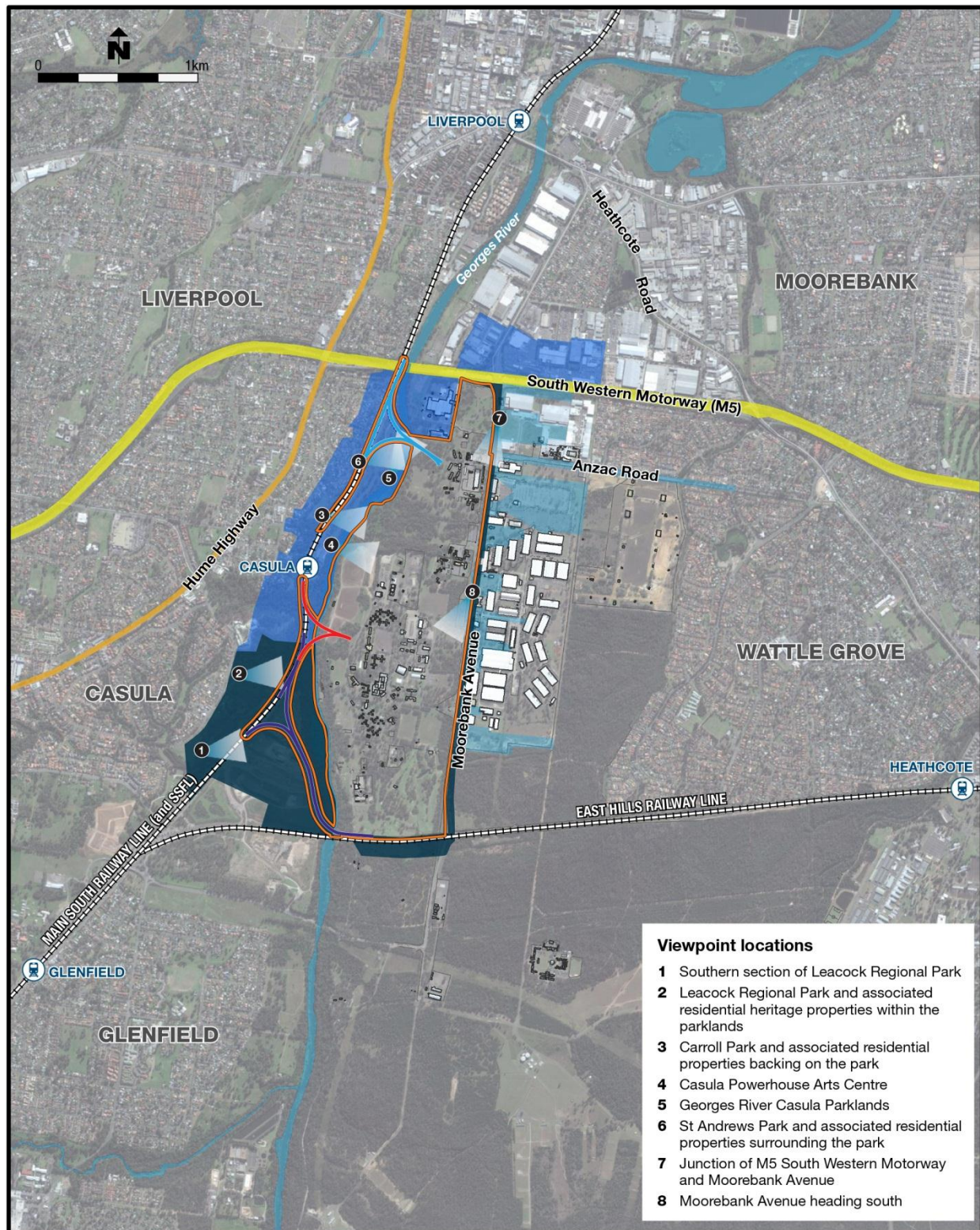


Figure 22.2 Visual catchment analysis and viewpoint location

- Visual catchment within the Project site
- Northern rail access option
- Central rail access option
- Southern rail access option
- 1 Viewpoint locations

Visual catchment outside the site (approximate)

- Direct views of the site
- Filtered views of the site
- Heavily/screened views of the site

22.2.3 Existing lighting environment

The existing night-time lighting environment within and surrounding the Project site was recorded by night-time illuminance measurements and photographs. These recordings were made during times of new or waxing crescent moons, which provide very little light. Positions for the lighting assessment (L1 to L21) are shown in Figure 22.12. The existing night-time lighting environment is summarised below.

Casula

Residents in Casula immediately west of the Main South Rail Line mostly overlook the Project site (i.e. these residences are elevated above the Project site). The appearance of the existing Project site is relatively dark from viewpoints in Casula, as shown in Photo 22.1.



Photo 22.1 Night-time view (20 September 2012) from receiver point L2 in Casula towards Project site – view taken from fence line of existing rail corridor

Moorebank Avenue

Moorebank Avenue is currently flanked by Defence facilities. The military areas vary from very dark lighting environments to quite bright lighting environments. Moorebank Avenue is lit by a combination of high pressure sodium lights and florescent lights, and is also intermittently lit by passing vehicle headlights.

Glenfield and Wattle Grove

Glenfield and Wattle Grove are both residential areas with dark lighting environments. The appearance of the existing Project site is relatively dark from viewpoints in Glenfield (cul-de-sac at end of Goodenough Street) and Wattle Grove (cul-de-sac at end of Corryton Circuit) as shown in Photo 22.2 and Photo 22.3.



Photo 22.2 Night-time view towards the Project site (gold dashed line) from viewpoint L16 located in the cul-de-sac at end of Goodenough Street



Photo 22.3 Night-time view towards the Project site (gold dashed line) from viewpoint L17 in cul-de-sac at end of Corryton Circuit, Wattle Grove

22.3 Landscape character impact assessment

The overall impact of the Project on the landscape character zones was determined by assessing the sensitivity and magnitude of the development on the landscape setting. Table 22.4 below provides a summary of the landscape character impacts.

Table 22.4 Summary of landscape character impacts

| | Zone 1– Fragmented vegetation | Zone 2– Riparian corridor | Zone 3– Residential development | Zone 4– Commercial/light industrial |
|--|--|--|--|--|
| Sensitivity | Moderate/High | Moderate/Low | Moderate | Low |
| Magnitude | High | Moderate/Low | Moderate | Moderate/Low |
| Overall landscape character impact rating | High | Moderate/Low | Moderate | Moderate/Low |

Source: Table 8 in Technical Paper 12 – *Visual impact assessment*

From a landscape character perspective, the Project would have the greatest impact on fragmented vegetation found on site with an overall landscape character impact rating of high. This is because the Project would require the permanent clearing of land and the removal of a portion of this character zone. Most impacts would be during the main construction phases, with minimal impact during Early Works. The majority of the vegetation located in this landscape character zone is of a moderate ecological rating (refer to Chapter 13 – *Biodiversity* for ecological rating definitions), but because of the presence of endangered and vulnerable vegetation communities and two threatened species listed under the NSW *Threatened Species and Conservation Act 1995* (TSC Act) and the EPBC Act, this landscape zone achieved a moderate/high sensitivity rating.

