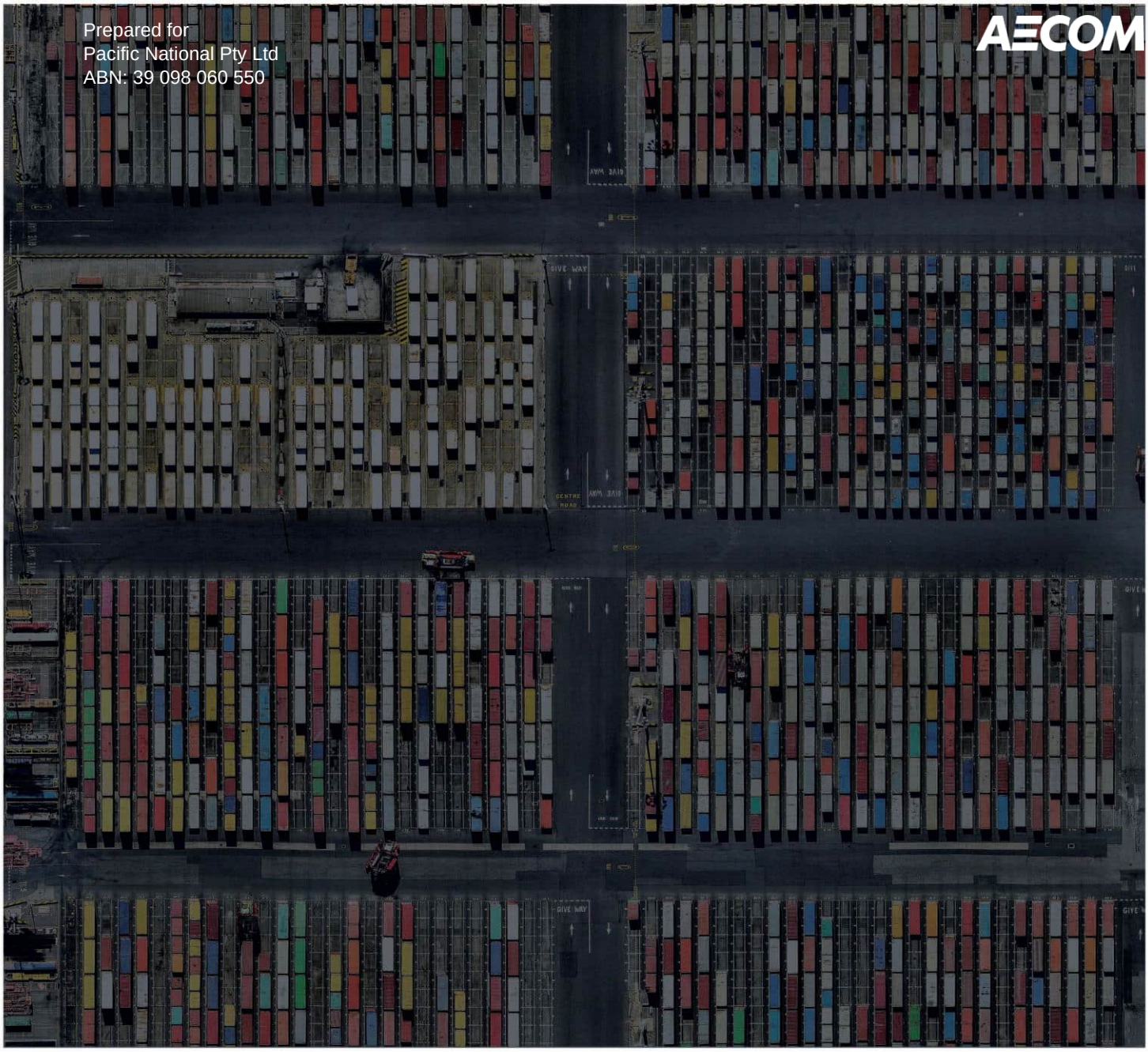

Little River Logistics Precinct

Preliminary Noise and Vibration Assessment

01-Jun-2023
Preliminary Noise and Vibration Assessment
Commercial-in-Confidence

Little River Logistics Precinct

Preliminary Noise and Vibration Assessment

Client: Pacific National Pty Ltd

ABN: 39 098 060 550

Prepared by

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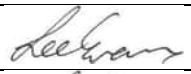
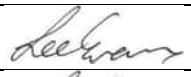
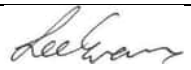
A	19-Oct-2022	Draft	Lee Evans Project manager	
1	20-Dec-2022	Final	Lee Evans Project manager	
2	01-Jun-2023	Final	Lee Evans Project manager	

Table of Contents

Executive Summary

This technical report provides a noise and vibration impact assessment conducted to support the environment effects referral for the Little River Project Logistics Precinct (the Precinct). The purpose of this report is to assess the potential construction and operational noise impacts associated with the Project to inform the preparation of a planning scheme amendment and support the environmental assessment.

Overview

Pacific National is proposing to develop a new 'state-of-the-art' integrated freight and logistics precinct in Little River, Victoria. The project is named the 'Little River Logistics Precinct' (LRLP) and the Project will deliver a significant asset, not just for Pacific National, but for the national freight supply chain, and the nation, generating increased rail mode share for interstate and, ultimately import/export freight. With the combined rail terminal and integrated warehousing, the Project will result in lower rail supply chain costs, reduced trucks on roads leading to reduced traffic congestion and increased road safety, and reduced greenhouse gas emissions.

Melbourne generates Australia's largest demand for the transport of interstate rail freight to destinations to the north in Brisbane and Sydney, and to Adelaide and Perth in the west. Melbourne's interstate intermodal terminals are located at Dynon, to the north of the Port of Melbourne. Pacific National's Melbourne Freight Terminal (MFT) interstate terminal is in South Dynon.

Capacity constraints at the MFT and other intermodal terminals in Dynon cannot meet the future demands for interstate containerised rail freight. Further, existing terminal leases in Dynon are not expected to be renewed beyond 2031. For these reasons, Pacific National is planning for its terminal operations in South Dynon to cease by 2031 – it will need to start transitioning services from this location in around 2029, hence it requires a new terminal to handle interstate rail freight by this time.

The Inland Rail Project is being delivered to improve the efficiency in moving freight along the eastern seaboard of Australia by rail and reduce reliance on road transport. The Inland Rail will accommodate double-stacked trains of 1,800m in length and is expected to drive a shift in interstate freight from road to rail. Terminal operations at Dynon cannot handle double-stacked trains, or trains of 1,800m in length efficiently.

New terminals are required to meet future demands for rail freight transport and future terminals will need to handle 1,800m long double-stacked trains and connect to the Inland Rail.

The Little River Logistics Precinct will deliver a new, open access, interstate intermodal terminal with the capacity to ultimately process more than 2 million twenty-foot equivalent units (TEUs) and handle 1,800m long, double-stacked trains. The interstate terminal will incorporate integrated 'Cargolink' warehousing that enables freight to be transported directly between the terminal and warehouses, which removes a step in the supply chain, improves supply chain efficiency and reduces heavy vehicle movements on public roads.

The Project also includes for an open access import/export (IMEX) terminal to shuttle freight on rail to/from the Port of Melbourne, and the future Bay West Port, which is planned for the future along the western side of Port Phillip Bay, nearby the Project site. The Project will be supported with general warehousing, which can capture the convenience of being located close to the terminal, and associated rail functions, commercial activities and other services.

Legislation

The Environment Protection Act aims to protect Victoria's air, water and land by adopting the 'general environment duty' (GED). The GED requires all individuals to take reasonably practicable steps to reduce the risk of harm to human health and the environment from pollution or waste, including noise.

The Environment Protection Regulations are used to further the purpose and give effect to the EP Act. Provisions under the EP Act include the GED and an obligation to not emit or permit to emit 'unreasonable noise'.

For the operation of 'commercial, industrial and trade premises', the Environment Protection Regulations (Part 5.3 Noise) set noise limits that apply in 'noise sensitive areas', above which noise is

prescribed to be unreasonable (Regulation 118). The Noise Protocol is a subordinate legislation document and it is required to be adhered to by law.

Construction noise should be managed in accordance with the EPA Publication 1834: Civil construction, building and demolition guide. Under the EP Act, anyone engaging in an activity posing a risk of harm to human health and the environment, from pollution or waste is required to eliminate or reduce the risk as far as reasonably practicable.

The noise and vibration impact assessment has determined the following:

Existing conditions

Noise monitoring was conducted throughout the study area to quantify the existing noise environment and determine the baseline noise levels. This information was used to characterise the existing noise environment, including the presence of other environmental noise sources, support the development of the project criteria and assess the potential change to the noise environment if the project is constructed.

A study area of up to two kilometres from the proposed location of the Precinct has been used for analysis to include sensitive receptors that could be impacted during the construction and operation phases of the project.

The noise and vibration sensitive receivers identified within the study area are classified as residential, rural residential, and two educational facilities (Little River Primary School and Cherry Creek Youth Justice Centre). Under the Greater Geelong Planning Scheme, sensitive receivers in the vicinity of the project are located within the Green Wedge Zone and Schedule (GWZ) and Special Use Zone and Schedule 6 (SUZ6).

Noise levels were found to be typical of a rural environment adjacent to roads and a rail corridor:

- Day period L_{eq} 48 to 51 dB(A)
- Evening L_{eq} 45 to 50 dB(A)
- Night period L_{eq} 39 to 45 dB(A)

Noise levels north of Little River Road were found to be lower than the levels at other locations as they are further away from the Princes Highway.

Construction Impact Assessment

The construction activities have been assessed at the nearest impacted noise sensitive receivers, for each stage of construction and associated activities, so that adequate mitigation measures can be recommended to avoid, minimise and manage potential impacts.

A risk-based approach has been used for the construction vibration impacts of the project to allow for vibration management measures to be developed for locations, structures or assets that fall within calculated safe working distances.

The initial construction stage of the Project is expected to occur for up to 24 months occur during normal working hours 7am – 6pm weekdays, 7am – 1pm Saturdays. There will be short periods of rail occupation, to construct the rail flyover, that will require ‘unavoidable works’ during the evening and night periods.

The construction noise levels are predicted to exceed the Environmental Reference Standard Objectives at multiple noise sensitive receptors during construction. Noise at impacted noise sensitive receptors should be managed in accordance with Section 4.4 of EPA Victoria Publication 1834 utilising a management plan.

The assessment identifies that construction noise from unavoidable night works occurring during construction of the rail flyover may interfere with sleep during the night at multiple noise sensitive receptors and exceed a to achieve reasonable ambient noise levels. Noise at impacted noise sensitive receptors should be managed in accordance with Section 4.5 of EPA Victoria Publication 1834.

Additional noise mitigation and management strategies have been recommended to reduce noise emissions so far as reasonably practicable.

Operational Impact Assessment

Operational noise emissions have been predicted using a three-dimensional computer noise model for the following scenarios:

- Project Opening (2029)
- Project Ultimate (2050)

It has been assumed that all the Precinct and all associate activities, including the rail movements and trucks will operate 24 hours per day, seven days per week. The noise limits for the night period (10pm to 7am) are the most stringent criteria, and operational activities that comply with this criterion would also comply with the day and evening noise limits.

The following key operational noise sources produced by the project have been identified as a potential risk to the amenity of nearby sensitive receptors:

- Rail flyover and associated maximum noise levels from freight train movements.
- Locomotive activity on site.
- Container handlers located in the IMEX terminal.
- Truck movements along Little River Road.

All modelled scenarios are predicted to comply with the Noise Protocol noise limits at all nearby sensitive receptors with noise mitigation measures implemented.

Mitigation measures are required to minimise the risk of noise and vibration impacts during operation so far as reasonably practicable, including and not limited to:

- Noise barriers along the site boundary and the flyover to reduce noise emissions.
- Selecting quieter machinery or electrification to reduce noise emissions from the container handlers located in the IMEX terminal.

Operational vibration produced by the Project is not expected to result in human disturbance or structural damage to surface structures. Operational vibration impacts are expected to be negligible due to distance from vibration sensitive receivers to the proposed locations of project infrastructure.

Offsite Rail Noise Assessment

The introduction of additional freight trains along the existing rail corridor due to the project are not predicted to exceed the Passenger Rail Infrastructure Noise Policy Investigation Thresholds.

Operational Traffic Assessment

The increase in traffic along Little River Road has the potential to increase traffic noise levels by 12 dB(A) or more at three noise sensitive receptors along Little River Road. There is no regulatory requirement to provide mitigation measures, however noise could be managed through road design, localised screening or treatment to noise sensitive buildings.

Glossary

Term	Definition	
'A' Weighted	Frequency filter designed to adjust the absolute sound pressure levels to correspond to the subjective response of the human ear. The A-weighting filter emphasises frequencies in the speech range (between 1 kHz and 4 kHz) which the human ear is most sensitive to.	
Ambient noise	The A-weighted equivalent continuous sound pressure level L_{Aeq}, is typically the descriptor used to describe ambient noise.	
Background level (L_{90} *or* L_{A90})	The L_{90} sound pressure level is used to quantify the background level. The A-weighted background level is termed the L_{A90}. The background level a day, evening or night period means the arithmetic average of the L_{A90} levels for each hour of that period for which the commercial, industrial or trade premises under investigation normally operates. The background level shall include all noise sources except noise from commercial, industrial or trade premises which appears to be intrusive at the point where the background level is measured.	
Decibel [dB]	The measurement unit of sound.	
Decibel scale	A three decibel increase in the sound pressure level corresponds to a doubling in sound energy. An increase or decrease of three decibels is typically considered to be the smallest change in sound level that a listener can detect. A change of five decibels, however, is clearly noticeable. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. This increase is typically perceived to sound twice as loud. The table below shows the sound pressure level that would be typically experienced when exposed to different sources:	
	0 dB	Threshold of human hearing
	40 dB	Whisper in a library
	50 dB	Open office space
	70 dB	Inside a car on a freeway
	80 dB	Outboard motor
	90 dB	Heavy truck pass-by
	100 dB	Pneumatic hammer
	110 dB	Rock concert
	120 dB	747 take off at 250 metres
Effective Noise Level (L_{eff})	In accordance with the Noise Protocol, adjustments to the measured noise level are applied to account for the effects of duration, tonality, intermittency and impulsiveness of the noise. The adjusted 30-minute noise level is called the '*Effective Noise Level*', which is assessed in relation to the noise limits.	

Term	Definition
Frequency [f]	Frequency is measured in Hertz (Hz). The frequency corresponds to the pitch of the sound: a high frequency to a high-pitched sound and a low frequency to a low-pitched sound.
Insertion loss	The reduction in sound pressure level at a receptor by inserting a barrier between the source and considered receptor.
Impulsiveness	A noise is more annoying when it has an impulsive component (such as banging noise). Where a noise source is impulsive, an adjustment is made to allow for the additional annoyance caused by the impulses.
L_{eq}	Equivalent (energy averaged) noise level measured over a time period. This noise descriptor is commonly used in environmental noise policies and assessments. The time period the measurement is averaged over is included in the subscript, i.e. $L_{Aeq, 30min}$.
L_{90}	The noise level exceeded 90% of the measurement period. This descriptor is used to represent the background noise level. The time period the measurement is averaged over is included in the subscript, i.e. $L_{A90, 30min}$
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{max}	The maximum sound pressure level measured over the measurement period. The A-weighted form is denoted as 'L_{Amax}'.
Noise sensitive area	Noise Protocol limits are set at noise sensitive areas. These are mainly residential dwellings, but can include, for example, motels and tourist establishments. Noise is assessed at the property boundary unless the boundary is greater than 10 m from the dwelling, in which case the assessment point is within 10 m of the dwelling.
Octave band	The International Standards Organisation has agreed upon preferred frequency bands for sound measurement and the octave band is the widest band for frequency analysis. The upper frequency limit is approximately twice the lower frequency limit and each band is identified by its band centre frequency. Typical octave band frequencies for environmental noise assessments are: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz and 8 kHz.
One-third octave band	Where more detailed information about a noise is required, standardised one-third octave band analysis may be used. There are three one-third octave bands for each octave band. (e.g. 25 Hz, 31.5 Hz, 40 Hz one-third octave bands cover the same frequency range as the 31.5 Hz octave band).
Peak particle velocity (PPV)	The maximum speed of a vibrating particle, in mm/s.

Term	Definition
	In buildings, these are the maximum levels measured at the foundation, or, the maximum levels measured in (x) or (y) horizontal directions, in the plane of the uppermost floor.
Sensitive receptor	Areas where the occupants, buildings or land use are potentially susceptible to the adverse effects of exposure to noise and vibration.
Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified receiving point.
Tonality	Noise is subjectively more annoying when it has a tonal component (a perceptible hum or whine). Tonality can be determined by subjective assessment or from one-third octave band analysis of the noise. Where a noise is tonal, an adjustment is made to allow for the additional annoyance caused by the tone.
Vibration dose value (VDV)	The VDV is a parameter that combines the magnitude of vibration and the duration for which it occurs to cumulatively quantify the level over an 8-hour or 16-hour period.

1.0 Introduction

1.1 Context

AECOM Australia Pty Ltd (AECOM) has been commissioned by Pacific National Pty Ltd (PN) to undertake a Noise and Vibration Impact Assessment (NVIA) to assess the impacts of a proposed planning scheme amendment for an integrated freight and logistics precinct on Little River Road, Little River, Victoria (the site).

The Project named the 'Little Rover Logistics Precinct' (LRLP) will serve as the future Victorian terminal for Pacific National and the development will support the future growth and development of the Victorian economy. With the combined rail terminal and integrated warehousing, the Project will result in lower rail supply chain costs, reduced trucks on roads leading to reduced traffic congestion and increased road safety, and reduced greenhouse gas emissions.

The core components of the precinct masterplan are:

- An open-access interstate intermodal terminal with a capacity of more than 2 million TEU per annum
- An open-access IMEX terminal with a capacity of approximately 500,000 TEU per annum
- Integrated terminal Cargolink warehousing and general warehousing comprising approximately 890,000m^2 of warehouses with offices
- Commercial activities and support services for workers and visitors
- Terminal administration/operations centre to provide management and security, rail and container handling equipment control, maintenance and other business services
- Holding tracks, staging lines and arrival/departure tracks to manage the loading and unloading of trains
- Rail connections to the Western Freight Line (part of the ARTC Interstate Freight Network) with rail bridges (flyovers) over the Melbourne-Geelong passenger railway
- Locomotive provisioning and wagon maintenance facilities
- External public road network upgrades to accommodate the increased traffic generated by the Project
- Conservation of a biodiversity offset area to enhance and protect areas of environmental value.

The master planning was informed by a range of constraints and design principles. This report represents one of a number of specialist technical assessments used to identify site constraints and provide a desktop assessment of the masterplan. In addition, the master planning was informed by the following considerations:

- Commercial – Maximising the land available for commercial use near the intermodal terminals and reducing the costs associated with supply chains
- Rail connections – Designing to meet the operating standards of the Victorian Rail system
- Staged Development – Designing to enable staging as terminal demand increases over time and the market demand for industrial development.

The current and future road and rail network surrounding the site has been determined by Pacific National with consideration of the demand induced by the Project, as well as the general growth in background transport demand.

While a number of masterplans have been presented, a range of alternative terminal layouts have also been proposed. However, site constraints combined with the need for operational efficiency (e.g. limiting the need for train movements to access the terminals) will influence the ultimate masterplan concept.

1.2 Purpose of this Report

The purpose of this report is to undertake an assessment of noise and vibration impacts during construction and operation for the proposed site and potential road and rail connections. This includes an understanding of the implications of any constraints on the development of a preferred concept layout for the site.

The scope of this NVIA report is to:

- Establish the applicable legislation, policies and guidelines to noise from this Project
- Establish the existing background noise levels in the vicinity of the Project
- Establish operational noise criteria, construction noise management levels and vibration limits that would apply to the Project
- Predict operational noise levels at nearby noise sensitive receptors due to operation of the Project
- Predict construction noise and vibration levels at nearby noise sensitive receptors due to the construction of the Project
- Predict noise levels from additional off-site traffic generated by both the operation and construction at nearby noise sensitive receptors due to the Project
- Assess the operational noise levels in accordance with the established environmental noise criteria and provide indicative noise control measures to reduce the risk of noise emissions so far as reasonably practicable
- Review the potential impacts of construction noise and vibration in relation to identified sensitive sites. Determine indicative noise control measures to reduce the risk of noise emissions so far as reasonably practicable
- Assess the risk of road traffic noise impacts as a result of additional traffic generation due to construction and operation of the Project and, where required, recommend noise management and mitigation measures to reduce the risk of noise emissions so far as reasonably practicable

1.3 Assumptions and limitations

It should be noted that this NVIA has been based on data that has been provided by PN and information currently available at the time of writing.

It is anticipated that as the design of the project progresses, some changes to the proposed design and layout may occur. Where possible, conservative estimates have been adopted throughout the study, and as such, the findings outlined in this report are expected to remain valid should minor changes to the project arise.

This report primarily focusses on the noise and vibration impacts due to the construction and operation of the Project, including changes to the local traffic network. Planning and design of these elements are to be addressed in other technical reports.

At the time of writing, all assumptions and limitations referred to in this assessment have been confirmed with PN.

2.0 Project Description

The following sections provide an overview of the Project, including location and surrounding noise sensitive receptor areas in the vicinity of the site.

2.1 Project Summary

Pacific National is proposing to develop a 'state-of-the-art' integrated freight and logistics precinct in Little River, Victoria. The Little River Logistics Precinct (**LRLP**) will deliver a significant asset, not just for Pacific National, but for the nation supply chain, and the nation, generating increased rail mode share for interstate and ultimately import/export freight. The Project will result in lower supply chain costs, reduced trucks on roads leading to reduced traffic congestion and increased road safety and reduced greenhouse gas emissions.

2.2 Project Explanation

Melbourne generates Australia's largest demand for the transport of interstate rail freight to destinations to the north in Brisbane and Sydney, and to Adelaide and Perth in the west. Melbourne's interstate intermodal terminals are located at Dynon, to the north of the Port of Melbourne. Pacific National's Melbourne Freight Terminal (MFT) interstate terminal is in South Dynon.

