MOOREBANK INTERMODAL COMPANY

Moorebank Intermodal Terminal Project Environmental Impact Statement

Volume 3

October 2014

PARSONS BRINCKERHOFF

Technical Paper 2
Noise and Vibration Impact Assessment

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Moorebank Intermodal Terminal EIS

Noise and Vibration Impact Assessment

Report Number 620.10816

1 October 2014

Parsons Brinckerhoff Australia Pty Ltd
Level 27, Ernst & Young Centre
680 George Street, Sydney
NSW 2000

Version: Revision 1

Moorebank Intermodal Terminal EIS

Noise and Vibration Impact Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Suite 7, 240 Waterworks Road
Ashgrove QLD 4060 Australia
(PO Box 844 Ashgrove QLD 4060 Australia)
T: +61 7 3858 4800 F: +61 7 3858 4801
brisbane@slrconsulting.com www.slrconsulting.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
620.10816	Revision 1	1 October 2014	Steven Walker	Henrik Malker	Steven Walker
620.10816	Revision 0	8 July 2014	Steven Walker	Henrik Malker	Steven Walker

Executive Summary

The Moorebank Intermodal Terminal Project

The Moorebank Intermodal Terminal (IMT) Project (the Project) involves the development of approximately 220 hectares (ha) of Commonwealth-owned land for the construction and operation of an intermodal terminal and associated infrastructure, facilities and warehousing. The Project will be on land currently occupied by the School of Military Engineering (SME) and a number of Department of Defence (Defence) units.

The primary function of the IMT is to be a transfer point in the logistics chain for shipping containers and to handle both international import and export (IMEX) cargo, as well as domestic interstate and intrastate (regional) cargo. The key aims of the Project are to promote the movement of container freight by rail between Port Botany and western and south-western Sydney, and reducing road freight on Sydney's congested road network.

The key features/components of the Project comprise an IMEX freight terminal, an interstate freight terminal and warehousing facilities. The Project would also include the construction and operation of a rail link to connect the main IMT site to the Southern Sydney Freight Line (SSFL). The rail connection from the SSFL would be via a bridge crossing the Georges River to the west of the IMT. Three rail access options are being considered; these are referred to as the northern, southern and central rail access options respectively. All three rail access options are included as part of the proposal concept and have been assessed as part of the Environmental Impact Statement (EIS).

The Project would likely commence in 2015 with the Early Works development phase and would proceed with concurrent construction and operation activities to the Full Build (operation of full IMEX terminal, warehousing and interstate terminal) – by approximately 2030. The proponent of the Project is the Moorebank Intermodal Company (MIC).

The Project is subject to both Commonwealth and NSW Government approvals, and the EIS has been prepared to support applications for both approvals. This assessment of potential noise and vibration impacts has been prepared consistent with the Commonwealth and NSW Government environmental assessment requirements for noise and vibration.

Existing Environment

The suburbs of Casula, Wattle Grove, North Glenfield and Liverpool surround the main IMT site. In these communities the receptors and land uses that are potentially sensitive to noise and vibration include; residences, educational institutions, places of worship, child care facilities, aged care facilities and places of recreation.

To quantify and characterise the existing noise environment at the surrounding communities, a total of 20 months of noise monitoring data has been obtained from ambient noise surveys. Noise surveys within the surrounding communities were initially carried out in November 2010, August 2011 and October 2011 with a continuous ambient noise monitoring survey commencing in July 2012.

The existing noise environment is characterised by local and distant road traffic noise, trains passing and noise from within the residential communities. The night-time noise environment is the most sensitive period as it represents the period of lowest use of the surrounding road and rail transport networks.

Noise and Vibration Assessment Criteria

Applicable acoustic legislation, policy and guidelines assessment criteria have been used to evaluate potential noise and vibration impacts.

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The assessment of construction noise was undertaken in accordance with the NSW EPA's *Interim Construction Noise Guideline* (ICNG), 2009. The ICNG provides recommended noise management levels (NMLs) that, where exceeded at noise sensitive receptors, trigger the implementation of feasible, reasonable and practical noise management and mitigation measures.

The assessment of potential operational noise impacts referenced daytime, evening and night-time noise criteria from the NSW EPA's *Industrial Noise Policy* (NSW INP), 2000. The following residential night-time noise levels represent the most conservative (lowest) operational noise assessment criteria:

- 38 dB(A) $L_{Aeq(15minute)}$ at Casula;
- 37 dB(A) $L_{Aeq(15minute)}$ at Wattle Grove, and;
- 38 dB(A) $L_{Aeq(15minute)}$ at Glenfield.

Noise from the operation of rail freight on the rail access connections to the SSFL has been assessed in relation to daytime, evening and night-time noise trigger levels defined in the *Rail Infrastructure Noise Guideline* (RING), (2013).

Potential noise from Project related road traffic on Anzac Road, Moorebank Avenue and the M5 Motorway has been assessed in relation to day time and night-time noise criteria from the NSW EPA's *Road Noise Policy* (RNP), 2011.

Impacts on human comfort and cosmetic damage from vibration have been assessed according to receptor specific objectives defined by the NSW EPA's *Environmental Noise Management Assessing Vibration: a technical guideline*, (2006).

Assessment of Noise During Construction

Predicted noise levels during piling and/or rail access construction works in Casula, Wattle Grove and Glenfield were above the NMLs. These noise levels, if experienced during construction, would trigger the investigation and implementation of reasonable and feasible noise mitigation measures.

The majority of daytime construction works would comply with the NMLs at all receptors and would not be expected to be require noise mitigation.

For those works that do exceed the NMLs, the standard construction noise mitigation measures recommended in this Technical Paper are expected to be effective in managing noise levels to meet the requirements of the ICNG. Due to the proposed noise intensive works and proximity of receptors in Casula, additional noise mitigation measures may be required where rail access construction works are required during evening or night-time rail possessions.

Assessment of Noise During Operation

In order to calculate the potential noise emission levels from the Project at the noise sensitive receptors, a noise prediction model for the operation of the Project has been developed using SoundPLAN V7.2 noise propagation software.

Noise levels from fixed and mobile plant were predicted in SoundPLAN using the CONCAWE prediction methodology, which is specially designed for large facilities and incorporates the influence of wind effects and the stability of the atmosphere.

Rail noise levels have been predicted in SoundPLAN using the *Nordic Rail Traffic Noise Prediction Method* (Kilde 1984). The calculation parameters include the speed and length of rail freight to determine the potential noise levels at a receptor during a passby event.

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For each rail access option, noise levels were predicted for the Project Phases B, C and Full Build as shown in the table below. The concept layouts do not include noise mitigation; all predicted noise levels therefore represent a worst case assessment of potential noise emissions. Based on regional meteorological conditions noise levels were predicted during neutral and adverse (noise enhancing) meteorological conditions.

Noise levels from the Project are generally expected to increase with the progressive development of the IMEX, interstate and warehousing facilities. Potential noise levels at the assessed noise sensitive receptors vary depending on the concept layouts and the proximity of each receptor to the dominant noise sources – rail mounted gantry cranes, trucks transporting containers, side picks, in-terminal transport vehicles and rail freight.

For the three rail access options, the noise levels have been predicted to exceed the NSW INP noise assessment criteria, triggering the investigation of reasonable and feasible noise mitigation. Due to the proximity of residential receptors to the western boundary of the main IMT site, the greater noise levels will be experienced in Casula.

Rail noise from the central and southern rail access connections to the SSFL are predicted to comply with the RING noise criteria. Predicted rail noise levels for the northern rail access option exceed the RING noise assessment criteria.

The table below summarises the potential noise reductions required to achieve the relevant noise criteria during neutral meteorological conditions. During the early morning and night-time of the winter months, potential adverse temperature inversion conditions may enhance the propagation of noise and, compared to neutral meteorological conditions, require additional mitigation of noise levels by 1 to 3 dBA.

Project Phase	**Reduction In Predicted Noise Levels Required To Meet Assessment Criteria (Neutral Conditions)**
Phase B Operation of 0.5 million twenty foot equivalent units (TEU) per annum IMEX facility and 100,000 sq. m of warehousing.	Industrial noise from main IMT operations: Up to 5 dBA northern rail access design. Up to 10 dBA central rail access design. Up to 11 dBA southern rail access design. Rail access connection to the SSFL: Up to 15 dBA northern rail access design.
Phase C Operation of IMEX facilities at 1.05 million TEU per annum; and operation of 250,000 sq. m warehousing.	Industrial noise from main IMT operations: Up to 6 dBA northern rail access design; Up to 10 dBA central rail access design; Up to 9 dBA southern rail access design. Rail access connection to the SSFL: Up to 17 dBA northern rail access design.
Full Build Operation of IMEX facility at 1.05 million TEU per annum; operation of interstate facility at 0.5 million TEU per annum; and operation of 300,000 sq. m warehousing.	Industrial noise from main IMT operations: Up to 9 dBA northern rail access design; Up to 13 dBA central rail access design; Up to 11 dBA southern rail access design. Rail access connection to the SSFL: Up to 17 dBA northern rail access design.

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Assessment of Rail Noise On The SSFL

Rail freight for the Project will access the main IMT site, via the SSFL, on the purpose built rail access connection. The Project will operate within the forecast capacity of the SSFL rail network. The Australian Rail Track Corporation (ARTC) has confirmed that noise mitigation at the Casula Powerhouse Arts Centre, in the form of a noise barrier and acoustic property treatment (windows and louvers), was implemented to control future noise levels. The SSFL opened in January 2013 with the determination of any additional requirement for noise mitigation at Casula to be based on verified (measured) noise levels from the SSFL. Where the IMT project operates within the design capacity of the SSFL the implemented noise mitigation would assist in controlling noise from trains accessing the IMT project.

During the future approvals or detailed design for the Project, if it is identified that rail freight from the Project would require an increase in the capacity of the SSFL, a noise assessment in accordance with Appendix 2 of the RING should be undertaken to identify any requirements for additional noise mitigation. Should the future operation of the SSFL network necessitate additional capacity requiring new infrastructure it would be subject to separate approval.

Assessment of Road Traffic Noise

The road traffic movements associated with the construction and operation of the Project would access the site via Moorebank Avenue with road traffic also utilising the M5 Motorway and Anzac Road. Road traffic noise from the Project on the M5 Motorway, Moorebank Avenue and Anzac Road are not expected to trigger a requirement for road traffic noise mitigation.

Assessment of Ground Vibration

Based on the closest distances between receptors and proposed works (40 m to 450 m), any potential ground vibration during construction is expected to comply with the assessment criteria for human comfort and cosmetic damage.

The main IMT site is located at least 450 m from nearest receptors; at this distance any potential ground vibration generated from IMT operations would not be perceptible. It is expected that ground vibration levels at nearest receptors would comply with the human comfort and cosmetic structural damage criteria. Based on the conceptual layouts for the three rail access options, the Project rail tracks would be at least 30 m from nearest residences; as such any perceptible ground vibration from rail freight is expected to be within the vibration criteria for both human comfort and the less conservative criteria for cosmetic structural damage.

Recommended Noise Mitigation Measures

To manage potential noise levels during construction it is recommended the Project implements a Construction Noise and Vibration Management Plan. The management plan would prescribe the hours of work and detail specific noise mitigation measures. Noise mitigation is likely to include the planning and scheduling of works to locate and orientate noisy equipment away from receptors, switching off equipment when not in use and selecting low noise emitting plant. The contractor would also implement consultation procedures to inform the community of the proposed works and any anticipated impacts.

Construction works with the potential to generate the highest noise levels, such as construction of the rail access connection to the SSFL, are likely to require additional noise mitigation measures such as temporary acoustic screens, observance of respite periods and scheduling works during less sensitive periods.

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The predicted exceedance of the NSW INP and RING (northern rail access only) during the operation phases indicates that the detailed design of the Project will need to include all reasonable and feasible noise mitigation to control off-site noise. The recommended management of operational noise is based on a hierarchy of control where the preferred measure is to mitigate noise by controlling it at the source through measures such as enclosures, silencers, noise reducing rail track forms and the procurement of plant and equipment with the lowest available noise levels.

Where additional noise mitigation is required the noise propagation pathway can be controlled by on-site noise walls or earth bunds and, where feasible and practical, locating plant behind twenty-foot equivalent unit (TEU) container stacks. The purpose of these structures is to fully impede the line of sight between the noise source and the receptor.

A hypothetical noise mitigation scenario incorporating conceptual noise barriers and acoustic enclosures in the northern rail access option was included in the noise prediction model. Predicted mitigated noise levels comply with both the NSW INP and RING noise assessment criteria at the majority of the assessed residences. At a few discrete locations, mitigated noise levels are above the NSW INP by 2 to 4 dBA depending on meteorological conditions and 2 dBA above the RING noise assessment criteria.

In reviewing the residual noise criteria exceedances it is noted that the NSW INP states a development would compliant if monitored levels are no more than 2 dB above a noise limits in a consent or licence condition.

Based on the predicted mitigated noise levels, the northern, central and southern rail access options would be expected to comply with the NSW INP and RING noise assessment criteria at the majority of the assessed residences where the detailed design and construction of the Project implements reasonable and practical noise control measures.

Conclusion

The assessment has determined that with the implementation of appropriate noise mitigation and management measures potential noise and vibration levels from the construction of the Project can meet the requirements of the ICNG and relevant vibration guidelines.

The detailed design of the operational phases of the Project should include the recommended noise mitigation measures consistent with the objectives of the NSW INP and RING. Based on the predicted noise levels for the unmitigated concept designs, the noise mitigation measures would be required to achieve minimum reductions of between 5 to 13 dBA depending upon the Project phase and the final design of the Project. Conceptual noise mitigation has demonstrated noise levels can be controlled in accordance with the NSW INP and RING at the majority of receptors.

During the proposed staged approvals for the development of the Project it is recommended the potential noise and vibration levels be continually assessed in accordance to all relevant legislation and guidelines and, as otherwise required, to inform the design and construction of noise mitigation measures for the Project.

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1.1 The Moorebank Intermodal Terminal Project

The Moorebank Intermodal Terminal (IMT) Project (the Project) involves the development of approximately 220 hectares (ha) of Commonwealth-owned land for the construction and operation of an intermodal terminal and associated infrastructure, facilities and warehousing. The Project will be located on land currently occupied by the School of Military Engineering (SME) and a number of other Department of Defence units.

The Project site is shown in **Figure 1**. Under the approved Moorebank Units Relocation (MUR) Project, the SME is planned to be relocated to Holsworthy Barracks by mid-2015, which would enable the construction of the Project to commence. The proponent is the Moorebank Intermodal Company (MIC), a Government Business Enterprise set up to facilitate the development of the Project.

The primary function of the IMT is to be a transfer point in the logistics chain for shipping containers and to handle both international import and export (IMEX) cargo, and domestic interstate and interstate (regional) cargo. The key aims of the Project are to promote the movement of container freight by rail between Port Botany and western and south-western Sydney and reduce road freight on Sydney's congested road network. The key features/components of the Project comprise:

- An IMEX freight terminal – designed to handle up to 1.05 million twenty foot equivalent unit (TEU) per annum (525,000 TEU inbound and 525,000 TEU outbound) of IMEX containerised freight to service 'port shuttle' train services between Port Botany and the Project.
- An interstate freight terminal – designed to handle up to 500,000 TEU per annum (250,000 TEU inbound and 250,000 TEU outbound) of interstate containerised freight to service freight trains travelling to and from regional and interstate destinations.
- Warehousing facilities – with capacity for up to 300,000 square metres (sq. m) of warehousing to provide an interface between the IMT and commercial users of the facilities such as freight forwarders, logistics facilities and retail distribution centres.

The Project would also include the construction and operation of a rail link to connect the main IMT site to the Southern Sydney Freight Line (SSFL). The rail connection from the SSFL would be via a bridge crossing the Georges River to the west of the IMT at either the north, south or centre of the Project site. These are referred to as the northern, southern and central rail access options respectively. All three rail access options are included as part of the proposal concept and have been assessed as part of the Environmental Impact Statement (EIS).

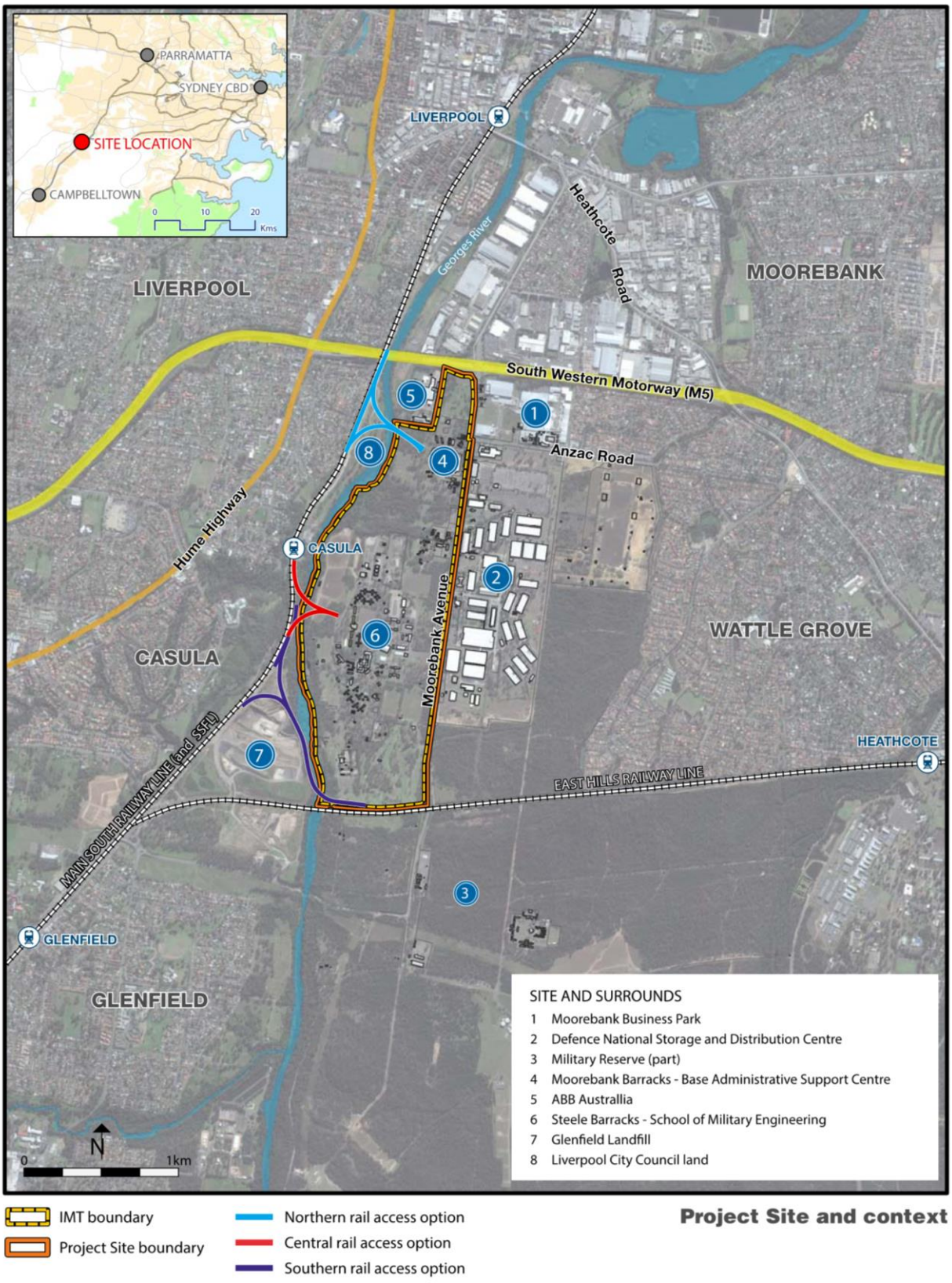
1.2 Rail Access Options and Layouts

The SSFL was commissioned in January 2013, within the Main South Railway Line corridor, and connects Port Botany to west and south-western Sydney. The SSFL will provide a direct route for freight trains from Port Botany to the Project site.

In order to maintain flexibility for future developers and operators of the Project, the proposal concept provides three indicative IMT internal layouts; one for each of three proposed rail access options (**Figure 1**). Once the selected developer/operator has been appointed, the Project would progress to the detailed design phase and one of the three rail access options would be selected.

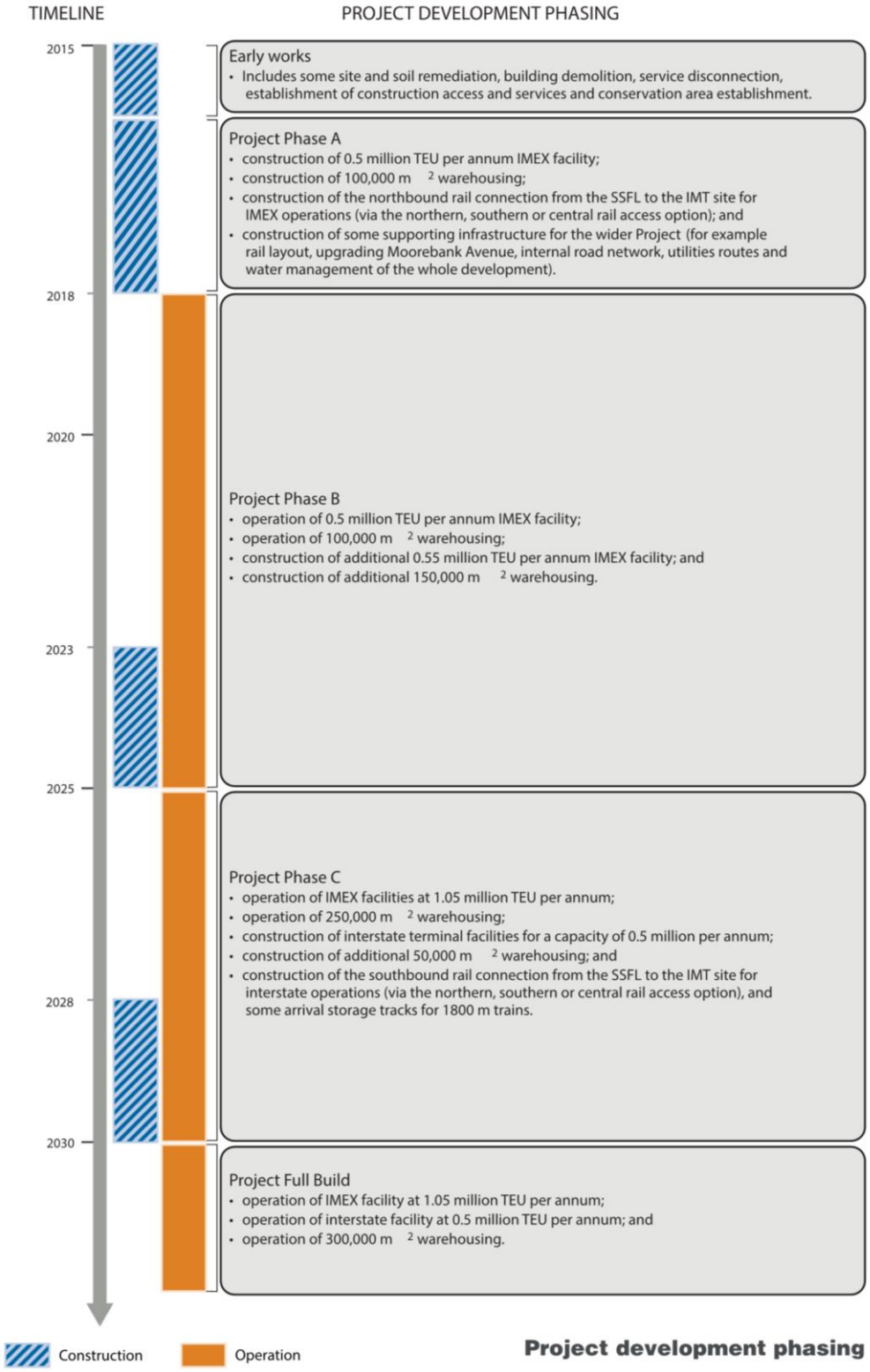
- Northern rail access option – with rail access from the north-western corner of the IMT site, passing through the former Casula Powerhouse Golf Course and crossing the Georges River;
- Central rail access option – with rail access from the centre of the western boundary of the IMT site, passing through Commonwealth land on the western bank of the Georges River; and
- Southern rail access option – rail access from the south-western corner of the IMT site, passing through the Glenfield Landfill site and crossing the Georges River and floodplain.

Figure 1 Project Site and Context



The Project is proposed to be phased (staged) in its development, as summarised in **Figure 2**. For the purposes of assessment of the Project, five project development phases have been identified and detailed in the EIS. These are indicative only, but illustrate the type of construction and operation activities that would occur over time at the Project site.

Figure 2 Project Development Phasing



1.3 Planning and Assessment Process

The proposal described in the main EIS provides an indicative layout and operational concept for the Project, including the proposed IMEX and interstate facilities, rail and road layouts, and locations of warehousing. Approval is specifically sought for the proposal concept, to ensure that later amendments to the detailed design within the specified parameters are permissible under the terms of the approval.

The Project is subject to both Commonwealth and NSW State Government approvals, and the EIS has been prepared to support applications for both approvals (EPBC number 2011/6086 and SSD-5066). The Project is a 'controlled action' under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore, MIC is seeking approval for the construction and operation of the Project from the (Commonwealth) Department of the Environment (DoE) under Part 9 of the EPBC Act.

Under the (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act), MIC is seeking a staged development approval for the Project as a State significant development (SSD). The EIS is seeking Stage 1 SSD development approval for the 'early works' to enable site preparation works to proceed without the need for any further approvals.

Subject to Stage 1 SSD development approval being received, the Project (with the exclusion of the early works) will be subject to further development applications and environmental assessment under the EP&A Act.

1.4 Noise and Vibration Technical Paper

Detailed in **Table 1**, this Technical Paper provides an assessment of potential noise and vibration impacts during the proposed construction and operation of the Project. As referenced in **Table 1**, the assessment has been prepared consistent with the Commonwealth and NSW State Government requirements for the assessment of noise and vibration.