The riparian corridor achieved an overall impact rating of moderate/low, as only minimal development would occur in this landscape character zone. Although endangered communities listed under the TSC Act and EPBC Act may be present in this character zone, the design of the Project would include the retention of the majority of this landscape character zone as a conservation area. The proposed rail access connection to the SSFL and Georges River bridge crossing would be the main additions within this zone (for all three rail access option layouts), as well as stormwater drainage lines and outlets to the Georges River.

Residential development surrounding the Project site achieved an overall landscape character impact rating of moderate, due to the number of potential visual receptors and the expected increase in the scale and bulk of development within the local area.

The commercial and light industrial character zone was shown to have an overall landscape character impact of moderate/low. This reflects that the Project would fit within the wider context of a commercial and industrial built form, which reduces the sensitivity of the zone to change.

The three rail access option layouts would have a similar effect on landscape character, as each option would affect a similar area of fragmented vegetation within the main IMT site. The requirement for clearing along the Georges River varies depending on the rail access option, with the southern rail access option affecting the most vegetation (refer Chapter 13 – *Biodiversity* for details of clearing). However, no option is likely to cause a major change to the landscape character of this zone due to the relatively small scale of the rail infrastructure within the long river corridor.

The southern rail access option is the only option that crosses the Glenfield Landfill site. That site currently has low sensitivity to change due to its degraded landscape character; however, over time it is expected to be revegetated and has the potential to become an area of public open space with high amenity value. While the southern rail access connection option would have some impact on this potential future landscape value, the existence of rail infrastructure to the east and south of this landfill would assist in reducing the magnitude of any such landscape character impact.

22.4 Visual impact assessment

Figure 22.2 shows the visual catchments outside the Project site and the key viewpoint locations that could be potentially visually affected by the Project. These viewpoints are representative of a wide range of visual receptors surrounding the Project site.

Visual impacts during the full life cycle of the Project are predicted to range from negligible to moderate/high.

22.4.1 Early Works phase

Table 22.5 summarises the visual impact assessment for the Early Works phase. Overall, Early Works would have limited impact on visual amenity. Of the eight viewpoints assessed, seven are predicted to have a moderate/low impact rating and one a negligible rating. Existing riparian vegetation along the Georges River and the retained conservation area would assist in screening a substantial amount of the Early Works activities for viewpoints west of the river. Receptors on Moorebank Avenue (Viewpoints 7 and 8) may notice an increase in site traffic and diversions; however, the low sensitivity and short duration of the view for these receptors would limit the severity of any impacts.

Table 22.5 Early Works visual impact summary table

| Viewpoint number (refer Figure 22.2 for locations) | Receptor type | Impact rating |
|---|------------------------------------|---------------|
| 1 | Public park | Moderate/Low |
| 2 | Public park | Moderate/Low |
| 3 | Public park/residential properties | Moderate/Low |
| 4 | Public facility | Moderate/Low |
| 5 | Public park | Negligible |
| 6 | Public park/residential properties | Moderate/Low |
| 7 | Public road | Moderate/Low |
| 8 | Public road | Moderate/Low |

Source: Based on Table 9A, Technical Paper 12 – *Visual Impact Assessment*

22.4.2 Phases A to C

Potential visual impacts associated with Phases A, B and C were analysed and collated into a single visual impact rating that includes the construction and completed operational elements of the Project at each phase. Results are summarised in Table 22.6.

Table 22.6 Phases A to C visual impact summary table

| Viewpoint number (refer Figure 22.2 for locations) | Receptor type | Impact rating | | |
|---|------------------------------------|-----------------------------|----------------------------|-----------------------------|
| | | Northern rail access option | Central rail access option | Southern rail access option |
| 1 | Public park | Moderate | Moderate | Moderate |
| 2 | Public park | Moderate/High | Moderate/High | Moderate/High |
| 3 | Public park/residential properties | Moderate/High | Moderate/High | Moderate/High |
| 4 | Public facility | Moderate/Low | Moderate/Low | Moderate/Low |
| 5 | Public park | Moderate/High | Negligible | Negligible |
| 6 | Public park/residential properties | Moderate/High | Moderate/Low | Moderate/Low |
| 7 | Public road | Moderate/High | Moderate/High | Moderate/High |
| 8 | Public road | Moderate/High | Moderate/High | Moderate/High |

Source: Based on Table 9B, Technical Paper 12 – *Visual Impact Assessment*

Impacts are predicted to range from negligible to moderate/high across the three rail access options.

Visual impacts of construction works during these phases would include:

- clearing of the development area of the Project site prior to construction;
- temporary fencing, lighting and builders' compounds;
- earthworks and infrastructure installation;
- road and rail building;

- stockpiling of materials; and
- tall construction cranes and other construction equipment.

No receptors received an impact rating of high. For receptors west of the Georges River, retained vegetation along the river and within the conservation area would assist in screening ground construction activities and construction of new low buildings.

Moderate/high impacts were predicted for many viewpoints due to their high sensitivity to visual change (private residences and public parks) and the impact of tall construction equipment that would be visible above the treeline during construction of both the import/export (IMEX) and interstate IMT facilities.

Impacts would be similar for the three rail access option layouts, with the exception of receptors within the Georges River Casula Parklands, St Andrews Park and residential properties surrounding St Andrews Park (Viewpoints 5 and 6). These receptors would have clear views of the construction and operation of the northern rail access connection and would therefore experience a greater visual impact from this option than from the central and southern rail access options.