Capacity constraints at the MFT and other intermodal terminals in Dynon cannot meet the future demands for interstate containerised rail freight. Further, existing terminal leases in Dynon are not expected to be renewed beyond 2031. For these reasons, Pacific National is planning for its terminal operations in South Dynon to cease by 2031 – it will need to start transitioning services from this location in around 2029, hence it requires a new terminal to handle interstate rail freight by this time.

The Inland Rail Project is being delivered to improve the efficiency in moving freight along the eastern seaboard of Australia by rail and reduce reliance on road transport. The Inland Rail will accommodate double-stacked trains of 1,800m in length and is expected to drive a shift in interstate freight from road to rail. Terminal operations at Dynon cannot handle double-stacked trains, or trains of 1,800m in length efficiently.

New terminals are required to meet future demands for rail freight transport and future terminals will need to handle 1,800m long double-stacked trains and connect to the Inland Rail.

The Project will adopt international best practice standards in integrated freight terminal design with associated warehousing. The Project will also deliver an interstate terminal that can contribute to meeting the future demands for interstate rail freight between Melbourne and other capital cities around Australia by using the increased capacity allowances in the Inland Rail Project.

2.3 The Project

The Little River Logistics Precinct will deliver a new, open access, interstate intermodal terminal with the capacity to ultimately process more than 2 million twenty-foot equivalent units (TEUs) and handle 1,800m long, double-stacked trains. The interstate terminal will incorporate integrated 'Cargolink' warehousing that enables freight to be transported directly between the terminal and warehouses, which removes a step in the supply chain, improves supply chain efficiency and reduces heavy vehicle movements on public roads.

The Project also includes for an open access import/export (IMEX) terminal to shuttle freight on rail to/from the Port of Melbourne, and the future Bay West Port, which is planned for the future along the western side of Port Phillip Bay, nearby the Project site. The Project will be supported with general warehousing, which can capture the convenience of being located close to the terminal, and associated rail functions, commercial activities and other services.

The project is seeking to achieve the following objectives:

- Provide a new, open access interstate intermodal terminal with capacity to meet Pacific National's Melbourne intermodal freight demand forecasts to 2050 and beyond.

- Deliver a cost-competitive and efficient rail supply chain, including delivering the outcomes of Inland Rail, for our customers that generate increased rail mode share, and help to meet Pacific National's Intermodal Growth Strategy.
- Maximise the options for the co-location of complementary functions including maintenance facilities and warehousing.
- Achieve optimum integration with the surrounding community, the broader transport network, and the environment.
- Deliver enhanced safety outcomes, The Precinct will form part of an Australia wide terminal and rail network.

The Project site is located at 132A Old Melbourne Road and well-located in relation to existing and future transport infrastructure. The site has approximately 3.9 kilometres of rail frontage to the existing Melbourne/Geelong rail corridor, which contains a dedicated freight line operated by ARTC, and is 1.5 kilometres from the Princes Freeway (M1), part of Victoria's arterial road network which is part of the State's Principal Freight Network (PFN). The site is also located adjacent to the future Outer Metropolitan Ring Corridor (a future multi-modal corridor for both road and rail) which will provide direct double stacked train access to the Inland Rail once constructed, the future Avalon Airport Precinct and potential future Bay West Port (see Figure 1).

The Little River Logistics Precinct will operate 24 hours a day seven (7) days a week.

The Project will cover approximately 375 hectares with rail terminals, freight handling, warehousing and supporting activities, along with 205 hectares of biodiversity offset land (see Figure 1).

It is planned to deliver the Project in stages over 25+ years. The first stage will include construction of a part of the interstate terminal, rail connections to the adjacent freight line, some warehousing, road connections and upgrades, and the creation of the biodiversity area – the latter proposed to rehabilitate back to its original Western Grassland state.

The Project will create a significant economic growth and additional jobs in the region and is integral to improving the movement of freight throughout Victoria and delivery Australia-wide. The Project is the largest integrated rail and logistics facility in Australia and is essential to realising the outcomes of the new rail infrastructure being delivered by the Australian and Victorian governments.

Figure 1 - Future Associated Infrastructure

Pacific National is progressing a Planning Scheme Amendment (PSA) to rezone the site to enable the intermodal freight terminal and warehousing precinct. The site is located outside of the Urban Growth Boundary within Green Wedge Land. The PSA will amend the City of Wyndham Planning Scheme and Ministerial intervention is being sought due to the significance of the project.

Prior to lodgement of the PSA, referrals under the Environment Effects and Environment Protection and Biodiversity Conservation acts will be submitted to State and Commonwealth departments respectively to obtain the necessary environmental approvals.

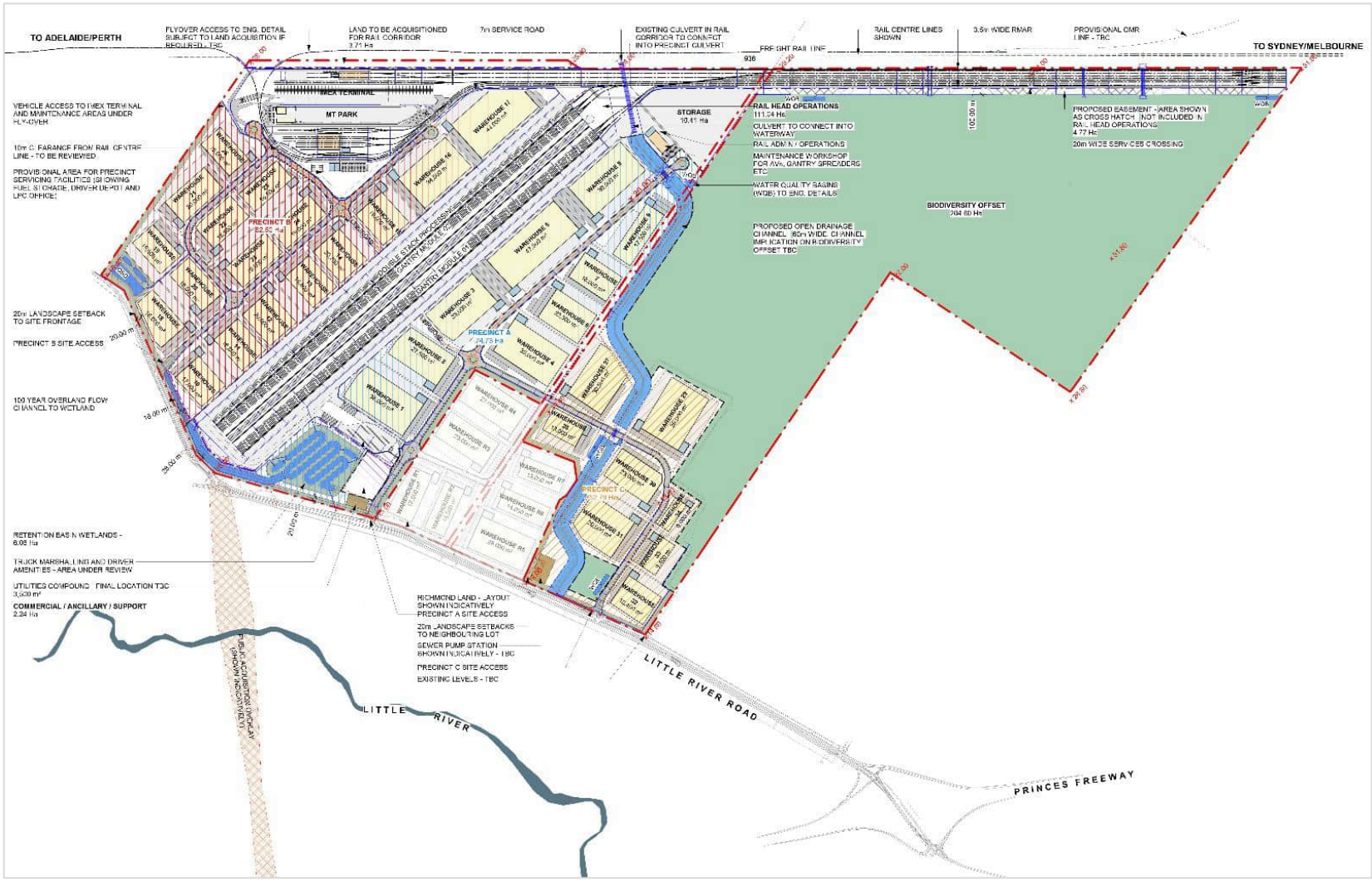


Figure 2 Proposed Masterplan Design Showing Project Site Location and Site Access Roads

2.4 Project Details

The Project will cover approximately 363 hectares with rail terminals, freight handling, warehousing and ancillary facilities, along with 205 hectares of biodiversity offset land as shown in the Little River Masterplan in Figure 2. The Project proposes to include:

- An open-access interstate intermodal terminal with a capacity of more than 2 million TEU per annum
- An open-access IMEX terminal with a capacity of approximately 500,000 TEU per annum
- Integrated terminal Cargolink warehousing and general warehousing comprising approximately 890,000m^2 of warehouses with offices
- Commercial activities and support services for workers and visitors
- Terminal administration/operations centre to provide management and security, rail and container handling equipment control, maintenance and other business services
- Holding tracks, staging lines and arrival/departure tracks to manage the loading and unloading of trains
- Rail connections to the Western Freight Line (part of the ARTC Interstate Freight Network) with rail bridges (flyovers) over the Melbourne-Geelong passenger railway
- Locomotive provisioning and wagon maintenance facilities
- External public road network upgrades to accommodate the increased traffic generated by the Project
- Conservation of a biodiversity offset area to enhance and protect areas of environmental value.

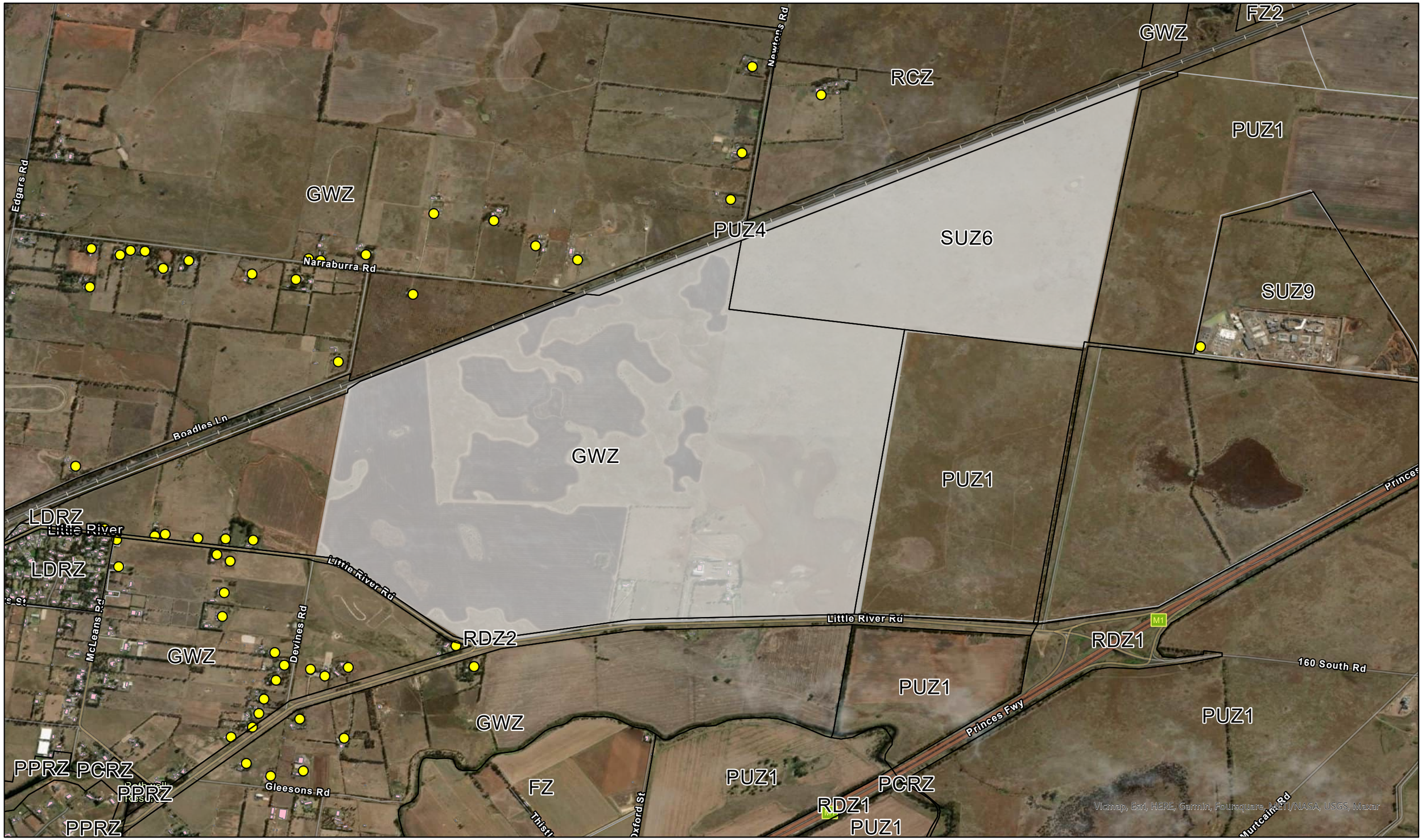
The Little River Intermodal Freight Terminal and warehousing precinct will operate 24 hours a day seven (7) days a week.

2.5 Site Description

The site is located approximately 40 kilometres south-west of the Melbourne CBD, 26km north-east of Geelong CBD, and 39 kilometres by rail to the Port of Melbourne.

The site has convenient access to the Princes Freeway that connects to Melbourne's major motorway and arterial road network and is part of the State's Principal Freight Network. The site is also adjacent to the Western Freight Line that is controlled by ARTC. The Western Freight Line transports rail freight between Melbourne and key destinations to the west of Adelaide and Perth, and until rail component of the Outer Metropolitan Ring Corridor is built in the future, will also provide access to Sydney and Brisbane via ARTC's network through metropolitan Melbourne.

The site overview including site boundary and surrounds is shown in Figure 3.



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DATUM GDA 1994, PROJECTION MGA ZONE 53

0 0.5 1
Kilometers
(when printed at A3)

Legend

- Sensitive Receptors
- Site Footprint

SITE OVERVIEW AND ZONING

FIGURE 3

A3 size

Located outside the Melbourne Urban Growth Boundary and within the City of Wyndham, the site is predominantly zoned ‘Green Wedge Zone’ and a smaller portion in the northeast is zoned ‘Special Use Zone’ for quarrying purposes. There are also numerous overlays that are summarised below.

A Planning Scheme Amendment is required to enable the delivery of a rail terminal and associated warehousing. The site is strategically located between the Princes Freeway and the Melbourne-Geelong Rail Corridor.

The City of Wyndham Planning Scheme applies the following planning controls to the Land and zoning and is shown in Figure 3.

- Green Wedge Zone and Schedule (GWZ)
- Special Use Zone and Schedule 6 (SUZ6)
- Environmental Significance Overlay and Schedule 1 (ESO1)
- Heritage Overlay and Schedule (HO133)
- Public Acquisition Overlay and Schedule 5 (PAO5)
- State Resource Overlay and Schedule 1 (SRO1)

Uses within these overlays include residential dwellings, public buildings and agricultural land.

2.6 Access arrangements

The proposed terminal has three access locations, all from Little River Road:

- Western access (located approximately 500 metres west of Old Melbourne Road): providing access to warehousing precinct B (area of 82.50 Ha), IMEX terminal and maintenance areas
- Central access (located approximately 500 metres east of Old Melbourne Road): providing access to warehousing precinct A (area of 74.73 Ha); Commercial, ancillary and support precinct (4.75 Ha); and trailer storage (12.37 Ha)
- Eastern access (located approximately 1.5 kilometres east of Old Melbourne Road): providing access to warehousing precinct C (area of 52.79 Ha).

During construction phase, it is expected that only the Central access will be utilised as it will be the closest in proximity to where the majority of the initial construction works will be conducted.

2.7 Internal road network

The movement patterns of vehicles in and out of the site, as well as throughout the Little River Logistics Precinct, are determined by their operation. The preliminary internal road network movements are as shown in Figure 4.

Further detailed assessment of the internal road network will be conducted in next stage of design development.

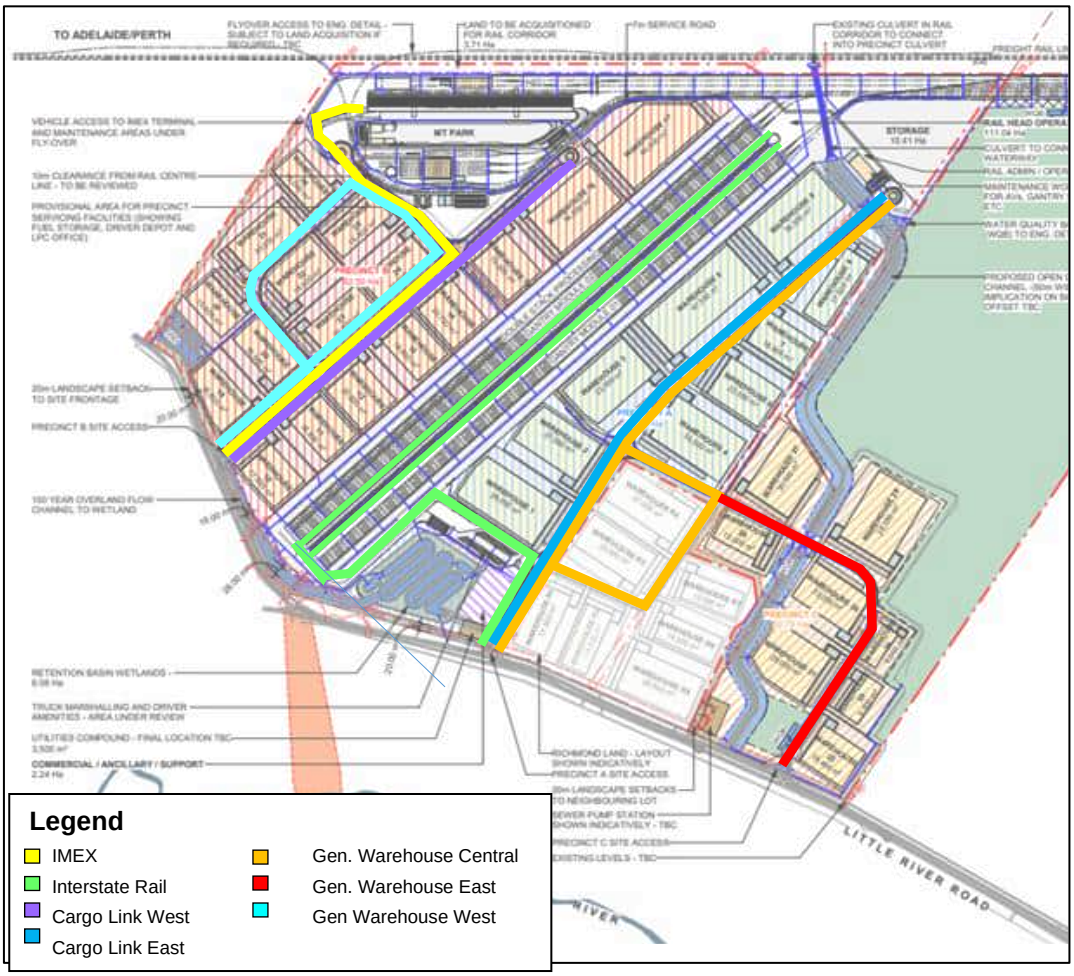


Figure 4 Map of Internal Road Movements

2.8 Proposed Construction and Operation

The development would comprise the following of construction of the following:

- Hardstand areas for container storage and laydown and loading/unloading areas
- New internal roads for light and heavy vehicles
- Rail infrastructure, including the rail overpass
- Warehouses, amenity buildings and the IMEX Terminal
- Installation of services and ancillary works.

Construction activities within the Project areas, including earthworks, will include:

- Installation/relocation of utilities
- Levelling of the site
- Construction of asphalt pavement hardstand areas for container storage and laydown
- Construction of new rail infrastructure
- Construction of warehousing and amenity buildings
- Construction of internal roads and new access roads connecting to Little River Road.

The construction staging of the Project is as indicated:

- Interstate Rail (2029)
- IMEX (2033)
- Warehousing Stage 1(2030),
- Warehousing Stage 2 (2038),
- Warehousing Stage 3 (2045),
- Project East – Cargo Link Delivery (2030)
- Project West – Cargo Link Delivery (2035)

The site will be operational 24 hours per day, 7 days per week.

3.0 Risk Assessment

In this risk assessment, the consequences of a risk occurring were assigned using a consequence guide and were developed considering existing conditions in the study area.

3.1 Methodology

A risk-based approach is adopted for assessment of the potential impacts of the Project. A risk assessment was carried out using an approach that is consistent with Australian/New Zealand Standard AS/NZS ISO 31000:2018 *Risk Management Process*.

The risk assessment process provides a method for:

- Facilitating a consistent approach to risk assessment across the various specialist studies
- Identifying key Project risks to inform where detailed investigations are required
- Ensuring the level of investigation is proportionate to the relative environmental risk
- Assessing the effectiveness of proposed mitigation measures and whether additional measures may be required.

Risk can be defined as a combination of:

- The magnitude of potential consequences of an event
- The likelihood of the event occurring.

The risk assessment process developed for the Project involved the assignment of consequence and likelihood ratings which were combined to give an overall risk level for each identified risk.

The initial findings of the impact assessment were used to identify and describe cause-and-effect pathways for the Project to determine links between Project activities and their subsequent environmental consequences (known as risk pathways). These risk pathways were identified considering the assets, values and uses requiring protection identified during the existing conditions assessment. Further detail regarding the methodology used to assess risk for this report has been included within Appendix A

3.2 Application of Mitigation Measures

An initial set of mitigation measures have been developed as part of this impact assessment. These mitigation measures are based on compliance with legislation and standard requirements that are typically incorporated into the delivery of infrastructure projects of similar type, scale and complexity.