Table 1 EIS Requirements Addressed Within This Technical Paper

Requirement		Technical Paper Reference
EPBC Act – Final EIS Guidelines - Section 8 Environmental Values and Management of Impacts		
Description of the environment and matters of NES.	Describe the existing noise environment at sensitive receptors surrounding the proposed site. In describing this information, this section must consider:	
	• Relevant meteorological conditions (including frequency and characteristics of temperature inversions).	Section 6
	• Topographic features which may influence noise and vibration impacts.	Section 3.1
Description of the environment and matters of NES.	• The EIS must also provide a description of existing levels of industrial and other noise and vibration, and comment on how noise and vibration levels have changed over time.	Section 3.2
Impacts to the environment by a Commonwealth Agency.	The EIS must provide a detailed and comprehensive analysis of the existing environmental conditions, likely changes. The following should be addressed in relation to impacts to the environment:	
	• Analyse and describe the contribution of the project to existing and planned noise and vibration at the local and regional scales.	Sections 8 to 16
	• The EIS should also outline the potential impacts of any contribution to the environment, including particular groups of people who may be especially vulnerable to changes in existing noise and vibration levels.	Sections 8 to 16

Requirement		Technical Paper Reference
Mitigation and compensatory measures	Where mitigation or proposed compensatory measures are proposed to address an identified impact, include:	
	• A description and assessment of the expected or predicted effectiveness of the mitigation measures, including the timing of measures.	Section 17
	• A description of management procedures setting out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing and complaint resolution.	Section 17
	Matters that must be considered in the proposed monitoring program include:	
	• Comprehensive monitoring of noise and vibration levels.	Section 17.5
NSW EP&A Act – Secretary's Environmental Assessment Requirements (EARs)		
Key Issues Noise and Vibration	Including but not limited to:	
	• Assessment of the noise and vibration impacts from the development (on and offsite), including cumulative impacts from the Southern Sydney Freight Line and the SIMTA intermodal proposal on sensitive receptors;	Sections 8 to 16
	• Consideration of associated road and rail noise impacts;	Section 15
	• The nature and sensitivity of, and impact to potentially affected receptors (including nearby residential areas of Moorebank, Wattle Grove and Casula, transport noise affected receptors and other sensitive land uses).	Section 3
	• The consideration of relevant meteorological conditions and topographical features.	Section 6
	Taking into account the *Interim Construction Noise Guideline* (DECC 2009), *NSW Industrial Noise Policy* (DEC), *Assessing Vibration: A Technical Guideline* (DECC 2006), *NSW Road Noise Policy* (DECCW 2011), and the *Rail Infrastructure Noise Guideline* (EPA 2013).	Section 5

1.5 Assumed Noise Control Measures

Noise mitigation measures for the operation of the Project, such as noise walls/ barriers, earth mounds or low noise rail track designs, have not been currently included in Project conceptual layouts. The assessed designs and operations applied in this Technical Paper represent the 'unmitigated' conceptual layouts. Consequently, the assessment of noise and vibration during the operation of the Project evaluates the worst case potential impacts.

The assessment of noise impacts has assumed the following measures would be implemented during the Project:

- Plant and equipment would be selected with as low as reasonably practicable source noise emissions.
- The motors of the rail mounted gantries will be supplied as standard with an acoustic enclosure around the motor and the motor exhaust acoustically lagged/insulated.
- Plant and equipment would be situated at the greatest feasible separation distance from nearest receptors.

- Rail freight trains will be a modern state of the art fleet with noise emissions that would conform to noise emission limits in licenses for Railway Systems Activities.
- The Project would take advantage of on-site measures to impede noise propagation such as situating plant and equipment behind container stacks.

2 PROPOSED OPERATIONS

A summary of the key IMT activities and sources of potential noise and vibration are provided below.

2.1 Intermodal Terminal Operations

The following types of equipment are anticipated to be utilised to move containers and for loading/unloading the trucks and rail cars:

- Working track lifting equipment – Rail mounted gantry (RMG) cranes capable of spanning four working rail tracks and one truck loading lane.
- Loaded container storage area lifting equipment – RMG cranes capable of spanning five containers and one truck loading lane, and capable of lifting one container over a five-high container storage stack.
- Empty container storage area lift equipment – empty handlers and side picks capable of lifting a container and stacking containers up to eight high.
- In-terminal transport vehicle (ITVs) –would move containers between the working tracks and the storage area. To manage noise emissions modern ITVs can be electrically powered vehicles.
- Switch engines – capable of pulling rail wagons and will be required to pull break and build trains within the Project site.
- Forklifts – to be used to transfer containers within the warehousing areas only.
- Rail freight trains – for the transportation of shipping containers on the IMEX and interstate rail lines via the SSFL.
- Heavy vehicles (trucks) – to transport containers between the Project site and Port Botany.
- Other equipment – this will include bomb carts, yard chassis, generators and air conditioning units. This equipment is not expected to be dominant sources of noise beyond the contribution of equipment listed above and have not been included in the noise model developed for the assessment of operational noise.

2.2 Rail Transport

The throughput capacity function of the site (IMEX and interstate) has been designed to operate within the forecast capacity of the SSFL. The three rail access connection options are discussed in Chapter 7 of the EIS. The key design features are summarised below.

The northern rail access option would be built at ground level to the northern end of the Northern Powerhouse Land (i.e. former Casula golf course). The access would cross the Georges River and floodplain on a bridge span will be designed to allow both IMEX and interstate connections between the SSFL and the IMT site.

The bridge will be one structure that would be split into the northbound and southbound rail connection. The rail connection and the bridge will include a single track to facilitate the arrival and departure of trains to and from the site. Within the boundary of the IMT site the single northbound track would expand to form the working and storage tracks associated with the IMEX terminal and the southbound track would expand to form the working and storage tracks for interstate trains.

The central rail access option would connect the IMT site to the SSFL across the Georges River and, as with the northern rail access option, would allow for connection between both the IMEX and interstate terminals and the SSFL. The bridge design would comprise two separate bridge structures, but would otherwise be similar to the design of the proposed northern rail access option with a single northbound track for the IMEX trains and a single southbound track for the interstate trains. Within the boundary of the site the single northbound and southbound tracks would expand to form the working and storage tracks for the IMEX and interstate terminals.

The southern rail access option would include a connection to the SSFL north of Glenfield Junction, crossing the George River and floodplain, and the Glenfield Landfill site. At this location, the SSFL is on a flyover structure and so the connection to the SSFL would need to be either located on an elevated structure or constructed on an embankment. The bridge design would comprise a single bridge structures and would be similar to the design for the northern and central rail access options.

For all three rail access connection options the freight trains travelling from the SSFL to the Main IMT site will not impact on the operations of the passenger train services in the Main South Line corridor or the East Hills Line.

IMEX Rail Movements

The rail layout for the IMEX terminal would be developed to exclusively service port shuttle services between Port Botany and the Project. Arrival/departure tracks on the site would provide a staging/holding area for trains departing and arriving at the terminal. The rail connection will allow for a maximum train speed of 60 km/h to or from the SSFL. A maximum train speed of 35 km/h within the Project site, although trains are expected to be regulated to 25 km/h.

The IMEX arrival/departure tracks would be 650 metres (m) long to cater for the proposed 600 m long IMEX trains with locomotives attached at each end. The arrival/departure tracks would allow for shunting and rearranging, to reconfigure the train with a single locomotive at the front.

The loading and unloading of containers for IMEX freight trains would be undertaken along the IMEX working tracks. When fully developed, the Project would include eight working tracks. Specific container handling equipment, such as RMG cranes, would operate between the tracks for loading and unloading operations. Switch engines would enter and depart from the working tracks to move rail wagons between the storage tracks and working tracks.

Interstate Rail Movements

The rail layout for the interstate terminal would be developed to exclusively service freight trains for interstate transportation of containers. An interstate rail yard would be developed in a similar layout to the IMEX rail yard, comprising arrival/departure storage tracks, working tracks and classification tracks. The indicative Project concept provides:

- Approximately four interstate arrival and departure tracks within the Project boundary would be designed to accommodate trains up to 1,800 m in length.
- Approximately four working tracks suitable for 900 m trains, trains greater than 900 m in length would be split on the arrival/departure tracks prior to being shunted onto working tracks.
- A separate grouping of combined storage and classification tracks.
- A rail spur (run-around track) to allow locomotives to be detached and re-positioned at the opposite end of the train.

The loading and unloading of containers to and from interstate freight trains would be undertaken along the interstate working tracks. Container handling equipment, such as RMG cranes, would be used for loading and unloading operations.

2.3 Road Transport

Road access to the Project site would be via access points on Moorebank Avenue. The road would be upgraded to provide two lanes in each direction as part of the project andsegregated depending on the vehicle type and destination within the Project Site. Trucks travelling to and from the Project Site would access Moorebank Avenue via the M5 Motorway.

Internal roads would include two entrances; main entrances for heavy vehicles generated by IMEX, interstate and warehouse traffic and secondary entrances for light vehicles, including administrative and maintenance staff vehicle parking. The internal roads would include a troubled truck parking area for up to 25 B-double sized trucks to investigate inbound heavy vehicles that are not validated by the automated checkpoint.

2.4 Warehousing Precinct

The warehousing precinct would provide the facade for the Project along Moorebank Avenue and would serve as a buffer between the terminal facilities and Moorebank Avenue. The warehousing precinct would extend along the eastern boundary of the Project Site and its size would vary with the three indicative IMT layouts. Development of the warehousing precinct would be phased with a maximum gross floor area up to a capacity of 300,000 sq. m.

2.5 Ancillary Services

Ancillary services for the IMEX and interstate operations would include; administration office buildings and facilities for operational and control staff and maintenance and repair buildings to provide covered work areas and parts storage for terminal equipment. These areas would be appropriate spaces for any maintenance that must be performed on the terminal container handling equipment, such as ITVs, side loaders and bomb carts and rail equipment.

A container/truck-wash treatment plant is proposed to enable clean water to be recirculated for washing containers, trucks and other heavy machinery at the site. The plant would include oil-removal, aeration, sand and carbon filtration, disinfection and detergent-dosing equipment.

The fuel system would receive, store and reticulate LNG to terminal equipment. The fuel system would also serve to receive, store and reticulate diesel. Small road tankers would operate on the site to distribute diesel to the train locomotives.

These activities are not expected to be a significant source of on-site noise beyond the contribution of the equipment in **Section 2.1** and the rail and road transportation.

2.6 Hours of Operation

The Project will operate for 24 hours a day, seven days a week during each phase of operation. During Phase B, truck gates to the terminal would be open 16 hours, 5.5 days a week, progressing to 24 hours a day, seven days a week by Phase C and the Full Build.

Construction works are proposed to be undertaken during the standard day time construction hours of 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm Saturdays. There may be occasions, most likely when constructing the rail spur within the SSFL rail corridor, when works are required outside of the standard day time hours during weekends or the evening (6.00 pm to 10.00 pm) or night-time (10.00 pm to 7.00 am) periods..

3 EXISTING ENVIRONMENT

3.1 Sensitive Receptors

The suburbs of Casula, Wattle Grove, North Glenfield and Liverpool surround the Project site. In these communities the receptors and land uses, potentially sensitive to noise and vibration, include residences, education institutions, places of worship, child care facilities, aged care facilities and places of recreation.

The Main IMT site is located to the immediate east of the Georges River and floodplain. There is a steep relief on either side of the floodplain between the Main IMT site and the surrounding suburbs. The nearest receptors in Wattle Grove and Glenfield are generally at the same ground level height as the main IMT site with some receptors up to 5 m above the residual level of the Main IMT site. At Casula nearest receptors are approximately <10 to 30 m above the residual ground level of the main IMT site.

The extent of line of sight to the rail access connection will be dependent on the northern, central or southern rail access options and the relative height above ground level of the IMEX and interstate track, particularly for the RMGs and the bridge crossing the Georges River and floodplain.

The sensitive receptors in **Table 2** and **Figure 3** have been applied to predict potential noise and vibration levels at nearest and/or potentially most affected receptors, to assess potential worse case impacts within the surrounding communities and, as required, inform the recommendation of mitigation measures.

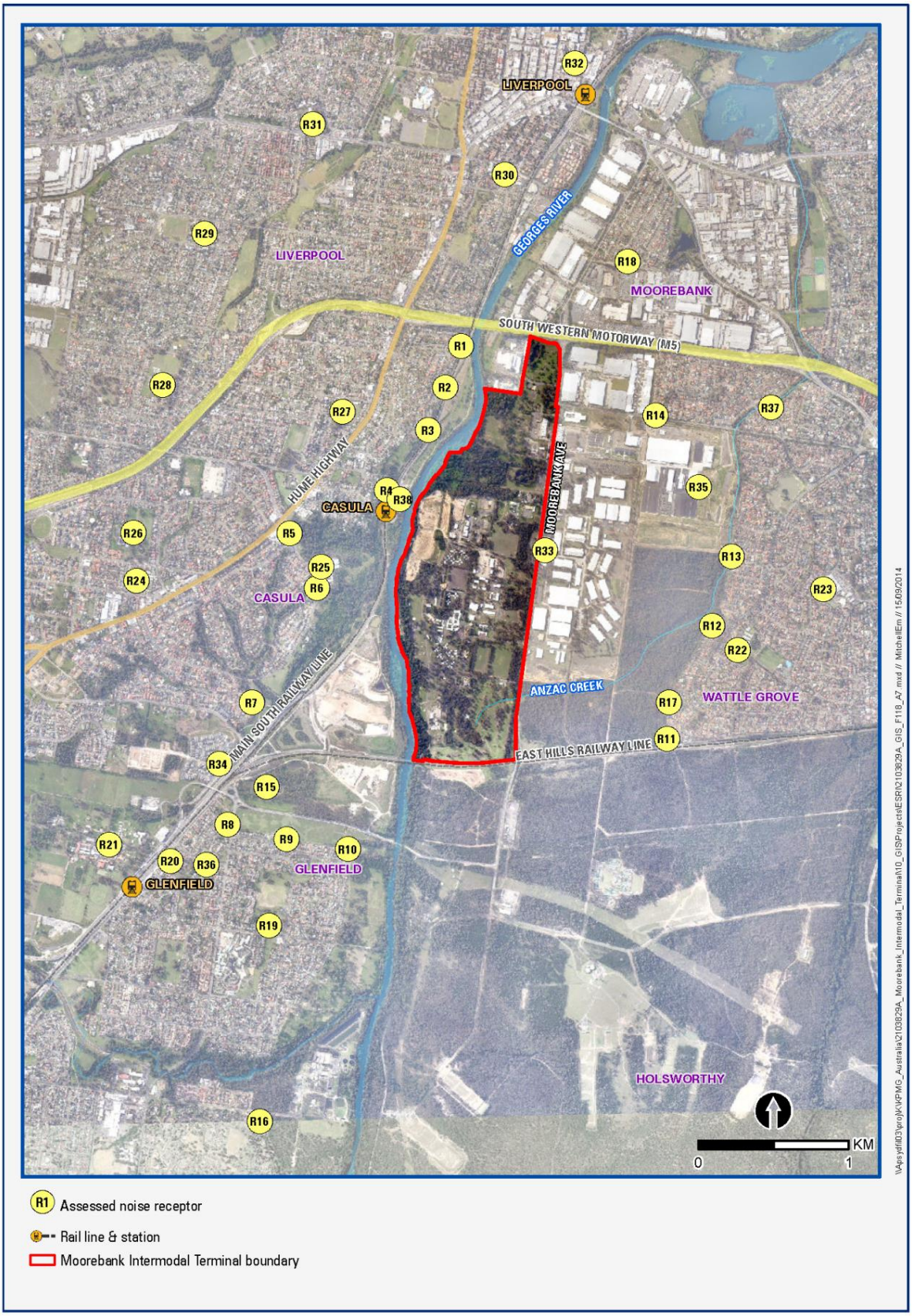
Table 2 Assessed Receptors

Receptor	Location	MGA Coordinate Reference	
		Easting	Northing
R1	Lakewood Crescent, Casula	307535	6242509
R2	St Andrews Boulevard, Casula	307430	6242235
R3	Buckland Road, Casula	307317	6241949
R4	Dunmore Crescent, Casula	307044	6241551
R5	Leacocks Lane, Casula	306397	6241264
R6	Leacocks Lane, Casula	306579	6240902
R7	Slessor Road, Casula	306145	6240139
R8	Canterbury Road, Glenfield	305986	6239330
R9	Ferguson Street, Glenfield	306378	6239233
R10	Goodenough Street, Glenfield	306783	6239167
R11	Wallcliffe Court, Wattle Grove	308903	6239900
R12	Corryton Court, Wattle Grove	309206	6240651
R13	Martindale Court, Wattle Grove	309335	6241111
R14	Anzac Road, Wattle Grove	308829	6242049
R15	Cambridge Avenue, Glenfield	306246	6239580
R16	Guise Public School	306200	6237359
R17	Yallum Court, Wattle Grove	308916	6240141
R18	Church Road, Liverpool	308643	6243069
R19	Glenwood Public School, Glenfield	306259	6238659
R20	Glenfield Public School, Glenfield	305604	6239088
R21	Hurlstone Agricultural School	305200	6239198

Receptor	Location	MGA Coordinate Reference	
		Easting	Northing
R22	Wattle Grove Public School	309373	6240489
R23	St Marks Coptic College, Wattle Grove	309942	6240895
R24	Maple Grove Retirement Village, Casula	305381	6240952
R25	All Saints Catholic College	306606	6241042
R26	Casula High School	305360	6241268
R27	Casula Primary School, Casula	306749	6242073
R28	Lurnea High School	305552	6242252
R29	St Francis Xaviers Catholic Church	305834	6243254
R30	Impact Church Liverpool	307828	6243646
R31	Liverpool West Public School	306552	6243980
R32	Liverpool Public School / TAFE NSW	308289	6244388
R33	DNSDC[1] Site up to end 2014	308092	6241149
R34	Glenfield Rise Development, Glenfield	305927	6239733
R35	DNSDC[1] Site after end 2014	309117	6241571
R36	Playground Learning Centre Glenfield	305845	6239063
R37	Wattle Grove Long Day Care Centre	309596	6242100
R38	Casula Powerhouse Arts Centre	307130	6241489

Note 1: DNSDC is the Defence National Storage Distribution Centre site which currently being relocated to West Wattle Grove – with full relocation expected by end 2014.

Figure 3 Noise Sensitive Receptors



3.2 Existing Noise Environment

3.2.1 Ambient Noise Surveys

Surveys of ambient noise levels in the surrounding suburbs were undertaken by Parsons Brinckerhoff Australia (Parsons Brinckerhoff). Noise surveys were initially carried out in November 2010, August 2011 and October 2011 with a continuous ambient noise monitoring survey commencing in July 2012.

SLR has relied on the ambient noise surveys to quantify and characterise the existing noise environment within the surrounding environment to the Project site. A total of 20 months of noise monitoring data was obtained to determine the existing daytime, evening and night-time noise levels. The measured noise levels are detailed in **Appendix B**, with the full 20 months of noise monitoring data is available upon request to Parsons Brinckerhoff.

To measure the long term ambient noise levels, noise loggers were externally deployed within the property boundary of residences and set to continuously measure A-weighted sound pressure levels with 15-minute statistical measurements obtained. The noise logger microphones were positioned 1.2 metres above ground level.

To determine the influence of local sources on the ambient noise environment, short term attended noise monitoring surveys were undertaken at each monitoring location in the presence of the field staff. A Rion NA 27 sound level meter was set to measure the A-weighted sound pressure levels with 15-minute statistical measurements obtained. The sound level meter microphone was positioned 1.2 metres above ground level.

All equipment was calibrated before and after each measurement event, within an acceptable margin of ±1 dB(A) of the reference signal.

The noise monitoring locations are detailed in **Table 3** and presented in **Figure 4**. The noise monitoring sites were selected to avoid the influence of uncharacteristic localised noise sources, such as air conditioning units or high road traffic noise, and to provide free field measurement in the absence of noise reflected from adjacent building facades.

The noise monitoring locations are representative of the residential suburbs adjacent to the Project site. Monitoring location L3 at Todd Court was selected to provide a representative measurement of existing road traffic noise from the M5 Motorway at nearest residential receptors to the north of the Project site. Existing road traffic noise from Moorebank Avenue was measured at noise monitoring location L6.

Table 3 Noise Monitoring Locations

Monitoring Location		Monitoring Period
L1	Aitape Place, Wattle Grove	2 to 8 November 2010
L2	Goodenough Street, Glenfield	2 to 7 November 2010
L3	Todd Court, Wattle Grove	17 to 30 August 2011
L4	Corryton Court, Wattle Grove	17 to 29 August 2011
L5	Buckland Road, Casula	6 to 14 October 2011
L6	Moorebank Avenue	29 August 2011
L7	Corryton Court, Wattle Grove	From July 2012
L8	Goodenough Street, Glenfield	From July 2012
L9	Buckland Road, Casula	From July 2012

Figure 4 Noise Monitoring Locations

3.3 Meteorological Conditions

The NSW INP *Industrial Noise Policy*[1] (NSW INP) recommends ambient noise monitoring is undertaken during satisfactory conditions of nil precipitation and wind speed less than 5 meters per second (m/s). To determine the meteorological conditions during the noise monitoring surveys, Bureau of Meteorology data has been referenced from the nearest weather stations; Holsworthy Control Range (station 67117), Bankstown Airport (station 66137) and Holsworthy Aerodrome (station 66161).

Any periods of unsatisfactory meteorological conditions were filtered from the measured long term noise levels below and detailed in **Appendix B**.

3.3.1 Attended Noise Surveys

At the noise monitoring locations in Casula the daytime, evening and night-time ambient noise environments were typically influenced by distant road traffic from the Hume Highway and M5 Motorway, local road traffic from residential roads and passenger and rail freight on the SSFL.

The existing daytime, evening and night-time noise environments at Wattle Grove was influenced by road traffic noise from local residential roads, distant road traffic noise from the M5 Motorway and distant rail noise from the East Hills rail line. The M5 Motorway influenced existing noise levels at the north of Wattle Grove (L3 Todd Court); at this location the existing M5 motorway road traffic noise barrier reduced the road traffic noise.

The daytime, evening and night-time noise environment in north Glenfield was primarily influenced by road traffic on Cambridge Avenue and Railway Parade and distant rail noise from the SSFL and East Hills line.

The noise environment at the communities surrounding the main IMT site was typically most sensitive between midnight and 3.00 am when the use of the surrounding road and rail transport networks was at its lowest. At all monitoring locations, noise from any existing industrial activity was not audible to Parsons Brinckerhoff staff during the noise monitoring events.

3.3.2 Long Term Baseline Noise Levels

The unattended ambient noise levels from 2010, 2011 and the continuous noise survey from 2012 have been applied to establish the overall Rating Background Level (RBL) for the day time, evening and night-time periods at each monitoring location. The RBLs in **Table 4** are the median of the L_{A90} noise levels in each measurement period as described in the NSW INP.

Table 4 Rating Background Levels

Monitoring Location		Representative Suburb	Rating Background Level, dBA		
			Daytime	Evening	Night-time
L1	Aitape Place	Wattle Grove	39	33	30[1]
L2	Goodenough Street	Glenfield	41	41	35
L3	Todd Court	Wattle Grove	57	54	46
L4	Corryton Court	Wattle Grove	38	39	37
L5	Buckland Road	Casula	41	39	32
L7	Corryton Court[2]	Wattle Grove	35	36	32
L8	Goodenough Street[2]	Glenfield	35	37	33
L9	Buckland Road[2]	Casula	39	39	33

Note 1: The lowest RBL recommended by the NSW INP is 30 dBA.
Note 2: Monitoring location from the continuous noise monitoring survey.

[1] Environmental Protection Agency, 2000.

The long term measured ambient (L_{Aeq}) noise levels are summarised in **Table 5**.

Table 5 Ambient Noise Levels

Monitoring Location		Representative Suburb	Ambient Noise Level (L_{Aeq}), dBA		
			Daytime	Evening	Night-time
L1	Aitape Place	Wattle Grove	54	50	50
L2	Goodenough Street	Glenfield	59	55	54
L3	Todd Court	Wattle Grove	62	61	58
L4	Corryton Court	Wattle Grove	56	46	47
L5	Buckland Road	Casula	57	53	52
L7	Corryton Court[2]	Wattle Grove	55	49	46
L8	Goodenough Street[2]	Glenfield	48	47	44
L9	Buckland Road[2]	Casula	55	54	53

3.4 Existing Ground Vibration

Potential sources of existing ground vibration within the surrounding communities would be road traffic movements on local roads and rail freight movements on the SSFL rail corridor. Existing industrial or commercial activities within the SME site do not generate sufficient ground vibration levels to be perceptible within the surrounding environment.

Based on previous studies of ground vibration, road and rail operations generally result in perceptible ground vibrations within close proximity (typically within 30 m) to the source. As such, it is likely the majority of receptors in Casula, Wattle Grove and Glenfield do not experience perceptible ground vibration. Furthermore, during the baseline noise surveys ground vibration was not perceptible at the residential noise monitoring locations.

4 ASSESSMENT APPROACH

4.1 Assessment Scenarios

The Project would progress over an approximate 15 year period in the development phases outlined in **Figure 2** (Early Works, Phase A, Phase B, Phase C and Full Build). Five development scenarios have been considered in this Technical Paper for the assessment of potential noise and vibration impacts.

The scenarios allowed for assessment of potential worst case impacts during intensive construction works and the capacity operations of each Phase. To assess potential worst case noise impacts, is based on all required construction plant and equipment in simultaneous operation. The five scenarios that were investigated were:

- Early Works – 2015. The assessment scenario is discussed in **Section 8** and is based on initial construction activity for the Early Works.
- Phase A – 2018. The construction of the 0.5 million TEU per annum IMEX facility, 100,000 sq. m warehousing and associated northbound rail access connection. The assessment scenario is discussed in **Section 9**.

- Phase B – 2025. Discussed in **Section 10**, the assessment scenario considers the potential worst case noise generating operation of the 0.5 million TEU per annum IMEX facilities, 100,000 sq. m warehousing and associated northbound rail access connection. It also considers the construction of additional 0.55 million TEU per annum IMEX facility and additional 150,000 sq m warehousing.
- Phase C – 2030. The assessment scenario considers a potential worst case year for the operation of the 1.05 million TEU per annum IMEX facilities, 250,000 sq. m warehousing and associated northbound rail access connection. The scenario also considers the construction of 0.5 million TEU per annum interstate terminal facilities, additional 50,000 sq. m warehousing and the southbound rail connection from the SSFL. The intensive construction works and the capacity operation for Phase C are discussed in **Section 11**.
- Phase Full Build – 2030. The potential worst case year for the capacity operations of 1.05 million TEU per annum IMEX facilities and 0.5 million TEU per annum interstate facilities and 300,000 sq. m of warehousing. The capacity operation for Phase Full Build is discussed in **Section 12**.

4.2 Assessment of Noise During Construction

At the time of this assessment, information on the proposed construction works was limited to indicative key work activities and an estimation of the construction plant likely to be required. The specific construction work locations were not known, as such the assessment of construction noise was based on a worst case assumption that construction could, at some time, be carried out at the closest site boundary location to each receptor.

A noise prediction spread sheet was developed to determine potential noise levels at the nearest receptors during construction of the main IMT site and rail access connections. The prediction spread sheet assumed the all equipment would be in operation and included a nominal 10 dBA attenuation accounting for; the impedance of noise propagation from intervening structures (such as stockpiles, landscaping and on-site buildings), the local topography and the intermittent operation of the construction equipment operating during daily construction activities.

Given the construction works will be mobile and extend across the majority of the main IMT site the predicted noise levels are conservative with lower predicted noise levels expected where works are undertaken at greater distance from receptors.

The prediction of worst case construction noise has been based on the minimum separation distances between receptors and infrastructure within the main IMT site and the rail access connections, as detailed in **Table 6**.