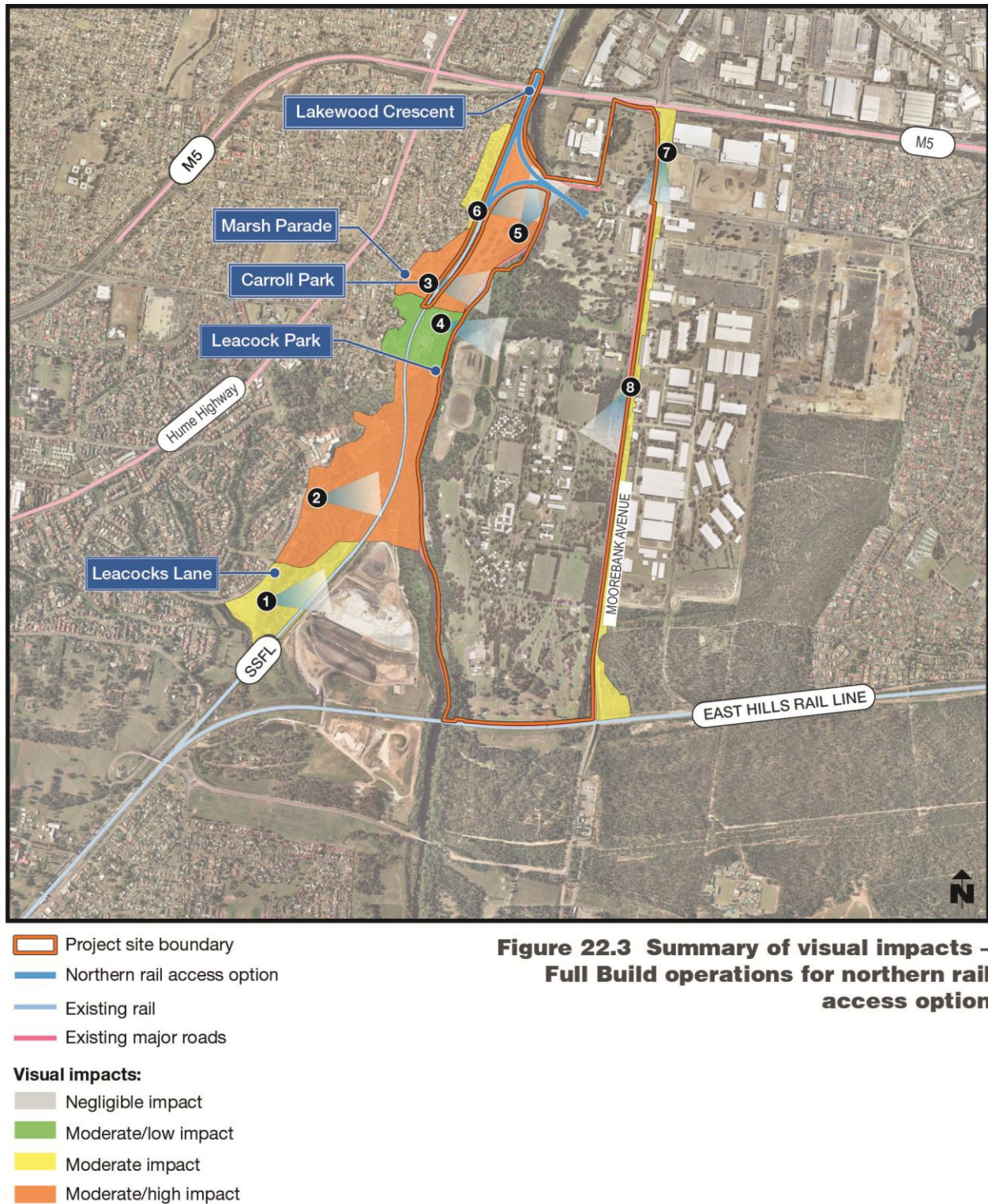
22.4.3 Full Build operations (from 2030)

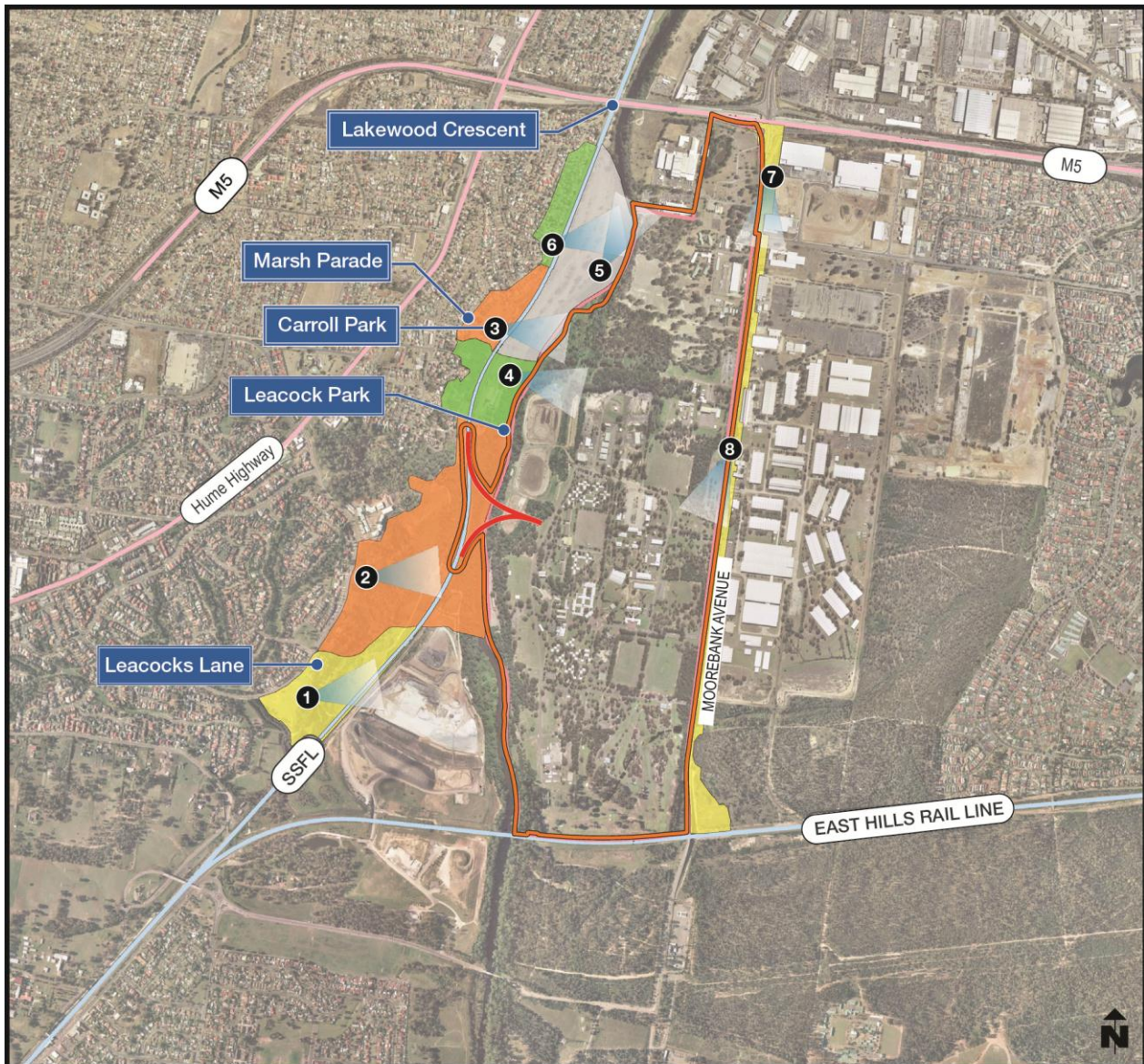
Once the Project is fully operational, visual impacts would range from negligible to moderate/high across the three rail access option layouts, as summarised in Table 22.7 and in Figure 22.3, Figure 22.4 and Figure 22.5.