As the operation strategies were well progressed at the commencement of this impact assessment, mitigating measures that were already incorporated in the design were included as initial mitigation measures. Initial risk ratings were applied to each identified risk pathway assuming that these initial mitigation measures were in place. Additional mitigation measures were developed where the initial risk ratings were categorised as medium or higher.

The risk and impact assessment process is iterative. Potential impacts were reassessed after the risk assessment and after mitigation measures were refined. The level of residual risk was reassessed using the same methodology to confirm the mitigation measure is effective in mitigating or managing potential impacts.

3.3 Project Risk Pathway

Noise associated with site activities are to be eliminated or minimised (so far as is reasonably practicable) in accordance with the Environment Protection Act 2017 (EP Act). Provisions under the EP Act include the General Environmental Duty (GED) and the obligation not to emit or permit to emit 'unreasonable noise'. The GED requires all reasonably practicable steps to be taken to eliminate or reduce the risk from noise.

A risk assessment of project activities was performed as a screening tool to prioritise the focus of the taking all reasonable and practicably steps to eliminate or reduce the risk from noise and vibration due to the Project. The risk pathways link project activities (causes) to their potential effects on the environmental assets, values or uses that are considered in more detail in the impact assessment. Risks were assessed for the construction, operation and decommissioning phases of the project. The identified risks and associated residual risk ratings are listed in Table 1.

Table 1 Risk Pathway Summary

Works area	Risk name	Risk pathway	Initial mitigation measure	Initial risk			Additional mitigation measure	Residual risk		
				C	L	Risk		C	L	Risk
All construction works	Construction noise	Construction causes an increase in noise that affects the amenity of sensitive receptors.	Manage noise and vibration with reference to EPA Victoria Vic Publication 1834, the ERS and the GED.	Moderate	Almost certain	High	Adopt additional management measures when on site mitigation measures are inadequate Noise and vibration monitoring	Moderate	Likely	Medium
All construction works	Construction vibration (amenity)	Vibration from construction works causes human disturbance.	Manage noise and vibration with reference to EPA Victoria Vic Publication 1834 Adopt set back distances derived using BS6472-1:2008 criteria.	Minor	Rare	Very low	Nil	Minor	Rare	Very low
All construction works	Construction vibration (damage)	Vibration from construction works cause structural damage to buildings and underground services.	Manage noise and vibration with reference to EPA Victoria Vic Publication 1834 Adopt set back distances derived using DIN 4150-3 criteria.	Minor	Rare	Very low	Nil	Minor	Rare	Very low

Works area	Risk name	Risk pathway	Initial mitigation measure	Initial risk			Additional mitigation measure	Residual risk		
				C	L	Risk		C	L	Risk
All site areas	Operational noise	The operation of the project leads to an increase in noise affecting amenity of nearby sensitive receptors.	Noise mitigation is included within project design to achieve compliance with the Noise Protocol	Minor	Likely	Medium	Commissioning noise measurements of fixed infrastructure	Minor	Possible	Low
Roads	Operational road traffic noise	The road traffic noise from Project related traffic on public roads	Nil	Moderate	Almost certain	High	Investigate relative increase in rail noise levels due to the project and recommend mitigation for noise sensitive receptors expected to experience a significant increase in noise levels.	Moderate	Likely	Medium
Rail	Operational rail noise	The rail noise from Project related train movements on the rail network	Nil	Minor	Likely	Low	Investigate relative increase in rail noise levels due to the project and recommend mitigation for noise sensitive receptors expected to experience a significant increase in noise levels.	Minor	Possible	Low
All site areas	Cumulative operational noise	The combined noise from the operation of the project with existing facilities causes disturbance at sensitive receptors.	Noise mitigation is included within project design to achieve compliance with the Noise Protocol and noise from existing industry has not been identified.	Minor	Likely	Low	Nil	Minor	Possible	Low

4.0 Potential Sources of Noise and Vibration

The following sections discuss expected sources of noise and vibration from the construction and operation of the Project.

4.1 Construction

The construction of the Project is expected to comprise the following:

- Levelling of the site, including bulk excavation and rock breaking
- Construction of rail infrastructure to connect the site to the existing rail network, and provide internal rail roads
- Construction of internal road infrastructure for vehicles on the site
- Construction of new access roads to connect the site with Little River Road
- Construction of warehouses
- Construction of hardstand areas for container storage and laydown
- Construction of buildings such as offices, wash bays and parking areas
- Installation of services and ancillary works.

Noise generated by these construction activities has the potential to temporarily change the existing acoustic environment. The potential impacts during construction are established as part of the risk assessment process (discussed in Section 3.0).

The key risk ratings associated with the probable disturbance to residential and community receptors are due to the operation of mobile plant, machinery, truck haulage and deliveries.

4.2 Operation

The initial risk ratings, presented in Section 3.0 highlight that noise generated by the operation of the following sources of noise and vibration could have a negative impact on the acoustic environment at nearby sensitive receptors:

- Container handlers (forklifts)
- Refrigerated containers
- Containers being moved and positioned with forklifts or gantries
- Idling locomotives
- Moving locomotives and wagons
- Rail curve squeal (L_{eq} and maximum noise levels due to trains travelling over the flyover)
- Wagon bunching and braking (maximum noise levels events as trains/wagons deaccelerate)
- Locomotive acceleration (maximum noise levels events as trains accelerate over the flyover)
- Moving trucks
- Idling trucks
- Commercial power washers for cleaning of locomotives, wagons and containers
- Project related traffic along the existing road network (e.g. Little River Road, Princes Highway)

Activities that are expected to produce the highest levels of vibration from the site are container handling and rail movements.

5.0 Legislation, Policy, Guidelines and Criteria

The key legislation, policy and guidelines/standards relevant to this NVIA are summarised in Table 2. These documents provide objectives for the Project to manage noise and vibration impacts from the construction and operation of the site at sensitive receptors.

Detailed information for each legislation, policy and guidelines/standards has been included within Appendix B.

Table 2 Key legislation, policy and standards for noise and vibration

Document	Description	Relevance to the Project
Legislation		
Environment Protection Act 2017 ***(EP Act)***	The Environment Protection Act aims to protect Victoria's air, water and land by adopting the 'general environment duty' (GED) which requires all individuals to take proactive steps to reduce the risk of harm to human health and the environment from pollution or waste. The Environment Protection Authority administers the Environment Protection Act and subordinate legislation.	Provisions under the EP Act include the GED and an obligation to not emit or permit to emit 'unreasonable noise'. Meeting the regulatory noise limits does not mean the GED has been met. The GED requires all reasonably practicable steps be taken to eliminate or reduce the risk from noise from the construction and operation of the project. Even if the GED is met, the noise may be unreasonable if it exceeds the noise limits or considering the factors in the definition of unreasonable noise in section 3(1) the EP Act.
Environment Protection Regulations 2021 (**Environment Protection Regulations**)	The Environment Protection Regulations give effect to the EP Act. The Noise Protocol (see below) is encompassed within the Regulations.	Section 5.3 Noise - (113) Noise Protocol - (116) Unreasonable and aggravated noise from commercial and trade premises.
Policy		
EPA Victoria Publication 1826: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues: March 2021 **(Noise Protocol)**	The Noise Protocol explains how to determine operational noise criteria for new and existing commercial, industrial and trade premises and entertainment venues as defined by The Regulations. The Noise Protocol is subordinate legislation and is required to be adhered to by law.	The Noise Protocol provides assessment criteria, including noise limits, for operational noise. The criteria apply at all nearby sensitive receptors during the operation of the project. The Noise Protocol provides guidance for the assessment and management of cumulative noise from multiple industrial premises (existing and planned). Meeting the regulatory noise limits does not mean the GED has been met. In addition to setting noise limits for industry, the EP Act 2021 requires that industry would take all reasonably practicable steps to eliminate or reduce the risk of harm to human

Document	Description	Relevance to the Project
		health and the environment from noise.
The Environment Reference Standard **(ERS)**	The ERS is made under Section 93 of the EP Act to support the protection of human health in Victoria. It sets out the environmental values of the ambient air, ambient sound, land and water environments that are sought to be achieved or maintained in Victoria and standards to support those values. Environmental values are the uses, attributes and functions of the environment that Victorians value. Standards for the environmental values are comprised of objectives for supporting different uses The ERS sets out objective noise levels based on Victoria's planning zones. The noise levels outlined in the ERS are objectives and are neither noise limits nor noise design criteria.	Identifies environmental values to support the following: sleep at night, child learning and development and human tranquillity and the enjoyment of outdoors in natural areas. Operators are required to consider residual risks from noise due to construction and operation on the environmental reference values (once all reasonably practicable measures have been taken to eliminate or otherwise minimise the risk of harm) with priority given to maintaining environmental values of "*natural areas*" for human tranquillity and enjoyment outdoors. Direct regulation prevails over the ERS, except for noise from: Construction to noise sensitive areas. Both construction and operations impacting on "*natural areas*" (as defined in the ERS). The residual risk to the environmental value of "*human tranquillity and enjoyment outdoors, in natural areas*" is considered relevant in these cases.
Guidance		
EPA Victoria Publication 1856 - Reasonably Practicable	Provides guidance on the methods used to define what is *Reasonably Practicable*.	Applies to all phases of the project.
EPA Victoria Publication 1992 – Guide to the Environment Reference Standard	Provides information about how the ERS would be applied to support decision making, and how the environmental values, indicators and objectives for each element of the environment would be interpreted.	Applies to all phases of the project.
EPA Publication 1996 – Noise Guideline, Assessing low frequency noise	Provides guidance on the assessment of low frequency noise (10 to 160 Hertz (Hz))	Applies to the operation of the project.
The Passenger Rail Infrastructure Noise Policy ***(PRINP)***	Provides guidance on the methods used to assess noise from new passenger rail infrastructure, changes to land use near existing and planned rail corridors, and redevelopment of existing passenger rail infrastructure	The passenger rail infrastructure on the Melbourne-Geelong line will not be modified as part of this project, therefore PRINP is not applicable to the project.

Document	Description	Relevance to the Project
Victorian Civil and Administrative Tribunal (VCAT) Precedents	Provide guidance on the methods used to assess noise from maximum noise level events during the hours of sleep.	The VCAT Precedent Criteria provides assessment criteria, for maximum noise level events that occur from the operation of the site during the night. The criteria apply at nearby sensitive receptors during the operation of the project and during the night.
VicRoads Traffic Noise Reduction Policy	Provides guidance on the methods used to assess noise from new or redeveloped arterial roads.	Not applicable to the project (Little River Road is a non-arterial road) Alterations to the Princes Freeway ramps may trigger TNRP.
EPA Victoria Publication 1834 - Civil Construction, Building and Demolition Guide	Provides guidance on the methods used to manage noise and vibration impacts from construction of commercial and industrial sites.	Applies to the construction phase of the project.
German Standard DIN 4150-3:2016 Vibration in Buildings – Effects on Structures (**DIN 4150-3**)	German Standard DIN 4150-3:2016 provides guidance on the assessment of building exposure and structural damage due to vibration.	There is no specific policy or guideline for the assessment of vibration in Victoria. These international standards are widely used for the assessment of vibration resulting from the construction of major projects in Victoria. Applies to construction and operation of the project.
British Standard BS6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting (**BS6472-1**)	British Standard BS6472-1:2008 provides guidance on the assessment of human exposure to vibration in buildings	

Activities that are expected to produce the highest levels of vibration from the site are container handling and rail movements. Based on expected vibration levels from these activities and sensitive receptors being located 50 to 100 metres from the Project Site's Boundary it is unlikely that thresholds provided by the following standards would be exceeded:

- DIN 4150-3:2016 Vibration in Buildings – Effects on Structures December 2016
- ISO 2631-2:2003 Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Part 2: Vibration in buildings (1 Hz to 80 Hz)

Accordingly, vibration levels from operation of the site have not been assessed.

6.0 Existing Conditions

Impacts of noise are related to the context of the receiving environment and existing conditions.

6.1 Noise Sensitive Receptors

The Project site is located within rural land, approximately one kilometre east of Little River township and one kilometre north of the Princes Highway. The nearest residential receptors to the site's boundary are located approximately:

- 50 metres south on Old Melbourne Road and Little River Road
- 150-200 metres north on Boadles Lane, Narraburra Road and Newtons Road
- 300 metres west on Little River Road.
- 700 metres east (Cherry Creek Youth Justice Detention Centre)

The following noise sensitive receptors have also been identified as part of the assessment:

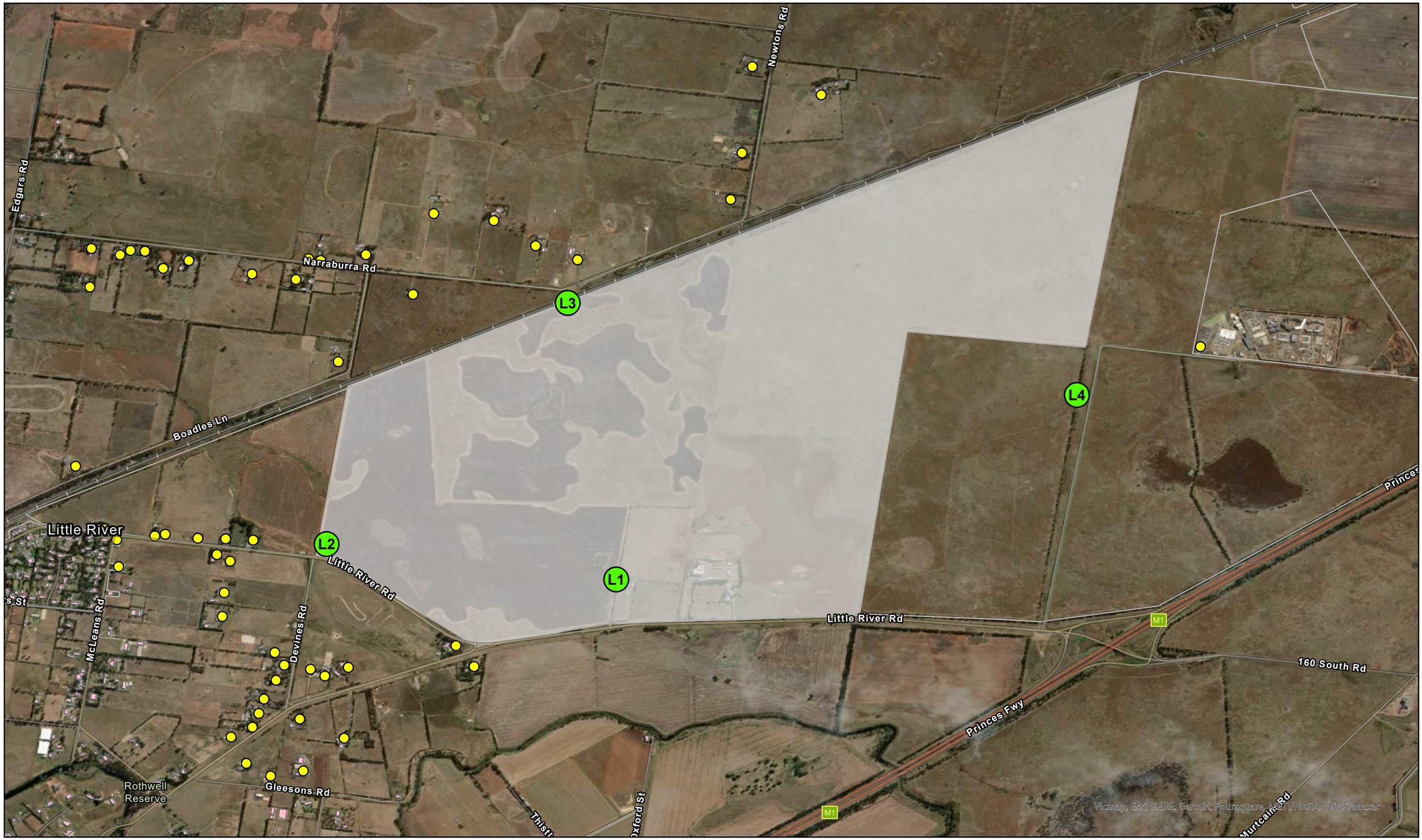
- Little River Primary School located 1,500 metres west of the site's boundary
- Little River township located 1,000 metres west of the site's boundary
- Rothwell Reserve located 1600 metres south west of the site's boundary

A 'study area' of approximately two kilometres around the proposed site has been applied as part of the assessment. Locations of noise sensitive receptors surrounding the site and within the study area are shown in Figure 5. Details of the existing acoustic environment are presented in Section 6.2.

Noise sensitive receptors in proximity to the site are currently exposed to noise and/or vibration being produced by the following:

- Road traffic noise from the Princes Highway at the site and surrounds
- Intermittent passenger and freight train pass-bys along the Geelong railway line, north of the project area
- Intermittent aircraft noise at the site and surrounds. Noise from Avalon airport, located approximately 8 kilometres southwest of the project area
- Noise from other industry was not observed at the site and nearest residential receptors.

Potential sources of noise and vibration that could impact sensitive receptors within the nominated study area have been listed in the following sections.



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Kilometers
(when printed at A3)

Legend

- Monitoring Locations
- Sensitive Receptors
- Site Footprint

PROJECT SURROUNDS AND NOISE MONITORING LOCATIONS

FIGURE 5

A3 size

6.2 Baseline Noise Monitoring

Baseline noise levels were measured to establish the existing noise environment at the site and surrounding residential receptors. Noise monitoring locations L1, L2, L3 and L4 are shown in Figure 5.

This information is used to describe the existing environment, support development of the project criteria and assess the potential changes to the noise environment if the Project was constructed.

The existing noise levels were measured with reference to the requirements outlined in the following documents:

- AS 1055:2018 - Acoustics - *Description and measurement of environmental noise*
- Noise Protocol – *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*

A summary of the methodology used to conduct noise measurements is provided below:

- Noise measurement equipment was deployed to suitable locations. The equipment measured noise levels continuously throughout the logging period
- All noise monitoring was undertaken in free field, with the microphone at least 3.5 metres from all reflecting surfaces at a height of 1.5 metres (this height is representative of the centre of a typical ground floor window)
- Equipment was set up in locations to minimise the impacts of extraneous noise sources, such as insects and mechanical noise sources e.g. air conditioners or external fans
- Each noise monitor was checked with a field calibrator at the start and completion of the monitoring period

The meteorological data was also gathered from the Bureau of Meteorology's Avalon Airport weather station. This information was used to identify periods where measured noise levels should be adjusted or removed due to extraneous weather. The data from each site was reviewed and was omitted where adverse weather conditions, or extraneous noise events, affected the measurements. Adverse weather conditions include wind speeds greater than 5 m/s and/or rainfall occurring within the hour.

6.2.1 Reported Acoustic Parameters

Existing noise levels were monitored and reported with reference to the following descriptors in relevant to Victorian regulations and guidelines:

- **Background noise level (L_{A90} dB)**: The noise level that is exceeded for 90 per cent of a specified period. Background noise levels are used to determine noise limits for the Project.
- **Ambient noise level (L_{Aeq} dB)**: Commonly used to describe continuous sound pressure level for all sound occurring during the measurement period. The ambient noise level is used to quantify industrial noise, and to assess environmental noise impacts.
- **Traffic noise level (L_{A10} dB)**: The noise level that is exceeded for 10 per cent of a specified period representing the higher noise levels during the measurement interval.

Figures showing the background levels at each location have been included within Appendix E.

6.2.2 Instrumentation

The equipment model details used for the unattended noise monitoring is presented in Table 3

Table 3 Unattended noise monitoring details

ID	Address	Equipment details	Serial Number
L1	425 Little River Road	Acoustic Research Lab's Ngara	878005
L2	132 Old Melbourne Road	Acoustic Research Lab's Ngara	8780D7
L3	132 Old Melbourne Road	Acoustic Research Lab's Ngara	87809F
L4	132 Old Melbourne Road	Acoustic Research Lab's Ngara	8780DD

6.3 Unattended Noise Monitoring

Unattended background noise monitoring was undertaken at four locations between 11 and 18 May 2022. The locations were selected to represent the existing conditions at noise sensitive receptor locations and to determine noise limits as per the Noise Protocol. A summary of these locations is presented in Table 4.

Table 4 Measurement Locations and Reasons for site Selection

ID	Address[1]	GPS Coordinates		Reason for Site Selection
		Latitude	Longitude	
L1	425 Little River Road	37°57'51.38"S	144°32'2.51"E	Represents noise sensitive receptors located to the south of the site.
L2	132 Old Melbourne Road	37°57'17.12"S	144°33'26.10"E	Represents noise sensitive receptors located to the west of the site.
L3	132 Old Melbourne Road	37°56'58.47"S	144°31'58.86"E	Represents noise sensitive receptors located to the north of the site and measured noise levels from rail pass-bys.
L4	132 Old Melbourne Road	37°57'46.04"S	144°31'8.55"E	Represents noise sensitive receptors located to the east of the site.

6.3.1 Average Background Noise Levels (L_{90})

A summary of the measured background noise levels is provided in Table 5.

Table 5 Background Noise Monitoring Results

ID	Location[1]	Average Measured L_{90} Noise Level, dB(A)		
		Day[1]	Evening[1]	Night[1]
L1	425 Little River Road (south)	41	38	32
L2	132 Old Melbourne Road (west)	39	36	31
L3	132 Old Melbourne Road (north)	34	34	31
L4	132 Old Melbourne Road (east)	40	39	33

1. Period definitions:

   Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

   Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

   Night: All days 10pm-to-7am

The lowest of the average background levels (L_{90}) have been used to derive the Project construction and operational criteria.

6.3.2 Ambient Noise Levels (L_{eq})

A summary of the average measured ambient noise levels is provided in Table 6.

Table 6 Ambient Noise Monitoring Results

ID	Location[1]	Average Measured L_{eq} Noise Level, dB[1]		
		Day[1]	Evening[1]	Night[1]
L1	425 Little River Road (south)	52	49	41 (30)
L2	132 Old Melbourne Road (west)	52	51	46 (36)
L3	132 Old Melbourne Road (north)	50	54	54 (30)
L4	132 Old Melbourne Road (east)	50	48	43 (31)

1 Period definitions:

Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

Night: All days 10pm-to-7am

2 Formatted X (Y) X being the averaged measured for the monitoring period and Y being the minimum measured hourly for the monitoring period.