Table 6 Nearest Distances Between Receptors And Construction Works

Receptor	Location	Distance Between Construction and Receptors, m			
		Main IMT Site Infrastructure	Rail Access Connection Options		
			Northern	Central	Southern
R1	Lakewood Crescent, Casula	450	40	1,230	1,510
R2	St Andrews Boulevard, Casula	510	50	940	1,200
R3	Buckland Road, Casula	500	40	620	900
R4	Dunmore Crescent, Casula	550	140	200	460
R5	Leacocks Lane, Casula	910	840	660	620
R6	Leacocks Lane, Casula	675	950	420	340
R7	Slessor Road, Casula	1,100	1,800	1,110	570
R8	Canterbury Road, Glenfield	1,300	2,550	1,740	1,240
R9	Ferguson Street, Glenfield	1,000	2,420	1,710	950

Receptor	Location	Distance Between Construction and Receptors, m			
		Main IMT Site Infrastructure	Rail Access Connection Options		
			Northern	Central	Southern
R10	Goodenough Street, Glenfield	850	2,450	1,680	690
R11	Wallcliffe Court, Wattle Grove	990	2,450	2,070	1,580
R12	Corryton Court, Wattle Grove	1,200	2,250	2,200	2,150
R13	Martindale Court, Wattle Grove	1,250	2,240	2,200	2,290
R14	Anzac Road, Wattle Grove	630	1,250	1,870	2,000
R15	Cambridge Avenue, Glenfield	1,100	2,100	1,450	910
R16	Guise Public School	2,250	4,400	3,600	2,640
R17	Yallum Court, Wattle Grove	950	2,300	2,040	1,650
R18	Church Road, Liverpool	760	1,100	2,300	2,500
R19	Glenwood Public School, Glenfield	2,000	3,100	2,300	1,460
R20	Glenfield Public School, Glenfield	1,900	3,000	2,240	1,780
R21	Hurlstone Agricultural School	2,050	3,200	2,450	2,100
R22	Wattle Grove Public School	1,375	2,450	2,390	2,400
R23	St Marks Coptic College, Wattle Grove	1,925	2,800	2,820	2,900
R24	Maple Grove Retirement Village, Casula	1,850	1,900	1,580	1,440
R25	All Saints Catholic College	675	820	370	350
R26	Casula High School	1,960	1,800	470	1,540
R27	Casula Primary School, Casula	960	590	770	970
R28	Lurnea High School	2,100	1,180	1,750	1,820
R29	St Francis Xaviers Catholic Church	2,250	1,910	2,200	2,420
R30	Impact Church Liverpool	1,180	940	2,400	2,600
R31	Liverpool West Public School	2,250	1,570	2,600	2,900
R32	Liverpool Public School / TAFE NSW	1,820	1,770	3,250	3,520
R33	DNSDC Site up to end 2014	250	1,000	960	1,010
R34	Glenfield Rise Development, Glenfield	1,350	2,280	1,550	970
R35	DNSDC Site after end 2014	1,000	1,980	2,000	2,100
R36	Playground Learning Centre Glenfield	1,700	2,790	2,300	1,480
R37	Wattle Grove Long Day Care Centre	1,410	2,050	2,640	2,700
R38	Casula Powerhouse Arts Centre	450	170	170	430

4.3 Assessment of Noise During Operation

Noise levels during the phased operation of each of the three concept designs have been predicted with a noise model developed for the Project utilising the SoundPLAN noise propagation software. The noise model has considered noise emissions from industrial plant, road vehicles and rail freight within the main IMT site and the rail freight on the associated rail access connections to the SSFL.

The potential noise levels from the operations within the main IMT site have been conservatively modelled during neutral (non-noise enhancing) and adverse (noise enhancing) meteorological conditions.

Analysis of the regional meteorological conditions is provided in **Section 6** with further discussion of the noise modelling provided in **Section 7**.

4.4 Cumulative Construction and Operation

The proposed construction and operational works are likely to overlap at certain times. Whilst construction and operation may occur simultaneously, in accordance with the relevant regulatory guidelines, this Technical Paper has assessed separately the noise levels from intensive construction works and capacity operations.

In the event receptors may experience noise from both construction and operation at a similar noise level, the cumulative noise level is likely to be no more than 1 to 3 dBA above the dominant contribution of either construction or operation. At the time of this assessment the design of the Project had not been progressed to allow for a more detailed understanding where construction and operations could overlap.

The reasonable and feasible mitigation measures in **Section 17** are recommended for the control of noise would provide practical control of total noise where cumulative construction and operation activities impact amenity within the surrounding communities.

4.5 Cumulative Rail and Industrial Operations

The characteristics and duration of noise emissions will vary between the rail operations on the tracks connecting to the SSFL and industrial noise from the main IMT site. Accordingly, potential noise emissions from these sources have been assessed in accordance with specific acoustic guidelines.

Notwithstanding this, some receptors in close proximity to both the rail access connection and the main IMT site may experience short term cumulative noise when IMT trains arrive/depart at the same time as container handling operations on the main IMT site. Potential cumulative noise levels would be no more than 3 dBA greater than the dominant contributing noise source and would be most likely to only affect those receptors in Casula immediately adjacent to the SSFL rail corridor and the rail access connection to the main IMT site.

The reasonable and feasible mitigation measures in **Section 17** are recommended for the control of noise during operation of both the main IMT site and the rail access connection and would provide practical control of total noise from the Project.

5 ASSESSMENT CRITERIA

5.1 Overview

The *Protection of the Environment Operations Act 199*7 (POEO Act) regulates noise generation and prohibits the generation of “offensive noise” as defined under the POEO Act. To assist in the implementation of the requirements under the POEO Act, the NSW Environmental Protection Agency (EPA) and NSW Office of Environment and Heritage (OEH) provide guidelines for the assessment and management of noise and vibration.

The regulatory guidance has been adopted to establish criteria, consistent with the Final EIS requirements of Commonwealth and the NSW EARs, for the purpose of assessing potential noise and vibration impacts associated with the construction and operation of the Project.

The RBLs from the continuous long term monitoring survey were generally more conservative than the RBLs from the shorter term background noise surveys undertaken in 2010 and 2011. As such, the continuous monitoring survey is the more representative measurement of the background noise environment. The RBLs from monitoring locations L7 (Wattle Grove), L8 (Glenfield) and L9 (Casula) were referenced in the determination of noise assessment criteria.

5.2 Construction Noise Management Levels

The *Interim Construction Noise Guideline*[2] (ICNG) sets out ways to manage the impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised below:

- Promote a clear understanding of ways to identify and minimise noise from construction works.
- Focus on applying all feasible and reasonable work practices to minimise construction noise impacts.
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours.
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage.
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.
- Whilst it is recognised the guideline is non-mandatory, it is applicable to the Project and has been adopted for the assessment of construction noise.

The ICNG provides construction noise management levels (NMLs) for residential and other noise sensitive receptors based on the background noise environment and the proposed times of construction work.

The NMLs are criteria to identify where feasible and reasonable mitigation measures are likely to be required to reduce and control noise levels. **Table 7** details the approach for establishing NMLs and their application during the planning and implementation of works.

Table 7 Recommended Construction Noise Criteria

Construction Period	NML dBA $L_{Aeq(15minute)}$	Application
Standard day time construction hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm	Noise affected RBL L_{A90} dBA + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
Highly noise affected	Highly noise affected LAeq dBA 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • Time identified by the community when they are less sensitive to noise (such as before or after school for works near schools, or mid-morning or mid-afternoon for works near residences) • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

[2] Department of Environment and Climate Change. 2009

Construction Period	NML dBA $L_{Aeq(15minute)}$	Application
Outside of standard day time construction hours	Noise affected RBL L_{A90} dBA + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours The proponent should apply all feasible and reasonable work practices to meet the noise affected level Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level the proponent should negotiate with the community

The RBLs measured at nearest residences to the Project site (**Table 4**) have been applied to establish NMLs for residential receptors in **Table 8**. The NMLs are highlighted in bold.

Table 8 Construction NMLs for Residential Receptors

Receptor	RBL dBA			NML dBA $L_{Aeq(15minute)}$		
	Daytime	Evening	Night	Daytime	Evening	Night
R1 Lakewood Crescent, Casula	39	39	33	**49**	**44**	**38**
R2 St Andrews Bd, Casula	39	39	33	**49**	**44**	**38**
R3 Buckland Road, Casula	39	39	33	**49**	**44**	**38**
R4 Dunmore Ct, Casula	39	39	33	**49**	**44**	**38**
R5 Leacocks Lane, Casula	39	39	33	**49**	**44**	**38**
R6 Leacocks Lane, Casula	39	39	33	**49**	**44**	**38**
R7 Slessor Road, Casula	39	39	33	**49**	**44**	**38**
R8 Canterbury Rd, Glenfield	35	37	33	**45**	**42**	**38**
R9 Ferguson Street, Glenfield	35	37	33	**45**	**42**	**38**
R10 Goodenough St, Glenfield	35	37	33	**45**	**42**	**38**
R11 Wallcliffe Ct, Wattle Grove	35	36	32	**45**	**41**	**37**
R12 Corryton Ct, Wattle Grove	35	36	32	**45**	**41**	**37**
R13 Martindale Ct, Wattle Grove	35	36	32	**45**	**41**	**37**
R14 Anzac Road, Wattle Grove	35	36	32	**45**	**41**	**37**
R15 Cambridge Ave, Glenfield	35	37	33	**45**	**42**	**38**
R17 Yallum Court, Wattle Grove	35	36	32	**45**	**41**	**37**
R18 Church Road, Liverpool	39	39	33	**49**	**44**	**38**
R24 Maple Grove, Casula	39	39	33	**49**	**44**	**38**
R34 Glenfield Rise Glenfield	35	37	33	**45**	**42**	**38**

The ICNG recommends NMLs for non-residential noise sensitive land uses, as detailed in **Table 9**.

Table 9 Construction NMLs for Other Noise Sensitive Land Use

Sensitive Land Use	NML dBA $L_{Aeq(15minute)}$
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generating theory own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)

Sensitive Land Use	NML dBA $L_{Aeq(15minute)}$
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, areas for reading or meditation)	External noise level 60 dB(A)
Commercial centres	Depends on the intended use of the centre. Refer to the recommended maximum internal levels in AS2107 for specific uses.

Note: The NMLs are applicable only during period when the land use is in use.

5.3 Operational Noise Criteria

5.3.1 Intrusive and Amenity Noise Criteria

In NSW noise from on-site industrial activity is assessed and managed in consideration to the NSW INP. The objectives of the policy are to:

- Establish noise criteria that would protect the community from excessive noise.
- Preserve the amenity for specific land uses.
- Apply the criteria for deriving project specific land uses.
- Promote uniform methods to assess noise impacts, including a procedure for evaluating meteorological effects.

The NSW INP sets out two noise assessment criteria; one to assess the potential for disturbance (intrusive criterion) and a second for managing noise amenity at surrounding land use (amenity criterion). The more stringent of the intrusive and amenity criteria is set as the project specific noise levels.

The intrusive criterion is a L_{Aeq} noise level determined as the RBL plus 5 dBA. Where required, the intrusive criteria are adjusted to account for potential annoying noise characteristics such as prominent tonal components, impulsiveness, intermittency, irregularity and dominant low frequency noise.

Referencing the RBLs the adopted intrusive noise criteria for residential receptors are detailed in **Table 10**.

Table 10 Intrusive Noise Criteria Residential Receptors

Receptor	RBL dBA			Intrusive Criteria dBA $L_{Aeq(15minute)}$		
	Daytime	Evening	Night	Daytime	Evening	Night
R1 Lakewood Crescent, Casula	39	39	33	**44**	**44**	**38**
R2 St Andrews Bd, Casula	39	39	33	**44**	**44**	**38**
R3 Buckland Road, Casula	39	39	33	**44**	**44**	**38**
R4 Dunmore Ct, Casula	39	39	33	**44**	**44**	**38**
R5 Leacocks Lane, Casula	39	39	33	**44**	**44**	**38**
R6 Leacocks Lane, Casula	39	39	33	**44**	**44**	**38**
R7 Slessor Road, Casula	39	39	33	**44**	**44**	**38**
R8 Canterbury Rd, Glenfield	35	37	33	**40**	**42**	**38**
R9 Ferguson Street, Glenfield	35	37	33	**40**	**42**	**38**
R10 Goodenough St, Glenfield	35	37	33	**40**	**42**	**38**
R11 Wallcliffe Ct, Wattle Grove	35	36	32	**40**	**41**	**37**
R12 Corryton Ct, Wattle Grove	35	36	32	**40**	**41**	**37**

Receptor	RBL dBA			Intrusive Criteria dBA $L_{Aeq(15minute)}$		
	Daytime	Evening	Night	Daytime	Evening	Night
R13 Martindale Ct, Wattle Grove	35	36	32	**40**	**41**	**37**
R14 Anzac Road, Wattle Grove	35	36	32	**40**	**41**	**37**
R15 Cambridge Ave, Glenfield	35	37	33	**40**	**42**	**38**
R17 Yallum Court, Wattle Grove	35	36	32	**40**	**41**	**37**
R18 Church Road, Liverpool	39	39	33	**44**	**44**	**38**
R24 Maple Grove, Casula	39	39	33	**44**	**44**	**38**
R34 Glenfield Rise Glenfield	35	37	33	**40**	**42**	**38**

The amenity criterion is based on the surrounding land use to the Project site. The criterion is designed to preserve noise amenity of the land use and protect against noise impacts such as community annoyance and speech interference. The NSW INP recommends the application of feasible and reasonable noise management and control measures to achieve the 'acceptable' amenity noise criteria. Where this cannot be achieved the 'maximum' amenity noise criteria is referenced.

In accordance with the NSW INP, the residential receptors surrounding the Project site have been defined as suburban land use. The amenity noise criteria for suburban residential receptors and other noise sensitive land uses are detailed in **Table 11**.

Existing noise levels at receptors were not influenced by industrial noise, consequently modifying adjustment factors were not applied to the amenity noise criteria.

Table 11 Amenity Noise Criteria

Land Use	Period	Acceptable Noise Level dBA L_{Aeq}	Maximum Noise Level dBA L_{Aeq}
Residential - daytime	Monday to Saturday Sundays & Public Holidays	**55**	**60**
Residential - evening	6.00 pm – 10.00 pm	**45**	**50**
Residential - night-time	10.00 – 7.00 am	**40**	**45**
School classrooms	When in use	**35** (internal)	**40** (internal)
Places of worship	When in use	**40** (internal)	**45** (internal)
Passive recreation areas	When in use	**50**	**55**
Active recreation areas	When in use	**55**	**60**
Commercial premises	When in use	**65**	**70**
Industrial premises	When in use	**70**	**75**

Note: Daytime Monday to Saturday is 7.00 am to 6.00 pm and 8.00 am to 6.00 pm on Sundays and Public holidays.

5.3.2 Project Specific Noise Assessment Criteria

For all the assessed residential receptors the intrusive noise criteria in **Table 10** are more stringent than the amenity noise criteria in **Table 11**. The intrusive noise criteria have been adopted as the project specific noise levels for the assessment of potential operational noise impacts at receptors.

5.4 Sleep Disturbance

The current approach to assessing potential sleep disturbance is to apply an initial screening criterion of background noise level plus 15 dB (as described in the Application Notes to the NSW INP). The sleep disturbance screening criterion applies outside bedroom windows during the night-time period.

Where the screening criterion is unlikely to be met, additional analysis of sleep disturbance impacts would be undertaken during the further environmental studies and detailed design phase. The additional analysis should consider the level of exceedance as well as factors such as:

- How often high noise events would occur
- The time of day (normally between 10.00 pm and 7.00 am)
- Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The adopted external sleep disturbance criteria for residential receptors are detailed in **Table 12**.

Table 12 Sleep Disturbance Noise Criteria

Residential Receptors	Night-time RBL dBA	Sleep Disturbance Criteria dBA $L_{A1,(1\ minute)}$
Casula	33	**48**
Wattle Grove	32	**47**
Glenfield	33	**48**

5.5 Rail Noise Criteria

Rail freight for the Project will arrive and depart on the SSFL, a dedicated rail freight corridor to the west of the Project site. The rail connection between the SSFL and the Project site is a non-network rail line exclusively servicing an industrial site.

Airborne noise from rail freight movements between the SSFL and the main IMT site boundary are assessed in accordance with the *Rail Infrastructure Noise Guideline*[3] (RING). The RING requires rail noise levels to be assessed to the NSW INP amenity noise criteria in **Table 11**.

The RING noise criteria apply where the rail line extends beyond the boundary of the Project site. Rail freight operating within the Main IMT site is assessed in accordance with the Project specific noise levels from the NSW INP (refer **Section 5.3.2**).

5.6 Road Traffic Noise Criteria

Where a development has the potential to result in an increase in road traffic noise levels, the impacts on sensitive receptors are assessed under the NSW *Road Noise Policy*[4]. For traffic operating on public roads the noise criteria for existing residences affected by additional traffic on existing sub-arterial roads are set out in **Table 13**. The RNP also provides noise criteria for impacts on other sensitive land uses.

Table 13 Road Traffic Noise Criteria

Road Category	Type of Proposal/Land Use	Day (7.00 am to 10.00 pm)	Night (10.00 pm to 7.00 am)
Freeway/arterial /sub-arterial roads	Existing residences affected by **additional traffic** on existing freeways/arterial/ sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 dBA	$L_{Aeq(9hour)}$ 55 dBA
	School classrooms	$L_{Aeq(1hour)}$ internal 40 dBA	Facility not in use
	Places of worship	$L_{Aeq(1hour)}$ internal 40 dBA	$L_{Aeq(1hour)}$ internal 40 dBA
	Aged care facilities	$L_{Aeq(15hour)}$ 60 dBA	$L_{Aeq(1hour)}$ internal 55 dB

[3] NSW Environmental Protection Authority, 2013.
[4] NSW Environmental Protection Authority, 2011.

Road Category	Type of Proposal/Land Use	Day (7.00 am to 10.00 pm)	Night (10.00 pm to 7.00 am)
Freeway/arterial /sub-arterial roads	Childcare facilities	Sleeping rooms $L_{Aeq(1hour)}$ internal 35 dBA Indoor play area $L_{Aeq(1hour)}$ internal 40 dBA Outdoor play area $L_{Aeq(1hour)}$ internal 35 dBA	Facility not in use

Note: All criteria are external, applicable at the facade of the affected residence.

In addition to the above road traffic noise criteria, the RNP *relative increase criteria* state that noise mitigation should be considered where the Project would increase existing/future existing road traffic noise by 12 dBA or more. In relation to the assessment criteria, the RNP notes that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

5.7 Ground Vibration Criteria

Plant will not operate continuously. As such the construction and operation of the Project are considered intermittent sources of vibration associated with two main types of impact: disturbance at receptors and potential cosmetic structural damage to buildings.

5.7.1 Human Comfort Vibration Objectives

In NSW *Assessing Vibration: a technical guideline*[5] provides for vibration criteria for intermittent sources of vibration. The vibration guideline nominates preferred and maximum vibration goals for critical areas, residences and other sensitive receptors as shown in **Table 14**.

The applicable human comfort vibration goal for an intermittent vibration source is defined in terms of Vibration Dose Values (VDVs). The VDV varies according to the duration of exposure where a higher vibration level is permitted if the total duration of the vibration event(s) is small.

The vibration guideline advises a low probability of adverse comment or disturbance to building occupants would be expected at or below the preferred values.

Table 14 Preferred and Maximum Vibration Dose Values for Intermittent Vibration

Building Type	Preferred VDV ($m/s^{1.75}$)	Maximum VDV ($m/s^{1.75}$)
Residential Daytime	0.20	0.40
Residential Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80
Workshops	0.80	1.60

Note: Daytime is 7:00 am to 10:00 pm and night-time is 10:00 pm to 7:00 am

5.7.2 Effects on Building Structures

The levels of vibration to cause damage to buildings tend to be at least an order of magnitude (10 times) greater than levels considered acceptable by people. This also applies to heritage buildings, unless they are structurally unsound. For this reason, the controlling vibration criterion at most locations is determined by the criteria for human responses which are more stringent than criteria for damage to building contents or structures.

[5] NSW Environmental Protection Authority, 2013, formerly Department of Environment and Conservation, 2006.

For the purpose of this assessment, vibration from the construction and operation of the Project has been assessed to the human perception objectives in **Table 14**. Where vibration levels are within the human comfort criteria they would also comply with those for limiting damage to buildings and structures.

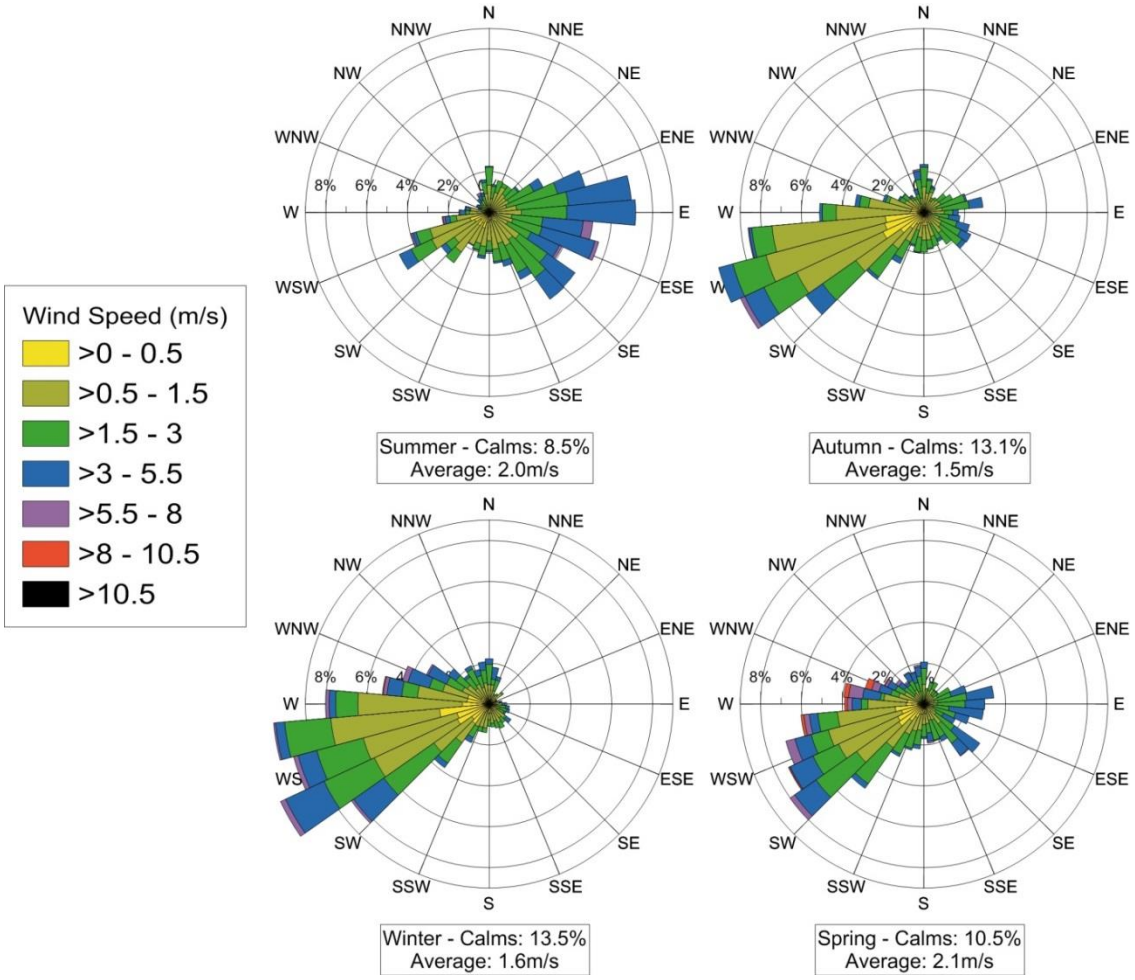
6 REGIONAL METEOROLOGICAL CONDITIONS

In accordance with the NSW INP the assessment of noise during the operation of the Project has considered potential regional wind gradient and temperature inversion effects which can focus sound wave propagation paths and may increase received noise at the receptor locations. To define the regional meteorological conditions at the Main IMT site, the 2013 meteorological data from the OEH Liverpool All Weather Station (AWS) was analysed for wind gradient and temperature inversion conditions.

6.1 Gradient Wind Flow

Wind gradients are considered a feature for the region where wind speeds of 3 m/s or less (measured at 10 m above the ground) occur for 30% or more of any daytime, evening or night-time period in any season. The seasonal wind distribution patterns for the OEH Liverpool AWS show that the prevailing wind direction is from the west-southwest and to a lesser extent from the west and from the southwest during the autumn, winter and spring. During the summer the prevailing wind direction is from the east. The seasonal wind rose data from the Liverpool AWS for the year 2013 is provided in **Figure 5**.

Figure 5 Seasonal Wind Rose Data for 2013



6.2 Temperature Inversions

During stable atmospheric conditions, where cooler air is trapped nearer to the ground surface by an upper layer of warm air, little or no vertical air movement occurs resulting in a refraction of sound waves. Stable atmospheric conditions generally occur during the night-time and early morning periods during the winter months.

Section 5.2 of the NSW INP requires an assessment of temperature inversion conditions where inversion conditions occur for 30% of the total night-time during winter (June, July and August). This occurrence equates to about two nights per week and has been selected by the NSW INP as representing a significant noise impact for further assessment.

Adopting the 2013 Liverpool AWS information on wind speed, wind direction, temperature, and relative humidity a meteorological atmospheric dispersion model for the region was developed in the Local Air Quality Impact Assessment for the EIS.

Applying the Pasquill-Gifford scheme for the classification of stability conditions and analysis of the dispersion model meteorological file, very stable (F-class stability conditions) are likely during the early mornings and night-time.

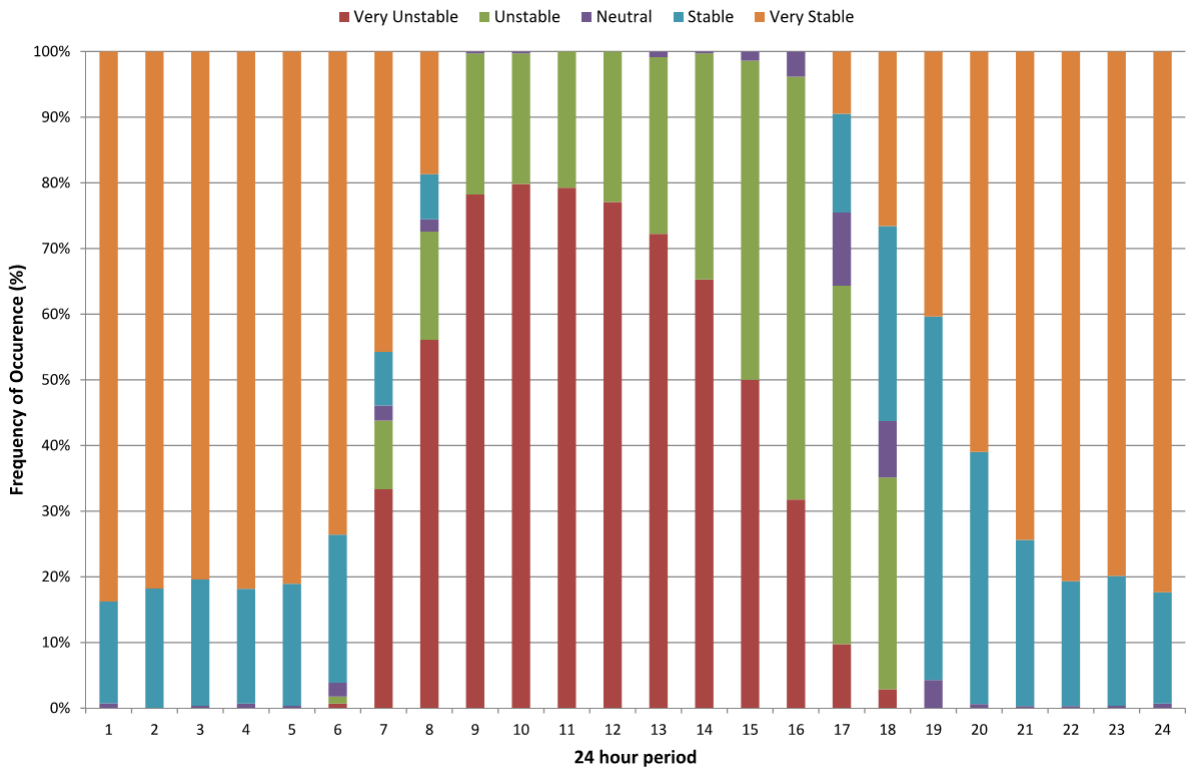
The meteorological data identified it is rare for there to be no wind during the night-time during the winter months. Therefore, the regional wind directions during the night-time of the winter months were analysed for wind speeds of 0 to 3 m/s to identify the prevailing source to receptor wind conditions during anticipated temperature inversion conditions. The analysis of wind conditions during the night-time period of the winter months is summarised in **Table 15**.