Table 22.7 Full Build operations visual impact summary table

| Viewpoint number (refer Figure 22.2 for locations) | Receptor type | Impact rating | | |
|--|--|--------------------------------|-------------------------------|--------------------------------|
| | | Northern rail access option | Central rail access option | Southern rail access option |
| 1 | Public park | Moderate | Moderate | Moderate |
| 2 | Public park | Moderate/High | Moderate/High | Moderate/High |
| 3 | Public park/ residential properties | Moderate/High | Moderate/High | Moderate/High |
| 4 | Public facility | Moderate/Low | Moderate/Low | Moderate/Low |
| 5 | Public park | Moderate/High | Negligible | Negligible |
| 6 | Public park/ residential properties | Moderate | Moderate/Low | Moderate/Low |
| 7 | Public road | Moderate | Moderate | Moderate |
| 8 | Public road | Moderate | Moderate | Moderate |

Source: Based on Table 9C, Technical Paper 12 – *Visual Impact Assessment*



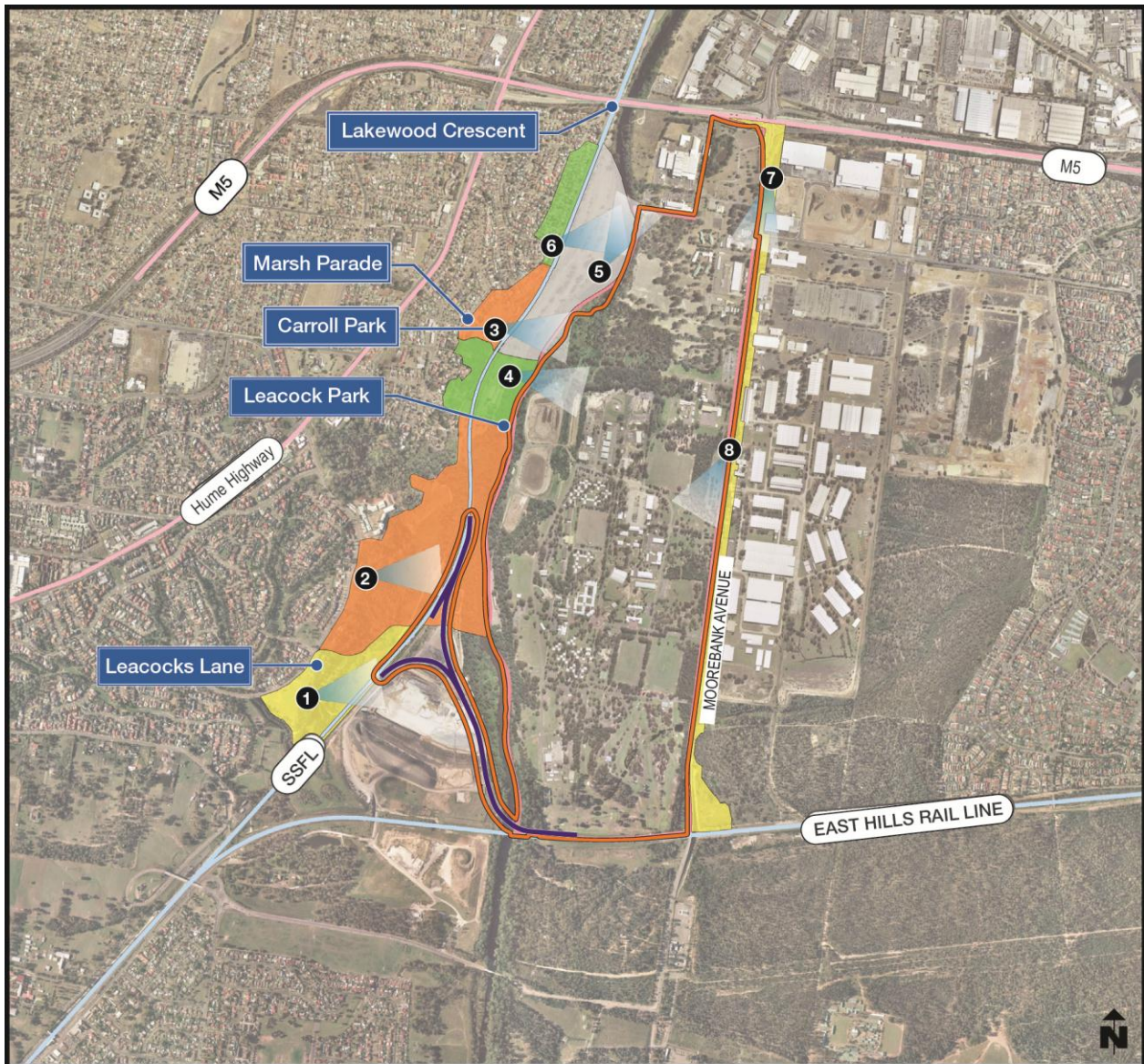


- Project site boundary
- Central rail access option
- Existing rail
- Existing major roads

Visual impacts:

- Negligible impact
- Moderate/low impact
- Moderate impact
- Moderate/high impact

Figure 22.4 Summary of visual impacts – Full Build operations for central rail access option



- Project site boundary
- Southern rail access option
- Existing rail
- Existing major roads

Visual impacts:

- Negligible impact
- Moderate/low impact
- Moderate impact
- Moderate/high impact

Figure 22.5 Summary of visual impacts – Full Build operations for southern rail access option

Figure 22.6 provides an indicative photomontage of the view of the northern rail access option looking east from Carroll Park and Figure 22.7 provides an indicative photomontage of the view of the southern rail access option looking east from Leacock Regional Park.