6.3.3 Traffic Noise Levels ($L_{10,18hr}$)

A summary of the average measured traffic noise levels is provided in Table 7

Table 7 Ambient Noise Monitoring Results

ID	Location[1]	Average Measured $L_{10,18hr}$ Noise Level, dB(A)[1]
L1	425 Little River Road (south)	51
L2	132 Old Melbourne Road (west)	54
L3	132 Old Melbourne Road (north)	44
L4	132 Old Melbourne Road (east)	49

1 Noise levels measured All days 6am-12 midnight

7.0 Impact Assessment

The following sections provides an assessment of noise and vibration impacts from the construction and operation of the Project.

7.1 Initial mitigation and management measures

The project design, construction methodology and operation strategies were progressed at the commencement of this impact assessment. Accordingly, mitigation measures that were already incorporated in the project planning have been considered within the assessment and risk assessment (Section 3.0).

These initial mitigation and control measures are summarised in Table 8.

Table 8 Planned mitigation and management measures

Design aspect	Mitigation and management measures
Construction	
Construction noise management	Construction of the project has been proposed during “Normal Working hours” (7am to 6pm Mondays to Fridays, and 7am to 1pm on Saturdays) to reduce the impact on surrounding noise sensitive receptors. Works within the rail corridor will require rail occupations (for safety) and are therefore considered to be “unavoidable”. These works may require 24-hour works including the night periods and weekends. **Unavoidable works** - are works which pose an unacceptable risk to life or property or a major traffic hazard and can be justified. Includes an activity which has commenced but cannot be stopped. The construction program is required to demonstrate that planned unavoidable works cannot be reasonably moved to normal work hours. This requires additional consideration of potential noise and vibration generating activities and controls to minimise noise and vibration. These controls can be recorded within the noise and vibration management plan and may form part of a broader environmental management plan.
Operation	
Site arrangement	The site has been orientated so the development layout (future warehouses and administration buildings) will provide noise shielding from the site to surrounding noise sensitive receptors. It is expected the warehouses will be built by from the year 2030 to 2045.
Truck routes	Internal truck route locations have been considered such that they are shielded from surrounding noise sensitive receptors by the built form of the development (warehouses, containers and buildings) or are located along the site boundary where noise barriers could more effectively mitigate noise levels.
On site refrigeration units	The location of the refrigeration units has been selected such that containers without refrigeration capabilities located in the IMEX / MT Park provide shielding from refrigeration units to surrounding noise sensitive receptors. Additionally, units with quieter refrigeration technology have been selected so noise levels from units significantly decrease when connected to the mains power.
Container handling	Pacific National has committed to providing gantry and container handling systems with “soft touch” technology enabled to reduce noise from container handling activities.

Mitigation measures in addition to those outlined in Table 8 have been recommended where:

- Predicted noise levels exceed the criteria provided in Appendix B
- It is considered necessary to preserve the existing acoustic environment, for example in order to satisfy the requirements of the ERS.
- There are reasonable and feasible opportunities to reduce the risk of noise and vibration to achieve the intention of the GED (as discussed in Section 8.4).

7.2 Construction Noise

In consultation with Pacific National, an initial construction stage with 11 work packages for the Project have been defined. Stage 1 includes construction of the following:

- Rail approach, flyover, holding lines and associated rail connections
- Empty Container Park
- Truck access roads
- Gantry module 1
- Loco provisioning and wagon maintenance
- Required services

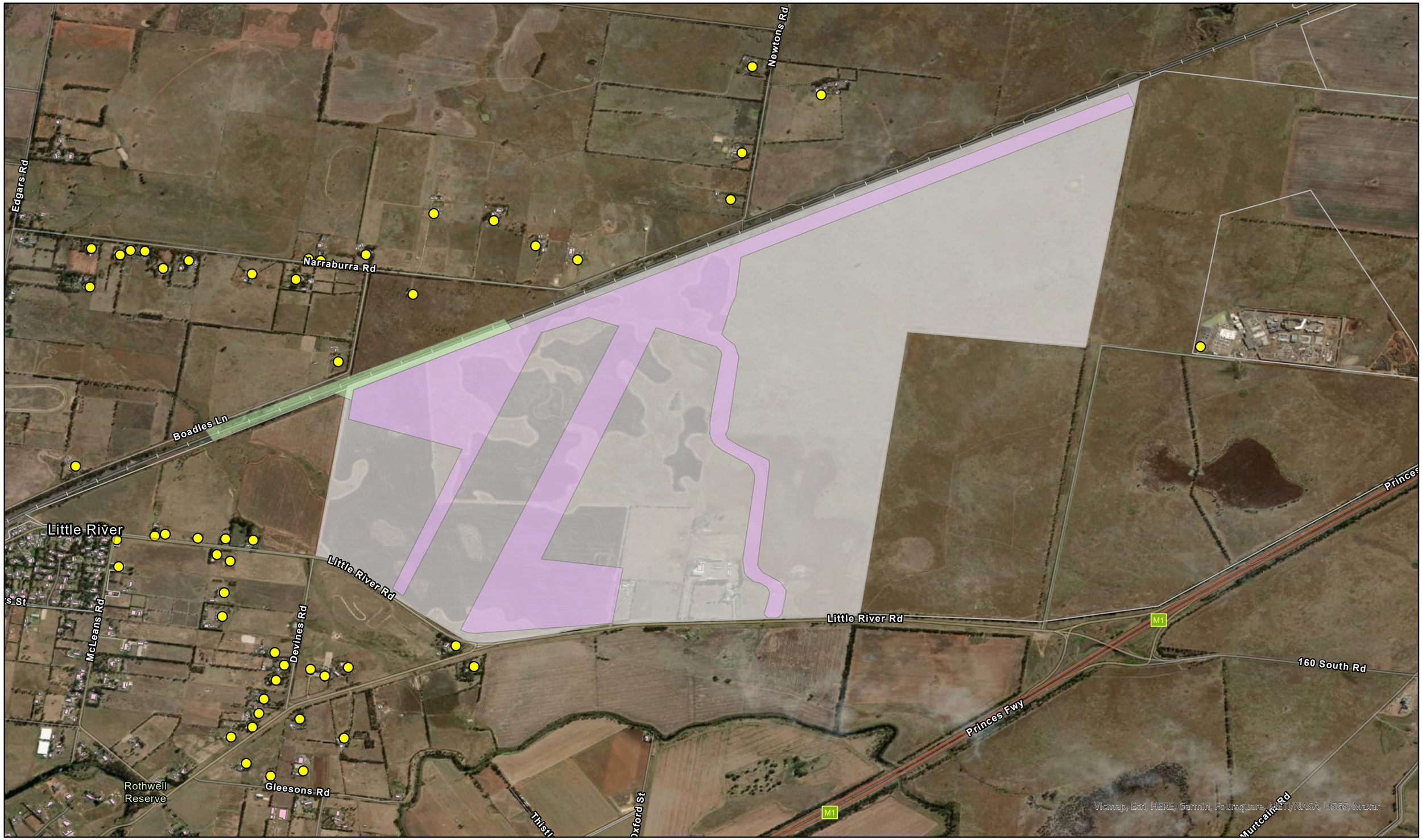
Work packages for Stage 1 Construction are described in Table 9. These would be confirmed by the construction contractor prior to work commencing and a further assessment would be undertaken if required. This should also apply for subsequent construction stages of the Project.

Table 9 Construction Assessment Work Packages (Stage 1)

Work Package	Activities	Estimated Duration	Approximate Sequencing
1	Bulk Earthworks	6 months	Month 1 to month 6
2	Subgrade / Sub Base Preparation	6 months	Month 3 to month 9
3	Drainage and Utility Services Installation	9 months	Month 1 to month 9
4	Rail Construction	18 months	Month 6 to month 24
5	Rail Flyover and Retaining Walls	20 months	Month 4 to month 24
6	Bridge Strengthening	20 months	Month 4 to month 24
7	Road and Hardstand Base Course Preparation	18 months	Month 6 to month 24
8	Concrete Works	12 months	Month 12 to month 24
9	Above Ground Installation of Utility Services	6 months	Month 18 to month 24
10	Buildings	12 months	Month 12 to month 24
11	General	24 months	Month 1 to month 24

The majority of the construction works are proposed to be undertaken during normal working hours (7am to 6pm Mondays to Fridays, and 7am to 1pm on Saturdays) over a period of up to 24 months. The proposed area for the construction works is shown in Figure 6.

For construction works to the rail flyover and connections to the existing rail network, 24/7 rail occupation may be required. These are considered to be “unavoidable works” and are likely to occur during the day, evening and night periods.



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Legend

- Construction Works - Flyover
- Construction Works - Site
- Site Footprint
- Sensitive Receptors

PRELIMINARY CONSTRUCTION WORKS AREA

FIGURE 6

A3 size

7.2.1 Construction Sources

Noise sources and their respective sound power levels for each work package are shown in Table 10.

These levels are typical values and are taken from data provided in Australian Standard AS2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites* and British Standard 5228: Part 1 2009 *Code of practice for noise and vibration control on construction and open sites*, 2009 and assume equipment is modern and in good working order.

Table 10 Equipment Sound Power Levels per Construction Work Package

Work Package	Activities	Plant / Machinery	Overall SWL dB(A)	Number
1	Bulk Earthworks	Prime movers and trailers	110	4
		Tipper Trucks	108	4
		Scrapers	106	12
		Graders	106	6
		Excavators	98	6
		Backhoes	96	2
		Vibrating rollers	105	6
		Water Carts	102	6
		Rock breakers	116	3
		Dozers	105	4
		Haul dump trucks	110	12
		Front end loaders	104	6
2	Subgrade / Sub Base Preparation	Prime movers and trailers	110	2
		Tipper Trucks	108	6
		Graders	106	4
		Rubber tyred rollers	105	4
		Vibrating rollers	105	4
		Water Carts	102	6
		Semi-trailers	110	12
		Front end loaders	104	6
3	Drainage and Utility Services Installation	Prime movers and trailers	110	2
		Tipper Trucks	108	6
		Excavators	98	6
		Backhoes	96	3
		Water Carts	102	2
		Rock breakers	116	2
		Dozers with rippers	105	1
		Haul dump trucks	110	3
		Front end loaders	104	4

Work Package	Activities	Plant / Machinery	Overall SWL dB(A)	Number
4	Rail Construction	Prime movers and trailers	110	2
		Tipper Truck	108	6
		Grader	106	3
		Excavators with tamping equipment	116	4
		Mechanical tampers	94	2
		Backhoe	96	6
		Vibrating roller	105	6
		Water Cart	102	4
		Haul dump truck	110	4
		Mobile crane	106	3
		Front end loader	104	6
5	Rail Flyover and Retaining Walls	Prime movers and trailers	110	2
		Tipper Truck	108	4
		Excavator	98	2
		Backhoe	96	2
		Vibrating roller	105	2
		Water Cart	102	2
		Rock breaker	116	2
		Haul dump truck	110	6
		Mobile crane	106	4
		Piling	113	2
		Front end loader	104	6
6	Bridge Strengthening	Prime movers and trailer	110	2
		Tipper Truck	108	3
		Excavator	98	3
		Backhoe	96	1
		Vibrating roller	105	1
		Water Cart	102	2
		Haul dump truck	116	1
		Rock breaker	110	2
		Haul dump truck	106	2
		Mobile crane	104	1
		Piling	113	1
		Front end loader	104	3
7		Prime movers and trailers	110	2
		Tipper truck	108	6

Work Package	Activities	Plant / Machinery	Overall SWL dB(A)	Number
	Road and Hardstand Base Course Preparation	Grader	106	6
		Rubber tyred roller	105	6
		Vibrating roller	105	6
		Water Cart	102	6
		Front end loader	104	6
		Asphalt laying machine	113	2
		Semi-trailers	110	12
8	Concrete Works	Front end loader	104	2
		Mobile crane	106	2
		Concrete truck	106	4
		Piling	113	1
9	Above Ground Installation of Utility Services	Mobile Crane	106	2
		Front end loader	104	2
10	Buildings	Mobile Crane	106	2
		Front end loader	104	2
11	General	Power tools	104	1
		Hand tools	94	1
		Generator	93	6

1. Sound powers are time weighted (i.e. expected equipment levels per 15 minute period)

7.2.2 Noise Modelling

A SoundPLAN three-dimensional noise model, implementing ISO 9613-2 A*coustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation* noise propagation algorithms, was built to calculate noise propagation from construction activities at the site. The following propagation effects were included in the predictive noise model:

- Attenuation of noise with distance, including geometrical spreading and air absorption
- Reflections from buildings and other acoustically-reflective structures
- Barrier effects due to obstructions between noise sources and residential receptors
- Ground absorption
- Local topographical changes.

Three scenarios have been modelled during Normal Working hours to assess cumulative construction noise impacts that may occur during the overlap of Stage 1 construction phases. These scenarios are:

- **Scenario 1:** Bulk Earthworks, Subgrade / Sub Base Preparation, Drainage and Utility Services Installation and General
- **Scenario 2:** Bulk Earthworks, Subgrade / Sub Base Preparation, Drainage and Utility Services Installation and General, Rail Construction, Rail Flyover and Retaining Walls, Bridge Strengthening and Road and Hardstand Base Course Preparation.
- **Scenario 3:** Rail Construction, Rail Flyover and Retaining Walls, Bridge Strengthening, Road and Hardstand Base Course Preparation, Concrete Works, Above Ground Installation of Utility Services, Buildings and General

One scenario has been modelled to assess construction noise impacts that may occur during construction of the flyover. This is unlikely to be completed during “normal working hours”, as works within the rail corridor will require rail occupation and be considered “unavoidable”:

- Scenario 4: Rail Flyover and Retaining Walls and Bridge Strengthening

For each scenario it has been assumed that equipment from a single phase will operate simultaneously and at location which is nearest to a given sensitive receptor. It can be expected that there may be differences between calculated and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement including the location of the plant equipment.

Given the absence of noise criteria in EPA 1834 for construction works during normal working hours and unavoidable works, noise due to construction at noise sensitive receptors has been assessed against the ERS objectives during normal working hours.

Additionally, it is required that construction works take all practicable and reasonable work practices to reduce the risk of noise at all times (including unavoidable works).

The calculated noise levels may change depending on the final construction methodology and further assessment would be undertaken if required. During construction it is likely that all equipment would not be always operating simultaneously in the one location. Accordingly, the predicted values are considered to represent a worst-case scenario.

7.2.3 Predicted Noise Levels

A summary of predicted results from construction activities are presented in Table 11.

Table 11 Predicted Construction Noise Level Summary

Scenario	Number of noise sensitive receptors within $L_{eq,15min}$ dB(A) range				
	< 35	30 - 40	40 – 50	50 – 60	> 60
Scenario 1 during normal working hours	0	0	21	25	8
Scenario 2 during normal working hours	0	0	15	30	9
Scenario 3 during normal working hours	0	0	17	28	9
Scenario 4 unavoidable works during the night (rail flyover)	1	10	22	18	2

7.2.4 Assessment against ERS

Environmental values are the uses, attributes and functions of the environment that Victorians value. Some examples are water that is safe to drink; air quality that sustains life, health and wellbeing; land that is suitable for production of food; and an ambient sound environment that supports sleep at night.

The ERS applies to the construction phase as a reference tool, it does not set compliance limits. The ERS Objective for the surrounds (*GWZ* and *PUZ*) are (Category IV) with outdoor noise indicators of:

- L_{eq} 35 dB(A) from 10 pm to 6 am
- L_{eq} 40 dB(A) from 6 am to 10 pm

In all cases, the measured period ambient noise levels presented in Section 6.3.2 are above the relevant ERS objective noise indicators.

Commentary with respect to the predicted construction noise and the ERS objective noise indicators is presented in Table 7.

Table 12 Construction Noise Assessment against the ERS

Land Use		Objectives		Objectives and Assessment Summary
		Day	Night	
Surrounding residential Cherry Creek Youth Justice Detention Centre. Little River Primary School (GWZ and PUZ9)	Category IV	40 dB(A)	35 dB(A)	Sleep during the night Noise from unavoidable rail flyover construction works may interfere with sleep during the night at multiple noise sensitive receptors. It is recommended that project employ all practicable and reasonable work practices to reduce levels of noise during these works (see following section).
				Domestic and recreational activities Construction noise may interfere with domestic and recreational activities at multiple receptors during each of the construction phases. It is therefore recommended that notification and consultation would be undertaken with reference to Section 4.3.2 of EPA Victoria Publication 1834 for impacted noise sensitive receptors.
				Normal conversation Construction noise may interfere with normal conversation at multiple receptors during each of the construction phases. It is therefore recommended that notification and consultation would be undertaken with reference to Section 4.3.2 of EPA Victoria Publication 1834 for impacted noise sensitive receptors.
Rothwell Reserve (PPRZ)	Category III	50 dB(A)	40 dB(A)	Child learning and development Construction noise may interfere with cognitive development and learning at the Cherry Creek Youth Justice Detention Centre. It is therefore recommended that notification and consultation would be undertaken with reference to Section 4.3.2 of EPA Victoria Publication 1834 for impacted noise sensitive receptors. Construction noise is not expected to interfere with cognitive development and learning at Little River Primary School due to its location being 1500 metres from the site's boundary.
				Human tranquillity and enjoyment outdoors in natural areas Construction noise is not expected to interfere with Human tranquillity and enjoyment outdoors in natural areas at Rothwell Reserve due to its location being 1600 metres from the site's boundary.
				Musical entertainment N/A – There are no musical entertainment venues within the study area.

7.2.5 Assessment of Unavoidable Night Works (Rail Flyover)

As shown in the previous section, the proposed unavoidable night works for construction of the rail flyover is predicted to interfere with sleep during the night at multiple noise sensitive receptors. It is required that it is required that construction works take all practicable and reasonable work practices to reduce levels of noise during these works. As such, the maintenance of existing ambient noise levels has been taken as a reasonable target.

The minimum measured hourly ambient noise levels at noise monitoring locations L1, L2, L3 and L4 was found to be L_{eq} 30dB(A) during the Night Period. As shown in Table 11, the predicted noise levels from construction of the rail flyover are expected to be above the target of L_{eq} 30dB(A) at surrounding noise sensitive receptors. It is therefore recommended that notification and consultation would be undertaken with reference to Section 4.4.2 of EPA Victoria Publication 1834 for impacted noise sensitive receptors.

7.2.6 Character of Construction Noise

Commentary on the likelihood of harm in the event that activities display any of the characteristics listed in Section 4.1.3 of EPA Victoria Publication 1834, is provided in Table 13.

Table 13 Potential Construction Noise Characteristics

Activity	Potential Noise Character	Factors that Influence the Risk of Harm (EPA Victoria Publication 1834)
General earthworks	Impulsive	**Proximity to people** The nearest works are approximately 50-150 metres from noise sensitive receptors. **Time of day** Daytime only for majority of construction works with only construction of the rail flyover to occur during the night due to required 24/7 rail occupation “unavoidable works”. **Duration of exposure** Up to 24 Months. **Background noise levels** The existing measured ambient levels are generally representative of rural environments. The predicted noise levels are above the measured existing ambient levels. **Construction fatigue** There are no other known works ongoing in the vicinity at present. **Summary** Generally, notification and consultation would be undertaken with reference to Section 4.3.2 of EPA Victoria Publication 1834. Additional mitigation for construction of Rail Flyover to be considered.
Heavy machinery	Low frequency noise	
Reverse beepers	Tonal	
Rock breaker	Impulsive, tonal	
Piling	Impulsive	
Ballast tamping	Impulsive	

7.3 Construction Vibration

Ground vibration caused by construction activities has the potential to cause an adverse response at sensitive receptors within the project study area.

7.3.1 Nearest vibration sensitive receptors

The nearest vibration sensitive receptors potentially disturbed by ground vibration during construction are 50-150 metres from the site and are residential use.

7.3.2 Vibration from construction works leading to human disturbance

Ground vibration caused by construction activities has the potential to cause an adverse response at sensitive receptors within the project study area.

7.3.2.1 Minimum Working Distances

Works outside of the minimum working distances presented in Table 14 would be considered to comply with the criteria presented in Appendix B.

Table 14 Ground vibration safe working distances from plant

Plant	Rating/Description	Human Response Minimum Working Distances (metres)
Drop hammer	3t Enclosed (30kJ per blow assumed)	100
	25 kJ per blow	100
	5 kJ per blow	35
Excavation	-	Avoid contact with structures
Jackhammer	Handheld	Avoid contact with structures
Large hydraulic hammer	(1,600 kg – 18-34t excavator)	73
Medium hydraulic hammer	(900 kg – 12-18t excavator)	23
Pile boring	≤ 800 mm	N/a
Small hydraulic hammer	(300 kg – 5-12t excavator)	7
Vibratory rig	50 kJ per cycle	100
Vibratory rig	10 kJ per cycle	100
Vibratory roller	< 50 kN (typically 1-2t)	15-20
	< 100 kN (typically 2-4t)	20
	< 200 kN (typically 4-6t)	40
	< 300 kN (typically 7-13t)	100
	> 300 kN (typically 13-18t)	100

If works are conducted along the boundary of the site, it is calculated that vibration at sensitive receptor may exceed thresholds from the following plant: drop hammer, large hydraulic hammer, vibratory rig and vibratory roller.

Therefore, it is recommended that notification and consultation would be undertaken with reference to Section 4.3.2 of EPA Victoria Publication 1834 for impacted sensitive receptors.

7.3.3 Vibration from construction works leading to structural damage to buildings and underground services

Construction activities have the potential to cause vibration that affects the structural integrity of buildings. The activities with the greatest potential for causing vibration impacts on sensitive receptors are rolling or compaction activities at the facilities.

7.3.3.1 Safe working distances

Table 15 presents the safe working distances which relate to cosmetic/structural damage for vibration-intensive construction equipment, in relation to the vibration criteria outlined in Appendix B.