Table 15 Analysis Of Regional Meteorological Conditions

Receptor Community	Prevailing Wind Direction	Frequency Of Occurrence (Winter)	Equivalent Days/Week
Casula	<45˚ to >300˚	14%	1
Wattle Grove	<225˚ to >120˚	15%	1
Liverpool/north Wattle Grove	>225˚ to <300˚	69%	5
Glenfield	>45˚ to <120˚	3%	0

The typical regional atmospheric stability for a 24-hour period is presented in **Figure 6**.

Figure 6 Analysis of Atmospheric Stability



Based on the analysis, to conservatively assess potential worst case noise levels during early morning and night-time during the winter months, moderate (F-class stability category) 3 C˚/100 m temperature inversion conditions with a WSW 2 m/s drainage wind condition have been included in the noise prediction model. This approach is consistent with the recommended default conditions for a moderate (F-Class stability category) inversion as defined in the NSW INP.

7 NOISE MODELLING PROCEDURES

7.1 SoundPLAN

In order to calculate the noise emission levels from the operation of the Project, a noise prediction model for the operation of the Project was developed using SoundPLAN V7.2 noise propagation software. SoundPLAN is a software package which enables development of a sophisticated computer model comprising a digitised ground map (containing ground contours and buildings), the location and acoustic sound power levels of significant noise sources on site and the location of receptors for assessment purposes.

The computer model generates noise emission levels taking into account such factors as the source sound power levels, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions .

7.2 Prediction Methodology

Noise levels from fixed and mobile plant and equipment were predicted in SoundPLAN with the CONCAWE prediction methodology. The CONCAWE prediction method is specially designed for large facilities and incorporates the influence of wind effects and the stability of the atmosphere. The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh[6], concluding that CONCAWE was accurate to ±2 dBA in any one octave band between 63 Hz and 4 kHz and ± 1 dBA overall.

Rail noise levels have been predicted in SoundPLAN with the *Nordic Rail Traffic Noise Prediction Method* (Kilde 1984) as it calculates both L_{Amax} and L_{Aeq} noise levels. The calculation factors the speed and length of rail freight to determine the maximum potential noise levels at a receptor during a passby event.

It is noteworthy that if the curve radius is small, at the lower end of the ≥300m and <500 m range or below 300 m, there are recent studies showing in some instances that small radius curves have given rise to curve squeal increasing the maximum noise levels by 20 dBA or more when compared to normal straight track conditions.

Whilst at this stage the curve radius for the rail connection options are not known, the Project is committed to managing curve squeal noise by designing the layouts to minimise small radius curves within the main IMT site and on the rail access. It has been assumed that the curve radius will be close to or above <500 m which would only incur a minor curve noise correction of +3 dBA to both the L_{AE} and L_{Amax} noise emissions.

Due to the low train speeds (25 to 35 km/h) within the main IMT site noise correction factors were not included for turnouts and crossovers. Consistent with a ballasted concrete span bridge no corrections were applied to the noise emissions from the rail access connecting the main IMT site to the SSFL.

7.3 Meteorological Conditions

Based on an analysis of the 2013 Liverpool AWS meteorological data (refer to **Section 6**), the conditions used to assess the effect of neutral and worst case meteorological conditions are shown in **Table 16** below.

Table 16 Meteorological Conditions – Neutral and Worst Case

Parameter	Neutral Weather	Worst Case Weather
Temperature	19°C	14°C
Humidity	63%	84%
Pasquill Stability Category	D	F
Wind Speed	0 m/s	2 m/s prevailing WSW direction.

7.4 Noise Emission Sources

The Project is only at the conceptual design stage. As such source sound power levels have been determined in consultation with potential suppliers of plant and equipment for the Project and source noise information from intermodal sites in Australia, Europe and the United States.

The adopted source noise levels for the key equipment noise emission sources are provided in **Table 17**. Reversing and other audible alarms for the truck movements and RMGs are included in the source noise levels.

[6] (Applied Acoustics, 9, 115. Marsh, K.J. (1982).

It has been assumed that all equipment will be designed to control potential noise characteristics of tonality, low frequency and impulsivity. No modifying correction factors have been applied to the noise emission sources or predicted noise levels.

Other equipment such as bomb carts, yard chassis and forklifts have not been modelled as the sound power levels are expected to be at least 10 dBA below the sound power levels of the equipment listed in **Table 17** and be operated within the warehousing buildings thus limiting their contribution to off-site noise levels.

Table 17 Source Noise Emission Levels

Noise Source	Sound Power Level, L_{Aeq} dBA
In-terminal Vehicles (ITV)	104
Working track lifting equipment - Rail Mounted Gantry (RMG)[1]	108
Side pick	108
Switch engine	103
Road Trucks	104
Stationary Locomotive	100

Note 1: Includes acoustic enclosure of the motor and acoustic lagging/insulation of the motor exhaust.

The source noise emission levels for the rail freight in **Table 18** have been taken from SLR's extensive measurement of rail freight on the NSW rail network. The adopted noise emission levels are representative of the modern rail freight applying best practice noise control technology anticipated to be in operation at the time the Moorebank IMT is commissioned.

The rail noise emissions include the influence of braking and wagon bunching but exclude rail horns as horns will only be required for emergency. Referencing the rail noise emission levels at 80 km/h, the sound exposure levels in this assessment were increased to account for the lower train speeds (ie longer exposure time) of 60 km/h on the rail spurs connecting the Main IMT site to the SSFL and 30 km/h rail operations within the Main IMT site.

Table 18 Rail Freight Noise Emission Levels

Noise Source	Noise Emission Level, dBA at 15 m At 80 km/h	
	Sound Exposure Level	L_{Amax}
Class 82 Locomotive (IMEX)	85	89 (exhaust)
C44Aci Locomotive (Interstate)	88	92 (exhaust)
Freight wagons (1,000 m in length)	100	93

8 EARLY WORKS

The Early Works are expected to commence in 2015 and would occur for approximately six months. All works are expected to be undertaken during the standard daytime hours of 7.00 am to 6.00 pm.

8.1 Noise Assessment

A review of the proposed Early Works described in the main EIS (Chapter 8) identified the work activities in **Table 19** with the greatest potential to generate noise and ground vibration emissions.

Table 19 Early Works

Early Works	Equipment	Sound Power Level, L_{Aeq} dBA
Heavy vehicles within the Main IMT site	Tipper truck	107
	Construction Trucks (12 – 15 tonne)	108
Service utility terminations and diversions	Excavator (30 tonne)	110
	Front End Loader	111
Lifting	Franna Crane	107
	Truck (12 – 15 tonne)	108
Landscaping	Tipper truck	107
	Front End Loader	111

The Early Works will be required across the main IMT site and the potential noise levels at individual receptors would vary dependent upon the specific work activities undertaken and the proximity of the receptor to the construction equipment. Potential noise levels experienced at any one location are likely to be short term (up to a month).

A summary of potential construction noise levels at the nearest residential receptors is provided in **Table 20**. The predicted noise levels are the same for the three rail access concepts layouts as the Early Works will be consistent whichever rail access connection design is taken to construction.

Table 20 Predicted Noise Levels Early Works

Construction Activity	Maximum Predicted Noise Levels, dBA L_{Aeq}		
	Casula NML = 49 dBA	Wattle Grove NML = 45 dBA	Glenfield NML = 45 dBA
Northern Rail, Central and Southern Rail Access Option Layouts			
Heavy vehicles with Main IMT site	30 – 42	29 – 36	30 – 38
Service Utility Terminations and Diversions	29 – 41	28 – 35	29 – 37
Lifting	24 – 36	23 – 30	24 – 31
Landscaping	32 – 44	31 – 38	32 – 40

For all proposed construction works the predicted noise levels at nearest residential receptors comply with the daytime NMLs of 49 dBA $L_{Aeq(15minute)}$ at Casula and 45 dBA $L_{Aeq(15minute)}$ at Wattle Grove and Glenfield.

Predicted noise levels of up to 49 dBA $L_{Aeq(15minute)}$ are within the construction NMLs for non-residential receptors at all commercial premises, education institutions, places of worship and places of recreation including the Casula Powerhouse Museum.

Based on the predicted noise levels, the Early Works would not require the implementation of specific mitigation measures to reduce potential noise levels from daytime works.

8.2 Ground Vibration Assessment

8.2.1 Safe Working Distances for Vibration Intensive Plant

The level of vibration potentially experienced at a receptor is dependent upon the vibration energy generated by the source, the predominant frequencies of vibration, the localised geotechnical conditions and the interaction of structures and features which can dampen vibration.

The recommended safe working distances for construction plant in **Table 21** are referenced from the Transport for NSW *Construction Noise Strategy*. Consistent with the guidelines for ground vibration (refer **Section 5.7**); the recommendations provide for the practical management of potential vibration to minimise the likelihood of cosmetic damage to buildings and disturbance or annoyance in humans.

Table 21 Recommended Safe Working Distances for Construction Equipment

Equipment Item	Rating/ Description	Safe Working Distance	
		Cosmetic Damage[1]	Human Response[2]
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 50 kN (Typically 2-4 tonnes)	6 m	20 m
	< 50 kN (Typically 4-6 tonnes)	12 m	40 m
	< 50 kN (Typically 7-13 tonnes)	15 m	100 m
	< 50 kN (Typically 13-18 tonnes)	20 m	100 m
	< 50 kN (Typically > 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	300 kg – 18 to 34t excavator	2 m	7 m
Medium Hydraulic Hammer	1,600 kg – 5 to 12t excavator	7 m	23 m
Large Hydraulic Hammer	1,600 kg – 12 to 18t excavator	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Note 1: Referenced from British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2*
Note 2: Referenced from DECCW's Assessing Vibration: a technical guideline

8.2.2 Human Comfort Vibration Assessment

Based on the general work zones, the proposed construction equipment is expected to be operated greater than 40 m to 450 m from nearest receptors. The heavy vibratory rollers (10 – 12 tonnes) would not be used within 100 m of receptors. Consequently, all construction equipment will be operated within the recommended safe working distances and potential ground vibration levels at nearest receptors would be expected to be within the human comfort criteria.

8.2.3 Cosmetic Damage Vibration Assessment

The separation distance(s) of at least 40 m to 450 m between the proposed works and the nearest receptors would be sufficient so that nearby buildings are unlikely to suffer cosmetic damage during the operation of the proposed construction equipment.

9 NOISE ASSESSMENT – PROJECT PHASE A

Phase A of the Project includes the construction of the initial IMEX terminal and warehousing proposed between 2016 and 2018.

9.1 Assessment of Potential Noise Levels

In reference to the typical construction plant and equipment listed in the main EIS (Chapter 8), the construction scenarios in **Table 22** were developed for the purpose of assessing potential worst case noise levels from the construction works during Phase A of the Project.

Table 22 Assessed Works for Phase A Construction

Phase A Works[1]	Equipment	Sound Power Level, L_{Aeq} dBA
Piling	Vibratory Piling Rig	121
	Front End Loader	111
	Tipper Truck	107
Excavation	Excavator (30 tonne)	110
	Front End Loader	111
	Tipper Truck	107
Compaction	Vibratory Roller (10 – 12 tonne)	117
	Smooth Drum Roller	113
Heavy Vehicles Within the Main IMT site	Tipper Truck	107
	Truck (12 – 15 tonne)	108
Rail Construction	Hi-Rail Dumper	103
	Rail Tamper	118
	Ballast Regulator	110
	Skid Steer Crane	110
	Rail Saw	113
Concreting	Concrete Pump	109
	Concrete Saw	111
	Concrete Truck/Agitator	112

Note 1: Phase A activities and potential construction noise emission sources identified from Chapter 8 of the EIS.

A summary of potential Phase A construction noise levels at the nearest residential receptors is provided in **Table 23**.

Table 23 Predicted Noise Levels Phase A Construction

Construction Activity	Predicted Noise Level, dBA L_{Aeq}		
	Casula NML = 49 dBA	**Wattle Grove NML = 45 dBA**	**Glenfield NML = 45 dBA**
Construction At The Main IMT Site For The Three Rail Access Option Layouts			
Piling	38 – **51**	38 – 44	38 – 45
Excavation	31 – 43	30 – 37	31 – 38
Compaction	35 – 47	34 – 41	35 – 42
Heavy Vehicles with Main IMT site	27 – 39	27 – 33	27 – 34
Concreting	32 – 47	32 – 38	33 – 39
Construction Of IMEX Rail Tracks (rail access connection)			
Northern Rail Access Connection (including piling)	41 – **72**	36 – 42	37 – 37
Central Rail Access Connection (including piling)	41 – **58**	37 – 39	36 – 40
Southern Rail Access Connection (including piling)	42 – **54**	37 – 40	36 – **47**

Note **Bold** highlight denotes predicted noise level is above the daytime NMLs.

Construction At The Main IMT Site

For piling works, the predicted noise levels of up to 51 dBA $L_{Aeq(15minute)}$ at nearest receptors in Casula exceed the 49 dBA $L_{Aeq(15minute)}$ NML, and would trigger the requirement for noise mitigation. Based on predicted noise levels, noise mitigation would not be required where piling is undertaken at least 600 m from residences in Casula.

Predicted noise levels from all other construction works within the main IMT are predicted to achieve the NMLs at residential receptors in Casula, Wattle Grove and Glenfield and would not trigger the requirement for noise mitigation.

Construction of Rail Access Connections

Construction of the IMEX rail tracks would, depending upon the rail access connection option, be undertaken approximately 40 m to 340 m from nearest receptors in Casula. The predicted noise levels of up to 54 to 72 dBA $L_{Aeq(15minute)}$ for the three rail access connection options exceed the 49 dBA $L_{Aeq(15minute)}$ NML at nearest receptors in Casula.

Based on the predicted noise levels, construction noise mitigation would be required where daytime rail construction works (including piling) are undertaken within 500 m of residential receptors in Casula. In the event rail construction works are required during the evening or night-time periods, noise mitigation would be required where residences are within 1,400 m from the rail construction works.

The predicted noise levels for the construction of the northern, central and southern rail access options achieve the NMLs at all residential receptors in Wattle Grove. The northern and central rail access options achieve the NMLs at all residential receptors in Glenfield. Predicted noise levels of 47 dBA $L_{Aeq(15minute)}$ during piling works for the southern rail access option are up to 2 dBA above the NML at nearest receptors in Glenfield.

The predicted noise levels of up to 60 dBA $L_{Aeq(15minute)}$ for the three rail access options are within the construction NMLs for non-residential receptors at all commercial premises and places of recreation. including the Casula Powerhouse Museum which is 150 m from the nearest rail construction works for the central rail access option. Likewise for the three rail access options, predicted noise levels of up to 53 dBA $L_{Aeq(15minute)}$ at nearest schools and churches are within the construction NMLs for education institutions and places of worship.

To assist the control of potential noise impacts during the construction, a range of noise management and mitigation measures have been provided in **Section 17**.

9.2 Assessment of Potential Ground Vibration Levels

The assessment of potential ground vibration impacts has referenced the safe working distances for construction equipment in **Table 21**.

Based on the general work zones, the proposed construction equipment is expected to be operated between 40 m to 450 m from nearest receptors. The heavy vibratory rollers (10 – 12 tonnes) would not be used within 100 m of receptors. Consequently, all construction equipment will be operated within the recommended safe working distances and potential ground vibration levels at nearest receptors expected to be within the human comfort criteria and nearby buildings are unlikely to suffer cosmetic damage.

10 NOISE ASSESSMENT – PROJECT PHASE B

Phase B of the Project is between 2018 and 2025, during which time the Project is likely to progress to an operation of IMEX facilities at 0.5 million TEU per annum at the IMEX facility with associated warehousing. Construction of the additional IMEX terminal facilities (to bring the total up to 1.05 million TEU) and additional warehousing construction will also be undertaken during this period.

Potential noise levels have been assessed for the year 2025 to be representative of worst case (peak) noise generating operations and construction works. All predicted noise levels exclude any noise mitigation at the main IMT site or rail access connections.

10.1 Noise Levels During Construction

In reference to the typical construction plant and equipment listed in the main EIS (Chapter 8), the construction scenarios in **Table 24** have been developed for the purpose of assessing potential worst case noise levels from the construction works during Phase B of the Project.

Table 24 Assessed Works for Phase B Construction

Phase B Works[1]	Equipment	Sound Power Level, L_{Aeq} dBA
Piling	Vibratory Piling Rig	121
	Front End Loader	111
	Tipper Truck	107
Excavation	Excavator (30 tonne)	110
	Front End Loader	111
	Tipper Truck	107
Compaction	Vibratory Roller (10 – 12 tonne)	117
	Smooth Drum Roller	113
Heavy Vehicles Within the Main IMT site	Tipper Truck	107
	Truck (12 – 15 tonne)	108
Concreting	Concrete Pump	109
	Concrete Saw	111
	Concrete Truck/Agitator	112

Note 1: Phase B activities and potential construction noise emission sources identified from Chapter 8 of the EIS.

A summary of predicted noise levels at the nearest residential receptors for Phase B construction works is provided in **Table 25**

Table 25 Predicted Noise Levels Phase B Construction

Construction Activity	Predicted Noise Level, dBA L_{Aeq}		
	Casula NML = 49 dBA	**Wattle Grove NML = 45 dBA**	**Glenfield NML = 45 dBA**
Construction At The Main IMT Site For The Three Rail Access Option Layouts			
Piling	42 – **51**	38 – **48**	38 – 45
Excavation	38 – 43	30 – 40	31 – 38
Compaction	39 – 47	34 – 44	35 – 42
Heavy Vehicles with Main IMT site	27 – 39	27 – 37	27 – 34
Concreting	32 – 45	32 – 42	33 – 39

Note **Bold** highlight denotes predicted noise level is above the daytime NMLs.

Construction At The Main IMT Site

For piling works, the predicted noise levels of up to 51 dBA $L_{Aeq(15minute)}$ at nearest receptors in Casula exceed the 49 dBA $L_{Aeq(15minute)}$ NML and predicted noise levels of up to 48 dBA $L_{Aeq(15minute)}$ exceed the 45 dBA $L_{Aeq(15minute)}$ NML at nearest receptors to the northern extent of Wattle Grove. Based on the predicted noise levels, to achieve the NMLs, construction noise mitigation would be required where piling is undertaken within 600 m of residences in Casula and within 850 m of residences in Wattle Grove and Glenfield.

Predicted noise levels from all other construction works within the main IMT site are predicted to achieve the adopted NMLs at residential receptors in Casula, Wattle Grove and Glenfield and would not trigger the requirement for noise mitigation.

The predicted noise levels of up to 56 dBA $L_{Aeq(15minute)}$ at commercial premises and places of recreation and predicted including the Casula Powerhouse Museum are within the construction NMLs for non-residential receptors noise levels of up to 47 $L_{Aeq(15minute)}$ at nearest schools and churches comply with the relevant construction NMLs.

To assist the control of potential noise impacts during the construction, a range of noise management and mitigation measures have been provided in **Section 17.**

10.2 Ground Vibration Levels During Construction

Where construction equipment is located at least 450 m from nearest receptors, no disturbance or cosmetic damage impacts are expected. The heavy vibratory rollers (10 – 12 tonnes) would not be used within 100 m of receptors.

10.3 Noise During Operation At Main IMT Site

To assess potential noise emissions during the operation of the Project between 2018 and 2025, the following equipment in **Table 26** were included in the noise prediction model to represent the capacity operations for Phase B.

Table 26 Assessed Operations

Equipment	Number of Items
Working Track RMG	4
RMG	9
Side Pick	4
ITV	23
Switch Engine	2
Heavy Vehicles	6
On-site Rail Freight Movements	13 daytime/4 evening/1 night-time

Note: The number of items (sources) includes a 10% reduction in total capacity to account for idling plant.

10.3.1 Neutral Meteorological Conditions

For each rail access option, the (unmitigated) noise levels at the assessed residential receptors in each suburb are summarised in **Table 27** (neutral meteorological conditions). The predicted noise levels at assessed receptors for the operation each concept layout are detailed in **Appendix C**.

Table 27 Predicted Noise Levels – Neutral Conditions

Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Northern Rail Access	**Central Rail Access**	**Southern Rail Access**
Casula	27 – **43**	29 – **48**	31 – **49**
Wattle Grove	30 – 36	31 – 35	32 – **38**
Glenfield	28 – 32	29 – 32	36 – **39**
Non-Residential Noise Sensitive Receptors	19 – 45	22 – 50	25 – 50

Note **Bold** highlight denotes predicted noise level exceeds the Project specific noise level criteria.

Northern Rail Access Option

Based on the predicted noise levels of up to 43 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels comply with the 44 dBA $L_{Aeq(15minute)}$ daytime and 44 dBA $L_{Aeq(15minute)}$ evening noise criteria at all assessed residential receptors in Casula. Predicted noise levels exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 5 dBA at the receptors nearest to the main IMT site. Based on predicted noise levels at the receptor on Slessor Road, the predicted noise levels comply with the daytime, evening and night-time noise criteria at the residences located at the southern extent of Casula.

At all the assessed residential receptors in Wattle Grove the predicted noise levels of up to 36 dBA $L_{Aeq(15minute)}$ comply with the 40 dBA $L_{Aeq(15minute)}$ daytime, 41 dBA $L_{Aeq(15minute)}$ evening and 37 dBA $L_{Aeq(15minute)}$ night-time noise criteria.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 32 dBA $L_{Aeq(15minute)}$ comply with the 40 dBA $L_{Aeq(15minute)}$ daytime, 42 dBA $L_{Aeq(15minute)}$ evening and 38 dBA $L_{Aeq(15minute)}$ night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Central Rail Access Option

Based on predicted noise levels of 48 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels at the residences in Casula immediately opposite the main IMT exceed the 44 dBA $L_{Aeq(15minute)}$ daytime, 44 dBA $L_{Aeq(15minute)}$ evening and 38 dBA $L_{Aeq(15minute)}$ night-time noise criteria by 4 dBA to 10 dBA. Based on predicted noise levels at the receptor on Slessor Road, the predicted noise levels comply with the daytime, evening and night-time noise criteria at the residences located at the southern extent of Casula.

At all the assessed residential receptors in Wattle Grove the predicted noise levels of up to 35 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 32 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Southern Rail Access Option

The predicted noise levels of up to 49 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent determined that noise levels at residences in Casula immediately opposite the main IMT site exceed the daytime and evening noise criteria by up to 5 dBA and exceed the night-time noise criterion by up to 11 dBA. As with the northern and central rail access options, the predicted noise levels to the southern extent of Casula comply with the noise criteria.

At all the assessed residential receptors in Wattle Grove the predicted noise levels of up to 38 dBA $L_{Aeq(15minute)}$ comply with the daytime and evening noise criteria at all assessed residential receptors. Based on the predicted noise levels of up to 38 dBA $L_{Aeq(15minute)}$ at the Anzac Road receptor, noise levels marginally exceed the 37 dBA $L_{Aeq(15minute)}$ night-time noise criterion by 1 dBA at the north extent of Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 39 dBA $L_{Aeq(15minute)}$ comply with the daytime and evening noise criteria. Based on predicted noise levels at the receptors Ferguson Street and Cambridge Avenue, noise levels marginally exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 1 dBA at the nearest residences to the main IMT site at the northern extent of Glenfield.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

10.3.2 Adverse Meteorological Conditions

The predicted (unmitigated) noise levels at the assessed residential receptors in each suburb are summarised in **Table 28** (adverse meteorological conditions). The predicted noise levels at assessed receptors for the operation each concept design are detailed in **Appendix C**.

Table 28 Predicted Noise Levels – Adverse Conditions

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Northern Rail Access	**Central Rail Access**	**Southern Rail Access**
Casula	27 – **45**	28 – **50**	31 – **50**
Wattle Grove	35 – **39**	36 – **40**	36 – **42**
Glenfield	26 – 30	28 – 31	36 – 39
Non-Residential Noise Sensitive Receptors	18 – 47	22 – 51	30 – 50

Note **Bold** highlight denotes predicted noise level exceeds the Project specific noise level criteria.

Northern Rail Access Option

Based on predicted noise levels at Buckland Road and Dunmore Road in Casula, the predicted noise levels of up to 45 dBA $L_{Aeq(15minute)}$ at the nearest residences immediately opposite the main IMT site exceed the 44 dBA $L_{Aeq(15minute)}$ daytime, 44 dBA $L_{Aeq(15minute)}$ evening and 38 dBA $L_{Aeq(15minute)}$ night-time noise criteria by up to 7 dBA. Based on predicted noise levels at the receptor on Slessor Road, the predicted noise levels comply with the daytime, evening and night-time noise criteria at the residences located at the southern extent of Casula.

Predicted daytime and evening noise levels in Wattle Grove comply with the noise criteria. Based on noise levels at Anzac Road, a marginal 1 dBA exceedance of the night-time criteria is predicted at the northern extent of Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 30 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Central Rail Access Option

Based on the predicted noise levels of up to 50 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels at the nearest residences immediately opposite to the main IMT site exceed the daytime and evening noise criteria by up to 6 dBA and the night-time noise criterion by up to 12 dBA. Based on predicted noise levels at the receptor on Slessor Road, the predicted noise levels comply with the daytime, evening and night-time noise criteria at the residences located at the southern extent of Casula.

At all the assessed residential receptors in Wattle Grove the predicted noise levels comply with the daytime and evening noise criteria but exceed the night-time noise criterion at all the assessed receptors by 2 to 5 dBA.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 31 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Southern Rail Access Option

Based on the predicted noise levels of up to 50 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels at the nearest residences immediately opposite to the main IMT site exceed the daytime and evening noise criteria by up to 6 dBA and the night-time noise criterion by up to 12 dBA. Based on predicted noise levels at the receptor on Slessor Road, the predicted noise levels comply with the daytime, evening and night-time noise criteria at the residences located at the southern extent of Casula.