Figure 22.6 Existing view (left) and photomontage of the Project (northern rail access option) (right), looking east from Carroll Park– indicative only, subject to detailed design



Figure 22.7 Existing view (left) and photomontage of the Project (southern rail access option) (right) looking east from Leacock Regional Park– indicative only, subject to detailed design

The greatest visual impact of the Full Build development would be on the public parks and residential properties situated on the elevated topography sloping west from the Georges River, as well as the residential properties backing onto the SSFL. Direct views over the entire operational Project would be limited to the properties directly adjacent to Leacock Regional Park and Carroll Park, where views would not be blocked by garden vegetation or other built form. The operational Project would also potentially be visible from the second storey of a small number of properties to the west of Leacocks Lane.

Visual impacts along Moorebank Avenue would reduce as construction machinery is removed and planting establishes along the road. Figures 22.8 and 22.9 provide indicative photomontages of views from Viewpoints 7 and 8 along Moorebank Avenue.

Photomontages have not been prepared specifically for the central rail access option as the central rail access is in a heavily vegetated area. Views towards the crossing from the western bank of the river, next to the Powerhouse museum, will be obscured by vegetation alongside the river banks and it is unlikely that the crossing will be seen from adjacent areas.



Figure 22.8 Existing view (left) and photomontage of view of Project (right) from Viewpoint 7 (looking south along Moorebank Avenue – indicative only, subject to detailed design)



Figure 22.9 Existing view (left) and photomontage of view of Project (right) from Viewpoint 8 (looking south along Moorebank Avenue – indicative only, subject to detailed design)

For the northern rail access option, the properties along the eastern edge of roads backing onto the SSFL (Viewpoint 6), as well as sections of the Georges River Casula Parklands (Viewpoint 5), would have direct views of the proposed George River rail crossing bridge for this option. These properties are unlikely to have views of the main IMT site due to the retained riparian vegetation along the river corridor. Figure 22.10 provides an indicative photomontage of the view from Viewpoint 5 in the Georges River Casula Parklands for the northern rail access option.

Figure 22.11 provides an indicative photomontage of the view from Viewpoint 6, looking east from St Andrews Park for the northern rail access option.



Figure 22.10 Existing view (left) and photomontage of indicative view (right) from the central section of the Georges River Casula Parklands, looking north (northern rail access option) from Viewpoint 5 – indicative only, subject to detailed design



Figure 22.11 Existing view (left) and photomontage (right) of indicative view from Viewpoint 6, looking east from St Andrews Park (northern rail access option) – indicative only, subject to detailed design

For the central rail access option, there may be noticeable removal of vegetation associated with the southbound central rail access connection from Viewpoint 2 (Leacock Regional Park and associated residential properties within the parkland); however, the rail infrastructure itself would likely be obscured by foreground vegetation.

For the southern rail access option, the rail access connection and long freight trains would be visible in the foreground from Viewpoint 1 (the southern section of Leacock Regional Park), behind the SSFL track. However, the existing similar rail infrastructure within this view would reduce the level of visual impact.

22.5 Light spill impacts

22.5.1 Early Works

The majority of the activities undertaken during Early Works would occur during standard daytime construction hours and would therefore not require lighting. However, as noted in Chapter 8 – *Project development phasing and construction* (section 8.8.5), some out of hours Early Works activities may be required for certain activities, including works to existing utilities and oversize deliveries. Lighting to enable these works (both from fixed lighting and movement of vehicles during night works) would have the potential for light spill impacts. However, this lighting would be contained within the area of actual works and designed to avoid light spill to surrounding areas as much as possible. In addition, potentially affected residents and relevant authorities would be notified in advance of works intended to be performed outside standard hours.

22.5.2 Construction

As with the Early Works development phase, the majority of the construction works for the Project would occur during standard daytime construction hours and would therefore not require lighting. However, some out of hours construction work may be required for works to existing utilities, oversize deliveries and works requiring track possessions for the tie-in to the SSFL. As explained in section 22.5.1 above, while lighting would have the potential for light spill impacts during construction, the lighting would be contained and positioned to avoid light spill to surrounding areas.

As discussed in section 13.3.2 of Chapter 13 – *Biodiversity*, light pollution from the Project construction works may have an effect on animals within remaining vegetated areas, which could lead to changes in behaviours such as foraging, reproduction and communication. The proposed vegetation restoration within the conservation area and landscape planting in the interior of the site is, however, likely to mitigate light spill impacts on fauna through the screening effects of increased vegetation cover. Subsequently, no significant effects on fauna are expected during construction of the Project.

22.5.3 Operation

Proposed (indicative) lighting concept

In accordance with the indicative lighting concept for the main IMT site (refer to section 3.2 of Technical Paper 13 – *Light Spill Impact Assessment* in Volume 9), the majority of the open container storage and circulation areas for the Project would be lit from equally spaced 30 m high masts. The lighting masts would normally support two to six 1,000 watt (W) high pressure sodium luminaires mounted on a headframe. The design of the luminaires would be a full cut-off type, to limit site glare and spill light towards residences.



Photo 22.4 Example of luminaires (Belconnen soccer facilities, Canberra)

Luminaire lights do not have a direct upward light component, but instead direct the light specifically to the task (i.e. the Project) with minimal light spill to the night sky and surrounding area. This would also minimise any direct views of bright floodlights. An example of the use of luminaires is shown in Photo 22.4. Although this photograph shows a major sports installation with well over 10 times the average illuminance proposed for the Project, it does demonstrate the strong cut-off of light spill at the edge of the facility. A similar cut-off would be expected from the proposed IMT lighting. The high pressure sodium lights proposed for the Project would have a warmer colour than that shown in this Photo 22.4 and would also contribute less to the overall brightness of the area.

Other areas, such as internal roads, gate areas, vehicle parking, movement and maintenance areas would use 20 m poles with full cut-off type luminaires. General surveillance lighting would be provided on 10.5 m poles. The lighting along Moorebank Avenue is proposed to be mounted at a height of 15 m.

No lighting is proposed for the rail access connections to the SSFL, other than train signalling lights. However, trains would use headlights at night. Trucks arriving and departing the IMT site on Moorebank Avenue would also use headlights, and onsite forklifts and rail mounted gantries would have working lights and flashing amber warning lighting.

Overall, the proposed lighting design would effectively contain any direct light spill and avoid substantial impacts on residential areas. Additional shielding could also be provided for specific luminaires if required.

Predicted light spill impacts from the Project

Figure 22.12 shows the calculated net illuminance values for specific locations in the vicinity of the Project. This includes the existing lighting environment, calculated illuminance from the Project and the predicted net illuminance. This does not include any 'sky glow' effect due to reflection of light from general pavement areas, due to the difficulty in calculating this effect. The sky glow effect can also be largely avoided through design measures to reduce the reflectance characteristics of the pavement.

The calculated IMT Project illuminance values for light spill from the Project were found to be an order of magnitude equivalent to the light from the moon days after or before a new moon (i.e. less than 0.03 lux).