Table 15 Structural Damage Set Back Distances

Plant	Rating/Description	Cosmetic Damage Safe Working Distances (metres)		
		Heritage	Residential	Industrial
Drop hammer	3t Enclosed (30kJ per blow assumed)	40	23	6
Drop hammer	25 kJ per blow	40	23	6
Drop hammer	5 kJ per blow	17	10	3
Excavation	-	2 [1]	1 [1]	<1
Hydraulic jacking rig	-	3	1.5	<1
Jackhammer	Handheld	1 [1]	1 [1]	<1
Large hydraulic hammer	(1,600 kg – 18-34t excavator)	34	22	7
Medium hydraulic hammer	(900 kg – 12-18t excavator)	12	7	2
Pile boring	≤ 800 mm	3	2	<1
Small hydraulic hammer	(300 kg – 5-12t excavator)	4	2	<1
Vibratory roller	< 50 kN (typically 1-2t)	8	5	2
	< 100 kN (typically 2-4t)	10	6	2
	< 200 kN (typically 4-6t)	20	12	3
	< 300 kN (typically 7-13t)	25	15	4
	> 300 kN (typically 13-18t)	30	20	6

Based on the location of noise sensitive receptors and safe working distances it is not expected that vibration from construction works would lead to structural damage of buildings.

7.4 Operational noise

7.4.1 Noise Modelling

A SoundPLAN three-dimensional noise model, implementing the following:

- ISO 9613-2 A*coustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation* noise propagation,
- Nordic Kilde Rep 130 (rail)
- CoRTN (road) algorithms, was built to calculate noise propagation from operational noise at the site.

The following propagation effects were included in the predictive noise model:

- Attenuation of noise with distance, including geometrical spreading and air absorption
- Reflections from buildings and other acoustically-reflective structures
- Barrier effects due to obstructions between noise sources and residential receptors
- Ground absorption
- Local topographical changes.

The following sections outline the operational scenarios and associated inputs that were used to predict operational noise from the Project.

7.4.2 Project Objective Noise Levels

This assessment has been prepared to meet the requirements of the EP Act (2017) and the associated Environment Protection Regulations. The GED requires proactive steps to be taken to eliminate or reduce the risk of harm to human health and the environment from noise.

Table 16 provides the project objective noise levels and the applicable reference document of guideline that applies to noise from the Project.

Table 16 Project Objective Noise Levels

Project Activity/Noise Source	Reference Standard	Project Objective Noise Level
On site industrial activities including container handling, refrigerated containers, truck movements and rail movements	The Noise Protocol	$L_{eff,30min}$ dB(A)
Maximum noise level events including rail movements (flyover radius squeal, brake squeal, wagon bunching, locomotive acceleration) and container handling	VCAT precedents	L_{max} 65 dB(A) (internal noise level of 55 dB(A) plus 10 dB allowance for noise reduction through an open window)
Off site rail (from freight movements)	PRINP	**Day** 65 dB(A) L_{eq} and change in L_{eq} of 3 dB(A) or more or 85 dB(A) L_{max} and change in L_{max} of 3 dB(A) or more **Night** 60 dB(A) L_{eq} and change in L_{eq} of 3 dB(A) or more or

Project Activity/Noise Source	Reference Standard	Project Objective Noise Level
		85 dB(A) L_{max} and change in L_{max} of 3 dB(A) or more
Off site traffic noise (from trucks and light vehicles)	VicRoads TNRP	Consideration will be given to limiting the external noise level increase to 12 dB(A).
	ERS Category IV (GWZ, LDRZ)	Outdoor noise indicators: • L_{eq} 35 dB(A) from 10 pm to 6 am • L_{eq} 40 dB(A) from 6 am to 10 pm
	VCAT precedent criteria	L_{max} 65 dB(A) (internal noise level of 55 dB(A) plus 10 dB allowance for window)
Low frequency noise from on site industrial activities including container handling, refrigerated containers, truck movements and rail movements	EPA Publication 1996	One-third octave band thresholds dB(Z) for 10 to 160 Hz

1. Detailed information for each legislation, policy and guidelines/standards has been included within Appendix C

7.4.3 Modelled Scenarios

The following scenarios have been modelled to capture operational noise from the site:

- Industrial noise assessment from the site at in accordance with the Noise Protocol for:
  - Project Opening (2029)
  - Project Ultimate (2050)
- Offsite rail noise assessment in accordance with PRINP
- Maximum noise level assessment from the site at Project Ultimate (2050) in accordance with established VCAT Precedent criteria.
- Traffic noise level assessment for comparison between Project Ultimate (2050) and existing noise levels.
- Low frequency noise assessment from the site at in accordance with the EPA Publication 1996 for:
  - Project Opening (2029)
  - Project Ultimate (2050)

Noise source locations and operational details for these scenarios are included in Appendix F

7.4.4 Reference Noise Level Data

Table 17 presents noise data from St Mary's Freight Hub (Pacific National, NSW) and AECOM's database adopted for this assessment. St Mary's Freight Hub is similar to the proposed Project and includes an intermodal terminal with container handling and storage.

Table 17 Summary of Sound Power Levels, dB

Source	Sound power level (SWL, dB) at octave band centre frequency, Hz								Overall SWL dB(A)
	63	125	250	500	1000	2000	4000	8000	
Container handler (forklift)	118	110	104	101	102	97	91	82	106
Container Refrigeration unit[1]	91	83	79	74	76	73	65	-	80
Metal knock[2, 3]	80	80	71	71	69	62	56	49	73
Metal knock[3] L_{max}	115	115	106	106	104	97	91	84	108
Commercial power washer	86	87	87	88	87	87	86	85	94
Idling truck	94	98	92	91	92	91	86	82	97
Moving truck	95	100	103	98	96	93	87	81	101
Truck Air Release L_{max}	108	105	107	105	101	101	102	96	109
Truck Deceleration and Engine Brake L_{max}	105	101	104	104	103	103	105	93	110
Idling loco	101	101	101	94	90	89	93	96	100
Wagon bunching L_{max} [4]	-	-	-	-	-	-	-	-	112
Brake squeal L_{max} [4]	-	-	-	-	-	-	-	-	113
Locomotive accelerating (notch 8) L_{max} 112	121	117	110	107	107	106	103	98	113

1. Carrier X2 2500A refrigeration units
2. The sound power level of the metal ‘knock’ has been duration adjusted to 30 minutes.
3. Assumes container handlers have “soft touch” technology enabled’
4. Reference: RHA Report 10-1142-R1 RAC Line-based Noise PRP Study – Noise Source Working Paper, Sep 2000
5. Reference: Independent Noise Test of Locomotive NR16 by Acoustic Studio dated 24th July 2022

Table 18 presents maximum noise level events from freight train pass-bys measured at unattended noise monitoring location L3 during the night period. This has been referenced for the assessment of the rail flyover maximum noise level assessment.

Table 18 Freight train night-time maximum noise levels

ID	Measurement period	Description	Overall SPL dB(A)
L3	11 to 18 May 2022	95th Percentile loudest L_{max} dB(A) noise event between 10pm and 7am	84

Table 19 presents noise levels measured at unattended noise monitoring location L3 during the night period for the average of 22 observed freight rail pass-bys. Train pass-bys were identified by analysis of the audio recordings. A noise level representative of a 30-minute period containing a freight train pass-by was then calculated and is referenced in the assessment of onsite rail L_{eq} noise levels.

Table 19 Freight train night-time L_{eq} noise levels

ID	Measurement period	Description	Overall SPL dB(A)
L3	11 to 18 May 2022	Average $L_{eq,30min}$ dB(A) for 22 freight rail pass-bys between 10pm and 7am	60

Table 18 presents existing $L_{10,18hr}$ traffic noise measured at unattended noise monitoring location L1. This has been referenced for the assessment of traffic noise levels along Little River Road.

Table 20 Existing traffic noise levels on Little River Road

ID	Measurement period	Description	Overall SPL dB(A)
L1	11 to 18 May 2022	Measured average $L_{10,18hr}$ dB(A) traffic noise	50

7.4.5 Industrial Noise Assessment

The assumptions and locations of industrial noise sources included in the industrial noise assessment are presented in Appendix F. To summarise the following noise sources were included in the industrial noise models:

Project Opening (2029) model:

- Metal knocks from container handling (100 events per 30-minutes in double stack processing)
- Truck movements
  - 44 per 30-minutes during the day
  - 18 per 30-minutes during the evening / night
- Idling trucks
  - 88 per 30-minutes during the day
  - 36 per 30-minutes during the evening / night
- Internal train movements (1 train every 1.5 hours)
- Idling locomotives (20 in double stack processing, holding lines and provisioning)

Project Ultimate (2050) model:

- Container handlers (6 in MT Park / IMEX)
- Metal knocks from container handling
  - 100 events per 30-minutes in double stack processing
  - 142 events per 30-minutes in MT Park / IMEX
- Refrigerated containers (100 in MT Park)
- Commercial power washers (2 in MT Park / IMEX)
- Truck movements
  - 405 per 30-minutes during the day
  - 309 per 30-minutes during the evening / night
- Idling trucks
  - 168 per 30-minutes during the day
  - 92 per 30-minutes during the evening / night
- Internal train movements (1 train every 1.5 hours)
- Idling locomotives (20 in double stack processing, holding lines and provisioning)

The Project Ultimate scenario includes the built form of the proposed development (warehousing buildings and administration buildings) which has been designed during the feasibility stage of the project to provide shielding to surrounding noise sensitive receptors.

Operational noise levels for day, evening and night operations at Project Opening (2029) and Project Ultimate (2050) have been modelled and assessed against Noise Protocol noise limits with and without noise mitigation. Noise contours for each scenario are presented in Appendix G.

7.4.5.1 Noise Character Adjustments

The tonal character of the predicted noise levels at the receptors was assessed in accordance with the Noise Protocol. The one third octave band operational noise levels at each receptor location were predicted. Analysis of the predicted one third octave band noise levels was undertaken in accordance with the procedure prescribed by Annex C of the Noise Protocol for the determination of tonality adjustments. It was determined that no tonality adjustment was applicable at any of the receptor locations.

The following adjustments have been applied for impact noise from containers knocks:

- An +3 dB(A) intermittency adjustment applied during the Day period, and
- +5 dB(A) intermittency adjustment applied for the Evening / Night period.

7.4.5.2 Train movements onsite

Train movements internal to the site have been modelled separately to other industrial noise sources using Kilde Rep 130 algorithms and calibrated using freight train pass-bys measured $L_{eq,30min}$ at unattended monitoring location L3. The assumptions for the internal rail assessment are presented in Appendix F. To summarise:

- For Project Opening (2029) and Project Ultimate (2050) it is expected that up to one train will enter the site every 1.5 hours i.e. 7 trains during the day period, 3 trains during the evening period and 6 trains during the night period. Accordingly, one train entering or exiting the site for a given 30-minute period during the day, evening and night has been modelled.
- Freight trains are expected to travel on site at 20km/h
- The rail flyover is up to 10 metres in height
- The radius of the flyover is less than 300 metres

7.4.5.3 Tonality – Rail Flyover

Based on the above assumptions for train movements, the predicted noise level at the nearest receptor (R42) due to a train entering the site is $L_{eq,30min}$ 40 dB(A).

The predicted level, which includes corrections intended to account for noise generated by the curve radius (as per Kilde), has been compared to the measured levels at the nearest noise monitoring location (L3) in order to define an appropriate tonality correction (wheel squeal) when calculating the effective noise level for comparison to the Noise Protocol limits.

Measured L_{eq} noise levels at unattended monitoring location L3 were generally 32-36 dB(A) during the night, 34-42 dB(A) during the evening and 37-45dB(A) during the day.

Therefore, a +2db(A) tonality adjustment has been applied to predicted noise levels at R42 during the day period to account for wheel squeal. A +5dB(A) tonality adjustment has been applied during the evening and night period:

Tonality corrections have been added to the results for the predicted Operational Noise Levels for Project Opening and (2029) and Project Ultimate (2050). A noise contour for train movements on site is included in Appendix G.

7.4.5.4 Noise from Warehouses

It has been identified that warehousing may include additional noise sources such as mechanical services and forklifts. Information on the fitout and operation of the warehousing is not available at the planning stage of the Project as operations will vary between operators. The exception is that heavy vehicle movements associated with the warehouse operations have been included as part of this assessment. Light vehicle movements are expected to be significantly less in volume and lower in noise level. However, the following things should be considered when designing warehouses:

- Warehouses should be located more than 150 metres from nearest noise sensitive receptors
- The built form of the warehouses shall be arranged such that it to provides shielding from activities within them (e.g. forklift movements) to surrounding noise sensitive receptors.
- The built form of the warehouses shall be arranged such that it provides shielding from mechanical equipment such as rooftop located air-conditioning.

7.4.5.5 Results Unmitigated

The unmitigated noise modelling results at nearest noise sensitive receptors for Project Opening (2029) and Project Ultimate (2050) are presented in Table 21 and Table 22.

Table 21 Predicted Unmitigated Operational Noise Levels $L_{Aeq,30min}$ – Industrial Noise Project Opening (2029)

NSR	Day Assessment $L_{eq,30min}$ dB(A)			Evening Assessment $L_{eq,30min}$ dB(A)			Night Assessment $L_{eq,30min}$ dB(A)		
	Result	Criteria	Over	Result	Criteria	Over	Result	Criteria	Over
R3	41	49	-	38	43	-	38	37	1
R4	42	49	-	39	43	-	39	37	2
R5	34	49	-	32	43	-	32	37	-
R8	33	49	-	32	43	-	32	37	-
R20	32	47	-	31	41	-	31	36	-
R21	32	47	-	31	41	-	31	36	-
R24	33	47	-	32	41	-	32	36	-
R42	43	45	-	45	39	6	45	36	9
R49	40	45	-	40	39	1	40	36	4
R50	42	45	-	42	39	3	42	36	6
R51	40	45	-	40	39	1	40	36	4
R52	37	45	-	37	39	-	37	36	1
R54	36	45	-	36	39	-	36	36	-
R55	30	48	-	30	44	-	30	38	-

1 Period definitions:

Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

Night: All days 10pm-to-7am

Table 22 Predicted Unmitigated Operational Noise Levels $L_{Aeq,30min}$ – Industrial Noise Project Ultimate (2050)

NSR	Day Assessment $L_{eq,30min}$ dB(A)			Evening Assessment $L_{eq,30min}$ dB(A)			Night Assessment $L_{eq,30min}$ dB(A)		
	Result	Criteria	Over	Result	Criteria	Over	Result	Criteria	Over
R3	43	49	-	41	43	-	41	37	4
R4	44	49	-	42	43	-	42	37	5
R5	39	49	-	38	43	-	38	37	1
R8	37	49	-	37	43	-	37	37	-
R20	37	47	-	36	41	-	36	36	-
R21	37	47	-	37	41	-	37	36	1
R24	40	47	-	40	41	-	40	36	4
R42	44	45	-	44	39	5	44	36	8
R49	43	45	-	43	39	4	43	36	7
R50	43	45	-	43	39	4	43	36	7
R51	42	45	-	41	39	2	41	36	5
R52	38	45	-	38	39	-	38	36	2
R54	37	45	-	37	39	-	37	36	1
R55	32	48	-	32	44	-	32	38	-

1 Period definitions:

Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

Night: All days 10pm-to-7am

7.4.5.6 Discussion

The predicted noise levels for the unmitigated Project Opening (2029) scenario exceed the relevant Noise Protocol noise limits at the following noise sensitive receptors:

- Evening period - R42, R49, R50 and R51
- Night period - R42, R49, R50, R51 and R52

The predicted noise levels for the unmitigated Project Ultimate (2050) scenario exceed Noise Protocol noise limits at the following noise sensitive receptors:

- Evening period - R42, R49, R50 and R51
- Night period - R3, R4, R5, R21, R24, R42, R49, R50, R51, R52 and R54

Mitigation measures to address these exceedances are discussed in Section 8.0.

7.4.6 Rail Flyover - Maximum Noise Level Assessment Unmitigated

Freight rail entering the site over the flyover has been modelled using Kilde Rep 130 algorithms and calibrated using freight train pass-bys measured L_{max} at unattended monitoring location L3. The assumptions for the rail flyover assessment are presented in Appendix F. To summarise:

- The rail flyover is up to 10 metres in height to allow for clearance over the existing rail line and the site's internal access roads
- The radius of the flyover is less than 300 metres
- Freight trains are expected to enter the site at 20 km/h.
- There are expected to be up to 6 trains entering and 6 trains exiting the site during the night period.

Based on the assumptions and modelling parameters set out, maximum noise level events from freight trains using the flyover have been modelled and assessed against VCAT Precedent criteria. This criteria is designed to consider the impacts of noise on the potential for sleep disturbance.

Noise contours for the rail flyover are presented in Appendix G.

7.4.6.1 Results

The unmitigated noise modelling results at nearest noise sensitive receptors for the rail flyover are presented in Table 23.

Table 23 Predicted rail flyover noise levels

NSR	Assessment L_{max} dB(A)		
	Result	VCAT Precedent Criteria	Exceedance
R42	75	65	10
R49	60	65	-
R24	59	65	-
R50	58	65	-
R21	56	65	-

1 VCAT precedent criteria applies externally to noise sensitive receptors and is assessed during the hours of sleep (10pm – 7am all days)

7.4.6.2 Discussion

As shown, the predicted maximum noise levels from the rail flyover exceed the VCAT Precedent criteria at noise sensitive receptor R42 by 10 dB(A). Based on the proposal it is expected that this event may occur up to 12 times per night period (6 trains entering and 6 trains exiting the site) and as such increase the risk of sleep disturbance at R42.

Mitigation of noise to address these exceedances is discussed in Section 8.0.

7.4.7 Operational Noise - Maximum Noise Level Assessment Unmitigated

Maximum noise level events at Project Ultimate (2050) have been modelled and assessed against VCAT Precedent criteria. The assumptions and locations of industrial noise sources included in maximum noise level assessment are presented in Appendix F. The following noise sources were included in the maximum noise model:

- Metal knocks from container handling (double stack processing and MT Park / IMEX)
- Locomotive accelerating at notch 8 (rail flyover and on site)
- Freight train/wagon brake squeal (rail flyover and on site)
- Wagon bunching (rail flyover and on site)
- Truck air release (site entry points and truck processing locations)

Noise sources have been modelled at worst case locations so that L_{max} events occur in positions that are closest to noise sensitive receivers and not shielding by the built form of the development.

In order to decrease maximum noise levels from container handling, Pacific National has committed to provided container handlers and gantry's with "soft touch" technology enabled.

Noise contours for calculated maximum noise levels are presented in Appendix G.

7.4.7.1 Results

The unmitigated noise modelling results at nearest noise sensitive receptors for calculated maximum noise level events are presented in Table 24.

Table 24 Predicted Maximum Noise Levels from the Site - Project Ultimate (2050)

NSR	Assessment L_{max} dB(A)		
	Result	VCAT Precedent Criteria	Exceedance
R3	60	65	-
R4	63	65	-
R5	53	65	-
R8	48	65	-
R20	47	65	-
R21	47	65	-
R24	46	65	-
R42	61	65	-
R49	53	65	-
R50	60	65	-
R51	60	65	-
R52	50	65	-
R54	46	65	-
R55	31	65	-

1 Period VCAT precedent criteria applies externally to noise sensitive receptors and is assessed during the hours of sleep (10pm – 7am all days)

7.4.7.2 Discussion

As shown the predicted maximum noise levels from events at the site comply with the VCAT Precedent criteria at surrounding noise sensitive receptors.

7.4.8 Offsite Rail Corridor Noise Assessment

As sourced from V/line online timetables for the Geelong line, there are currently up to 55 trains per day (6am to 10pm), and 11 trains per night (10pm to 6am) passing through Little River, on the Geelong – Melbourne existing passenger rail corridor.

Table 25 Existing Passenger Trains (V/line) along the Melbourne – Geelong Rail Corridor

Direction	Period	Mon to Fri	Saturday	Sunday
Melbourne to Geelong	Day (6am to 10pm)	30	21	21
	Night (10pm to 6am)	7	5	6
Geelong to Melbourne	Day (6am to 10pm)	25	21	22
	Night (10pm to 6am)	4	2	1
Total Trains	Day (6am to 10pm)	55	42	43
	Night (10pm to 6am)	11	7	7

Based on analysis of the unattended noise monitoring data and V/line South Western freight schedule, there are currently at least 2 freight train pass-bys per night

Offsite train movements existing and future (with Project) have been modelled using Kilde Rep 130 algorithms using the above trains numbers and assessed against PRINP Night-time (10pm to 6am) noise investigation thresholds. The assumptions for the model include:

- 12 freight trains will pass through the corridor during the night-time due to the project based on one freight train entering the site every 1.5 hours.
- Freight trains were calibrated using freight train pass-bys measured L_{eq} at unattended monitoring location L3
- Freight trains due to the project were conservatively modelled at 80km/h as they pass-by the site
- Noise due to existing V/line trains was calculated using SELs stated in the Melbourne Metro Tunnel Environmental Effects Statement

The results at receptor nearest to the rail corridor (R42) are presented in Table 26.

Table 26 Predicted Rail Corridor Noise Levels

NSR	Night-time Assessment $L_{eq,8hr}$ dB(A)				
	Existing	Future (with project)	Difference	PRINP Night Time (10pm – 6am) Threshold	Exceedance
R42	49	56	+7	60	-

As shown, rail noise due to the project is not expected to exceed the PRINP Noise Investigation Thresholds during the Night. It is also expected that the Day-time investigation thresholds will not be exceeded.

7.4.9 Operational Traffic Assessment

The Project will increase traffic volumes along Little River Road, to and from the Princes Highway.

The Project forecasts 11,602 heavy vehicles and 16,279 light vehicles 24-hr Annual Average Daily Traffic (two way, AADT) along Little River Road to the Princes Highway by 2050. Based on VicRoads traffic data Little River Road currently has a traffic volume of 1100 AADT with 5% heavy vehicles. The existing vehicle speed limit for Little River Road is 100 kilometres per hour (km/h).