At the majority of assessed residential receptors in Wattle Grove the predicted noise levels comply with the daytime and evening noise criteria. Predicted noise levels of up to 42 dBA $L_{Aeq(15minute)}$ marginally exceed the daytime noise criterion by 2 dBA at Anzac Road and the night-time noise criterion at all the assessed receptors by 2 to 5 dBA.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 39 dBA $L_{Aeq(15minute)}$ comply with the daytime and evening noise criterion but marginally exceed the night-time noise criterion but 1 dBA at the northern extent of Glenfield.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

10.3.3 Noise Assessment Rail Access Connection

To assess potential rail noise levels the daily rail freight movements in **Table 29** represent the total peak rail traffic in and out of the Main IMT site during Phase B operations.

Table 29 Daily Rail Freight Movements

Phase B	Daytime	Evening	Night-time
IMEX Track	13	4	1

Note: It has been assumed that the daytime, evening and night-time rail freight movements will be evenly distributed over each period (11 hour daytime, 4 hour evening and 9 hour night-time).

The predicted (unmitigated) rail noise levels at Casula, Wattle Grove and Glenfield, are summarised in **Table 30**.

Table 30 Predicted Noise Levels From Rail Access Connection to SSFL

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Daytime L_{Aeq} Criteria = 55 dBA	**Evening L_{Aeq} Criteria = 45 dBA**	**Night-time L_{Aeq} Criteria = 40 dBA**
Northern Rail Access Option			
Casula	10 – 55	<10 – **54**	<10 – **45**
Wattle Grove	15 – 20	14 – 19	<10 – 10
Glenfield	10 – 29	<10 – 28	<10 – 19
Non-Residential Noise Sensitive Receptors	<10 – 30	<10 – 29	<10 – 20
Central Rail Access Option			
Casula	<10 – 39	12 – 38	<10 – 29
Wattle Grove	13 – 18	12 – 18	<10 – 10
Glenfield	11 – 24	10 – 23	<10 – 14
Non-Residential Noise Sensitive Receptors	<10 – 40	<10 – 40	<10 – 31
Southern Rail Access Option			
Casula	29 – 38	23 – 37	19 – 28
Wattle Grove	25 – 29	24 – 28	15 – 19
Glenfield	20 – 35	19 – 35	10 – 26
Non-Residential Noise Sensitive Receptors	12 – 36	11 – 37	<10 – 28

Note: The predicted rail noise levels assumes curve radius of well above 300m without the development of curve squeal.

Northern Rail Access Connection Option

Predicted noise levels comply with the daytime noise criterion at all assessed receptors in Casula. Based on the predicted noise levels at Lakewood Crescent of up to 54 dBA L_{Aeq} during the evening and 45 dBA L_{Aeq} during the night-time; the rail noise levels are predicted to exceed the evening noise criteria by 9 dBA and the night time criterion by 5 dBA at residences immediately adjacent to the rail access connection. The predicted noise levels during the evening and night-time comply with the noise criteria at all other assessed receptors.

Predicted noise levels at all residential assessed receptors in Wattle Grove and Glenfield comply with the daytime, evening and night-time amenity noise criteria.

Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

Central Rail Access Connection Option

Predicted noise levels at all assessed receptors in Casula, Wattle Grove and Glenfield comply with the daytime, evening and night-time amenity noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

Southern Rail Access Connection Option

Predicted noise levels at all assessed receptors in Casula, Wattle Grove and Glenfield comply with the daytime, evening and night-time amenity noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

11 NOISE ASSESSMENT – PROJECT PHASE C

Phase C of the Project is between 2025 and 2030, during which time the Project will progress to an operation of IMEX facilities at 1.05 million TEU per annum with associated warehousing. Construction of the interstate terminal facilities, additional warehousing and southbound connection to the SSFL will also be undertaken during this period.

Potential noise levels have been assessed for the year 2028 to be representative of worst case (peak) noise generating operations and construction works. All predicted noise levels for operation of the Project are for the designs without noise mitigation.

11.1 Noise Levels During Construction

Based on the indicative construction works discussed in the main EIS (Chapter 8), the key noise generating construction works for Phase C would be similar to Phase A and require the equipment in **Table 31**.

Table 31 Predicted Noise Levels Phase C Construction

Construction Activity	Predicted Noise Level, dBA L_{Aeq}		
	Casula NML = 49 dBA	**Wattle Grove NML = 45 dBA**	**Glenfield NML = 45 dBA**
Construction At The Main IMT Site For The Three Rail Access Option Layouts			
Piling	38 – **51**	38 – **48**	38 – 45
Excavation	31 – 43	30 – 37	31 – 38
Compaction	35 – 47	34 – 41	35 – 42
Heavy Vehicles with Main IMT site	27 – 39	27 – 33	27 – 34
Concreting	32 – 47	32 – 38	33 – 39
Construction Of IMEX Rail Tracks (rail access connection)			
Northern Rail Access Connection (including piling)	41 – **72**	36 – 42	37 – 37
Central Rail Access Connection (including piling)	41 – **58**	37 – 39	36 – 40
Southern Rail Access Connection (including piling)	42 – **54**	37 – 40	36 – **47**

Note **Bold** highlight denotes predicted noise level is above the daytime NMLs.

Construction At The Main IMT Site

For piling works, the predicted noise levels of up to 51 dBA $L_{Aeq(15minute)}$ at nearest receptors in Casula exceed the 49 dBA $L_{Aeq(15minute)}$ NML and predicted noise levels of up to 48 dBA $L_{Aeq(15minute)}$ exceed the 45 dBA $L_{Aeq(15minute)}$ NML at nearest receptors in Wattle Grove. Based on the predicted noise levels, to achieve the NMLs, construction noise mitigation would be required where piling is undertaken within 600 m of residences in Casula and within 850 m of residences in Wattle Grove and Glenfield.

Predicted noise levels from all other construction works within the Main IMT are predicted to achieve the adopted NMLs at residential receptors in Casula, Wattle Grove and Glenfield and would not trigger the requirement for noise mitigation.

Construction of Rail Access Connections

Construction of the interstate rail tracks would, depending upon the rail access connection option, be undertaken approximately 40 m to 200 m from nearest receptors in Casula. The predicted noise levels of up to 54 dBA to 72 dBA $L_{Aeq(15minute)}$ for the three rail access connection options exceed the 49 dBA $L_{Aeq(15minute)}$ NML at Casula and trigger the requirement for construction noise mitigation.

Based on the predicted noise levels, construction noise mitigation would be required where daytime rail construction works (including piling) for the rail access connection options are undertaken within 500 m of residential receptors in Casula. In the event rail construction works are required during the evening or night-time periods, noise mitigation would be required where residences are within 1,400 m from the construction works.

The predicted noise levels for the construction of the northern, central and southern rail access connection options achieve the NMLs at all residential receptors in Wattle Grove. The northern and central rail access connection options achieve the NMLs at all residential receptors in Glenfield, however predicted noise levels of 47 dBA $L_{Aeq(15minute)}$ during piling works for the southern rail access connection, of are up to 2 dBA above the NML at nearest receptors at the northern extent of Glenfield.

The predicted noise levels of up to 60 dBA $L_{Aeq(15minute)}$ are within the construction NMLs for non-residential receptors at all commercial premises and places of recreation including the Casula Powerhouse Museum which is 150 m from the nearest rail construction works for the central rail access option. Predicted noise levels of up to 53 dBA $L_{Aeq(15minute)}$ at nearest schools and churches are within the construction NMLs for education institutions and places of worship.

To assist the control of potential noise impacts during the construction, a range of noise management and mitigation measures have been provided in **Section 17**.

11.2 Ground Vibration Levels During Construction

Consistent with assessment of Early Works (**Section 8.2**) and Phase A works (**Section 9.2**), works where construction equipment is operated at least 40 m to 450 m from nearest receptors, no disturbance or cosmetic damage impacts are expected. The heavy vibratory rollers (10 – 12 tonnes) would not be used within 100 m of receptors.

11.3 Noise During Operation At Main IMT Site

To assess potential noise emissions during the operation of the Project between 2025 and 2030, the following equipment in **Table 32** were included in the noise prediction model representative of capacity operations for Phase C.

Table 32 Assessed Operations

Equipment	Number of Items
Working Track RMG	4
RMG	9
Side Pick	4
ITV	23
Switch Engine	3
Heavy Vehicles	13
On-site Rail Freight Movements	19 Daytime/ 6 evening/15 night-time

Note: The number of items (sources) includes a 10% reduction in total capacity to account for idling plant.

11.3.1 Neutral Meteorological Conditions

The predicted (unmitigated) noise levels at the assessed residential receptors in each suburb are summarised in **Table 33** (neutral meteorological conditions). The predicted noise levels at assessed receptors for the operation each concept design are detailed in **Appendix D**.

Whilst Phase C represents an increase in operations from Phase B, potential noise levels have not increased from predicted noise levels at all receptors due to additional buildings screening on-site noise emissions.

Table 33 Predicted Noise Levels – Neutral Conditions

Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Northern Rail Access	**Central Rail Access**	**Southern Rail Access**
Casula	28 – **44**	29 – **48**	27 – **47**
Wattle Grove	30 – 36	31 – **38**	30 – 37
Glenfield	29 – 32	30 – 34	27 – 30
Non-Residential Noise Sensitive Receptors	21 – 46	23 – 50	16 – 49

Note **Bold** highlight denotes predicted noise level exceeds the Project specific noise level criteria.

Northern Rail Access Option

At the assessed residential receptors at Buckland Road and Dunmore Crescent the predicted noise levels of up to 44 dBA $L_{Aeq(15minute)}$ comply with the daytime and evening noise criteria but exceed the night-time noise criterion by up to 6 dBA at all other assessed receptors in Casula. Applying the predicted noise levels at the other assessed receptors, the daytime, evening and night-time noise criteria are predicted to be achieved at the northern and southern extents of Casula.

At all the assessed residential receptors in Wattle Grove the predicted noise levels of up to 36 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 32 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Central Rail Access Option

Predicted noise levels of up to 48 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels exceed the daytime and evening noise criteria by 1 to 4 dBA at the receptors in Casula immediately opposite to the main IMT site. Based on predicted noise levels at the other assessed receptors, the daytime and evening noise criteria are achieved at the northern and southern extents of Casula. With the exception of the southern extent of Casula, predicted noise levels at the majority of receptors adjacent to the main IMT site exceed the night-time noise criterion by 1 to 10 dBA.

At all the assessed residential receptors in Wattle Grove the predicted noise levels of up to 38 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening noise criteria but marginally exceed the night-time noise criterion at the northern extent of Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 34 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Southern Rail Access Option

Predicted noise levels of up to 47 dBA $L_{Aeq(15minute)}$ exceed the daytime and evening noise criteria by 1 to 3 dBA and the night-time noise criterion by 1 to 9 dBA at the majority of receptors in Casula. Based on predicted noise levels at Slessor Road, noise levels comply with the daytime, evening and night-time noise criteria at southern extent of Casula.

At all the assessed residential receptors in Wattle Grove the predicted noise levels of up to 37 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 30 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

11.3.2 Adverse Meteorological Conditions

The predicted (unmitigated) noise levels at the assessed residential receptors in each suburb are summarised in **Table 34** (adverse meteorological conditions). The predicted noise levels at assessed receptors for the operation each concept design are detailed in **Appendix D**.

Table 34 Predicted Noise Levels – Adverse Conditions

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Northern Rail Access	**Central Rail Access**	**Southern Rail Access**
Casula	27 – **45**	29 – **50**	25 – **48**
Wattle Grove	38 – **41**	37 – **42**	35 – **41**
Glenfield	28 – 31	30 – 33	25 – 28
Non-Residential Noise Sensitive Receptors	21 – 47	24 – 51	15 – 49

Note **Bold** highlight denotes predicted noise level exceeds the Project specific noise level criteria.

Northern Rail Access Option

Based on predicted noise levels of up to 45 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels at the assessed residential receptors in Casula immediately opposite to the main IMT site levels marginally exceed the daytime and evening noise criteria by 1 dBA. Predicted noise levels to the northern and southern extent of Casula comply with the daytime and evening noise criteria.

Predicted noise levels exceed the night-time noise criterion by 2 to 7 dBA at the majority of assessed receptors. Based on predicted noise levels at the Slessor Road receptor, compliance to the night-time noise criteria is predicted at the southern extent of Casula.

Predicted noise levels of up to 41 dBA $L_{Aeq(15minute)}$ at the receptors on Wattle Grove comply with the evening noise criterion at all receptors but marginally exceed the daytime noise criterion by 1 dBA. The 37 dBA $L_{Aeq(15minute)}$ night-time noise criterion is exceeded at the majority of assessed receptors in Wattle Grove by up to 4 dBA.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 33 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Central Rail Access Connection Option

Referencing the predicted noise levels of up to 50 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels at the receptors immediately opposite the main IMT site exceed the daytime and evening noise criteria by 1 to 6 dBA. Based on predicted noise levels of up to 39 dBA $L_{Aeq(15minute)}$ at the receptors on Leacocks Lane and Slessor Road, the daytime and evening noise criteria is achieved at receptors located in the south of Casula.

The night-time noise criterion is exceeded by 1 to 12 dBA at the majority of assessed receptors in Casula. Referencing the predicted noise level of 34 dBA $L_{Aeq(15minute)}$ at the Slessor Road receptor, the night-time noise criterion would be achieved at the southern extent of Casula.

Predicted noise levels of up to 42 dBA $L_{Aeq(15minute)}$ at receptors in Wattle Grove comply with the daytime noise criterion and, based on noise levels at the Anzac Road receptor, marginally exceed the evening criterion by 1 dBA at the northern extent of Wattle Grove. The night-time noise criterion is exceeded by 1 to 5 dBA at all the assessed receptors in Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 33 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Southern Rail Access Connection Option

Referencing the predicted noise levels of up to 48 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, noise levels at the receptors immediately opposite the main IMT site exceed the daytime and evening noise criteria by 1 to 4 dBA. Based on predicted noise levels of up to 36 dBA $L_{Aeq(15minute)}$ at the receptors on Leacocks Lane and Slessor Road, the daytime and evening noise criteria is achieved at receptors located in the south of Casula.

The night-time noise criterion is exceeded by 1 to 10 dBA at the majority of assessed receptors in Casula. Referencing the predicted noise levels at Leacocks Lane and Slessor Road, the night-time noise criterion would be achieved at the southern extent of Casula.

Predicted noise levels at receptors in Wattle Grove comply with the daytime and evening noise criteria. The night-time noise criterion is achieved at the majority of assessed receptors, however based on predicted noise levels of up to 41 dBA $L_{Aeq(15minute)}$ at the receptors on Yallum Crescent and Anzac Road, the night-time noise criterion is exceeded by up to 4 dBA at the nearest receptors.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 28dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

11.3.3 Rail Access Connection

The daily rail freight movements in **Table 35** represent the total peak rail traffic in and out of the Main IMT site during Phase C operations.

Table 35 Daily Rail Freight Movements

Phase C	Daytime	Evening	Night-time
IMEX Track	19	6	15

Note: It has been assumed that the daytime, evening and night-time rail freight movements will be evenly distributed over each period (11 hour daytime, 4 hour evening and 9 hour night-time).

For each of the concept designs rail noise levels from the section of IMEX track connecting the site boundary to the SSFL have been predicted at Casula, Wattle Grove and Glenfield, as summarised in **Table 36**. The predicted noise levels do not vary between the 11 hour daytime, 4 hour evening and 9 hour night-time periods as the 24 hour rail movements are evenly distributed.

Table 36 Predicted Noise Levels From Rail Access Connection to SSFL

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Daytime L_{Aeq} Criteria = 55 dBA	**Evening L_{Aeq} Criteria = 45 dBA**	**Night-time L_{Aeq} Criteria = 40 dBA**
Northern Rail Access			
Casula	<10 – **57**	<10 – **56**	<10 – **57**
Wattle Grove	16 – 21	16 – 20	16 – 21
Glenfield	<10 – 27	<10 – 27	<10 – 27
Non-Residential Noise Sensitive Receptors	<10 – 34	<10 – 31	<10 – 31
Central Rail Access			
Casula	110 – 40	11 – 40	11 – 40
Wattle Grove	14 – 19	14 – 20	14 – 20
Glenfield	12 – 25	12 – 26	12 – 26
Non-Residential Noise Sensitive Receptors	<10 – 41	<10 – 42	<10 – 42
Southern Rail Access			
Casula	26 – 40	26 – 40	26 – 40
Wattle Grove	22 – 31	22 – 31	22 – 31
Glenfield	21 – 37	21 – 37	21 – 37
Non-Residential Noise Sensitive Receptors	13 – 39	13 – 39	13 – 39

Note: The predicted rail noise levels assumes curve radius of well above 300m without the development of curve squeal.

Northern Rail Access Connection Option

Based on predicted noise levels of up to 57 dBA $L_{Aeq(9hour)}$ at Lakewood Crescent and St Andrews Boulevard, the predicted noise levels at the northern extent of Casula exceed the daytime noise criterion by 2 dBA, the evening noise criterion by 11 dBA and the night-time noise criterion by 17 dBA. At all other receptors the noise levels comply with the daytime, evening and night-time noise criteria.

Predicted noise levels at all assessed receptors in Wattle Grove and Glenfield comply with the daytime, evening and night-time amenity noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

Central Rail Access Connection Option

At all assess residential receptors in Casula, Wattle Grove and Glenfield the predicted noise levels comply with the daytime, evening and night-time noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

Southern Rail Access Connection Option

At all assess residential receptors in Casula, Wattle Grove and Glenfield the predicted noise levels comply with the daytime, evening and night-time noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

12 NOISE ASSESSMENT – PROJECT FULL BUILD

The Full Build of the Project from 2030 is the operation of the IMEX facility up to 1.05 million TEU per annum and the interstate facility up to 0.5 million TEU per annum and up to 300,000 sq. m of warehousing. All predicted noise levels for operation of the Project are for the concept layout options without noise mitigation.

12.1 Noise During Operation At Main IMT Site

To assess potential noise emissions during the operation of the Project from 2030, the following equipment in **Table 37** were included in the noise prediction model representative of capacity operations for Project Full Build.

Table 37 Assessed Operations

Equipment	Number of Items
Working Track RMG	8
RMG	14
Side Pick	5
ITV	48
Switch Engine	3
Heavy Vehicles	25
On-site Rail Freight Movements	IMEX trains 19 daytime/6 evening/15 night-time
	Interstate trains 3 daytime/evening/3 night-time

Note: The number of items (sources) includes a 10% reduction in total capacity to account for idling plant.

12.1.1 Neutral Meteorological Conditions

The predicted (unmitigated) noise levels at the assessed residential receptors in each suburb are summarised in **Table 38** (neutral meteorological conditions). The predicted noise levels at assessed receptors for the operation each concept design are detailed in **Appendix E**.

Table 38 Predicted Noise Levels – Neutral Conditions

Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Northern Rail Access	Central Rail Access	Southern Rail Access
Casula	30 – **47**	31 – **51**	29 – **49**
Wattle Grove	33 – **38**	32 – **39**	32 – **39**
Glenfield	32 – 35	31 – 34	29 – 32
Non-Residential Noise Sensitive Receptors	24 – 49	24 – 53	18 – 52

Note **Bold** highlight denotes predicted noise level exceeds the Project specific noise level criteria.

Northern Rail Access Option

Based on predicted noise levels of up to 47 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, the noise levels at receptors in Casula immediately opposite the main IMT site exceed the daytime and evening noise criteria by up to 3 dBA. Based on predicted noise levels of up to 42 dBA $L_{Aeq(15minute)}$ at the assessed receptors on Lakewood Crescent and Slessor Road, noise levels comply with the daytime and evening noise criteria at the northern and southern extents of Casula. Noise levels exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 9 dBA at the majority of assessed receptors. Predicted noise levels comply with the night-time criterion at the southern extent of Casula.

Predicted noise levels of up to 38 dBA $L_{Aeq(15minute)}$at receptors in Wattle Grove comply with the daytime and evening noise criteria. Predicted noise levels comply with the 37 dBA $L_{Aeq(15minute)}$ night-time noise criteria at the majority of receptors, however based on noise levels predicted at Anzac Road the night-time noise criteria is marginally exceeded by 1 dBA at the northern extent of Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 35 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Central Rail Access Option

Based on predicted noise levels of up to 51 dBA $L_{Aeq(15minute)}$ at Buckland Road and Dunmore Crescent, the noise levels in Casula exceed the daytime and evening noise criteria by up to 7 dBA at the majority of assessed receptors. Based on predicted noise levels of up to 42 dBA $L_{Aeq(15minute)}$ at the assessed receptors on Lakewood Crescent, Leacocks Lane and Slessor Road, noise levels comply with the daytime and evening noise criteria at the northern and southern extents of Casula. Noise levels exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 12 dBA at the majority of assessed receptors. Predicted noise levels comply with the night-time criterion at the southern extent of Casula.

Predicted noise levels of up to 39 dBA $L_{Aeq(15minute)}$ at receptors in Wattle Grove comply with the daytime and evening noise criteria. Noise levels comply with the night-time noise criterion at the majority of assessed receptors but marginally exceeded the 37 dBA $L_{Aeq(15minute)}$ criterion by 2 dBA at the northern extent of Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 34 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Southern Rail Access Connection Option

The predicted noise levels of up to 49 dBA $L_{Aeq(15minute)}$ exceed the daytime and evening noise criteria by up to 5 dBA at the majority of assessed receptors. Based on predicted noise levels of up to 42 dBA $L_{Aeq(15minute)}$ at the assessed receptors on Lakewood Crescent, Leacocks Lane and Slessor Road, noise levels comply with the daytime and evening noise criteria at the northern and southern extents of Casula.

Noise levels exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 11 dBA at the majority of assessed receptors but do comply with the night-time criterion at the southern extent of Casula.

Predicted noise levels of up to 39 dBA $L_{Aeq(15minute)}$ at receptors in Wattle Grove comply with the daytime and evening noise criteria. Noise levels comply with the night-time noise criterion at the majority of assessed receptors but marginally exceeded the 37 dBA $L_{Aeq(15minute)}$ criterion by 2 dBA at the northern extent of Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 34 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

12.1.2 Adverse Meteorological Conditions

For each unmitigated rail access option conceptual layout, the predicted noise levels at the assessed residential receptors in each suburb are summarised in **Table 39** (adverse meteorological conditions). The predicted noise levels at assessed receptors for the operation of each rail access option are detailed in **Appendix E**.

Table 39 Predicted Noise Levels – Adverse Conditions

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Northern Rail Access	Central Rail Access	Southern Rail Access
Casula	36 – **49**	30 – **52**	29 – **51**
Wattle Grove	34 – **43**	34 – **44**	31 – **44**
Glenfield	31 – 34	31 – 34	28 – 31
Non-Residential Noise Sensitive Receptors	23 – 51	25 – 54	18 – 52

Note **Bold** highlight denotes predicted noise level exceeds the Project specific noise level criteria.

Northern Rail Access Option

Predicted noise levels of up to 49 dBA $L_{Aeq(15minute)}$ at the majority of assessed receptors in Casula exceed the daytime and evening noise criteria by up to 5 dBA and the night-time noise criterion by up to 11 dBA. Based on predicted noise levels of up to 36 dBA $L_{Aeq(15minute)}$ at the receptor on Slessor Road, noise levels at the southern extent of Casula are predicted to comply with the daytime, evening and night-time noise criteria.

Predicted noise levels and at the majority of assessed receptors in Wattle Grove comply with the daytime and evening noise criteria. Based on a predicted noise level of 43 dBA $L_{Aeq(15minute)}$ at the Anzac Road receptor, noise levels exceed the daytime and evening noise criteria by 1 to 2 dBA at the northern extent of Wattle Grove. The night-time noise criterion is exceeded by 1 to 6 dBA at all the assessed receptors in Wattle Grove.

At the assessed residential receptors in Glenfield the predicted noise levels of up to 34 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Central Rail Access Option

Predicted noise levels of up to 52 dBA $L_{Aeq(15minute)}$ at the receptors in Casula exceed the daytime and evening noise criteria by up to 7 dBA at the majority of assessed receptors. Based on predicted noise levels of up to 41 dBA $L_{Aeq(15minute)}$ at the assessed receptors on Leacocks Lane and Slessor Road, noise levels comply with the daytime and evening noise criteria at the southern extent of Casula. Noise levels exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 14 dBA at the majority of assessed receptors but comply with the criterion at the southern extent of Casula.

Predicted noise levels of up to 44 dBA $L_{Aeq(15minute)}$ at most receptors in Wattle Grove comply with the daytime noise criterion. However, based on noise levels at the Anzac Road receptor, noise levels marginally exceed the evening criterion by 3 dBA at the northern extent of Wattle Grove. The night-time noise criterion is exceeded by 4 to 7 dBA at all the assessed receptors in Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 34 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

Southern Rail Access Option

Predicted noise levels of up to 51 dBA $L_{Aeq(15minute)}$ at the receptors in Casula exceed the daytime and evening noise criteria by up to 7 dBA at the majority of assessed receptors. Based on predicted noise levels at the assessed receptors on Leacocks Lane and Slessor Road, noise levels comply with the daytime and evening noise criteria at the southern extent of Casula. Noise levels exceed the 38 dBA $L_{Aeq(15minute)}$ night-time noise criterion by up to 13 dBA at the majority of assessed receptors but comply with the criterion at the southern extent of Casula.

Predicted noise levels of up to 44 dBA $L_{Aeq(15minute)}$ at receptors in Wattle Grove exceed the daytime noise criteria by 1 to 4 dBA but comply with the evening noise criteria at most receptors. The predicted exceedance of evening noise criteria by 3 dBA occurs to the northern extent of Wattle Grove. The night-time noise criterion is exceeded by 4 to 7 dBA at all the assessed receptors in Wattle Grove.

At all the assessed residential receptors in Glenfield the predicted noise levels of up to 31 dBA $L_{Aeq(15minute)}$ comply with the daytime, evening and night-time noise criteria.

At all non-residential receptors the predicted noise levels comply with the daytime, evening and night-time amenity noise criteria of the NSW INP.

To assist the interpretation of predicted noise levels, the predicted noise level contours for the Full Build IMT operations (excluding the rail access connection) are shown in **Figure 7** (North rail access otpion), **Figure 8Figure 8** (Central rail access option) and **Figure 9** (Southern rail access option). All noise levels were predicted for neural meteorological conditions.