As shown in Figure 22.12, the greatest net increase in light spill is predicted for locations L6, L10 and L15, which are along Moorebank Avenue and away from residential areas. Light spill impacts from road lighting at Moorebank Avenue are typically exempt from consideration and compliance under AS 4282, as this would comprise public lighting which is subject to a different series of standards (the AS/NZS 1158 *Road lighting*). Notwithstanding this, calculations were carried out along sample sections of Moorebank Avenue and indicated maximum values ranging from 5.1 to 10.7 lux. Currently, Defence has no residential buildings adjacent to Moorebank Avenue and the future use of the current DNSDC site will remain industrial. This means that under AS 4282 the area would be classified commercial (which broadly covers commercial, industrial and light industrial land uses), which would have an allowable limit of 25 lux. The road lighting luminaires for the Project are proposed to comprise full cut-off type luminaires. This considered, the allowable limit would be easily met and no direct effect on any residential areas is predicted.

For some residential locations that overlook the Project site, there would be a noticeable change in the brightness of the area on clear nights. In foggy conditions, the brightness may be less but there would be a local sky glow effect.

Photo 22.5 gives an indication of what the Project would look like at night based on existing light conditions. The brightness of the Project (in the approximate position of the area shown with a dashed outline), once developed, would have a similar relative intensity to that of the existing Casula Powerhouse Arts Centre on a clear night. In foggy conditions, the brightness may be less, but there would be some local sky glow.



Photo 22.5 Night-time view from high ground receiver point overlooking the Project site

From viewpoints in Casula (L1 to L4, refer Figure 22.12), there would be no substantial change to the existing lighting environment. The calculated Project values vary from 0.00 to 0.02 lux where residences are above and adjacent to the Main South Rail Line. This is because of the large distances involved, and the relative height of many of the Casula residences that face the Project site, which would be only a few metres below the actual height of the high mast luminaires.

From viewpoints in Glenfield and Wattle Grove (L17–L120, refer to Figure 22.12), there would be no substantial change to the existing lighting environment. Locations L17 to L19 would be shielded by trees, which would further reduce the impacts of light spill on the area.

Direct light effects are predicted for the proposed conservation area and the Georges River, as detailed in Technical Paper 13 – *Light Spill Assessment*. Potential light spill impacts on biodiversity are discussed in Chapter 13 – *Biodiversity*. With the proposed landscape planting and revegetation within the conservation area in place, significant light pollution impacts are not expected.

Impacts of train headlights

Depending on the rail access option selected for the Project, transitory lighting from train headlights on trains leaving the Project site at night would potentially affect some residential locations, as follows:

- For the northern rail access option, trains leaving the IMT would directly face some residents in Casula. The use of headlights on high beam could result in potential illuminance of 8.8 lux at the residential boundary at a distance of 150 m. This could have a substantial impact on local residents. The impact of this could be mitigated by avoiding the use of high beam lights on trains until the trains are running on the SSFL. Similar measures are currently applied at Port Botany.
- For the central rail access option, trains leaving the IMT would directly face some residents in Casula, particularly trains headings north. Potential illuminance at the residential boundary could be 4.1 lux for trains heading north on a clear night with no sky glow. Again, the impact of this could be mitigated by avoiding the use of high beam lights on northbound trains, until the trains are running on the SSFL.

- For the southern rail access option, no substantial impact is predicted from train headlights, due to the greater distance between the trains and the potentially affected residences, with potential illuminance varying from 0.35 to 0.98 lux on a clear night with no sky glow.

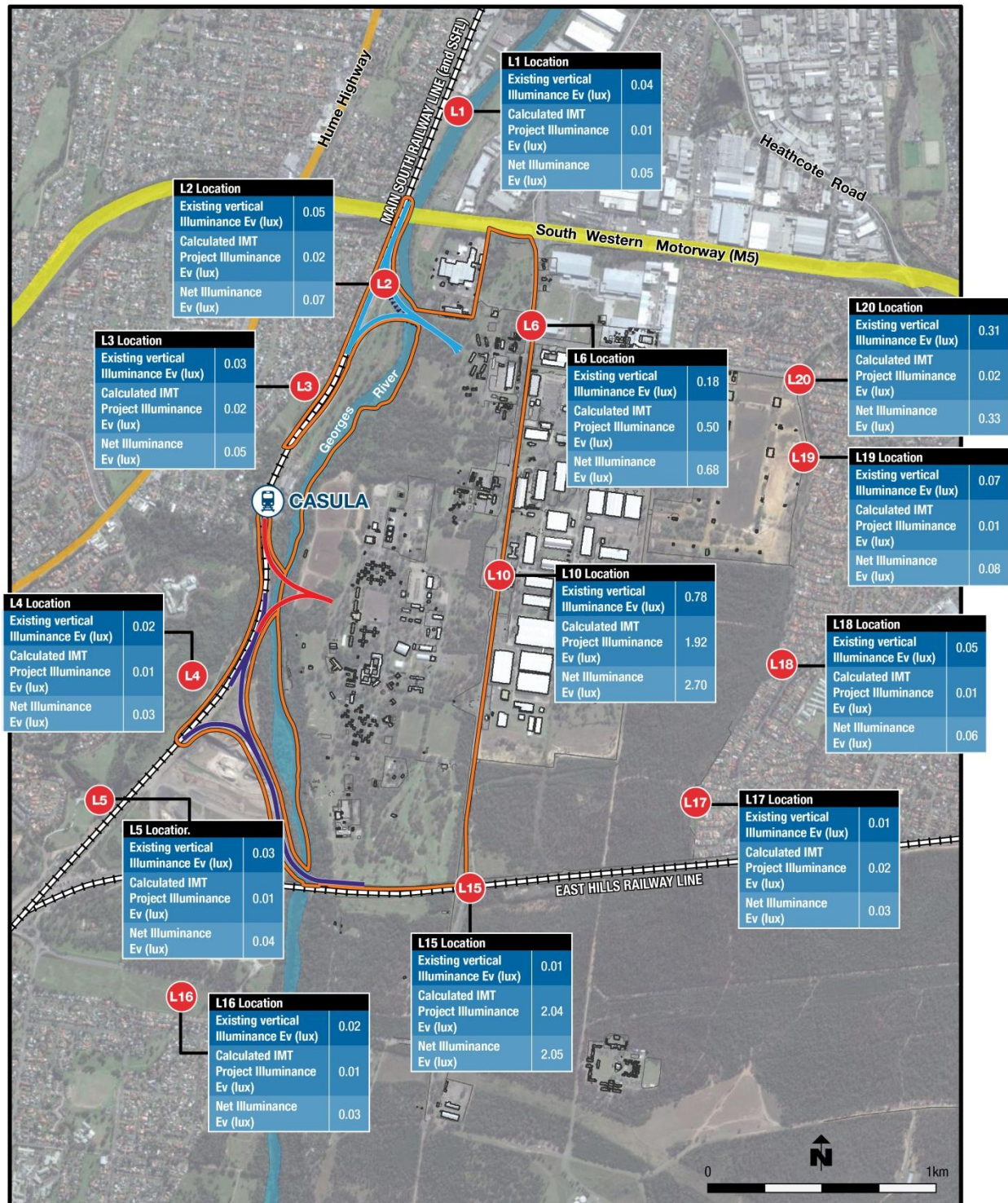


Figure 22.12 Predicted net illuminance values at specific locations around the Project