The following upgrades to the local road network may occur to facilitate the heavy and light vehicles movements associated with the Project:

- Duplication of the bridge (Little River Road) over the Princes Highway.
- Widening of Little River Road within the existing road reserve, including the provision of hard shoulders.
- Improvements to the capacity of the three entrance/exits to the Project site.

The VicRoads Traffic Noise Reduction Policy (TNRP) is used in Victoria for the assessment of traffic noise from arterial roads and freeways. Little River Road is not a municipal road and is not a VicRoads declared arterial road; therefore, the TNRP does not strictly apply to the Project. The upgrades will occur within the existing road reserve and are unlikely to require the removal of any buildings or structures, therefore these changes to the roads would not trigger the requirement for mitigation.

However, the Project will result in an increase in road traffic volume, particularly trucks along Little River Road. The purpose of the assessment is to understand the potential changes in road traffic noise levels at noise sensitive receptors along Little River Road, and whether some form of noise amelioration is warranted.

The due diligence assessment considers the following criteria designed to minimise road traffic noise impacts to sensitive receptors:

- **ERS**
  - ERS Objective for the surrounds (*GWZ* and *PUZ*) are (Category IV) with outdoor noise indicators of:
    - L_{eq} Day 40 dB(A) from 6 am to 10 pm
    - L_{eq} Night 35 dB(A) from 10 pm to 6 am
- **VicRoads TNRP**
  - Where the noise level adjacent to **Category A or B** buildings prior to road improvements is less than **50 dB(A)L10 (18hr)**, consideration will be given to limiting the external noise level increase to **12 dB(A).**
- **VCAT Precedent Criteria**
  - A maximum noise level event of 65 dB(A), to assess the maximum noise levels from trucks and the use of compression release engine brakes when entering the site.

The assumptions for the operational traffic assessment are presented in Appendix F. Existing noise levels along Little River Road are as follows:

- The existing road traffic noise $L_{10,18hr}$ at L1 was measured to be 50 dB(A)
- The existing average ambient noise levels at L1 was measured to be L_{eq} 52 dB(A) from 6am to 10pm and 40 dB(A) from 10pm to 6am

7.4.9.1 Offsite Traffic ERS Assessment

Noise from offsite traffic is not regulated by the Noise Protocol. The ERS values consider the impacts of offsite noise associated with the Project and the impact on the local amenity. The ERS applies as a reference tool, it does not set compliance limits.

The ERS Objective for the surrounds (*GWZ* and *PUZ9*) are (Category IV) with outdoor noise indicators of:

- L_{eq} Day 40 dB(A) from 6 am to 10 pm
- L_{eq} Night 35 dB(A) from 10 pm to 6 am

In all cases, the measured ambient noise levels for receptors located along Little River Road are above the relevant ERS objective noise indicators. As such, a comparison between existing and future $L_{10,18hr}$ noise levels from Little River Road has been conducted in accordance with the VicRoads TNRP.

7.4.9.2 VicRoads TNRP Assessment

The forecasted road traffic volumes for the year 2050 have been used to predict future traffic noise levels along Little River Road using the method provided by the Calculation of Road Traffic Noise (CoRTN, Department of Transport, UK, 1988) and the difference to the measured existing $L_{10,18hr}$ noise levels has been shown.

As a benchmark, this difference has been compared to the 12 dB(A) increase recommended by the VicRoads TNRP for noise environments less than $L_{10,18hr}$ 50 dB(A).

Noise contours for operational traffic are presented in Appendix G.

7.4.9.3 Results

The noise modelling results at nearest noise sensitive receptors for operational traffic and comparison to measured existing noise levels are presented in Table 27.

Table 27 Predicted Road Traffic Noise Levels, $L_{10,18h}$

NSR	Distance to Little River Road (metres)	Assessment $L_{10,18hr}$ dB(A)		
		Existing	Result	Difference
R3	125	50	62	**+12**
R4	50	50	68	**+18**
R5	400	50	57	+7

7.4.9.4 Discussion

As shown the operational traffic noise from the site is expected to increase road traffic noise levels at receptors located along Little River Road by 12 dB(A) or more at noise sensitive receptors R3 and R4. In accordance with the TNRP, consideration should be given to limiting the external noise level increase to **12 dB(A).**

Mitigation of noise to address these exceedances is discussed in Section 8.0.

7.4.9.5 Offsite Traffic L_{max} Assessment

Maximum noise level events from trucks approaching the site and decelerating / using engine brakes have been modelled along Little River Road and assessed against VCAT Precedent criteria. Noise sources were located in worst case positions where trucks are expected to decelerate and closest to a noise sensitive receptor. The results are presented in Table 28.

Table 28 Predicted Road Traffic Noise Levels, Trucks L_{max}

NSR	Distance to Little River Road (metres)	Assessment L_{max} dB(A)		
		Result	VCAT Precedent Criteria	Exceedance
R3	125	54	65	-
R4	50	63	65	-
R5	400	46	65	-

As shown the predicted maximum noise levels from trucks decelerating and using engine brakes along Little River Road are expected to comply with the VCAT Precedent criteria at nearest noise sensitive receptors.

7.5 Operational Vibration

Activities that are expected to produce the highest levels of vibration from the site are container handling and rail movements. Based on expected vibration levels from these activities and sensitive receptors being located 50 to 100 metres from the Project Site's Boundary it is unlikely that thresholds provided by the following standards would be exceeded:

- DIN 4150-3:2016 Vibration in Buildings – Effects on Structures December 2016
- British Standard BS6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting

Accordingly, vibration levels from operation of the site have not been assessed.

8.0 Mitigation

Mitigation of Impacts should consider the Environment Protection Act's General Environmental Duty which requires proactive steps to be taken to eliminate or reduce the risk of harm to human health and the environment from pollution or waste.

8.1 Reasonably Practicable

The GED requires proactive steps to be taken to eliminate or reduce the risk of harm to human health and the environment from pollution or waste. These steps should be taken in accordance with EPA Victoria Publication 1856:2020 *Reasonably Practicable* which provides guidance as to the factors to consider when defining proportionate controls to minimise harm. Key factors in the approach include:

- Eliminate first: Can you eliminate the risk?
- Likelihood: What's the chance that harm would occur?
- Degree (consequence): How severe could the harm be on human health or the environment?
- Your knowledge about the risks: What do you know, or what can you find out, about the risks your activities pose?
- Availability and suitability: What technology, processes or equipment are available to control the risk? What controls are suitable for use in your circumstances?
- Cost: How much does the control cost to put in place compared to how effective it would be in reducing the risk?

When assessing control measures to reduce noise levels from Refinery, discussions should include these factors and be documented for submission to the Responsible Authority.

8.2 Construction noise and vibration

Construction noise and vibration would be managed in accordance with EPA Victoria Publication 1834 and be reduced as far as possible to avoid unnecessary impacts upon sensitive receptors. This would include the development of a plan to manage noise during construction in consultation with the EPA Victoria. An example framework for *Managing Noise and Vibration from construction Activities* is set out in Appendix B and includes:

Management During Normal Working Hours:

- Techniques for managing noise with reference to Section 4.3.3 of EPA Pub 1834
- Traffic management measures with reference to Section 4.3.1 of EPA Pub 1834
- Communication steps with reference to Section 4.3.2 of EPA Pub 1834
- In terms of vibration, require any works that are undertaken closer than the safe working distances to be assessed further.

Management Outside Normal Working Hours:

- In addition to the steps and techniques set out above for Normal Working Hours, additional Outside of Normal Working Hours communication steps with reference to Section 4.4.2 of EPA Pub 1834
- Scheduling techniques for managing noise Outside Normal Working Hours with reference to Section 4.4.1 of EPA Pub 1834

Based on the assessment of construction noise set out in Section 7.2, it has been calculated that construction noise may interfere with the following at multiple noise sensitive receptors during normal working hours:

- Normal conversation and
- Domestic and recreational activities
- Learning and development at Cherry Creek Youth Detention Centre

Noise at impacted noise sensitive receptors should be managed in accordance with Section 4.4 of EPA Victoria Publication 1834 utilising a management plan following a similar framework to the example set out in Appendix B.

It has also been identified that construction noise from unavoidable night works occurring during construction of the rail flyover may interfere with sleep during the night at multiple noise sensitive receptors and exceed a reasonable target such as the maintenance of ambient noise levels.

Noise at impacted noise sensitive receptors should be managed in accordance with Section 4.5 of EPA Victoria Publication 1834 utilising a management plan following a similar framework to the example set out in Appendix B.

8.2.1 Ground vibration

Sensitive receptor R4 has been identified to be located within the human amenity minimum working distance for plant producing vibration. In accordance with the EPA Victoria Publication 1834, it is therefore recommended that further assessment be undertaken prior to construction works commencing.

8.3 Operational noise

8.3.1 Industrial Noise Assessment

The unmitigated noise modelling has identified that noise from the site may exceed the Noise Protocol noise limits at the following noise sensitive receptors:

- **Project Opening (2029)** R3, R4, R42, R49, R50, R51 and R52
- **Project Ultimate (2050)** R3, R4, R5, R21, R24, R42, R49, R50, R51, R52 and R54.

To reduce the noise and comply with Noise Protocol noise limits the following mitigation measures have been adopted in the noise model.

Project Opening (2029)

- 6.0 metre noise barriers located along the northern boundary and along the southern boundary (in proximity to the double stack processing truck route)
- 8.0 metre noise barrier located along the southern boundary (in proximity to the double stack processing truck route)
- 120.0 metre noise barrier to be incorporated as part of the flyover structure (from ground to top of flyover)
- 1.5 metre barriers located on the northern sides of the flyovers
- 1.5 metre barrier located on the southern side of the western flyover

Project Ultimate (2050)

- Barriers proposed for Project Opening are to remain
- Container handlers located within the IMEX terminal to be reduced in noise levels by at least 10 dB(A) (e.g. through selection of quieter machinery, installation of mufflers or electrification).

Noise contours for the compliant scenarios including locations of the proposed barriers are presented in Appendix G.

The mitigated noise modelling results at nearest noise sensitive receptors for Project Opening (2029) and Project Ultimate (2050) are presented in Table 29 and Table 30.

Table 29 Predicted Operational Noise Levels $L_{Aeq,30min}$ – Industrial Noise Project Opening with Mitigation (2029)

NSR	Day Assessment $L_{eq,30min}$ dB(A)			Evening Assessment $L_{eq,30min}$ dB(A)			Night Assessment $L_{eq,30min}$ dB(A)		
	Result	Criteria	Exceedance	Result	Criteria	Exceedance	Result	Criteria	Exceedance
R3	36	49	-	33	43	-	33	37	-
R4	35	49	-	32	43	-	32	37	-
R5	32	49	-	30	43	-	30	37	-
R8	30	49	-	28	43	-	28	37	-
R20	29	47	-	28	41	-	28	36	-
R21	30	47	-	28	41	-	28	36	-
R24	30	47	-	28	41	-	28	36	-
R42	30	45	-	30	39	-	30	36	-
R49	35	45	-	35	39	-	35	36	-
R50	37	45	-	36	39	-	36	36	-
R51	34	45	-	34	39	-	34	36	-
R52	32	45	-	32	39	-	32	36	-
R54	33	45	-	33	39	-	33	36	-
R55	30	48	-	30	44	-	30	38	-

1 Period definitions:

Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

Night: All days 10pm-to-7am

Table 30 Predicted Operational Noise Levels $L_{Aeq,30min}$ – Industrial Noise Project Ultimate with Mitigation (2050)

NSR	Day Assessment $L_{eq,30min}$ dB(A)			Evening Assessment $L_{eq,30min}$ dB(A)			Night Assessment $L_{eq,30min}$ dB(A)		
	Result	Criteria	Exceedance	Result	Criteria	Exceedance	Result	Criteria	Exceedance
R3	39	49	-	37	43	-	37	37	-
R4	38	49	-	35	43	-	35	37	-
R5	38	49	-	36	43	-	36	37	-
R8	34	49	-	34	43	-	34	37	-
R20	33	47	-	32	41	-	32	36	-
R21	34	47	-	33	41	-	33	36	-
R24	36	47	-	36	41	-	36	36	-
R42	36	45	-	36	39	-	36	36	-
R49	37	45	-	36	39	-	36	36	-
R50	37	45	-	36	39	-	36	36	-
R51	36	45	-	36	39	-	36	36	-
R52	33	45	-	33	39	-	33	36	-
R54	34	45	-	34	39	-	34	36	-
R55	32	48	-	32	44	-	32	38	-

1 Period definitions:

Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

Night: All days 10pm-to-7am

With the proposed mitigation measures, noise levels from the Project are predicted to achieve the assessment criteria at all noise sensitive receptors for the 2029 and 2025 scenarios. The proposed mitigation measures should be reviewed during detailed design.

8.3.2 Rail Flyover - Maximum Noise Level Assessment - Mitigated

The unmitigated noise modelling has identified that noise from a freight train entering the site over the flyover is expected to exceed the VCAT Precedent criteria at noise sensitive receiver R42.

To comply with the VCAT precedent criteria the following mitigation measures have been adopted in the noise model:

- 1.5 metre barriers located on the northern side of the flyovers
- 1.5 metre barrier located on the southern side of the western flyover

The mitigated noise modelling results at nearest noise sensitive receptors for the rail flyover are presented in Table 31.

Table 31 Predicted Mitigated Rail Flyover Noise Levels

NSR	Rail Flyover Assessment L_{max} dB(A)		
	Result	VCAT Precedent Criteria	Exceedance
R42	62	65	-
R49	58	65	-
R24	59	65	-
R50	58	65	-
R21	56	65	-

1. VCAT precedent criteria applies externally to noise sensitive receptors and is assessed during the hours of sleep (10pm – 7am all days)

Noise contours for the compliant modelling scenarios including locations of the proposed barriers are presented in Appendix G.

8.3.3 Maximum Noise Level Assessment

To reduce noise as far as so reasonably practicable, and to meet requirements of the GED, additional mitigation options for further investigation include:

- Use of track lubrication and wagon steering to minimise curve squeal
- Use of electronically controlled pneumatic braking systems to minimise brake squeal
- Building treatments at noise sensitive receptors e.g. glazing upgrades and supporting ventilation to enable windows to remain closed.
- Include in employment contracts and subcontractor agreements clauses that require minimisation of noise and compliance with directions from management to minimise noise
- Regularly inform container handler and container handler drivers of the importance of noise minimisation on site and train them to use equipment in ways to minimise noise

8.3.4 Operational Traffic Assessment

It been identified that the Project may increase traffic noise levels by 12dB(A) or more at three noise sensitive receptors along Little River Road. To mitigate roads traffic noise at these receptors it is recommended that off-reservation attenuation (i.e. upgraded building glazing and façade) is investigated. Alternative means of mitigation are not considered appropriate due to the following:

2. Seeking a reduction in noise by a low noise pavement is not expected to be feasible. Noise from trucks travelling at low speed is dominated by the engine and exhaust as opposed to the interaction between the tyres and the road pavement.
3. Noise barriers are not cost effective when resolving exceedances at a small number of receivers that are widely spaced apart.

The investigation of off-reservation measures is to be undertaken subject to practicability testing and agreement from key stakeholders.

8.3.5 Low frequency Noise Assessment

Low frequency noise has been considered in relation to the outdoor low frequency thresholds outlined in EPA Publication 1996. Noise inputs were available in octave bands from 12.5Hz and above.

Predicted low frequency noise levels for the proposed mitigated Project Opening (2029) and Project Ultimate (2050) Day periods at the worst affected noise sensitive receptors have been included with a comparison to the outdoor low frequency threshold from EPA Victoria Publication 1996 in Table 32.Low frequency noise levels for other periods and noise sensitive receptors were observed to be less than the presented noise levels.

Table 32 Low Frequency Assessment

Reference	One-third octave band centre frequency (Hz)												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
EPA Victoria Publication 1996 outdoor thresholds, dB(Z)	**92**	**89**	**86**	**77**	**69**	**61**	**54**	**50**	**50**	**48**	**48**	**46**	**44**
Predicted noise level at R2 during the Day for 2029 dB(Z)		44	47	45	48	51	54	50	45	44	40	40	37
Predicted noise level at R2 during the Day for 2050 dB(Z)		44	47	45	48	51	54	50	45	44	40	40	37
Exceedance	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

The predicted noise levels at the nearest noise sensitive receptor are significantly lower than the outdoor thresholds provided by EPA Victoria Publication 1996. Therefore, it is not expected that there will be a significant risk of annoyance at the nearest receptors due to low frequency noise. However, to reduce noise as far as so reasonably practicable, and to meet requirements of the GED, additional mitigation options for further investigation include:

- For machinery operating at site:
  - Install exhaust mufflers and / or opt for “quieter” machinery.
  - If possible, control machinery such that they do not operate simultaneously and are turned off when not in use (not idling).
- If possible, control locomotives such that they do not operate simultaneously and are turned off when stationary.

8.4 Assessment of Reasonably Practicable Mitigation Measures

Additional noise mitigation measures for the project have been considered and assessed in order to demonstrate that the mitigation measures provided in Section 8.3 represent the limit of measures that are considered to be reasonable and practicable for the Project in accordance with the GED.

Table 33 Noise mitigation measures – Assessment of practicability

Mitigation Measure	Factor to consider (EPA Victoria Publication 1856)	Commentary on Practicability	Effectiveness	Adopted?
Quieter machinery	Elimination	Not possible	High. The input noise levels used in the assessment are based on typical equipment selections. It could be that lower noise equipment is available with little additional cost. In which case, these items would be considered.	Yes, for ancillary machinery: • Soft Touch Technology enabled on gantry and container handlers • Track lubrication • Electronically controlled pneumatic braking systems • Electric or hydrogen powered equipment to reduce the noise compared to diesel powered equipment. • Pacific National is seeking solutions to reduce noise with the introduction of biodiesel and hydrogen for locomotives, and is exploring the benefits of battery electric locomotives (ESG strategy 2022)
	Likelihood	Low. Noise levels are predicted to be in compliance with the relevant limit based on the input noise levels presented herein.		
	Degree/Consequence	Low. Noise levels are predicted to be in compliance with the relevant limit based on the input noise levels presented herein.		
	Knowledge	High		
	Availability	High		
	Cost	Moderate		
Additional noise barriers around the site perimeter	Elimination	Not possible	Low-High. Noise barriers will be design for the Project site to reduce noise at the surrounding noise sensitive receptors. The effectiveness of each noise barrier will depend on the location of the barrier in relation to the source and the receptor e.g. the closer the barrier is to the	Yes. Noise barrier heights have been investigated for 5m, 6m and 8m, to reduce noise from the site as far as is reasonably practicable.
	Likelihood	Low Noise levels are predicted to be compliant without the incorporation of additional noise barriers for the site.		
	Degree/Consequence	Low Noise levels are predicted to be compliant without the incorporation of additional noise barriers for the site.		
	Knowledge	High		

Mitigation Measure	Factor to consider (EPA Victoria Publication 1856)	Commentary on Practicability	Effectiveness	Adopted?
	Availability	High	noise source and/or receptor the more effective the noise attenuation.	
	Cost	High		
Enclosures around individual items of equipment	Elimination	Not possible	Low. There are no elevated receptors in the vicinity and noise sources from the site are generally not fixed. Therefore, there is no justification for enclosing (i.e. putting a roof on or acoustic enclosure) the equipment.	No.
	Likelihood	Low. Noise levels are predicted to be in compliance with the relevant limit without the inclusion of enclosures.		
	Degree/Consequence	Low. Noise levels are predicted to be in compliance with the relevant limit without the inclusion of enclosures.		
	Knowledge	High		
	Availability	High		
	Cost	Moderate		
Site orientation	Elimination	Not possible	High: The layout of the development can provide shielding in similar effect to noise barriers for surrounding noise sensitive receptors.	Yes. The site has been orientated such that the built form the development (warehouses and administration buildings) will provide shielding to surrounding noise sensitive receptors
	Likelihood	Low. Noise levels are predicted to be in compliance with the relevant limit based on current design.		
	Degree/Consequence	Low		
	Knowledge	High		

Mitigation Measure	Factor to consider (EPA Victoria Publication 1856)	Commentary on Practicability	Effectiveness	Adopted?
	Availability	High		
	Cost	High		
Site location	Elimination	Not possible	Potentially high. However, the location of the site is dictated by factors other than noise.	No.
	Likelihood	Low		
	Degree/Consequence	Low		
	Knowledge	High		
	Availability	Low		
	Cost	Very high		

9.0 Conclusion

This technical report provides a noise and vibration impact assessment conducted to support the environment effects referral for the Little River Project Logistics Precinct (the Precinct).

The purpose of this report is to provide an assessment of the noise and vibration impacts during construction and operation for the proposed site and potential road and rail connections. This includes an understanding of the implications of any constraints on the development of a preferred concept layout for the site.

9.1 Existing Conditions

Noise monitoring was conducted throughout the study area to quantify the existing noise environment and determine the baseline noise levels. This information was used to characterise the existing noise environment, including the presence of other environmental noise sources, support the development of the project criteria and assess the potential change to the noise environment if the project is constructed.

9.2 Construction Noise and Vibration Assessment

Work phases for the initial construction stage have been developed in consultation with Pacific National and the proposed equipment has been detailed within this report.

The initial construction stage of the Project is expected to occur for up to 24 months occur during normal working hours 7am – 6pm weekdays, 7am – 1pm Saturdays. There will be short periods of rail occupation, to construct the rail flyover, that will require ‘unavoidable works’ during the evening and night periods.

Construction phases were used to determine the potential construction noise levels. The construction noise levels are calculated to exceed the Environmental Reference Standard Objectives at multiple noise sensitive receptors during construction. Noise at impacted noise sensitive receptors should be managed in accordance with Section 4.4 of EPA Victoria Publication 1834 utilising a management plan following a similar framework to the example set out in Appendix B.

It has also been identified that construction noise from unavoidable night works occurring during construction of the rail flyover may interfere with sleep during the night at multiple noise sensitive receptors and exceed a reasonable target such as the maintenance of ambient noise levels. Noise at impacted noise sensitive receptors should be managed in accordance with Section 4.5 of EPA Victoria Publication 1834 utilising a management plan following a similar framework to the example set out in Appendix B.