Figure 7 Predicted Noise Level – Full Build Operations (Northern Rail Access Option)

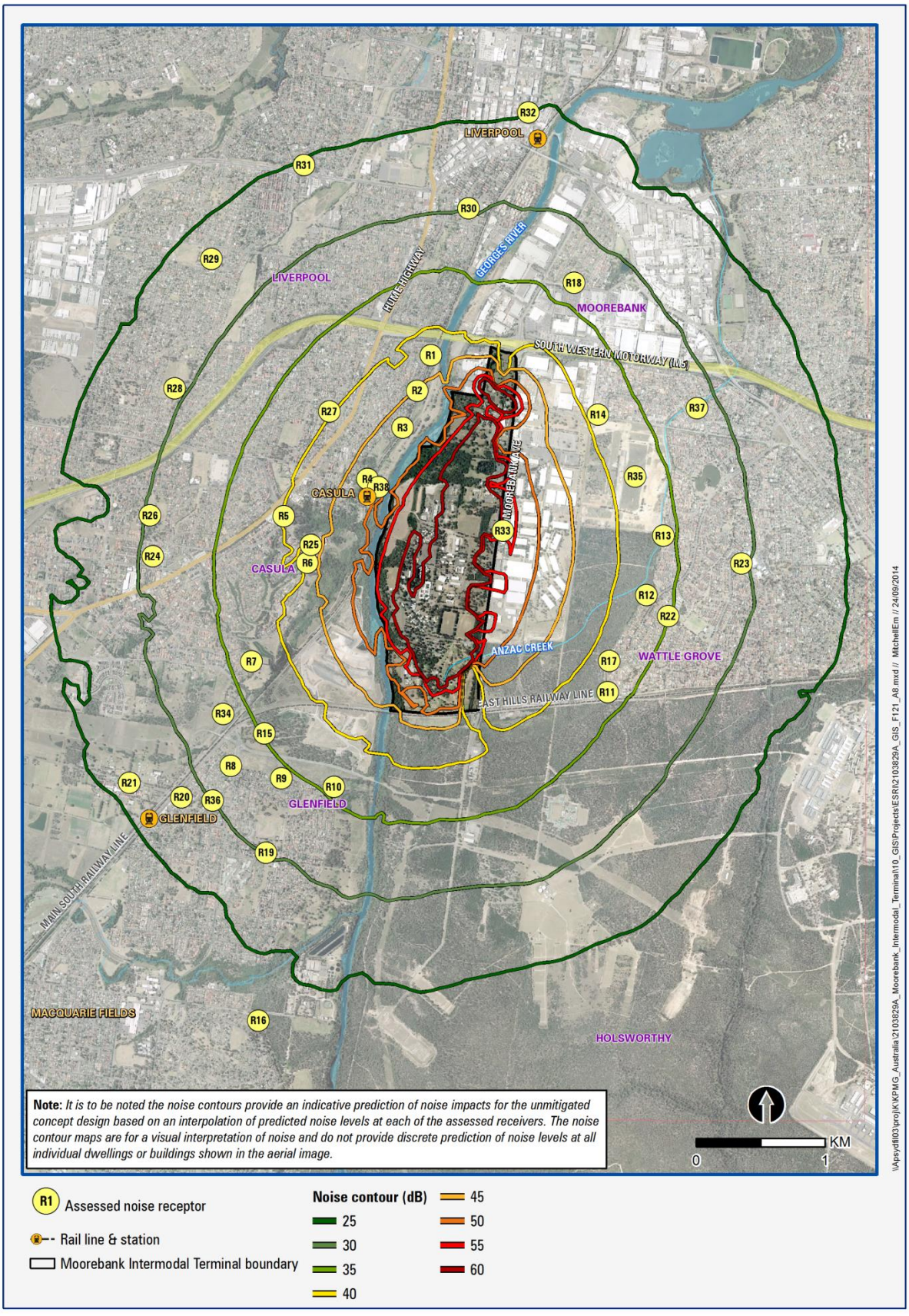


Figure 8 Predicted Noise Level – Full Build Operations (Central Rail Access Option)

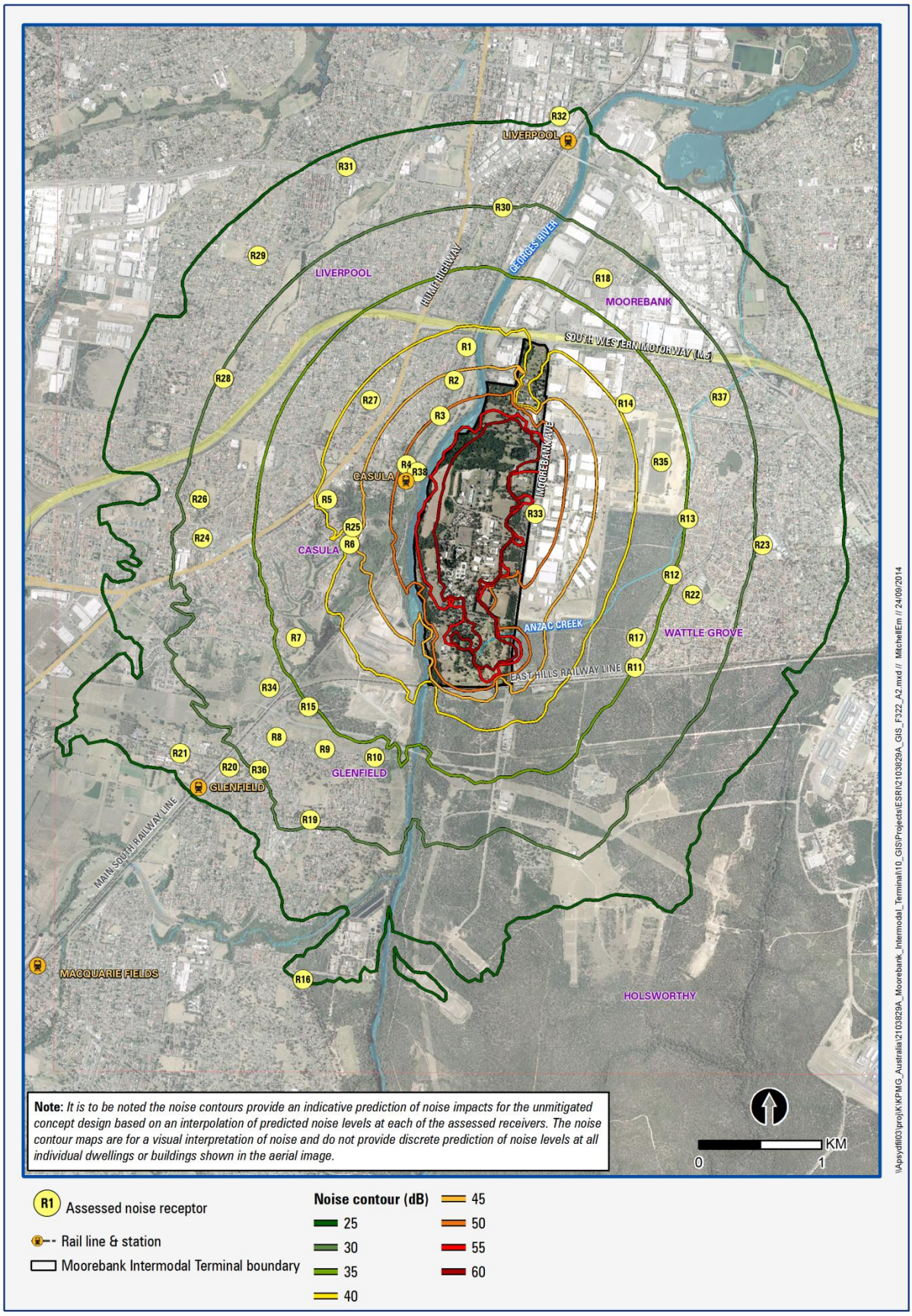
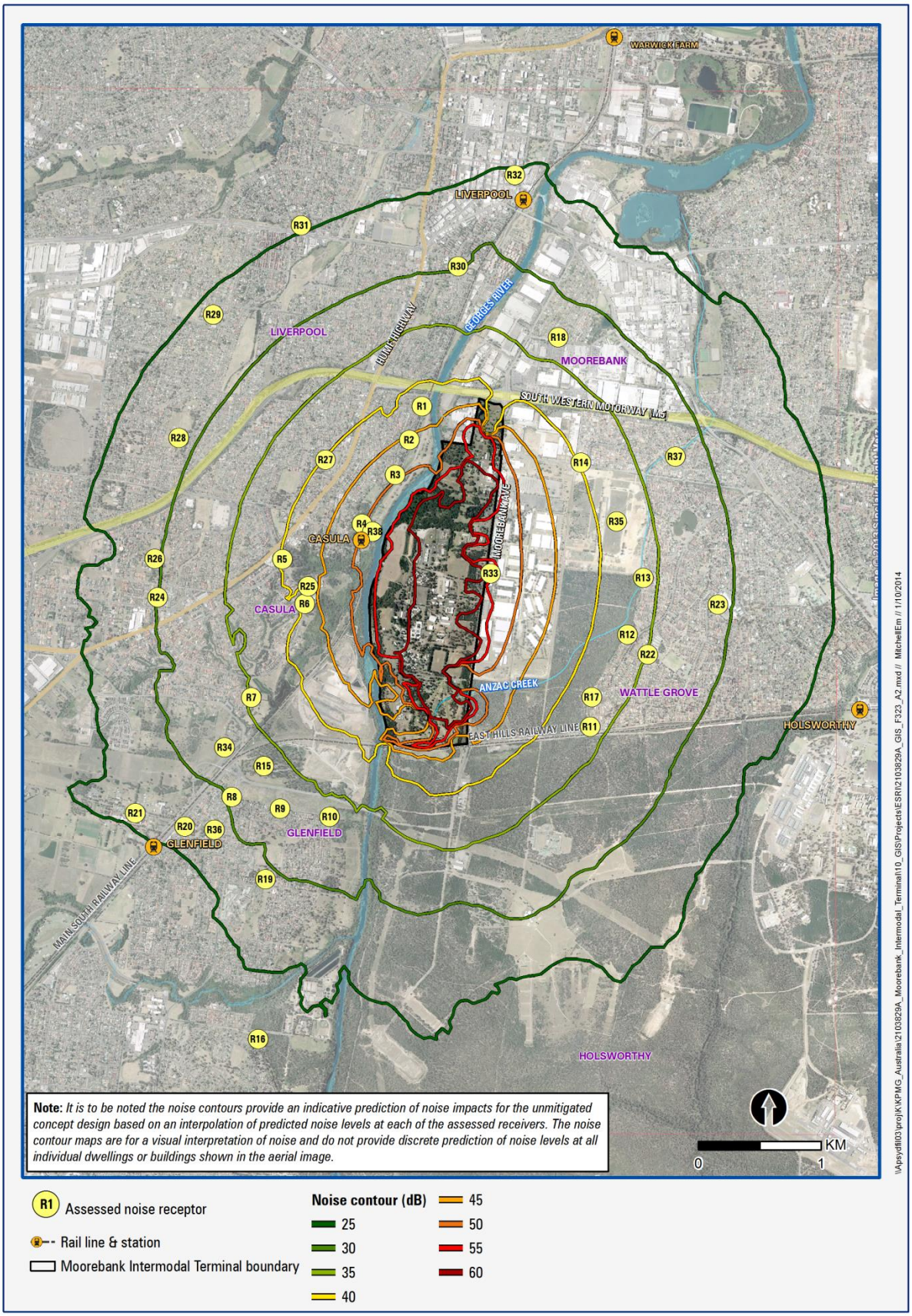


Figure 9 Predicted Noise Level – Full Build Operations (Southern Rail Access Option)



12.1.3 Noise From Operation Of Rail Access Connection

The daily rail freight movements in **Table 40** represent the total peak rail traffic in and out of the Main IMT site during Full Build operations.

Table 40 Daily Rail Freight Movements

Phase B	Daytime	Evening	Night-time
IMEX Track	19	6	15
Interstate Track	1	1	1

Note: It has been assumed that the daytime, evening and night-time rail freight movements will be evenly distributed over each period (11 hour daytime, 4 hour evening and 9 hour night-time).

Predicted rail noise levels from the section of IMEX track connecting the site boundary to the SSFL have been predicted at Casula, Wattle Grove and Glenfield, as summarised in **Table 41**.

The predicted noise levels do not significantly vary between the 11 hour daytime, 4 hour evening and 9 hour night-time periods as the 24 hour rail movements are evenly distributed. The daily movements of interstate trains are predicted to not influence rail noise levels at receptors which are dominated by noise from the IMEX trains.

Table 41 Predicted Noise Levels From Rail Access Connection to SSFL

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Daytime L_{Aeq} Criteria = 55 dBA	Evening L_{Aeq} Criteria = 45 dBA	Night-time L_{Aeq} Criteria = 40 dBA
Northern Rail Access Option			
Casula	10 – **57**	<10 – **56**	10 – **57**
Wattle Grove	16 – 21	10 – 21	17 – 21
Glenfield	10 – 27	<10 – 27	10 – 27
Non-Residential Noise Sensitive Receptors	<10 – 35	<10 – 35	<10 – 35
Central Rail Access Option			
Casula	11 – 40	11 – 40	15 – 40
Wattle Grove	14 – 18	14 – 17	14 – 18
Glenfield	13 – 26	13 – 25	13 – 26
Non-Residential Noise Sensitive Receptors	<10 – 42	<10 – 41	<10 - 42
Southern Rail Access Option			
Casula	26 – 40	25 – 39	30 – 40
Wattle Grove	22 – 31	21 – 30	22 – 31
Glenfield	22 – 37	21 – 37	22 – 37
Non-Residential Noise Sensitive Receptors	13 – 39	13 – 39	13 – 39

Note: The predicted rail noise levels assumes curve radius of well above 300m without the development of curve squeal.

Northern Rail Access Connection Option

Based on predicted noise levels of up to 57 dBA L_{Aeq} at Lakewood Crescent, St Andrews Boulevard and Buckland Road the predicted noise levels at the northern extent of Casula exceed the daytime noise criterion by 2 dBA, the evening noise criterion by 11 dBA and the night-time noise criterion by 17 dBA. At all other assessed receptors further to the south in Casula the noise levels comply with the daytime, evening and night-time noise criteria.

Predicted noise levels at all assessed receptors in Wattle Grove and Glenfield comply with the daytime, evening and night-time amenity noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

Central Rail Access Connection Option

At all assess residential receptors in Casula, Wattle Grove and Glenfield the predicted noise levels comply with the daytime, evening and night-time noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

Southern Rail Access Connection Option

At all assess residential receptors in Casula, Wattle Grove and Glenfield the predicted noise levels comply with the daytime, evening and night-time noise criteria. Predicted noise levels at non-residential noise sensitive receptors comply with the NSW INP amenity criteria.

13 SLEEP DISTURBANCE ASSESSMENT

Operational events during the night-time and early morning, such as containers being manoeuvred heavily and shunting of rail freight, can result in short-lived high noise events with the potential to lead to sleep disturbance.

To identify where sleep disturbance may be an issue, a typical noise event of maximum sound power level 120 dBA L_{Amax} was included in the noise prediction model to be representative of container handling. To provide a worse case assessment of likely noise levels, the noise source was located to the west of the Main IMT site where container storage and on-site buildings would not screen the propagation of noise.

Potential maximum noise levels in **Table 42** were predicted at the nearest receptors in Casula, indicative of nearest receptors with direct line of sight to the Main IMT site.

Table 42 Predicted Maximum Noise Levels

Receptor		Predicted Maximum Noise Level, L_{Amax} dBA
R1	Lakewood Crescent, Casula	37
R2	St Andrews Boulevard, Casula	42
R3	Buckland Road, Casula	47
R4	Dunmore Crescent, Casula	45
R5	Leacocks Lane, Casula	33
R6	Leacocks Lane, Casula	20
R7	Slessor Road, Casula	25

Based on the predicted maximum noise levels of up to 47 dBA L_{Amax} at nearest receptors in Casula, the sleep disturbance objectives of 47 dBA L_{Amax} at Casula and 48 dBA L_{Amax} at Wattle Grove and Glenfield would be achieved at all assessed receptors. Consistent with OEH guidelines, by complying with the sleep disturbance objectives a more detailed assessment of potential sleep disturbance impacts is not required.

Due the total number of equipment (noise sources) operating with the main IMT site, discrete high noise events may not be audible at the nearest receptors. Where noise from short-lived events is audible, the potential characteristics, such as bangs, crashes and other impact sounds, can be distinguishable from other noise generated by the Project and the surrounding road and rail transport networks. Consequently, even where the sleep disturbance noise objectives are achieved the Project should implement necessary measures to limit the potential for short-lived high noise events.

For the nearest residential receptors in Casula potentially affected by rail noise, the predicted maximum (L_{Amax}) noise levels from the worst case IMEX and interstate train movements during the Full Build are summarised in **Table 43**.

Table 43 Predicted Maximum Noise Levels From Rail Access Connection

Rail Access Connection Layout	Predicted Maximum Noise Level, L_{Amax} dBA
Northern rail access connection	39 – 86
Central rail access connection	35 – 68
Southern rail access connection	45 – 63

There are no specific objectives specified in the RING for assessing sleep disturbance from a non-network rail line. For a network rail line the RING proposes maximum noise design objectives of 80 dBA L_{Amax} for a new rail corridor and 85 dBA L_{Amax} for a redevelopment of a rail corridor. The SSFL has been designed to an 80 dBA L_{Amax} maximum noise criterion. As such applying the sleep disturbance objectives of 47 dBA L_{Amax} at Casula and 48 dBA L_{Amax} at Wattle Grove and Glenfield to train movements on the rail access connection is considered onerous.

The maximum noise levels are predicted to be within 80 dBA L_{Amax} at the nearest receptors in Casula for the central and southern rail access connection layouts. Predicted noise levels for the northern rail access of up to 83 dBA L_{Amax} at Lakewood Crescent and 86 dBA L_{Amax} at Buckland Road in Casula are above the commonly used maximum noise objectives for rail. Sleep disturbance impacts may therefore be experienced at the nearest receptors to the northern rail access connection.

The predicted noise levels at all assessed residential receptors in Wattle Grove and Glenfield comply with the adopted 80 dBA L_{Amax} sleep disturbance objective for all three rail access connection options.

It is recommended that a detailed assessment of sleep disturbance impacts from train movements is undertaken during the further noise impact assessments for the future approvals and detailed design. Where deemed necessary, mitigation measures, such as recommended in **Section 17** of this Technical Paper, may be required to reduce and control maximum noise events from sources such as locomotive exhausts and wagon bunching.

14 NOISE ON NETWORK RAIL LINE

Rail freight for the Project will operate on the SSFL with IMEX and interstate trains accessing the site via the SSFL on the purpose built rail access. The SSFL officially opened in January 2013 and the initial operation of the Project will be within the capacity of the SSFL.

At Full Build, the Moorebank IMT will require the following train journeys (return journeys are presented along with one-way train paths in brackets):

- For 1.05 million TEU IMEX, 20 train return movements (40 one-way) per day
- For 500 million TEU Interstate 1.7 average per day (3.5)
- Total (IMEX plus interstate) = 21.7 (43.5) average per day.

The SSFL capacity currently is 24 (48) train paths per day, which is sufficient for the total demand generated by the Moorebank IMT. Analysis of future demand on the SSFL shows a likely need to upgrade the SSFL in the future and this need for capacity increase is foreshadowed by the Australian Rail Track Corporation (ARTC's 2013) *SSFL Operational Noise and Vibration Management Plan* (ONVMP), which assessed and designed noise mitigation for 62 freight train movements per day in year 2020.

However, the extent to which other operators will occupy the SSFL in future is not known. Therefore the relationship between the Moorebank IMT demand and the need for an upgrade is unproven, especially given that Moorebank's demand is within the current capacity. Should the proposal require upgrades to the SSFL in the future, this would become a matter to be addressed as part of the broader operations of the SSFL.

It is understood no rail operations from the Project would occur on the East Hills Railway Line corridor; the Moorebank IMT would not directly influence future rail noise emissions from this rail corridor.

14.1 Southern Sydney Freight Line Noise Assessment

Potential rail noise from the SSFL was considered during the approval of the SSFL project, as detailed in the ONVMP prepared by ARTC in March 2013. The assessed rail noise levels in the noise and vibration management plan are representative of SSFL operations including the capacity for IMEX and interstate rail freight. An independent assessment of SSFL rail noise levels has not been required for this Technical Paper.

Detailed prediction of rail noise was undertaken in the noise and vibration management plan to assess rail noise levels to the SSFL rail noise criteria of 55 dBA $L_{Aeq,24hour}$ and 80 dBA L_{Amax} at residential receptors. Where necessary, the assessed noise levels were applied to inform the recommendation of mitigation measures to reduce potential rail noise impacts.

14.2 Rail Noise Assessment Methodology

Rail noise levels were predicted with a rail noise model developed with the CadnaA software. The model adopted datasets for local terrain, the design of the SSFL, track speeds and passenger and freight rail services to calculate rail noise levels at nearest receptors adjacent to the SSFL rail corridor.

Rail noise predictions were undertaken with and without the SSFL project to determine the L_{Aeq} and L_{Amax} noise levels and any potential increase or decrease in rail noise with the project. Both the predicted noise levels and potential change in rail noise with the project were considered in the determination of noise mitigation.

Rail noise levels were not predicted at receptors in Wattle Grove, as based on the assessment of rail noise levels at receptors in closer proximity to the rail line than Wattle Grove, potential operational noise levels would comply with the planning noise criteria.

14.3 Predicted Rail Noise Levels

Predicted day time and night-time rail noise levels from the planned operation of the SSFL at Casula and Glenfield are detailed in **Table 44**. The predicted noise levels are referenced from the ONVMP and are based on receiver catchments applied to the noise modelling; maximum L_{Amax} noise levels were not predicted for all receptors.

Table 44 SSFL Operational Rail Noise

Location	Predicted Operational Rail Noise Level, dBA	
	24 hour L_{Aeq}	L_{Amax}
Casula		
Phoenix Crescent	64.2	-
Lakewood Crescent	67.1	-
St Andrews Boulevard	68.1 – 69.2	85.8
Buckland Avenue	54.4 – 69.3	-
Marsh Parade	53.7 – 56.1	-
Ashcroft Avenue	53.4	-
Dunmore Crescent	62.9	-
Leacocks Lane	43.5 – 48.4	-
Slessor Road	56.8 – 57.7	-
Casula Powerhouse Museum	68.4	89.1
Glenfield		
Foreman Street	65.6	-
Railway Parade	64.8 – 65.6	-
Wentworth Avenue	64.5	-
Newtown Road	59.7	-
Roy Watts Road	61.3	73

Note Source – SSFL Operational Noise and Vibration Management Plan (ARTC)

14.4 Noise Mitigation

The ONVMP identified that noise mitigation may be required to reduce rail noise at the Casula Powerhouse Arts Centre and some residences in Casula. ARTC has advised MIC that noise mitigation, in the form of a noise barrier and acoustic property treatment (windows and louvers), has been implemented at the Casula Powerhouse Arts Centre to control SSFL noise. It is understood that ARTC is currently undertaken verification measurements of SSFL rail noise to ascertain if any additional noise mitigation at noise sensitive receptors in Casula is required.

The existing and any future noise mitigation implemented for the SSFL would be expected to attenuate noise contributions from rail freight associated with the IMT project where the IMT project operates within the design capacity of the SSFL.

A copy of the ONVMP can be obtained at the website address below. Contained within the noise and vibration management plan are the predicted noise levels and the design drawings which detail the recommended noise barrier locations.

https://www.ssfl.artc.com.au/approvals/

15 ASSESSMENT OF ROAD TRAFFIC NOISE

Road traffic for the construction and operation of the Project will utilise the existing road network with light and heavy vehicles accessing the Main IMT site from Moorebank Avenue. The majority of road traffic will operate on the M5 Motorway in the east and west directions with a small proportion of road traffic using Anzac Road.

A review of the long term noise monitoring data (L_{Aeq} noise levels) at location L3 Todd Court indicate that existing road traffic noise levels from the M5 Motorway exceed the 60 dBA $L_{Aeq(15hour)}$ daytime and 55 dBA $L_{Aeq(9hour)}$ night-time noise criteria at residences adjacent to the Motorway. Accordingly, the Project should not increase existing road traffic noise by greater than 2 dBA and noise mitigation would be considered where existing/future daytime and/or night-time L_{Aeq} road noise levels are exceeded by 12 dBA or more.

Based on the separation distances of at least 600 m to nearest receptors to Moorebank Avenue and measured existing ambient noise levels, potential road traffic noise levels from Moorebank Avenue (between south of the M5 Motorway and Cambridge Avenue) are expected to comply with the RNP. Consequently the contribution of Project road traffic shall not result in overall road traffic noise levels greater than 60 dBA $L_{Aeq(15hour)}$ daytime and 55 dBA $L_{Aeq(9hour)}$ night-time.

Nearest residences are approximately 15 m from Anzac Road and based on future existing road traffic volumes in 2015 (without the Project), the road traffic noise levels are likely to be above the 60 dBA $L_{Aeq(15hour)}$ daytime and 55 dBA $L_{Aeq(9hour)}$ night-time noise criteria. In line with the RNP, the Project should not increase existing road traffic noise from Anzac Road by greater than 2 dBA and noise mitigation would be considered where existing/future daytime and/or night-time L_{Aeq} road noise levels are exceeded by 12 dBA or more.

15.1 Road Traffic Volumes

The future existing road traffic volumes (without the Project 'no build') and total road traffic volumes, including the construction and operation of the Project, are summarised in **Table 45** for daytime volumes and **Table 46** for night-time volumes.

Table 45 Daytime Road Traffic Volumes

Phase	Road	Future Existing Traffic		Future Traffic With IMT	
		Total Traffic	% Heavy Vehicles	Total Traffic	% Heavy Vehicles
Early Works	M5 Motorway between Moorebank Avenue and Hume Highway	127,385	10	127,657	10
	M5 Motorway between Moorebank Avenue and Heathcote Road	115,545	10	115,635	10
	Moorebank Avenue between Anzac Road and M5 Motorway	14,630	6	15,046	6
	Moorebank Avenue between Cambridge Ave. and Anzac Road	12,757	4	12,935	4
	Anzac Road between Delfin Drive East and Delfin Drive West	9,027	3	9,090	3
Phase A	M5 Motorway between Moorebank Avenue and Hume Highway	131,952	10	134,086	11
	M5 Motorway between Moorebank Avenue and Heathcote Road	121,905	10	122,512	11
	Moorebank Avenue between Anzac Road and M5 Motorway	14,802	6	17,974	16
	Moorebank Avenue between Cambridge Ave. and Anzac Road	12,897	4	13,536	4
	Anzac Road between Delfin Drive East and Delfin Drive West	9,248	3	9,472	3

Phase	Road	Future Existing Traffic		Future Traffic With IMT	
		Total Traffic	% Heavy Vehicles	Total Traffic	% Heavy Vehicles
Phase B	M5 Motorway between Moorebank Avenue and Hume Highway	140,663	11	144,963	12
	M5 Motorway between Moorebank Avenue and Heathcote Road	125,977	11	127,191	12
	Moorebank Avenue between Anzac Road and M5 Motorway	16,159	6	22,540	22
	Moorebank Avenue between Cambridge Ave. and Anzac Road	14,055	4	15,269	4
	Anzac Road between Delfin Drive East and Delfin Drive West	11,015	3	11,440	3
Phase C	M5 Motorway between Moorebank Avenue and Hume Highway	147,945	11	153,090	12
	M5 Motorway between Moorebank Avenue and Heathcote Road	130,039	11	131,491	11
Phase C	Moorebank Avenue between Anzac Road and M5 Motorway	17,028	6	24,664	24
	Moorebank Avenue between Cambridge Ave. and Anzac Road	14,907	4	16,360	4
	Anzac Road between Delfin Drive East and Delfin Drive West	12,520	3	13,029	3
Full Build	M5 Motorway between Moorebank Avenue and Hume Highway	150,056	11	154,919	13
	M5 Motorway between Moorebank Avenue and Heathcote Road	131,565	11	132,896	12
	Moorebank Avenue between Anzac Road and M5 Motorway	17,173	6	24,350	25
	Moorebank Avenue between Cambridge Ave. and Anzac Road	15,086	4	16,133	4
	Anzac Road between Delfin Drive East and Delfin Drive West	13,128	3	13,494	3

Note Daytime is the period 7.00 am to 10.00 pm and night-time is the period 10.00 pm to 7.00 am.