- Project site boundary
- Northern rail access option
- Central rail access option
- Southern rail access option
- L1 Lighting observation locations

22.6 Urban and landscape design principles

Urban design principles have been identified for the Project, as discussed in section 7.3 in Chapter 7 – *Project built form and operations*. The Project would maximise the integration of terminal facilities and the associated warehousing precinct by providing screening, breakout space for public and staff, and way-finding throughout the Project site.

22.6.1 Built form

The Project site has been broken into six development areas relating to IMT uses, as shown in Table 22.8.

Table 22.8 Development areas for Moorebank IMT

| Development areas | Description |
|--|--|
| Warehousing development area | The warehousing development area would front Moorebank Avenue and would be the highly visible face of the development. As the main entry point to the Project site is located here, the landscaping and streetscape would be well considered. |
| Administration development area | This development area would be separated from the terminals to provide a safer and more commercial style work environment for employees. |
| Conservation area | This development area (also known as the conservation area) would front the Georges River and provide a visual barrier to neighbouring development. It would also maintain the existing riparian corridor which borders the western side of the Project site. |
| IMEX and interstate development areas (two precincts) | These development areas would be access controlled and restricted to the public. |
| Rail access (this includes land subject to the northern, central and southern rail access options) | The bridge across the Georges River, connecting the main IMT site to the SSFL, would be designed taking into account the visual and amenity impacts of the structure. For the northern rail access option in particular, the design would seek to reduce visual impacts and maintain the amenity values of the Georges River Casula Parklands by allowing free access underneath the bridge (to avoid bisecting the park). |

The layout and locations of these development areas differs slightly between the rail access option indicative layouts (refer Figures 7.4 to 7.6 in Chapter 7 – *Project built form and operations*), and the exact boundary between development areas would be confirmed in future development application stages. However, for all three options, the warehousing and administration development areas would front onto Moorebank Avenue, with the IMEX and interstate IMT area behind. For all three rail access options, the conservation area would front the Georges River to the west of the main IMT site, providing a visual barrier to neighbouring development.

While the built form for the Project is substantial, the setbacks and landscaping in front of the warehousing on Moorebank Avenue would soften what may otherwise be a utilitarian built form.

Building design would be considered further during the detailed design process and would be consistent with controls outlined in the *Liverpool Development Control Plan 2008, Part 7 Development in Industrial Areas* (LCC 2008c). These controls include:

- facade treatment – adopting a contemporary architectural appearance and use of architectural elements to articulate facades;
- materials – use of quality materials such as brick, glass and steel to construct the facades and masonry material for construction of factory units or similar;

- colours – choice of finishes and colours which limit the amount of contrast with the surrounding landscape with the preferred use of muted colours;
- building design, incorporating considerations such as location of administration buildings at the front; and
- lighting to be provided in the car park and external entry paths, with consideration given to light spill impacts on the amenity of adjoining residents.

As the Project is situated near an existing industrial estate, the proposed built form is likely to sit well within the current built environment.

22.6.2 Landscape design

The landscape strategy would enhance the biodiversity of the Project site along the Georges River corridor, retaining much of the vegetation and maintaining a green buffer and visual screen between the IMT development and residences to the west (shown as the conservation area on Figures 7.4 to 7.6). The landscape strategy would be further developed during detailed design as described in section 22.7.

Way-finding principles would be applied to the Project to assist navigation around the various development areas and function on the main IMT site. The placement of buildings, roadways and use of landscaping would contribute to effective way-finding for users onsite.

22.7 Management and mitigation

22.7.1 Visual and urban design measures

Detailed design

Visual mitigation measures and urban design principles have been considered during the development of indicative concept layouts and reflected in the Project.

Visual mitigation measures already proposed as part of the Project include:

- avoiding clearing of the conservation area which currently obscures and filters views into the Project site;
- enhancing existing native vegetation adjoining the Georges River;
- enhancing existing native trees with extended and consolidated planting; and
- setback controls which would conserve the natural character and streetscape along Moorebank Avenue and allow for effective landscaping.

Additional measures to be considered further in the detailed design stage are outlined below and apply to all three rail access option indicative layouts:

- Consider the siting of development to minimise vegetation clearing.

- Maximise integration of the terminal facilities and the associated warehousing precinct by providing vegetation screening, way-finding throughout the Project site, breakout space for the public and staff, and visual relief.
- Provide additional native trees to the car park areas to maximise the opportunity for shade and to provide a landscape frontage that is scaled to complement the new buildings.
- Provide landscaping along Moorebank Avenue, including extensive tree and shrub planting on road frontages, that provides visual relief from the industrial appearance of the warehousing, with a layered approach along the streetscape.
- Consider localised earth mounding and native canopy tree planting to internal landscape areas on the western side of the new buildings to mitigate visual impacts from residential areas.
- Choose finishes and materials that limit the amount of contrast with the surrounding landscape, with the preferred use of muted colours.
- Take opportunities to start early rehabilitation and supplementary planting of endemic species to the conservation area on the western boundary.
- Place higher buildings fronting Moorebank Avenue and Anzac Road to provide a visual buffer from the IMT operations beyond, while also ensuring they make a positive visual contribution to the streetscape.
- Consider options for tree planting adjacent to buildings and rail lines, to reduce visual impacts (while also considering any required security constraints and rail line fell distances).
- Consider the building design further during the detailed design process and be consistent with controls outlined in the *Liverpool Development Control Plan 2008, Part 7 Development in Industrial Areas* (LCC 2008c), including facade treatment, materials, building design and lighting.

The following additional mitigation measure is proposed for the northern rail access option layout:

- Consider detailed design of the Georges River bridge crossing to reduce visual impact and maintain the amenity value of the Georges River Casula Parklands by allowing free access underneath the bridge (to avoid bisecting the park).