Three sensitive receptors have been identified to be located within the human amenity minimum working distance for plant producing vibration. In accordance with the EPA Victoria Publication 1834, it is therefore recommended that further assessment be undertaken prior to construction works commencing.

9.3 Operational Noise Assessment

The following scenarios were modelled to capture operational noise from the Project site:

- Industrial noise assessment from the site at in accordance with the Noise Protocol for:
  - Project Opening (2029)
  - Project Ultimate (2050)
- Maximum noise assessment from the site’s rail flyover in accordance with established VCAT Precedent criteria
- Maximum noise assessment from the site at Project Ultimate (2050) in accordance with established VCAT Precedent criteria.

- Traffic noise level assessment for comparison between Project Ultimate (2050) and existing noise levels.

9.3.1 Industrial Noise Assessment

Noise levels from industrial operations on the site are calculated to comply with Noise Protocol noise limits with the following noise mitigation measures implemented:

- 6.0 metre noise barriers located along the northern boundary, along the southern boundary (in proximity to the double stack processing truck route)
- 8.0 metre noise barrier located along the southern boundary (in proximity to the double stack processing truck route)
- 10.0 metre noise barrier to be incorporated as part of the flyover structure (from ground to top of flyover)
- 1.5 metre barriers located on the northern sides of the flyovers
- 1.5 metre barrier located on the southern side of the western flyover
- Container handlers located within the IMEX terminal to be reduced in noise levels by at least 10dB(A) (e.g. through selection of quieter machinery, installation of mufflers or electrification).

Locations of the proposed noise barriers for the Project site are presented in Appendix G.

9.3.2 Rail Flyover Assessment

Maximum noise levels from the freight rail travelling along the flyover are calculated to comply with VCAT Precedent criteria with:

- 1.5 metre barriers located on the northern sides of the flyovers
- 1.5 metre barrier located on the southern side of the western flyover

Locations for the proposed noise barriers for the industrial are shown in Appendix G.

9.3.3 Maximum Noise Level Assessment

Maximum noise levels from the site activities (e.g. Metal knocks from container, locomotive accelerating, freight train/wagon brake squeal, wagon bunching an truck air release are calculated to comply with VCAT Precedent criteria without mitigation.

9.3.4 Offsite Rail Noise Assessment

The introduction of additional freight trains along the existing rail corridor due to the project are not predicted to exceed the Passenger Rail Infrastructure Noise Policy Investigation Thresholds.

9.3.5 Operational Traffic Assessment

The increase in traffic along Little River Road has the potential to increase traffic noise levels by 12 dB(A) or more at three noise sensitive receptors along Little River Road. There is no regulatory requirement to provide mitigation measures, however noise could be managed through road design, localised screening or treatment to noise sensitive buildings.

9.3.6 Assessment of Reasonably Practicable Mitigation Measures

Additional noise mitigation measures have been investigated (in Section 8.3) to demonstrate that the mitigation measures provided represent the limit of measures that are considered to be reasonable and practicable for the Project in accordance with the GED. The following measures have been adopted:

Quieter machinery:

- Container handlers and gantry to have “soft touch” technology enabled.
- Use of track lubrication and wagon steering to minimise curve squeal
- Use of electronically controlled pneumatic braking systems to minimise brake squeal
- Electric or hydrogen powered equipment to reduce the noise compared to diesel powered equipment.
- Pacific National is seeking solutions to reduce noise with the introduction of biodiesel and hydrogen for locomotives and is exploring the benefits of battery electric locomotives (ESG strategy 2022)

Site Orientation:

- The site has been orientated such that the development layout (warehouses and administration buildings) will provide shielding to surrounding noise sensitive receptors

10.0 References

Legislation

- Environment Protection Act 1970.
- Environment Protection Act 2017, as amended by the *Environment Protection Amendment Act 2018.*

Australian Policies and Guidelines

- *Civil construction, building and demolition guide,* EPA Victoria Publication 1834 (December 2020).
- *Noise guideline – assessing low frequency noise,* EPA Victoria Publication 1996 (June 2021).
- *Guide to the Environment Reference Standard,* EPA Victoria Publication 1992 (June 2021).
- *Reasonably practicable,* EPA Victoria Publication 1856 (September 2020).

Victorian Regulations

- Environment Protection Regulations 2021.
- General Environmental Duty
- The Environment Reference Standard; May 2021
- *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, EPA Victoria Publication 1826.
- Transport (Compliance and Miscellaneous) Act 1983
- The Passenger Rail Infrastructure Noise Policy
- VicRoads Traffic Noise Reduction Policy

Australian Standards

- Australian Standard 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*.
- Australian/New Zealand Standard ISO 31000:2009 *Risk Management Process*.

Overseas and International Standards

- International Standard ISO 9613-2:1996 – *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*, 1996
- German Standard DIN 4150-3:2016 Vibration in Buildings – Effects on Structures
- British Standards 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.*

Appendix A

Risk Assessment

Appendix A Risk Assessment

Assigning consequence of risks

In this risk assessment, the consequences of a risk occurring were assigned using a consequence guide. Specific consequence categories were developed considering existing conditions in the study area. The consequence rating criteria used in the risk assessment specifically for risks relating to noise and vibration is shown below.

Impact	Qualitative description	
	Noise	Vibration
Negligible	Construction • noise is not audible. Operation • no increase in noise level.	Construction • vibration is within applicable limits • no damage to structures.
Minor	Construction • noise is audible but within project noise criteria. Operation • noise levels increase but comply with project criteria.	Construction • isolated exceedances of project limits • no damage to structures.
Moderate	Construction • noise is occasionally above project criteria. Operation • noise levels increase and are greater than project criteria.	Construction • extended periods of exceedances of project limits • superficial damage to structures.
Major	Construction • noise levels above project criteria for extended periods of time. Operation • noise levels significantly increase and are greater than project criteria.	Construction • long-term exceedances of project limits • structural damage.
Severe	Construction • not applicable as noise would not result in regional scale impacts. Operation • noise levels significantly increase and above project criteria for extended periods of time.	Construction • vibration causes widespread structural damage.

Assigning likelihood of risks

A likelihood rating for each identified risk pathway was assigned using the guide in the following table. The likelihood criteria in the risk assessment range across a scale from ‘almost certain’ where ‘the event is expected to occur in most circumstances or is planned to occur’ to ‘rare’ where ‘the event may occur only in ‘exceptional circumstances’.

Level	Description
Rare	The event may occur only in exceptional circumstances
Unlikely	The event could occur but is not expected
Possible	The event could occur
Likely	The event will probably occur in most circumstances
Almost Certain	The event is expected to occur in most circumstances or is planned to occur

Risk assessment matrix and risk rating

The consequence and likelihood were combined to arrive at a risk rating, using the risk assessment matrix shown in the following table. The complete risk register for noise and vibration is presented in Section 3.0.

Table 34 Risk matrix

		Consequence ratings				
		Negligible	Minor	Moderate	Major	Severe
Likelihood rating	Rare	Very Low	Very Low	Low	Medium	Medium
	Unlikely	Very Low	Low	Low	Medium	High
	Possible	Low	Low	Medium	High	High
	Likely	Low	Medium	Medium	High	Very High
	Almost Certain	Low	Medium	High	Very High	Very High

When risks were rated as medium or above, the impacts associated with the risk pathway were assessed in an increasing level of detail and prompted further exploration of potential mitigation and management actions to reduce the overall impact.

Appendix B

Noise and Vibration Criteria

Noise and vibration criteria

General Noise

Environment Protection Act 2017

Noise in Victoria is managed primarily through the *Environment Protection Act 2017* (EP Act) and associated regulations. The EP Act sets out legislative framework and provides a General Environmental Duty (GED) for the protection of human health and the environment from pollution and waste. Harm from noise pollution is classified as harm that may have an:

> *Adverse effect on the amenity of a place or premises that unreasonably interferes with or is likely to unreasonably interfere with enjoyment of the place or premises.*

Section 166 of the EP Act states that non-residential places or premises must not emit unreasonable noise or permit unreasonable noise to be emitted. Unreasonable noise means noise that:

a. is unreasonable having regard to the following:

I. Its volume, intensity or duration;

II. Its character;

III. The time place or other circumstances in which is it emitted

IV. How often it is emitted;

V. Any prescribed factors; or

b. is prescribed unreasonable

The EP Act also includes the Environmental Reference Standard (ERS) which sets out environmental values and objectives of the ambient air to be achieved or maintained in Victoria. This ERS is not a compliance standard. Its primary function is to provide an environmental assessment and reporting benchmark.

General Environmental Duty

The GED requires proactive steps to be taken to eliminate or reduce the risk of harm to human health and the environment from pollution or waste. The GED applies at all times, during construction and operation of the project, for any activities posing a risk of harm to human health and the environment. The following sections of the EP Act apply to the GED:

- Section 25(1) of the EP Act states that a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution must minimise those risks so far as reasonably practicable.
- Section 6 of the EP Act states that minimising risks of harm to human health and the environment requires the duty holder to eliminate risks of harm to human health and the environment so far as reasonably practicable and, if it is not reasonably practicable to eliminate those risks, then reduce those risks as far as reasonably practicable.
- Section 6(2) of the EP Act states factors to give regard to when determining what is reasonably practicable in relation to the minimising of risks to harm to human health and the environment.

EPA Publication 1856 - Reasonably Practicable

EPA Victoria Publication 1856:2020 *Reasonably Practicable* provides guidance as to the factors to consider when defining proportionate controls to minimise harm, as follows:

- Eliminate first: Can you eliminate the risk?
- Likelihood: What's the chance that harm would occur?
- Degree (consequence): How severe could the harm be on human health or the environment?
- Your knowledge about the risks: What do you know, or what can you find out, about the risks your activities pose?
- Availability and suitability: What technology, processes or equipment are available to control the risk? What controls are suitable for use in your circumstances?
- Cost: How much does the control cost to put in place compared to how effective it would be in reducing the risk?

The items above have been considered when assessing the suitability of noise mitigation measures for the Project.

Environmental Reference Standard

The ERS is made under Section 93 of the Environment Protection Act to support the protection of human health in Victoria. It sets out the environmental values of the ambient air, ambient sound, land and water environments that are sought to be achieved or maintained in Victoria and standards to support those values.

Information about how the ERS would be applied to support decision making, and how the environmental values, indicators and objectives for each element of the environment would be interpreted is provided in the *Guide to the Environment Reference Standard* (EPA Victoria Publication 1992).

Environmental values are the uses, attributes and functions of the environment that Victorians value. Standards for the environmental values are comprised of objectives for supporting different uses. The ERS sets out objective noise levels based on Victoria's planning zones. The noise levels outlined in the ERS are objectives and are neither noise limits nor noise design criteria.

The ERS applies to the construction phases of the project and is a reference tool, it does not set compliance limits. The ERS does not apply in situations where specific regulations apply to that part of the environment or activity, for example, the control of commercial and industrial noise activities under the Environment Protection Regulations.

The ERS provides a framework, based on environmental values, for assessing the ambient sound environment over a period of time for different categories of land use, as shown in the following table:

ERS Land-use Categories

Category I	An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity and high site coverage.	Industrial Zone 1 (IN1Z) Industrial Zone 2 (IN2Z) Port Zone (PZ) Road 1 Zone (RDZ1) Capital City Zone (CCZ) Docklands Zone (DZ)
Category II	Medium rise building form with a strong urban or commercial character. Typically contains mixed land uses including activity centres and larger consolidated sites, and an active public realm.	Industrial Zone 3 (IN3Z) Commercial 1 Zone (C1Z) Commercial 2 Zone (C2Z) Commercial 3 Zone (C3Z) Activity Centre Zone (ACZ) Mixed Use Zone (MUZ) Road 2 Zone (RDZ2)

Category III	Lower rise building form including lower density residential development and detached housing typical of suburban residential settings or in towns of district or regional significance.	Residential Growth Zone (RGZ) General Residential Zone (GRZ) Neighbourhood Residential Zone (NRZ) Urban Floodway Zone (UFZ) Public Park and Recreation Zone (PPRZ) Urban Growth Zone (UGZ)
Category IV	Lower density or sparse populations with settlements that include smaller hamlets, villages and small towns that are generally unsuited for further expansion. Land uses include primary industry and farming.	Low Density Residential Zone (LDRZ) Township Zone (TZ) Rural Living Zone (RLZ) Green Wedge A Zone (GWAZ) Rural Conservation Zone (RCZ) Public Conservation and Resource Zone (PCRZ) Green Wedge Zone (GWZ) Farming Zone (FZ) Rural Activity Zone (RAZ)
Category V	Unique combinations of landscape, biodiversity and geodiversity. These natural areas typically provide undisturbed species habitat and enable people to see and interact with native vegetation and wildlife.	Natural areas are classified as land within Category V irrespective of the planning zones that apply to that land.
Category I, II, III or IV	Depending on surrounding land uses and the intent of the specific planning zone (which may have a diversity of uses) as specified in a schedule to the planning zone	Comprehensive Development Zone (CDZ) Priority Development Zone (PDZ) Special Use Zone (SUZ) Public Use Zone (PUZ)

The environmental values of the ambient sound environment are set out in Table 3.1 of the ERS, as reproduced below:

Environmental values of the ambient sound environment

Environmental value	General description
Sleep during the night	An ambient sound environment that supports sleep at night
Domestic and recreational activities	An ambient sound environment that supports recreational and domestic activities in a residential setting
Normal conversation	An ambient sound environment that allows for a normal conversation indoors without the need to raise voices
Child learning and development	An ambient sound environment that supports cognitive development and learning in children
Human tranquillity and enjoyment outdoors in natural areas	An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas.
Musical entertainment	An ambient sound environment that recognises the community's demand for a wide range of musical entertainment

EPA Victoria Publication 1992 provides the following context with respect to the indicators and objectives for the ambient sound environment:

> *The objectives vary with the time interval for the relevant time of day. The lower night-time objectives compared to the day/evening objective for the same category apply to the environmental*

value of sleep during the night. For example, in category III, the objective for the $L_{Aeq,8\ hr}$ from 10 pm to 6 am is 40 dB(A), whereas for the same category the objective for the outdoor $L_{Aeq,16hr}$ during the day and evening (6 am to 10 pm) is 50 dB(A). This is sufficient to maintain the environmental value of sleep for most people during the night, even with bedroom windows open.

The ERS objectives also differ based on the land use category. The objectives for developed areas are based on the Australian Standard for design sound levels within buildings AS/NZS 2107:2016. These levels were adjusted to the outdoor environment (in free-field conditions) based on the typical noise reduction provided by the building envelope within the corresponding land use setting. For example, the difference in noise level from outdoors to indoors with the window open is generally understood to be 10 dB(A). Similarly, for typical older Australian dwellings without additional noise control, a reduction of 15 dB(A) can reasonably be expected when windows are closed. Greater noise reduction, around 20 dB(A), can be achieved in contemporary constructions that include thermal efficiency measures (such as thermal double glazing for the prevention of air leakage). Even higher noise reduction can be expected where specific acoustic treatments have been incorporated.

The ERS objectives for sound in the ambient environment are designed to achieve and maintain the environmental values that relate to the intended use of buildings in specific land use categories. The differences in objectives recognise the reality of current ambient sound levels that can reasonably be expected in developed areas. In some land use settings, such as category I, some modification to living arrangements or building design is expected (such as closed windows or improved acoustic attenuation). In the more urbanised ERS land use categories (I and II), additional noise attenuation above standard contemporary energy-efficient construction may be required to achieve internal noise levels equivalent to those observed in other land use categories.

Table 5.1 of EPA Victoria Publication 1992 provides further guidance as to the interpretation of the ERS environmental values described in the following table:

Derivation and interpretation of objectives for ambient sound environmental values

Environmental value	Indicator type	Derivation	Interpretation
Sleep during the night	Decibel level as an outdoor $L_{Aeq,8\ hour}$ (in free field conditions)	Decibel level objectives are derived from standards for design of building interiors suitable for sleep (AS/NZS 2107:2016). The objectives are adapted based on expected building attenuation in the land use setting and whether the occupant is more likely to sleep with their windows opened or closed. In category I, the night-time objective is consistent with the levels suggested by enHealth (2018) as evidence-based limits outdoors and the interim target in the World Health	Not meeting the decibel level objectives outdoors in the ambient sound environment indicates that there is an increased risk of sleep disturbance due to noise (difficulty falling asleep, awakening, poor quality sleep). An increased potential risk of sleep disturbance can be expected when the levels are exceeded: even if windows are closed in the more urbanised areas in categories I and II when windows are open in categories III and IV.

Environmental value	Indicator type	Derivation	Interpretation
		Organization Night noise guidelines for Europe (WHO, 2009).	
Domestic and recreational activities	Decibel level as an outdoor $L_{Aeq,16\ hour}$ (in free field conditions)	Decibel level objectives for domestic and recreational activities are derived from standards for design of building interiors suitable for living areas of residential buildings in different land use settings (AS/NZS 2107:2016). The objectives are adapted, based on expected building attenuation in the land use setting and whether the occupant is more likely have windows opened or closed. In category I, the day-time objective is consistent with the level suggested by enHealth (2018) as evidence-based limits outdoors.	The objectives are set at levels above which there is an increased risk of disturbance by noise. Not meeting the decibel levels outdoors can affect domestic and recreational activities that people conduct at home and other residences. Noise can be expected to interfere with reading and other tasks that require concentration or sustained attention, such as working from home, watching television, listening, rest and recreation. An increased risk of disturbance to domestic and recreational activities can be expected when the levels are exceeded: for categories I and II, outdoors and indoors, even if windows are closed, for categories III and IV, outdoors and indoors when windows are open.
Normal conversation	Decibel level as an outdoor $L_{Aeq,16\ hour}$ or an outdoor $L_{Aeq,8\ hour}$ (in free-field conditions)	Ambient sound can interfere with speech intelligibility (the ability of speech to be heard and understood). The objectives are based on evidence of speech intelligibility at different ambient sound levels.	The risk of interference to normal conversation increases when ambient sound levels exceed the day-evening objectives for categories I and II. This risk increases as the distance between the speaker and the listener increases. In category I, if sound levels increase above the level of the day-evening objective, the ability to hold a normal conversation indoors can be affected when the windows are open. In category I and II, conversations outdoors can require a higher vocal effort as sound levels increase above the level of the day-evening objective.
Child learning and development	Decibel level as $L_{Aeq,16\ hour}$ (in free-field conditions)	Decibel level objectives for child learning and	Ambient sound levels exceeding the objectives pose a risk to children being able to hear and

Environmental value	Indicator type	Derivation	Interpretation
		development are derived from standards for design of building interiors suitable for teaching spaces and classrooms in educational buildings. (AS/NZS 2107:2016) In categories I, II and III, the objectives are based on having the classroom windows closed on the facade most exposed to the sound. The objectives do not apply to spaces inside buildings used for sleeping during daytime, as may occur in childcare centres.	understand complicated spoken messages in classrooms and learning areas. In categories I and II, additional building attenuation may be warranted to achieve acceptable internal sound levels. For example. AS/NZS 2107:2016 recommends a range of 35 to 45 dB(A) for teaching spaces and single classrooms. Above this range, most people would be dissatisfied with the level of intruding sound.
Human tranquillity and enjoyment outdoors in natural areas	Qualitative	This objective is based the World Health Organization Guidelines for community noise (WHO, 1999) recommendations to protect the outdoors in parkland and conservation areas from disruption of tranquillity. WHO (1999) states: 'existing quiet outdoor areas would be preserved and the ratio of intruding noise to natural background sound would be kept low'.	Introducing non-natural sounds into natural areas poses a potential risk to visitor experience, disruption of tranquillity and loss of enjoyment of the natural area.
Musical entertainment	None	Recognises the importance of musical entertainment to Victoria's culture and economy. It carries over the policy goal of SEPP N-2 (Victorian Government, 1989b)	Decisions that introduce sounds into the environment where musical entertainment is performed pose a risk to this value.

Environment Protection Regulations 2021

The objective of the *Environment Protection Regulations 2021* is to further the purpose and give effect to the EP Act by imposing obligations in relation to environmental protection.

Section 113 of the EP Regulations specifies that predictions, measurement, assessment and analysis of noise within a noise sensitive area must be conducted in accordance the Noise Protocol. The EP Regulations consider noise from a commercial, industrial or trade premises unreasonable if noise levels emitted from the premises exceed noise limits prescribed by the Noise Protocol.

EPA Publication 1826 – The Noise Protocol

EPA Publication 1826:2021 *This Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (Noise Protocol),* is incorporated into the Environment Protection Regulations.

Part I: Commercial, industrial and trades premises of the Protocol sets outs methodology for establishing regulatory noise limits and assessing noise levels from a new or existing commercial, industrial and trade premises to determine unreasonable noise or aggravated noise under EP Regulations. Noise limits are calculated from planning overlays and background noise levels measured within an area in absence of commercial noise.

In accordance with the methodology of the Noise Protocol, the noise limits have been determined and are presented in the below. The derivation of the noise limits is provided in Appendix C.

Noise Protocol Noise Limits

Noise Sensitive Area	Noise Limits L_{eq} dB(A)		
	Day[1]	Evening[1]	Night[1]
South (Old Melbourne Road, Little River Road)	49	43	37
East (Cherry Creek Youth Justice Detention Centre)	47	41	36
North (Boadles Lane, Narraburra Road, Newtons Road)	45	39	36
West (Little River Road)	48	44	38

1 Period definitions:

Day: Monday-to-Saturday 7am-to-6pm; Sundays N/A ;

Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm

Night: All days 10pm-to-7am

The Noise Protocol requires the assessment of commercial and industrial noise over a 30-minute period and also requires that commercial, industrial and trade premises take all reasonable steps to ensure that the cumulative noise from two or more premises does not exceed the noise limit at the nearest noise sensitive areas.

Meeting noise limits established by the Noise Protocol does not mean the GED has been met. In addition to setting noise limits for industry, the Environment Protection Act requires that industry should take all reasonably practicable steps to eliminate or reduce the risk from noise.