Table 46 Night-Time Road Traffic Volumes

Phase	Road	Future Existing Traffic		Future Traffic With IMT	
		Total Traffic	% Heavy Vehicles	Total Traffic	% Heavy Vehicles
Early Works	M5 Motorway between Moorebank Avenue and Hume Highway	15,080	10	15,164	10
	M5 Motorway between Moorebank Avenue and Heathcote Road	11,739	10	11,768	10
	Moorebank Avenue between Anzac Road and M5 Motorway	2,951	5	3,081	5
	Moorebank Avenue between Cambridge Ave. and Anzac Road	3,021	4	3,086	4
	Anzac Road between Delfin Drive East and Delfin Drive West	2,317	2	2,339	2

Phase	Road	Future Existing Traffic		Future Traffic With IMT	
		Total Traffic	% Heavy Vehicles	Total Traffic	% Heavy Vehicles
Phase A	M5 Motorway between Moorebank Avenue and Hume Highway	15,620	10	15,936	10
	M5 Motorway between Moorebank Avenue and Heathcote Road	12,385	10	12,492	10
	Moorebank Avenue between Anzac Road and M5 Motorway	2,986	5	3,473	5
	Moorebank Avenue between Cambridge Ave. and Anzac Road	3,054	4	3,286	4
	Anzac Road between Delfin Drive East and Delfin Drive West	2,374	2	2,455	2
Phase B	M5 Motorway between Moorebank Avenue and Hume Highway	16,654	11	17,205	11
	M5 Motorway between Moorebank Avenue and Heathcote Road	12,799	11	12,978	11
	Moorebank Avenue between Anzac Road and M5 Motorway	3,259	5	4,099	8
	Moorebank Avenue between Cambridge Ave. and Anzac Road	3,328	4	3,669	4
	Anzac Road between Delfin Drive East and Delfin Drive West	2,827	2	2,947	2
Phase C	M5 Motorway between Moorebank Avenue and Hume Highway	17,518	11	18,062	11
	M5 Motorway between Moorebank Avenue and Heathcote Road	13,212	11	13,379	11
	Moorebank Avenue between Anzac Road and M5 Motorway	3,435	5	4,256	11
	Moorebank Avenue between Cambridge Ave. and Anzac Road	3,530	4	3,795	4
	Anzac Road between Delfin Drive East and Delfin Drive West	3,214	2	3,306	2
Full Build	M5 Motorway between Moorebank Avenue and Hume Highway	17,768	11	20,738	19
	M5 Motorway between Moorebank Avenue and Heathcote Road	13,367	11	14,184	14
	Moorebank Avenue between Anzac Road and M5 Motorway	3,464	5	7,852	41
	Moorebank Avenue between Cambridge Ave. and Anzac Road	3,573	4	4,243	3
	Anzac Road between Delfin Drive East and Delfin Drive West	3,370	2	3,604	2

Note Daytime is the period 7.00 am to 10.00 pm and night-time is the period 10.00 pm to 7.00 am.

15.2 Assessment of Road Traffic Noise

The road traffic volumes have been applied to calculate the change in road traffic noise emissions from the M5 Motorway and predict road traffic noise levels at nearest residential receptors to Moorebank Avenue and Anzac Road. Road traffic noise levels have been predicted using the *Calculation of Road Traffic Noise* methodology assuming:

- Change in road traffic noise from the M5 Motorway was based on changes in road traffic volume.

- Nearest receptors are located 600 m from Moorebank Avenue (between south of M5 Motorway and Cambridge Avenue.
- Signposted speeds of 100 km/h on the M5 Motorway and 60 km/h on Moorebank Avenue and Anzac Road.

The predicted change in road traffic noise emissions from the M5 Motorway, including the Project road traffic are shown in **Table 47**.

The predicted increase in M5 Motorway road traffic noise levels, with the inclusion of Project road traffic, are less than 2 dBA and comply with the RNP for all Project Phases.

Table 47 Predicted Change In Road Traffic Noise – M5 Motorway

Phase	M5 Motorway	Change In Road Traffic Noise Level, dBA	
		Daytime	Night-time
Early Works	Between Moorebank Avenue and Hume Highway	0.2	0.0
	Between Moorebank Avenue and Heathcote Road	0.0	0.0
Phase A	Between Moorebank Avenue and Hume Highway	0.2	0.0
	Between Moorebank Avenue and Heathcote Road	0.0	0.0
Phase B	Between Moorebank Avenue and Hume Highway	0.2	0.1
	Between Moorebank Avenue and Heathcote Road	0.1	0.1
Phase C	Between Moorebank Avenue and Hume Highway	0.3	0.2
	Between Moorebank Avenue and Heathcote Road	0.1	0.1
Full Build	Between Moorebank Avenue and Hume Highway	0.1	1.3
	Between Moorebank Avenue and Heathcote Road	0.0	0.5

The predicted road traffic noise levels at nearest receptors 600 m from Moorebank Avenue are provided in **Table 48**.

Table 48 Predicted Road Traffic Noise – Moorebank Avenue

Phase	Moorebank Avenue	Road Traffic Noise With IMT At Receptors, dBA	
		Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
Early Works	Total from traffic between Anzac Road and M5 Motorway and between Anzac Road and Cambridge Avenue.	56.9	51.0
Phase A	Total from traffic between Anzac Road and M5 Motorway and between Anzac Road and Cambridge Avenue.	58.4	51.0
Phase B	Total from traffic between Anzac Road and M5 Motorway and between Anzac Road and Cambridge Avenue.	59.7	51.5
Phase C	Total from traffic between Anzac Road and M5 Motorway and between Anzac Road and Cambridge Avenue.	60.2	52.0
Full Build	Total from traffic between Anzac Road and M5 Motorway and between Anzac Road and Cambridge Avenue.	60.2	55.8

Road traffic noise from Moorebank Avenue, including IMT road traffic volumes, is predicted to comply with the RNP noise criteria of 60 dBA $L_{Aeq(15hour)}$ daytime and 55 dBA $L_{Aeq(9hour)}$ night-time at nearest receptors. The exceedances of 0.2 dBA during the daytime (Phase C and Full Build) and 0.8 dBA during the night-time (Full Build) are negligible and would not trigger any requirements for noise mitigation.

The Project road traffic will represent a less than 10% increase in future existing road traffic movements on Anzac Road. This increase represents potential increase in road traffic noise of less than 0.5 dBA. Potential road traffic noise from the Project on Anzac Road is not expected to result in a noise impact or trigger the requirement for noise mitigation.

15.3 Construction Of The Rail Access Connection

The construction of the northern and central rail access connections would require up to 25 heavy vehicles (trucks) per day to access the west of the Georges River on the local roads of Charles Street, Mill Road, Speed Street, Shepard Street and Powerhouse Road. These local roads are intermittently used by residential road traffic and the noise environment at residences is not expected to be adversely impacted by 2 to 3 heavy vehicles per hour.

The 25 heavy vehicles per day for the construction of the Southern rail access connection would access the work areas from Cambridge Avenue via Moorebank Avenue or Glenfield Road. These roads are part of the well-utilised local road network and therefore the proposed construction road traffic is not expected to increase in daytime road traffic noise on these roads.

16 ASSESSMENT OF GROUND VIBRATION DURING OPERATION

The Main IMT site is located at least 450 m from nearest receptors; at this distance any potential ground vibration generated from IMT operations would not be perceptible. It is expected that ground vibration levels at nearest receptors will comply with the human comfort (disturbance) and cosmetic structural damage criteria in **Section 5.7**.

The greater potential for ground vibration is likely to be the operation of rail freight accessing the SSFL on the rail access connection. Project trains will operate at up to 60 km/h on the SSFL access tracks and, dependent on the rail access option selected and designed in detail, will operate 30 m to 100 m from nearest residences in Casula.

The primary metrics used to describe ground-borne vibration from train passbys are as follows:

- L_{Vmax} the 'Maximum Vibration Level' occurring during a train passby event. This is normally defined as the maximum root mean square (rms) vibration level during the train passby averaged over a one second interval. The vibration level is usually expressed in dB re 10^{-9} m/s.
- VDV the 'Vibration Dose Value' is used to indicate the total vibration exposure during the daytime or night-time period. It is a cumulative measure and indicates the combined effect of all train passby events within the daytime or night-time period.

16.1 Assessment of Rail Freight Ground Vibration

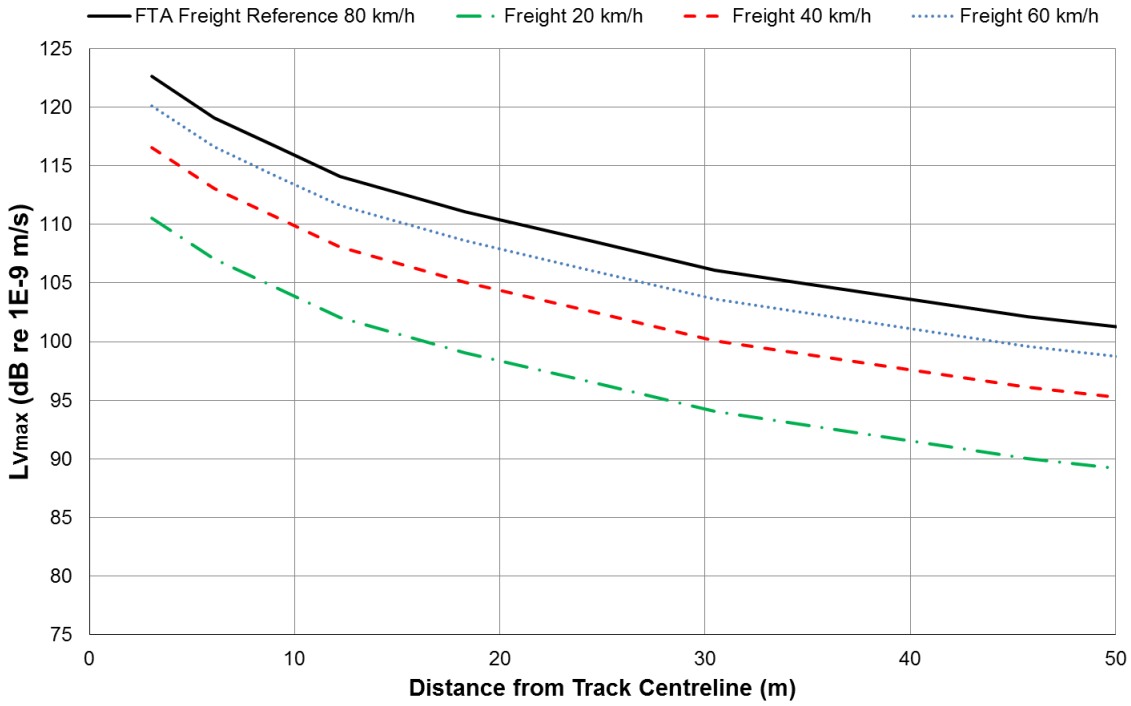
The US Federal Transit Administration's (FTA's) '*Transit Noise and Vibration Impact Assessment*' report provides indicative vibration levels versus distance for a variety of transport systems, including freight systems. **Figure 10** shows the indicative freight vibration levels at various speeds, assuming a '20log' speed relationship.

Through experience on projects such as the operational noise and vibration review of the Epping to Thornleigh Third Track, SLR has found the FTA vibration levels to be a reliable indication of likely ground-borne vibration from rail freight passby events.

As discussed in **Section 5.7** (**Table 14**), the lowest threshold of perceptible vibration for most people is approximately 0.13 mm/s rms. This equates to a L_{Vmax} of 103 dB. Demonstrated in **Figure 10**, for rail freight at 60 km/h the 103 dB vibration level is anticipated to be achieved at distances of 30 m or greater from the track.

Based on the conceptual layouts, the rail access connection to the SSFL will be at least 30 m to 100 m from nearest residences; as such any perceptible ground vibration levels are expected to be within the vibration criteria for both human comfort (VDV) and the less conservative criteria for cosmetic structural damage.

Figure 10 Indicative Freight Vibration Levels



17 RECOMMENDED NOISE MANAGEMENT AND MITIGATION

This section provides recommendation of a range of noise and vibration management and mitigation measures to reduce and control potential noise and vibration levels at nearest receptors.

Where implemented in full the recommendations are likely to achieve the feasible, reasonable and practical control of potential off site impacts to:

- Minimise potential for disturbance at all potentially affected receptors; and
- Preserve acoustic amenity in the surrounding environment; and
- Achieve the noise and vibration assessment criteria adopted.

The recommended measures promote the principles of best management practice and community engagement, and have been developed based on the proposed Project and predicted impacts in this Technical Paper.

17.1 Construction Noise and Vibration

17.1.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) would be prepared prior to commencement of each phase of works and be implemented through all phases of construction. The CEMP will provide the framework for the management and mitigation of all potential environmental impacts from the construction works.

A Construction Noise and Vibration Management Plan (CNVMP) would be included in the CEMP to document mechanisms for demonstrating compliance with the project approvals and commitments made in the Project EIS, including the recommended construction noise and vibration management and mitigation measures provided in this Technical Paper.

17.1.2 Noise and Vibration Management

The predicted noise levels from piling and rail access construction works trigger the investigation and implementation of feasible and reasonable construction noise mitigation measures. Dependent upon the specific construction works undertaken, **Table 49** summarises where construction noise mitigation may need to be implemented.

Table 49 Potential Requirement For Construction Noise Mitigation

Construction	Where Noise Mitigation Maybe Required
Piling Works for all rail access connection options	Piling works are undertaken within approximately 600 m of residences in Casula and within approximately 800 m of residences in Glenfield.
Rail Access Connection works for all rail access connection options	Daytime construction works undertaken within 450 m from nearest receptors in Casula and up to 1,400 m residences where rail construction is required outside of the standard daytime hours, such as during rail possession.

It is recommended that the following noise and vibration management and mitigation measures are to be investigated and, as required, implemented through the CNVMP prior to and during all the noise generating construction works for each of the Project stages:

- Where reasonable and feasible, standard construction working hours should be restricted to 7.00 am and 6.00 pm (Monday to Friday) and 8.00 am and 1.00 pm on Saturdays.

  No works should be undertaken on Sundays or public holidays, unless necessitated for activities such as to minimise impacts to the local community maintaining health and safety on site, and/or where site conditions (such as rail possession works) expressly require construction outside these times.

- Works would be undertaken outside of the standard day time construction hours where:
  - Delivery of materials/ equipment is requested by the Police and other authorities such as temporary road closures required by the NSW Roads and Maritime Services.
  - Works are required to maintain health and safety, avoid loss of life or injury and to prevent environmental damage.
  - Works are not audible at nearest receptors.
  - Works are undertaken during rail possession and any time to maintain the operational service of adjacent rail corridors.

- Night works should be programmed to minimise the number of consecutive nights work impacting the same receptors.

- During site inductions and toolbox talks, all site workers (including subcontractors and temporary workforce) are to be made aware of the hours of construction and how to applying practical, feasible and reasonable measures to minimise noise and vibration when undertaking construction activities (including driving vehicles).
- Quieter and less vibration emitting construction methods should be applied where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles would minimise noise and vibration impacts.
- The construction site should be arranged to minimise noise impacts by locating potentially noisy activities away from the nearest receptors wherever possible.
- Where possible, equipment with directional noise emissions should be oriented away from sensitive receptors.
- Where work is proposed in the vicinity of residences, potentially affected residents should be advised, at least 2 weeks prior to the commencement of works, of the potential noise and vibration levels and the proposed management measures to control environmental impacts.
- Whenever possible, loading and unloading areas should be located away from the nearest residences.
- Reversing of equipment should be minimised so as to prevent nuisance caused by reversing alarms. This can be achieved through one-way traffic systems and the use of traffic lights which can also limit the use of vehicle horns.
- Broadband reversing alarms are to be used instead of tonal reversing alarms, in particular outside standard working hours (night-time track possession works). Sub-contractors should also be notified of this requirement and where possible (particularly for night works) this should be included as a contractual requirement.
- Equipment which is used intermittently is to be shut down when not in use.
- All engine covers are to be kept closed while equipment is operating.
- Where possible, trucks associated with the work are not to be left standing with their engine operating in a street adjacent to a residential area.
- Sign-posted traffic speeds should be adhered to and all drivers will implement responsible driving practices to minimise unnecessary acceleration and braking events. Traffic movements should be scheduled to minimise continuous traffic flows (convoy).
- The site manager (as appropriate) should provide a community liaison phone number and permanent site contact so that noise and/or vibration related complaints, if any, can be received and addressed in a timely manner. Consultation and cooperation between the site(s) and neighbours to the site(s) would assist in limiting uncertainty, misconceptions and adverse reactions to noise and vibration.
- Attended noise and ground vibration measurements should be undertaken at monthly intervals and upon receipt of adverse comment/ complaints during the construction programme to confirm the noise and vibration levels at adjacent communities and receptors are consistent with the prediction in this assessment and any approval and/or licence conditions.

In the event noise generating construction works are undertaken outside of the standard daytime construction hours or measured construction noise levels at nearest residences are greater than 75 dBA L_{Aeq}, the following additional noise mitigation is to be considered:

- Localised acoustic screens; a solid structure such as plywood fencing with an absorptive acoustic to surround noise generating construction plant or work locations. To be effective for ground level noise the screens should be lined with acoustic absorptive material, be at least 2 m in height and located within 5 m of the noise source;
- Dominant noise generating mechanical plant should be fitted with feasible noise mitigation controls such as exhaust mufflers and engine shrouds;

- Respite periods of one hour are recommended for every continuous three hour period of work, alternatively day time works should be scheduled between 9.00 am and 12.00 pm and 2.00 pm and 5.00 pm;
- Where works are required outside of the standard day time hours, where practical undertake noisy construction work during less sensitive 6.00 pm to 10.00 pm evening period.

17.2 Noise Mitigation IMT Operations

The Technical Paper has assessed potential noise levels for the unmitigated conceptual designs of the Project. In order for the predicted noise levels to meet the project specific noise levels from the NSW INP and RING, noise mitigation would be required.

To comply with relevant noise assessment criteria, the predicted noise levels during neutral conditions would require the noise reductions in **Table 50**. During the early morning or night-time during the winter months when noise enhancing temperature inversion conditions may occur, noise mitigation would be required to potential reduce noise levels by a further 1 to 3 dBA.

Table 50 Potential Noise Reduction Requirements

Project Phase	Reduction In Predicted Noise Levels To Achieve Assessment Criteria (Neutral Conditions), dBA
Phase B Operation of 0.5 million twenty foot equivalent units (TEU) per annum IMEX facility and 100,000 sq m of warehousing.	Industrial noise from main IMT operations: Up to 5 dBA northern rail access design. Up to 10 dBA central rail access design. Up to 11 dBA southern rail access design. Rail access connection to the SSFL: Up to 15 dBA northern rail access design.
Phase C Operation of IMEX facilities at 1.05 million TEU per annum; and operation of 250,000 sq. m warehousing.	Industrial noise from main IMT operations: Up to 6 dBA northern rail access design; Up to 10 dBA central rail access design; Up to 9 dBA southern rail access design. Rail access connection to the SSFL: Up to 17 dBA northern rail access design.
Full Build Operation of IMEX facility at 1.05 million TEU per annum; operation of interstate facility at 0.5 million TEU per annum; and operation of 300,000 sq. m warehousing.	Industrial noise from main IMT operations: Up to 9 dBA northern rail access design; Up to 13 dBA central rail access design; Up to 11 dBA southern rail access design. Rail access connection to the SSFL: Up to 17 dBA northern rail access design.

Analysis of the noise prediction model has identified the RMGs, on-site trucks, side picks, ITVs and trains on the rail access connection to be the dominant contribution to the predicted noise levels at the assessed receptors. To achieve the noise reductions in **Table 50**, mitigation treatments will need to reduce noise from all dominant noise sources.

The Project will implement all reasonable and feasible noise mitigation to control potential noise levels. In reviewing the potential requirements for noise mitigation, in the event the Project does not meet the assessment criteria and where noise levels are as low as reasonably practicable, the following guidelines from the NSW INP can be considered:

- Achievable noise limits can be negotiated with Regulators and the community.
- The project specific noise levels adopted in this Technical Paper are not automatically interpreted as the conditions for consent without consideration of other factors both environmental, social and economic consistent with the objectives of the Environmental Protection Act. In this regard, where appropriate, noise limits can be set above the project specific noise levels.

17.2.1 Noise Mitigation

The following noise mitigation measures have been recommended to reduce worst case operational noise levels by up to 14 dBA L_{Aeq} (adverse conditions) at the nearest receptors demonstrating the Project could achieve the NSW INP and RING noise objectives. In order to achieve the required 14 dBA attenuation to total received noise levels it is likely a combination of the recommended measures would be required.

The recommended noise mitigation measures have been developed applying a hierarchy of noise control where the greatest noise reduction can be achieved through control of source emissions and then attenuation of noise propagation between the source and receptor.

Based on the predicted noise levels, the recommended noise mitigation measures to control rail noise should be considered for the Northern, Central and Southern rail access option layouts for the main IMT site and the Northern rail access connection option.

Control of Source Noise Emissions

- The design and implementation of the Project is to apply plant and equipment selected with the lowest noise emissions.
- Mechanical components on fixed and mobile equipment, such as motors, gearboxes and exhausts, should include enclosures and acoustic insulation (lagging) and silencers to limit noise emissions. The appropriate design of acoustic enclosures and acoustic insulation can reduce source noise levels of individual plant and equipment by 10 dBA or greater.
- Where feasible, motors and mechanical noise generating components of the RMGs should be located near to ground level rather than the top of the gantry.
- Where feasible to provide a lower noise emission, electric motors and vehicles should be operated instead of diesel powered equipment.
- The following measures are to be incorporated into the design and operation of the freight trains on the Northern rail access connection and the rail track on the main IMT site:
    - The rail freight will operate at a speed of up to 60 km/h on the rail connections to the SSFL. At these speeds the freight locomotives (engine and exhaust) will be the dominant source of noise above the noise emitted from the wheel/rail interface and wagon bunching. Rail noise barriers would provide the most effective control of noise emissions form locomotives.
    - The track would require an incline/ descent to access the site and the SSFL rail corridor. The track is to be designed to minimise acute changes in vertical alignment which can reduce the requirement for locomotives to operate at high throttle notch on the ascent or under heavy braking on the descent.
    - It is recommended the rail lines are continuously welded track to remove joints.
    - The rail access bridge should be designed as a concrete or composite/ concrete structure to minimise potential reradiated noise from vibrating sections of the elevated track. Detailed noise analysis should be undertaken to identify both airborne and reradiated noise contributions to effectively mitigate total noise emissions.
    - Locomotives accessing the Main IMT site should have approval to operate on the network consistent with the noise limits for locomotives detailed in relevant Railway Systems Activities Licences.
- In addition to the mitigation measures above, to further control potential rail noise from wheel squeal the following measures are recommended:
    - The turn radius of curved track sections should be greater than 500 m to reduce tight turns in the alignment.

  - Track greasing systems should be investigated on curved sections of track to lubricate at the wheel rail interface to reduce friction.
  - The track system maintenance should include measures such as grinding to remove rail roughness, treatment of roughness on the wheels of locomotives and wagons, adjustment of bogie-suspension tracking and brake system set up.
- Unless for health and safety reasons, heavy vehicles should avoid the use of horns within the Main IMT site.

Controlling the Propagation of Noise from the Main IMT site

- Noise walls or noise barriers should be installed within the main IMT site to impede the line of sight between noise sources and nearest receptors. Where a noise wall or barrier fully impedes line of sight to all dominant noise sources a reduction in received noise level of 10 dB(A) or more can be achieved.
  - Noise walls/ barriers would need to be solid structures, typically constructed of concrete or similar material.
  - Additional absorptive material could be applied to the internal facades of the noise walls/ barriers to reduce reflected noise from the wall/ barriers.
  - TEU containers can be used as noise barriers where they are stack to ensure no gaps or openings and effectively impeded the direct line of sight to nearest receptors. This is likely to require an operational management procedure to ensure the container areas adjacent to the residential communities are maintained to ensure the TEU containers are at the maximum practicable height at all times (typically up to 5 TEUs in height).
  - To provide effective noise control the noise walls/ barriers would need to achieve a transmission loss of at least 10 dBA greater than the insertion loss.
  - Where feasible all rail tracks should be designed to maximise the separation distance between rail lines and the nearest residences.
  - For the Northern rail access connection option, noise walls/barriers should be investigated for the rail tracks on the rail access connection between the SSFL and the main IMT site boundary. Due to the elevated location of residences in Casula the noise wall/ barriers on the viaducts of the rail access connection may require a cantilevered design to increase the mitigation of noise from locomotives.
  - It is recommended that on-site noise walls/ barriers are constructed at the earliest opportunity in the Project development to provide noise attenuation during all construction and operation phases.
- Earth mounding can be used similar to noise walls/ barriers to attenuate the propagation of noise between the site and nearest affected receptors. Where earth mounding can fully impede line of sight to dominant noise sources, reductions to ground level noise sources of 10 dBA L_{Aeq} or greater may be achievable.
  - The earth mounding can be used in conjunction with noise walls/ barriers to increase the height of on-site noise treatments.
  - For each rail access option it is recommended earth mounding be considered on the main IMT site to the western extent of the IMEX and interstate rail lines.
- Where feasible all on-site buildings and structures would be designed and constructed to impede noise from ground level operation of heavy vehicles, side picks and ITVs. The detailed design of the IMT should, where feasible, locate the warehouse buildings to the west of the site to impede the propagation of noise to Casula.

Operational Noise Management

Prior to the commencement of operations of each stage of development the Proponent should develop and implement an Operational Noise and Vibration Management Plan (ONVMP). The ONVMP would detail the staged operation of the Project, the potential off-site operational noise levels as determined during the detailed design process and all measures to manage and mitigation operational noise and vibration.

As a minimum the ONVMP would include:

- The operational noise criteria/ limits as defined by the relevant Project Approvals and Environmental Protection Licence.
- Identification of all surrounding receptors and land use that would be potentially sensitive to noise and vibration.
- Identification of all noise and vibration generating operations and the time-tabling for these operations.
- The location and specification of any on-site and off-site noise mitigation, including the requirement for future mitigation as part of the staged operation.
- Detailed measures for managing operational noise including checklist and auditing procedures to ensure measures are actioned prior to commencement of noise generating activity.
- Procedures for the monitoring and reporting of operational noise and vibration.
- Procedures for consultation with the community regarding operations and operational noise and vibration.
- Complaint handling procedures.

The following measures are recommended to manage noise generating operations. The measures can reduce the frequency of noisy activity and, where feasible, limit the requirement for high noise generating operations during the more sensitive evening and night-time periods.

Where feasible and practical to do so:

- The majority of rail freight arrival and departure operations are to be timetabled during the day time and evening hours of 7.00 am to 10.00 pm.
- Locomotive shunting and maintenance are to be undertaken during the day time and evening period of 7.00 am to 10.00 pm.
- Heavy vehicles would be operated to limit the requirement for reversing and audible reversing alarms, such as the use of one-way systems for on-site roads.
- Control of source noise emissions from third party rail freight is outside the direct control of the Project. It is recommended that, as a contractual commitment for all rail operators accessing the site are required to undertake regular maintenance of all rail freight for wheel flat spots and locomotive exhausts.