Offsite mitigation (such as the use of screening vegetation) within the public domain in Carroll, Leacock and St Andrews parks would potentially limit existing regional views and their value to the community. For this reason, no offsite screening is proposed.

Early Works

As Early Works would have a minimal impact on visual amenity, no mitigation measures are proposed specifically for this Project development phase.

22.7.2 Light spill measures

Construction

Lighting required during construction of the Project would be designed and located to minimise the effects of light spill on surrounding sensitive receivers, including residential areas and the proposed conservation area.

Operation

For all three rail access options, light spill mitigation measures to be considered during detailed design (for use during Project operations) include:

- designing lighting to minimise impacts on surrounding existing and future residents and the proposed conservation zone as much as possible;
- considering the use of shields on luminaire lighting to minimise brightness effects;
- selecting asymmetric light distribution-type floodlights as part of the proposed lighting design, which are mounted such that the front glass is horizontal (to ensure the light is directed specifically to the task, with minimal direct light spill to the surrounding area);
- considering low-reflection pavement surfaces to reduce brightness;
- minimising the quantity of light and energy consumption in parts of the IMT site that are not active, while retaining safe operation; and
- monitoring of light spill during the operation of the Project.

The above measures are considered applicable to all three rail access options. The following two measures are specific to the northern and central rail access options respectively:

- For the northern rail access option, in consultation with train operators, consider the practice of avoiding the use of high beam lights on northbound and southbound trains leaving the IMT site until they are on the SSFL, to minimise transitory light spill impacts on residences in Casula.
- For the central rail access option, in consultation with train operators, consider the practice of avoiding the use of high beam lights on northbound trains leaving the IMT site until they are on the SSFL, to minimise transitory light spill impacts on residences in Casula.

22.8 Summary

The key aspects of the visual and urban design assessment are summarised below:

During Early Works:

- Impacts are considered to be moderate/low, with one negligible rating.
- The retained conservation area and existing riparian vegetation would screen a substantial amount of the Early Works activities for viewpoints to the west of the Georges River.

- The majority of activities would occur during standard daytime construction hours and would not require lighting. Where works are required outside of standard construction hours, potentially affected residents and relevant authorities would be notified in advance.

As Early Works would have a minimal impact, no mitigation measures are proposed specifically for this development phase.

During construction:

- Impacts are predicated to range from negligible to moderate/high for different receptors.
- Moderate/high impacts were predicted for many viewpoints due to the impact of tall construction equipment such as cranes that would be visible above the treeline during construction of both the IMEX and interstate IMT facilities. Other construction impacts would be associated with earthworks, clearing and vegetation removal and construction of the warehousing. Along Moorebank Avenue there would be localised visual impacts from construction fencing and the warehousing development area would be highly visible.
- Impacts are likely to be similar for the three rail access options, with the exception of receptors within the Georges River Casula Parklands, St Andrews Park and the residential properties surrounding St Andrews Park. These receptors would experience greater visual impact associated with the northern rail access connection, relative to the central and southern rail access options, as these receptors would have a clear view of the northern rail access.
- The majority of activities would occur during standard daytime construction hours and would not require lighting; however, some out of hours construction work may be required. Lighting would be contained and positioned to avoid light spill to surrounding areas.

During operation:

- Impacts are predicted to range from negligible to moderate/high for different receptors.
- The greatest visual impact of the Full Build development would be on public park and residential receptors on the elevated areas to the west of the Georges River and residential properties backing onto the SSFL.
- For some residential locations that overlook the Project site, these receptors would also experience a noticeable change in the brightness of the area on clear nights.
- The warehousing development would front Moorebank Avenue and would dominate views towards the Project site from the east. The visual impacts would reduce as landscaping is established.
- Trains leaving the Project site via the northern and the central rail access options would directly face some residents in Casula, and the use of headlights could affect local residents. Impacts could be mitigated by avoiding the use of high beams lights on trains until they are running on the SSFL.

Table 22.9 summarises the potential visual impacts at Full Build for each rail access option, without mitigation.

Table 22.9 Summary of visual and light spill impacts of the Project at Full Build, without mitigation, for each rail access option

| Impact | IMT layout and associated rail access connection option | | |
|---|---|---------|----------|
| | Northern | Central | Southern |
| Operation of the IMT | | | |
| Visual impact to viewpoint 1 (Southern section of Leacock Regional Park) | • | • | • |
| Visual impact to viewpoint 2 (Leacock Regional Park and associated residential heritage properties within the parklands) | • | • | • |
| Visual impact to viewpoint 3 (Carroll Park and associated residential properties backing onto the park) | • | • | • |
| Visual impact to viewpoint 4 (Casula Powerhouse Arts Centre) | • | • | • |
| Visual impact to viewpoint 5 (Georges River Casula Parklands) | • | - | - |
| Impact | IMT layout and associated rail access connection option | | |
| | Northern | Central | Southern |
| Visual impact to viewpoint 6 (St Andrews Park and associated residential properties surrounding the park) | • | • | • |
| Visual impact to viewpoint 7 (Junction of M5 Motorway and Moorebank Avenue) | • | • | • |
| Visual impact to viewpoint 8 (Moorebank Avenue heading south) | • | • | • |
| Light spill impacts resulting in a noticeable change in the brightness of the area on clear nights | • | • | • |
| Operation of the rail access connection | | | |
| Visual impact to viewpoint 5 (Georges River Casula Centre) and viewpoint 6 (St Andrews Parkland and associated residential properties surrounding the park) | • | - | - |
| Visual impact to viewpoint 2 (Leacock Regional Park and associated residential properties within the parklands) | - | • | - |
| Visual impact to viewpoint 1 (Southern section of Leacock Regional Park) | - | - | • |
| Impact to residential properties in Casula due to train headlights | • | • | - |

Key: • = impact, - = no impact

The key mitigation measures proposed to avoid and minimise the impacts of the Project during construction and operation include:

- containing construction lighting within the area of actual works and designing it to avoid light spill to surrounding areas as much as possible;
- incorporating urban design principles into the Project design, including facade treatment, building design, materials and colour;
- visual mitigation measures such as landscaping, screening/ buffering of less attractive activities/infrastructure;
- additional measures to be considered during detailed design, including additional landscaping along Moorebank Avenue; localised earth mounding and native canopy tree planting to internal landscaped areas on the western side of new buildings to mitigate visual impacts from residential areas;

- light spill mitigation measures to be considered during detailed design include designing lighting to minimise light spill; the use of shields on luminaires to minimise brightness effects; and low reflection pavement surfaces; and
- for the northern and the central rail access options, considering the practice of not using high beam lights on trains that are leaving the Project site to minimise transitory light spill impacts on residents in Casula.