17.3 Predicted Noise Levels With Conceptual Noise Mitigation

Conceptual noise mitigation measures have been included in the concept layout of the northern rail access option to demonstrate the recommended noise mitigation measures can theoretically achieve a reasonable reduction to unmitigated noise levels. Mitigated noise levels have been predicted for the Full Build operation of the Project for the northern rail access option.

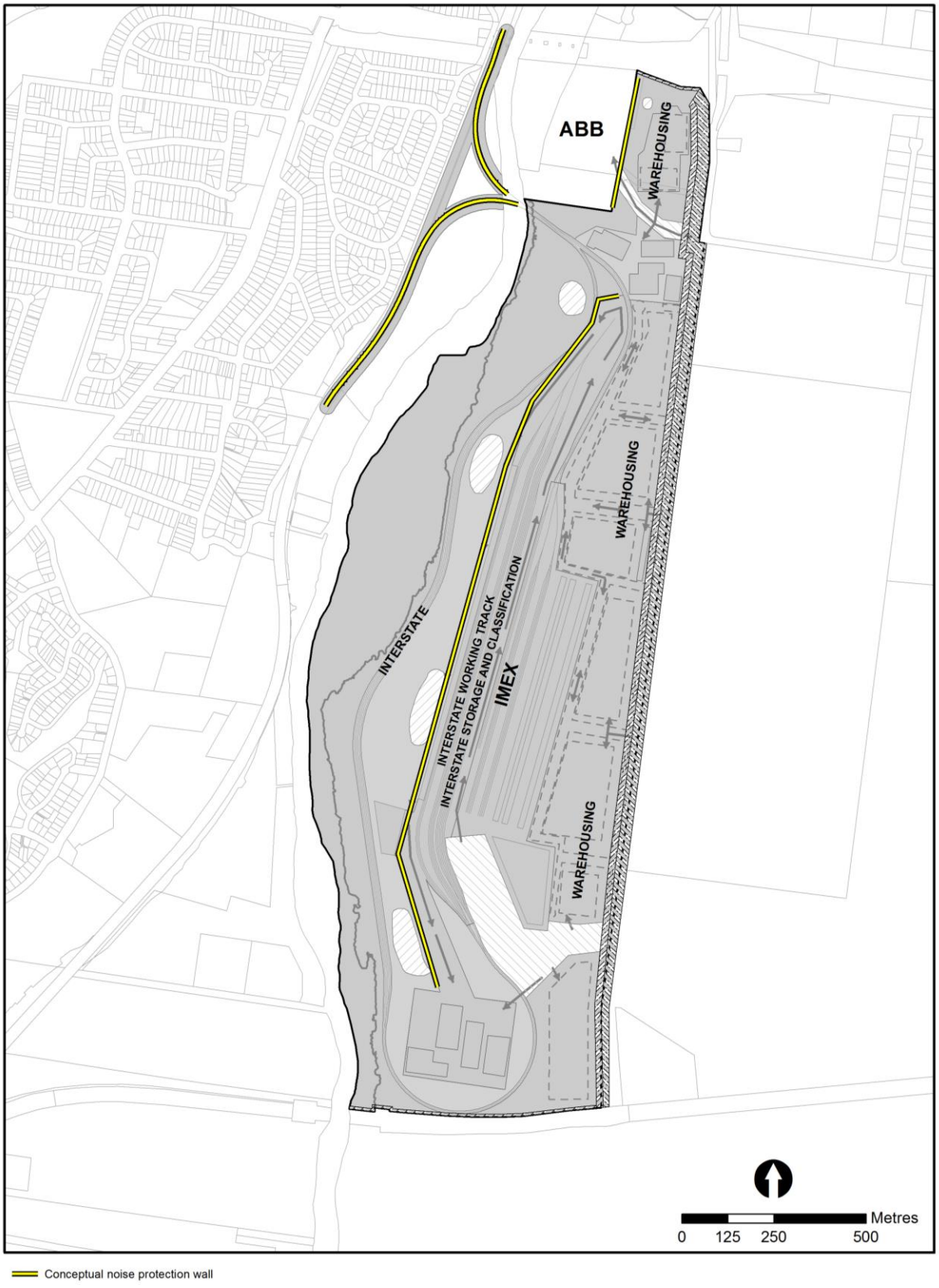
The requirement for noise mitigation will be confirmed during the detailed design phase. As such, the conceptual noise mitigation outlined below is only for the purpose of demonstrating at the EIS stage the likely performance of on-site noise mitigation measures.

17.3.1 Conceptual Noise Mitigation

The following noise mitigation measures were included in the noise prediction model. The location of the noise barriers/walls are presented in **Figure 11**.

- Each RMG would have an acoustic treatment of the machinery house to control noise from the electrical drives, motors, gearboxes and air handling machinery. A SWL of 100 dBA for each RMG has been modelled, which represents an 8 dB reduction in source noise emissions. The SWL is considered a low noise emission for a RMG accounting for additional noise contribution from the RMG trolley rails and the hoist.
- Noise barriers/walls have been modelled within the IMT project site at a height to impede the propagation of noise from all ground level equipment, specifically the ITVs and road trucks.
- Noise barriers/walls have been modelled adjacent to the interstate and IMEX rail spurs to impede noise from the locomotives and assist in mitigating discrete noise events such as wheel squeal.
- The 'noise barriers' can be a combination of acoustic barriers, solid walls, earth mounding or warehouse buildings.

Figure 11 Conceptual Noise Mitigation - Northern Rail Access Option



17.3.2 On-Site IMT Operations with Conceptual Mitigation

Predicted noise levels for the Fully Build operation of the northern rail access with noise mitigation are summarised in **Table 51**. Residual noise impacts, where predicted noise levels are above the NSW INP noise assessment criteria, are highlighted in bold.

Table 51 Mitigated IMT Noise Levels Northern Rail Access Option

Residential Receptor		$L_{Aeq(15min)}$ Noise Level, dBA		Predicted Reduction, dBA	
		Neutral	**Adverse**	**Neutral**	**Adverse**
R1	Lakewood Cr, Casula	31	36	11	10
R2	St Andrews Bld, Casula	36	37	9	10
R3	Buckland Road, Casula	**39**	**41**	8	8
R4	Dunmore Cr, Casula	**41**	**42**	6	7
R5	Leacocks Lane, Casula	35	35	5	6
R6	Leacocks Lane, Casula	37	37	6	6
R7	Slessor Road, Casula	31	30	5	5
R8	Canterbury Road, Glenfield	28	27	3	3
R9	Ferguson Street, Glenfield	31	29	3	3
R10	Goodenough St, Glenfield	32	31	3	3
R11	Wallcliffe Cr, Wattle Grove	34	**39**	2	2
R12	Corryton Cr, Wattle Grove	34	**39**	2	2
R13	Martindale Cr, Wattle Grove	33	**38**	2	2
R14	Anzac Road, Wattle Grove	36	**41**	2	1
R15	Cambridge Ave, Glenfield	31	30	4	4
R17	Yallum Cr, Wattle Grove	35	**40**	2	2
R18	Church Road, Liverpool	31	37	1	1
R24	Retirement Village, Casula	26	26	4	5
R34	Glenfield Rise Development	29	28	4	4

Based on predicted noise levels at Buckland Road and Dunmore Crescent, noise levels at receptors immediately opposite the main IMT site in Casula are predicted to exceed the night-time noise criterion by only 1 dBA to 3 dBA during neutral meteorological conditions. At all other assessed receptors in Casula and Glenfield noise levels comply with the daytime, evening and night-time noise criteria.

During adverse metrological conditions the exceedance of the night-time criteria at the receptors immediately opposite the main IMT site in Casula is 2 dBA to 4 dBA. Based on the noise levels predicted at Anzac Road, noise levels at the northern extent of Wattle Grove are predicted to exceed the daytime noise criteria by 1 dBA. At the receptors in Wattle Grove the noise levels exceed the night-time noise criterion by no more than 4 dBA.

Noise levels comply with the daytime, evening and night-time noise criteria at all assessed receptors in Glenfield during adverse meteorological conditions.

The predicted noise levels for the unmitigated concept design exceeded the noise assessment criteria by up to 9 dBA during neutral weather meteorological conditions and by up to 11 dBA during adverse meteorological conditions. The noise mitigation has achieved the noise criteria at the majority of the assessed residences.

In reviewing the noise criteria exceedances it is noted that Section 11.1.3 of the NSW INP states:

'A development will be deemed to be in non-compliance with a noise consent or licence conditions if the monitored noise levels is more than 2 dB above statutory noise limit specified in the consent or licence conditions'.

As such, where IMT noise levels at Casula and Wattle Grove are measured at or below the predicted noise levels in **Table 51**, noise levels at Buckland Road (neutral meteorological conditions) and at Wallcliffe Court, Corryton Court and Martindale Court (adverse meteorological conditions) would be considered to comply with the noise assessment criteria.

17.3.3 Rail Access To The SSFL

The predicted mitigated noise levels from rail freight operations on the rail connection to the SSFL are presented in **Table 52**. Noise levels have been predicted for the night-time operations with any residual impacts above the 40 dBA L_{Aeq} night-time noise assessment criteria from the RING highlighted in bold.

Table 52 Mitigated Rail Noise Levels Northern Rail Access Option

Residential Receptor		$L_{Aeq(9hour)}$ Noise Level, dBA	Predicted Reduction, dBA
R1	Lakewood Cr, Casula	**42**	15
R2	St Andrews Bld, Casula	36	12
R3	Buckland Road, Casula	35	12
R4	Dunmore Cr, Casula	31	4
R5	Leacocks Lane, Casula	17	3
R6	Leacocks Lane, Casula	17	0
R7	Slessor Road, Casula	11	0
R8	Canterbury Road, Glenfield	13	1
R9	Ferguson Street, Glenfield	20	5
R10	Goodenough St, Glenfield	16	1
R11	Wallcliffe Cr, Wattle Grove	18	0
R12	Corryton Cr, Wattle Grove	21	0
R13	Martindale Cr, Wattle Grove	23	0
R14	Anzac Road, Wattle Grove	26	1
R15	Cambridge Ave, Glenfield	17	6
R17	Yallum Cr, Wattle Grove	19	0
R18	Church Road, Liverpool	34	0
R24	Retirement Village, Casula	12	1
R34	Glenfield Rise Development	11	0

The proposed rail noise mitigation has reduced rail noise levels by up to 15 dBA at residences and now achieves compliance to the noise assessment criteria at the assessed residences with the exception of receptors in the region of Lakewood Crescent. This is due to the residences being situated within approximately 30 m of the rail spurs to residences at this location. The residual noise impact is a marginal 2 dBA exceedance of the night-time noise criterion.

17.3.4 Concluding Comments On Noise Mitigation

The conceptual noise mitigation included for the northern rail access option has achieved a significant reduction to noise levels and potential noise impacts. The residual impacts are more acceptable in line with the objectives of the NSW INP and RING and would be addressed further during the detailed design phase.

Where the concept layouts for the central and southern rail access options adopt acoustic enclosures on the RMGs and noise barriers to the west of the main IMT site, a reciprocal noise mitigation performance would be expected at nearest receptors. The central and southern rail access options would also be expected to achieve the NSW INP and RING noise assessment criteria at the majority of the assessed receptors.

17.4 Recommendation For Future Assessments

The future approval of the Project phases is expected to include revised assessment of potential noise and vibration levels as more detailed design information becomes available. It is recommended the following are considered in the assessment of potential impacts and design of as required mitigation measures.

- During the detailed design of the Project the specification of operating plant and machinery of the Project will be confirmed. This should include the provision of one-third octave band noise emission data from equipment Vendors to facilitate a detailed assessment of annoyance characteristics in accordance with NSW INP.
- To verify the predicted noise levels and recommended noise mitigation in this Technical Paper, the predictive assessment of potential noise levels should be revised for the detailed design of the construction and operation of the selected rail access option.
- The specific vibration propagation characteristics can be highly variable depending on the ground conditions at a given location. As such it is recommended that ground vibration impacts are reviewed during the detailed design in particular where Project rail track is to be within 30 m of residences.

17.5 Noise And Vibration Monitoring

The ambient noise monitoring surveys within Casula, Wattle Grove and Glenfield will be continued throughout the construction and operation of the Project. The noise surveys will quantify any potential noise from the Project and identify any trends/changes in the ambient noise environment during the progressive development.

The measured noise levels and contribution from the operation of the Project will be continually applied to the detailed design of the Project to ensure the design includes appropriate mitigation to reduce and control noise during construction and operation. The monitoring data will also include any changes to the ambient noise environment from new developments such as the SIMTA project.

In the event of any noise or vibration related complaint or adverse comment from the community, where feasible to do so, noise and ground vibration levels will be measured at the potentially affected premises. In accordance with procedures in the CNVMP and ONVMP, the measured noise and/or vibration levels would then be assessed to ascertain if remedial action is required.

18 CUMULATIVE NOISE ASSESSMENT

The Sydney Intermodal Terminal Alliance (SIMTA) is proposing to develop an intermodal terminal facility on the site currently occupied by the DNSDC on Moorebank Avenue. The site for the SIMTA development is to the immediate east of the Main IMT site and the two projects would, if both approved, operate simultaneously. In accordance with the EARs an assessment of potential cumulative impacts levels is required to assess these simultaneous operations.

The capacity of the SSFL is likely to constrain the development and operational capacity of the two IMTs at the Moorebank site. The SSFL is likely to be capacity-constrained above a throughput of 1.7 million TEUs, and this assumption is based upon the premise that additional upgrades are made to the SSFL, including additional passing loops and intermediate signalling to enhance the train line's capacity to allow a throughput of 1.7 million TEUs.

At full operation the two proposed developments would provide1.05 million TEUs (IMEX facility) and 0.5 million TEUs (interstate facility) throughput capacity at the Moorebank IMT Project and 1 million TEU throughput capacity at the SIMTA project. The joint operations of the two projects would exceed the feasible capacity on the SSFL.

In response to this constraint, three potentially more realistic scenarios have been considered in the EIS for the assessment of potential cumulative impacts should the two projects operate simultaneously. In all cases the cumulative assessments are based on operations of the two developments at year 2030; when both are at Full Build operational levels.

The cumulative scenario 1 has been based on the northern rail access connection. Cumulative scenario 2 and 3 are based on the southern rail access connection because only a shared rail connection to the SSFL is likely to be feasible in the event there are two intermodal facilities and the southern rail access is the more feasible option for both projects.

It is noted that these scenarios have been developed by MIC purely for the purposes of an indicative cumulative impact assessment should these types of developments operate adjacent to each other in this location. MIC has not consulted with SIMTA on these scenarios.

Based on the minimum separation distance of approximately 450 m to nearest receptors, no ground vibration impacts are expected and the vibration objectives for human comfort and cosmetic damage would be achieved during cumulative operations.

18.1 Noise Assessment Criteria

It is likely that the IMT and SIMTA developments would proceed under separate development approvals with specific commitments to managing noise levels. There is also the potential that whichever development enters into operations first may influence the ambient noise environment and constrain the permissible intrusive noise emissions of the other development.

Due to the conceptual nature of the possible cumulative operation of the IMT and SIMTA projects, the NSW INP amenity noise criteria have been applied for the purpose of evaluating potential cumulative noise impacts. The NSW INP amenity criteria are provided below in **Table 53**.Error! Reference source not found.

Table 53 Amenity Noise Criteria

Land Use	Period	Acceptable Noise Level dBA L_{Aeq}	Maximum Noise Level dBA L_{Aeq}
Residential - daytime	Monday to Saturday Sundays & Public Holidays	**55**	**60**
Residential - evening	6.00 pm – 10.00 pm	**45**	**50**
Residential - night-time	10.00 – 7.00 am	**40**	**45**
School classrooms	When in use	**35** (internal)	**40** (internal)
Places of worship	When in use	**40** (internal)	**45** (internal)
Passive recreation areas	When in use	**50**	**55**
Active recreation areas	When in use	**55**	**60**
Commercial premises	When in use	**65**	**70**

Land Use	Period	Acceptable Noise Level dBA L_{Aeq}	Maximum Noise Level dBA L_{Aeq}
Industrial premises	When in use	**70**	**75**

18.2 Scenario 1 – Warehousing On The SIMTA Site

The development of this scenario has considered the SSFL capacity constraints, the need for an IMT in the area, the existing zoning of the SIMTA site (IN1 – General Industrial which permits warehouse or distribution centres) and development which would be complementary to an IMT.

For this scenario it is assumed that:

- The Moorebank IMT Project operates in accordance with how it is defined in the Moorebank IMT Project EIS for Full Build operations with the northern rail access connection (and as described in this Technical Paper).
- An intermodal facility is not located on the SIMTA site. Instead intensified warehousing development is located on the site which could support the Moorebank IMT. For the purposes of this assessment:
  - An indicative proposed warehouse capacity of 300,000 sq. m has been assumed on the SIMTA site.
  - All buildings have been digitised in the noise prediction model and external operations assumed of 10 side picks, 35 forklifts and 12 road trucks.

Both sites are assumed to be operational 24 hours a day seven days a week. The predicted cumulative noise levels for the IMT Project and proposed warehousing development are summarised in **Table 54** for neutral and adverse meteorological conditions.

Table 54 Predicted Cumulative Noise Levels – Scenario 1

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA	
	Neutral Meteorological Conditions	Adverse Meteorological Conditions
Casula	37 – **48**	36 – **49**
Wattle Grove	34 – 40	40 – **45**
Glenfield	32 – 36	31 – 35
Non-Residential Noise Sensitive Receptors	24 – 50	24 – 51

Note **Bold** highlight denotes predicted noise level exceeds the night-time NSW INP amenity noise criteria.

Predicted noise levels at receptors in Casula comply with the daytime noise criterion however, depending on the meteorological conditions, exceed the evening noise criterion by 3 dBA during neutral meteorological conditions and up to 4 dBA during adverse meteorological conditions. Noise levels exceed the night-time noise criterion by 8 dBA during neutral meteorological conditions and up to 9 dBA during adverse meteorological conditions. At receptors in Wattle Grove the predicted noise levels exceed the night-time noise criterion by 5 dBA during adverse meteorological conditions but otherwise comply with daytime, evening and night-time noise criteria.

At all assessed receptors in Glenfield the predicted noise levels comply with the daytime, evening and night-time noise criteria. Noise levels at the non-residential noise sensitive receptors comply with the amenity noise criteria.

To comply with the noise criteria, noise mitigation may be required at both the Moorebank IMT and SIMTA warehousing development. The conceptual noise mitigation scenario assessed in **Section 17.3** demonstrates that feasible and reasonable noise mitigation can control noise emissions from the Moorebank IMT site. Applying similar noise barriers and low noise plant, noise emissions from the warehousing development can be controlled. It is therefore likely that with appropriate noise mitigation the cumulative noise levels could achieve the amenity noise criteria.

18.3 Scenario 2 – IMEX Operations At Both Sites

This scenario considers a split of intermodal operations between the two developments allowing for:

- A 500,000 TEU IMEX development and a 500,000 TEU Interstate development on Moorebank IMT site.
- A 500,000 TEU IMEX development on SIMTA site.
- 300,000 sq. m warehousing on both the Moorebank IMT site and on the SIMTA site.

To assess this scenario the predicted operational noise levels for the Moorebank IMT Full Build scenario have been reduced by 3 dBA to reflect the reduction in annual operations from 1 million TEU to 500,000 TEU.

The predicted noise levels for the SIMTA development have been referenced from the noise impact assessment report[7] prepared for the SIMTA EIS. Noise levels were not predicted at individual receptors in the SIMTA EIS; as such operational noise levels at the noise sensitive receptors have been estimated from the noise contour maps within the SIMTA EIS. Noise contour maps were prepared for neutral meteorological conditions only. Operational noise levels have been reduced by 3 dBA to reflect the halving of operations.

The predicted cumulative noise levels for the IMT Project and proposed warehousing development are summarised in **Table 55**.

Table 55 Predicted Cumulative Noise Levels – Scenario 2

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Moorebank IMT*	**SIMTA IMT**	**Cumulative Noise**
Casula	31 – **46**	27 – 40	35 – **47**
Wattle Grove	29 – 34	24 – 35	30 – 38
Glenfield	26 – 29	27 – 30	30 – 32
Non-Residential Noise Sensitive Receptors	15 – 49	22 – 37	23 – 49

Note **Bold** highlight denotes predicted noise level exceeds the night-time NSW INP amenity noise criteria.
* Denotes noise levels for the unmitigated southern rail access.

At Casula the predicted unmitigated noise levels from the Moorebank IMT project site result in a predicted marginal 2 dBA exceedance of the 45 dBA L_{Aeq} evening noise criteria and an exceedance of up to 7 dBA of the 40 dBA L_{Aeq} night-time noise criteria.

Cumulative noise levels at Wattle Grove and Glenfield are predicted to comply with the adopted INP amenity noise criteria. Noise levels at the non-residential noise sensitive receptors comply with the amenity noise criteria.

[7] Wilkinson Murray, May 2013. Noise Impact Assessment Report (12186-C Version C)

To comply with the noise criteria, noise mitigation may be required at both the Moorebank IMT and SIMTA IMT developments. The conceptual noise mitigation scenario assessed in **Section 17.3** demonstrates that feasible and reasonable noise mitigation can control noise emissions from the Moorebank IMT site. It is therefore likely that with appropriate noise mitigation at the Moorebank IMT and SIMTA projects the cumulative noise levels could achieve the amenity noise criteria.

18.4 Scenario 3 – Only Interstate Operations At The Moorebank IMT

This scenario considers a split of intermodal operations between the two developments allowing for:

- A 500,000 TEU Interstate development on Moorebank IMT site.
- A 1 million TEU IMEX development and 300,000 sq. m ware on SIMTA site.

To assess this scenario the predicted operational noise levels for the Moorebank IMT Full Build scenario have been modelled for just the Interstate operations and predicted noise levels referenced from the noise contour maps prepared for the SIMTA EIS which assessed a 1 million TEU development at the SIMTA site.

The predicted cumulative noise levels for the IMT Project and proposed warehousing development are summarised in **Table 56**.

Table 56 Predicted Cumulative Noise Levels – Scenario 3

Residential Receptor	Predicted Noise Levels, L_{Aeq} dBA		
	Moorebank IMT	**SIMTA IMT**	**Cumulative Noise**
Casula	34 - **49**	30 – 37	38 – **50**
Wattle Grove	32 – 37	27 – 38	33 – **41**
Glenfield	29 – 32	30 – 33	33 – 35
Non-Residential Noise Sensitive Receptors	18 – 52	25 – 40	26 – 52

Note **Bold** highlight denotes predicted noise level exceeds the night-time NSW INP amenity noise criteria.
* Denotes noise levels for the unmitigated southern rail access.

At Casula the predicted unmitigated noise levels from the Moorebank IMT project site comply to the daytime noise criterion but exceed the 45 dBA L_{Aeq} evening noise criterion by up to 5 dBA and the 40 dBA L_{Aeq} night-time noise criterion by up to 10 dBA.

At Wattle Grove predicted noise levels comply with the daytime and evening noise criteria but marginally exceed the 40 dBA L_{Aeq} night-time noise criteria by 1 dBA. Cumulative noise levels at Glenfield are predicted to comply with the adopted INP amenity noise criteria. Noise levels at the non-residential noise sensitive receptors comply with the amenity noise criteria.

To comply with the noise criteria, noise mitigation may be required at both the Moorebank IMT and SIMTA IMT developments. The conceptual noise mitigation scenario assessed in **Section 17.3** demonstrate that feasible and reasonable noise mitigation can control noise emissions from the Moorebank IMT site, it is therefore likely that with appropriate noise mitigation cumulative noise levels could achieve the amenity noise criteria

18.5 Cumulative Road Traffic

The *Traffic, Transport and Accessibility Impact Assessment* for the EIS has considered the daily total road traffic movements for the cumulative scenarios. The road traffic volumes do not significantly change from those assessed in **Section 15** of this report.

For each cumulative scenario the potential road traffic noise levels from the M5 Motorway and Anzac Road are predicted to comply with the RNP. During the Full Build operation of the cumulative scenarios the road traffic noise levels on Moorebank Avenue may exceed the daytime and night-time noise criteria, but this exceedance would be marginal (less than 2 dBA). As such, noise mitigation to reduce road traffic noise levels from Moorebank Avenue is not likely to be required.

18.6 Rail Noise Levels

There would be no change in predicted rail noise levels for the northern rail access should cumulative scenario 1 be developed. Predicted rail noise levels for the northern rail access exceed the RING noise criteria by up to 17 dBA.

For scenario 2 and 3, the total daily IMEX and interstate rail movements on a shared rail connection will be the same as assessed for the Moorebank IMT southern rail access layout. Predicted rail noise levels for the southern rail access comply with the RING noise criteria.

18.7 Noise Mitigation

For all three cumulative scenarios it will be necessary for the Project and the proponent of the warehousing development to implement feasible and reasonable noise mitigation measures such as those discussed in **Section 17** of this report.

The noise mitigation measures should control specific noise emissions from the respective developments to achieve the noise criteria established as part of regulatory approvals and licensing. However, a noise sharing agreement or similar covenant may be required to implement negotiated noise limits and provide a mechanism for both proponents to review potential simultaneous operations and where required provide coordinated management of potential issues.

The design of noise mitigation would need to be determined during the detailed design phase and, as required, be included in future environmental assessments for the IMT Project.

19 CONCLUSION

This Technical Report presents the assessment of potential noise and vibration impacts for the proposed IMT Project.

The predicted noise levels for the majority of daytime construction works during the Early Works, and Phases A, B and C are expected to comply with the ICNG without the requirement for noise mitigation. Where noise generating works such as bulk earthworks and rail construction activities are undertaken in proximity of residences the range of noise mitigation measures in this Technical Report are likely to be required to reduce and control noise consistent with the ICNG.

During rail construction works and any construction works required outside of the standard day time hours, additional noise mitigation measures, such as localised noise screens and respite periods, have been recommended to achieve ICNG noise goals and minimise potential for disturbance.

Three conceptual layout options have been proposed for the operation of the Project. For each conceptual layout, the predicted unmitigated noise levels at nearest residential receptors during Phases B, C and Full Build operations are likely to exceed the project specific noise levels depending on the phase of the Project and the meteorological conditions.

Based on the predicted noise levels a range of noise management and mitigation measures have been recommended for investigation during further assessment of noise for the detailed design of the Project. It is recommended the Project considers noise control measures such as enclosures, silencers, noise reducing designs for the rail lines, acoustic walls/ barriers and earth mounding within the main IMT site.

A conceptual noise mitigation scenario incorporating noise barriers and acoustic enclosures in the northern rail access option was included in the assessment. Based on the predicted mitigated noise levels, where the Moorebank IMT adopts reasonable and practical noise control measures in the detailed design, the northern, central and southern rail access options would be expected to comply with both the NSW INP and RING noise assessment criteria at the majority of the assessed residences.

Should the assessment criteria not be achieved at all receptors, where the Project has reduced noise levels to be as low as reasonably practicable, achievable noise limits can be negotiated with Regulators and the community.