For the purposes of assessing unreasonable noise, frequency spectrum should also be considered as a prescribed factor.

EPA Publication 1996 Assessing Low Frequency Noise

EPA Victoria Publication 1996 is a guideline for acoustic consultants and other qualified professionals who assess low frequency noise (10 to 160 Hertz (Hz)).

Predicted noise levels at noise sensitive receptors may be compared against the relevant low frequency threshold levels (Table 2 for indoor or Table 3 for outdoor measurements). However, noise level calculations in the low frequency range can be problematic and of limited accuracy.

In addition, EPA Victoria Publication 1996 provides the following guidance with respect to predicting low frequency noise:

> *Predicting expected noise levels at noise sensitive receptors may be compared against the relevant low frequency threshold levels (Table 2 for indoor or Table 3 for outdoor measurements). However, noise level calculations in the low frequency range can be problematic and of limited accuracy.*
>
> *The use of noise calculations would be restricted to indicative estimations only. Due to this, calculations would only be used as a screening tool to assess the risk of low frequency noise from the proposed development and/or extension of existing commercial, industrial and trade premises.*
>
> *Other factors you would consider:*
>
> - *Noise data provided by equipment manufacturers and suppliers of noise control solutions may not be available at low frequencies. The frequency range of most acoustic testing standards doesn't extend below one-third octave band 50 Hz.*
> - *Equipment noise levels from measurements conducted at other facilities can be used as an input for noise calculations. However, the uncertainty associated with using data from another site needs to be considered.*
> - *Engineering calculation methods for the outdoor propagation of sound would be used with caution. The procedures such as those within ISO 9613-2:1999 or CONCAWE (1981), can be based on empirical data in octave bands rather than one-third octave bands, meaning the value of attenuation factors at low frequencies may not be documented.*

The outdoor noise threshold criterion to be used for outdoor assessments is provided in Table 3 of EPA Victoria Publication 1996, as follows:

One-third octave low-frequency noise thresholds, *EPA Victoria Publication 1996*

Frequency (Hz)	One-third octave band threshold level, $L_{Zeq,15min}$ dB												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

Freight rail noise

Transport (Compliance and Miscellaneous) Act 1983

Section 251B(2) of the *Transport (Compliance and Miscellaneous) Act 1983* (TCM Act) only applies to noise from passenger rail services and does not apply to freight rail.

EPA Publication 1826 – The Noise Protocol

In accordance with the requirements of the Environment Protection Regulations, noise from freight rail movements within the site, including all operational activities (e.g. idling locomotives, maintenance facilities, loading areas, IMEX terminal) are subject to the Noise Protocol.

Noise from freight rail is not subject to the Noise Protocol when moving along the rail corridor and entering or exiting a siding.

The Passenger Rail Infrastructure Noise Policy

The Passenger Rail Infrastructure Noise Policy (PRINP) was released in April 2013, and applies to new passenger rail infrastructure, changes to land use near existing and planned rail corridors, and redevelopment of existing passenger rail infrastructure. The policy has been put in place to effectively manage rail noise, which will help provide good urban, transport and social outcomes as Victoria grows.

Section 5 of PRINP states that:

- *(Applicable Transport bodies and planning authorities) need not have regard to this policy (PRINP) when exercising powers or performing functions in regard to:*
- *New freight or tram infrastructure projects or;*
- *Where the Noise Protocol (previously SEPP N-1) provisions apply.*

PRINP also includes:

> *When assessing whether the investigation thresholds are exceeded, transport bodies and planning authorities should consider noise from current rail activity and forecast future trends in rail activity. Noise from both passenger rail and freight rail activity should be considered where the corridor is or is likely to be also used for freight rail operations. Where **redevelopment of passenger rail infrastructure** is being considered, noise from activity levels with and without the redevelopment should be assessed.*

There are no proposed changes to the existing passenger rail tracks along the Geelong-Melbourne rail corridor as part of the Project. At this stage of the Project, the future plans for the Geelong-Melbourne passenger rail track (Geelong Fast Rail) are unknown. The existing freight corridor will service the freight movements to and from the Project site. However, there may be corridor wide implications to the introduction of the project so the PRINP investigation thresholds should be considered.

The investigation thresholds for the redevelopment of existing passenger rail infrastructure are presented in the table below.

PRINP Assessment Criteria for Redevelopment of Existing Passenger Rail Infrastructure

Time	Type of Receiver	Investigation Thresholds
Day (6 am to 10 pm) dB(A) External	Residential dwellings and other buildings where people sleep including aged person homes, hospitals, motels and caravan parks. Noise sensitive community buildings including, schools, kindergartens and libraries.	65 dB(A) L_{Aeq} **and** change in L_{Aeq} of 3 dB(A) or more **or** 85 dB(A) L_{Amax} **and** change in L_{Amax} of 3 dB(A) or more
Night (10 pm to 6 am) dB(A) External	Residential dwellings and other buildings where people sleep including aged person homes, hospitals, motels and caravan parks	60 dB(A) L_{Aeq} **and** change in L_{Aeq} of 3 dB(A) or more **or**

Time	Type of Receiver	Investigation Thresholds
		85 dB(A) L_{Amax} **and** change in L_{Amax} of 3 dB(A) or more

VCAT Precedent Criteria – Maximum Noise Level Events

The Victorian Civil & Administrative Tribunal (VCAT) has issued decisions regarding train noise criteria that provide applicable precedents for developments. Appendix D summarises the relevant precedent criteria. These criteria are drawn from sleep disturbance studies summarised in NSW EPA document Environmental Criteria for Road Traffic Noise, 1999 (ECRTN) and the subsequent New South Wales Department of Environment, Climate Change and Water's NSW Road Noise Policy, 2011 which states:

> *From the research on sleep disturbance to date it can be concluded that:*
>
> - *Maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep.*
> - *One or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly*

However, as stated in the Kilker vs Stonington decision the internal noise target of L_{max} 50 dB(A) is considered too onerous for the assessment of rail noise:

> *The acoustic report prepared by Ms Hui provided a comprehensive examination of the relevant factors concerning the site and the proposal; noise measurements; a summary of the available criteria; interstate experience; and previous advice to VCAT Tribunals in relation to this issue. Ms Hui summarised her findings as follows:*
>
> > *"A previous VCAT decision relating to a residential development in the City of Stonnington adjacent to a railway line recommended that noise from trains should not exceed 50dBLmax inside the dwellings. This criterion is considered to be extremely stringent and this view is also held by City of Stonnington's consultants, Watson Moss Growcott Acoustics Pty Ltd. After consideration of sleep disturbance criteria nominated by the NSW EPA, it is recommended that a more appropriate criterion would be for maximum noise levels of trains not to exceed 55dBA in bedroom areas and 60dBA in living room areas"*

Based on the body of precedents and this, it is considered that the following external noise criteria are appropriate for the rail noise from the project:

- The 95% loudest L_{max} dB(A) rail noise event during the night time period (10pm to 7am) shall not exceed the criterion of 65 dB outside bedrooms and 70 dB outside living rooms.

The L_{max} criteria applies externally to noise sensitive receptors and assumes a 10dB(A) reduction will occur through an open window.

The criteria have also been applied to other maximum noise level events from the site. As shown in Appendix D, VCAT precedent criteria may also be applied to commercial activities such as carparks and loading/unloading activities.

Traffic noise (offsite)

VicRoads Traffic Noise Reduction Policy

The VicRoads Traffic Noise Reduction Policy (TRNP,2005) applies to limiting noise next to new or improved roads:

> *Where arterial roads and freeways are built on new alignments, or where existing arterial roads or freeways are widened by two or more lanes **and** buildings previously protected from traffic noise are exposed by the removal of buildings required for widening*.

The traffic noise level will be limited to the objectives set out below or the level that would have prevailed if the road improvements had not occurred, whichever is the greater:

- ***Category A** – Residential dwellings, aged persons home, hospitals, motels, caravan parks and other buildings of a residential nature, the noise level objective will be 63 dB(A) $L_{10,18hr}$ measured between 6am and midnight*
- ***Category B** –Schools, kindergartens libraries and other noise-sensitive community buildings, the noise level objective will be 63 dB(A) $L_{10,12hr}$ measured between 6am and 6pm.*
- *Where the noise level adjacent to **Category A or B** buildings prior to road improvements is less than **50 dB(A)L10 (18hr)**, consideration will be given to limiting the external noise level increase to **12 dB(A).***

The following upgrades may occur to facilitate the Project:

- Duplication of the bridge (Little River Road) over the Princes Highway
- Widening of Little River Road within the existing road reserve, including the provision of hard shoulders.
- Improvements to the capacity of the three entrance/exits to the Project site.

The upgrades will occur within the existing road reserve and not require the removal of any buildings or structures, therefore the TRNP does not strictly apply.

Little River Road is also a municipal road, not a VicRoads declared arterial road. Therefore, the TRNP does not apply to the project, and the assessment of potential noise emissions is not required under the Policy.

However, the project will result in an increase road traffic volumes along Little River Road. To understand the potential changes in road traffic noise levels at noise sensitive receptors along Little River Road, a due diligence assessment has been undertaken utilising the following:

- **Environmental Reference Standard (ERS)**
  - ERS Objective for the surrounds (*GWZ* and *PUZ*) are (Category IV) with outdoor noise indicators of:
    - L_{eq} Day 40 dB(A) from 6 am to 10 pm
    - L_{eq} Night 35 dB(A) from 10 pm to 6 am
- **VicRoads TNRP**
  - Where the noise level adjacent to **Category A or B** buildings prior to road improvements is less than **50 dB(A)L10 (18hr)**, consideration will be given to limiting the external noise level increase to **12 dB(A).**
- **VCAT Precedent Criteria**
  - A maximum noise level event of 65 dB(A), to assess the maximum noise levels from trucks and the use of compression release engine brakes when entering the site.

Construction Noise

EPA Victoria Publication 1834 - Civil Construction, Building and Demolition Guide

In Victoria there is no over-arching legislation for the control of noise from construction however, EPA Publication 1824:2020 *Civil Construction, Building and Demolition Guide* provides information to help inform the decisions and steps you can take to eliminate in accordance with the GED.

For the purposes of this assessment the project has been classified as a "*commercial and industrial construction and demolition site*".

Section 4.3 "*Managing noise and vibration during working hours*" provides normal working hours and noise management measures that would be adopted at all times whilst Section 4.4 "*Managing noise and vibration outside normal working hours"* provides additional requirements for noise management outside of those hours.

This is presented in the following table:

Working hours defined in EPA Victoria Publication 1834

Period	Recommendations
Normal working hours Monday to Friday; 7am – 6pm Saturdays; 7am – 1pm	Construction noise at any time during the day might still be considered unreasonable, depending on the work practices and circumstances in which the noise is emitted. Assessment must consider the attributes of the noise and the time, place and circumstances in which it is emitted.
Weekend/evening work hours Monday to Friday; 6pm – 10pm Saturdays; 1pm – 10pm Sundays and Public Holidays; 7am – 10pm	Construction noise levels at any residence must not exceed the background (L_{A90}) noise by: • 10 dB(A) or more for up to 18 months after project commencement • 5 dB(A) or more for 18 months or more after project commencement
Night period Monday to Sunday; 10pm – 7am	Construction noise is to be inaudible within a habitable room at any residential premises. If audible, this is considered unreasonable noise under the EP Act. However, provision is made for circumstances of unavoidable works, low-noise or managed-impact works. **Unavoidable works** - are works which pose an unacceptable risk to life or property or a major traffic hazard and can be justified. Includes an activity which has commenced but cannot be stopped. You would need to demonstrate that planned unavoidable works cannot be reasonably moved to normal work hours. This requires additional consideration of potential noise and vibration generating activities and controls to minimise noise and vibration. These can be recorded within the noise and vibration management plan and may form part of a broader environmental management plan.

Blasting is not proposed to be part of the construction methodology for this project.

Construction Vibration

There are no existing statutory requirements or guidelines for assessing or managing vibration from the construction of major infrastructure in Victoria.

Recent major impact assessments in Victoria have instead used criteria from British or German standards or from the International Standards Organisation (ISO). Accordingly, the human amenity criteria adopted herein are based on British Standard BS6472-1:2008 and the structural damage criteria are based on German Standard DIN 4150-3:2016.

Note that blasting is not expected to be part of the construction methodology for this project and therefore has not been discussed in this report.

DIN4150-3:2016

German Standard DIN 4150-3 "*Structural vibration in buildings – Effects on structures*" (DIN 4150-3) outlines 'safe limits' as Peak particle velocity (PPV) levels up to which no damage due to vibration effects have been observed for particular classes of buildings. Damage is defined as anything from minor non-structural effects such as superficial cracking in cement render to the separation of partitions or intermediate walls from load bearing walls. Safe limits applied to vibration levels of a short duration are summarised in the following table:

Structural Damage 'Safe Limits' for Construction Short-term Vibration on Structures (DIN 4150-3)

Group	Type of Structure	Peak Particle Velocity (PPV) in mm/s		
		At Foundation at a Frequency of:		
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. heritage-listed)	3	3 to 8	8 to 10

1 For frequencies above 100 Hz, the higher values in the 50 Hz to 100 Hz column would be used.

The more stringent values shown in the table below can be applied when evaluating the effects of long-term or continuous vibration on structures.

Structural damage 'safe limits' for construction vibration for long-term vibration impacts on structures

Group	Type of Structure	Guideline Values for Velocity (mm/s) of Vibration at Horizontal Plane of Highest Floor (All Frequencies)
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10
2	Dwellings and buildings of similar design and/or occupancy	5
3	Structures that, because of their sensitivity to vibration, cannot be	2.5

Group	Type of Structure	Guideline Values for Velocity (mm/s) of Vibration at Horizontal Plane of Highest Floor (All Frequencies)
	classified under lines 1 and 2 and are of intrinsic value (e.g. Heritage buildings)	

British Standard BS6472-1:2008

British Standard BS6472-1:2008 "*Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*" (BS6472-1:2008) includes Vibration Dose Value (VDV) ranges for workshops, offices, residences (daytime and evening).

These ranges highlight the values where adverse vibration impacts for most persons could be expected. The vibration dose values for these building types are presented in the table below. For offices and workshops, multiplying factors of two and four respectively would be applied to the VDV ranges for a 16-hour day.

Vibration Dose Value Ranges for Buildings (BS6472-1:2008)

Place and Time	Low Probability of Adverse Comment $ms^{-1.75}$	Adverse Comment Possible $ms^{-1.75}$	Adverse Comment Probable $ms^{-1.75}$
Residential buildings 16-hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8-hour night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Offices	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2
Workshops	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

Vibration descriptors relevant to construction

The dose values for human amenity outlined in in *British Standard BS6472-1:2008* are a measure of the weighted spectral vibration experienced over a specified period whereas construction vibration is often measured as a PPV.

Peak particle vibration criteria are generally preferable as they allow for an immediate review of discrete events that exceed a pre-determined threshold. The PPV can be described as the rate at which a particle of ground is moving, i.e. a measure of ground vibration, in millimetres per second.

Furthermore, PPV is considered the simplest indicator of both perceptibility and the risk of damage to structures.

British Standard BS5228-2:2009 suggests that:

> *…..for construction it is considered more appropriate to provide guidance in terms of the PPV (peak particle velocity), since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage, Furthermore, since many of the empirical vibration predictors yield results in terms of PPV, it is necessary to understand what the consequences might be of any predicted levels in terms of human perception and disturbance.*

A reasonable approach that has been adopted for other projects in Victoria is to convert the human amenity vibration dose values to a representative PPV value.

By setting criteria that are readily understood and measurable, the communications between stakeholders can be quickly advanced leading to prompt adjustments to construction practices if required.

Managing Noise and Vibration from Construction Activities

Construction noise would be managed in accordance with EPA Victoria Publication 1834. This includes the development of a plan to manage noise during construction in consultation with the EPA Victoria.

Management During Normal Working Hours

The plan would include the following general good practice techniques taken from Section 4.3.3 of EPA Victoria Publication 1834:

- Undertake preparatory work off site where there is low potential for impacting people (e.g. formwork, cutting or prefabrication of materials off site prior to transporting to the construction site)
- Connect to the electricity network as early as possible to avoid the use of diesel generators.
- Restrict areas where mobile plant can operate so that it is away from people who could be affected by noise.
- Locate site vehicle access and waiting areas away from people who could be affected by noise.
- Plan vehicle movements to avoid manoeuvres and idling at location nearest to nearby people.
- Use quieter equipment or methods. This may require considering:
  - buying or leasing quieter equipment
  - avoiding metal-to-metal and metal-to-stone contact
  - installing mufflers
  - reducing throttle and turning off equipment when not in use
  - placing things down rather than throwing
  - educating drivers to use driving practices that minimise noise.
- Use low-noise saw blades.
- Use electrical equipment rather than equipment driven by a diesel generator.
- Use low-noise emitting generators.
- Use effective alternatives to ‘beeper’ alarms (e.g. broadband alarms, proximity sensors).
- Avoid using reversing alarms by designing site layout to avoid reversing (e.g. drive-through for parking and deliveries).
- Maintain equipment by:
  - inspecting regularly and maintaining equipment to ensure good working order
  - checking machines with enclosures, including doors and door seals and that the door closes properly against seals
  - maintaining air lines on pneumatic equipment so they do not leak.
- Maintain vehicles by:
  - considering good working conditions of mufflers
  - securing loose parts that may rattle.
- Limit noise caused by people on site. This may include procedures to:
  - avoid yelling and shouting on site (note: if people on site need to shout to hear each other over the site ambient noise, it is possible the noise level may be putting their hearing at risk)
  - minimising the use and volume of any electrical amplified sound-reproducing equipment, for example radios, stereos, televisions, or public address systems.

- Plan transport and haulage routes to minimise the number of trucks/vehicles. Where there are large numbers of truck movements, consider truck route and truck waiting protocols (e.g. engines on/off and restart requirements).
- Implement substitute methods taking into consideration:
  - alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fractures. The suitability of alternative methods would be considered on a case by case basis, including what potential risks they involve.
  - alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electrical generator located away from nearby people.

The plan would also include the following general traffic management measures taken from Section 4.3.1 of EPA Victoria Publication 1834:

- Organise deliveries and access, with consideration given to:
  - combining loads to reduce noise and congestion in surrounding streets
  - optimising the number of vehicle trips to and from your site
  - maintaining vehicles in good condition
  - promoting good driving behaviour, to prevent sudden acceleration and unjustified use of
  - engine brakes
  - consulting and informing potentially noise-affected residences regarding designated
  - access routes to your site. Ensure drivers are aware and use nominated vehicle routes
  - providing on site parking for staff and on site truck waiting areas away from nearby people.
  - Install bunding or walls to minimise noise for truck waiting areas
  - scheduling deliveries to nominated hours only.

The plan would also include the following general communication steps taken from Section 4.3.2 of EPA Victoria Publication 1834:

- In the early stages of planning, identify and assess those potentially impacted by noise, then document and maintain the information for the duration of your project or activities.
- Engage community to keep them informed, for example community meetings with community
- and workers.
- Notify community before and during construction, communicating information such as:
  - dates and times (start and finish) when noise would be generated
  - why the noise is necessary
  - type of noise
  - measures to minimise noise volume, for example, installation of noise barriers
  - measures to minimise disturbance, for example, works scheduled to cease on certain days to provide residents with a break from the noise and discuss expected noise after implementation of management measures
  - contact details for information (the contact person would have a level of knowledge and responsibility that would enable them to provide a real-time response to queries and complaints)
  - what is happening now and what is happening next.

-

- Also consider:
  - using media such as a project-related website, letter box drops, meetings, individual contacts and notify in languages other than English where appropriate
  - following an agreed time period to contact community/residents regarding planned work outside normal working hours
  - offering alternative accommodation for affected residents when unavoidably noisy works would occur at night.
- Install and maintain a site information board at the front of your site with contact details, hours
- of operations, after hours emergency contact details, and regular information updates. Locate the board so it's visible from the outside boundary.
- Maintain a process for managing complaints.

In terms of vibration, any works that are required to be undertaken closer than the safe working distances presented in the previous sections would be assessed further.

Management Outside Normal Working Hours

Additional to the steps and techniques set out above for Normal Working Hours, the plan would include the following additional communication steps taken from Section 4.4.2 of EPA Victoria Publication 1834 for managing noise impacts outside of normal working hours:

- Manage expectations of the community by explaining:
  - what will happen, with as much detail as possible
  - why unavoidable works are required outside normal working hours
  - the timing and nature of works that may affect them and details of any changes to construction work schedules
  - the criteria for qualification for offsite mitigation such as respite offers, acoustic treatment or alternative accommodation.
- Notify residents early so they can make plans to cope with the noise.

The plan would also include the following general scheduling steps taken from Section 4.4.2 of EPA Victoria Publication 1834 :

- Plan quieter unavoidable work activities outside normal working hours.
- Schedule noisy unavoidable work when it is less likely to affect residents' sleep and for shorter periods, wherever possible.
- Schedule respite periods if unavoidable work is near residents. Consult with residents who may be most affected about restricting the number of nights per week and/or per calendar month when you undertake works.
- Stockpile material from unavoidable work activities that occur outside normal hours in, for example, an acoustic enclosure. Also restrict load-out to occur during normal working hours.
- Train all workers regarding unavoidable work activities that occur outside normal working hour

Appendix C

Noise Protocol Limit Determination

Victorian Policies and Guidelines

In rural Victoria, the EPA Guidelines *Noise limit and assessment protocol* (Noise Protocol) applies to noise from industrial and commercial premises. The Noise Protocol specifies the procedure for establishing noise criteria, and for measuring and assessing commercial noise at noise sensitive locations.

Under the Noise Protocol assessment procedures, noise from the source under consideration is measured or predicted to determine its impact over a continuous 30-minute period. Adjustments to the noise level are applied to account for the effects of duration, tonality, intermittency and impulsiveness. The resultant noise level is called the Effective Noise Level.

This section presents the assessment using the Rural Area Method of the Noise Protocol.

Time Periods

Under the Noise Protocol, noise criteria are established for the three periods: Day, Evening and Night. The Environment Protection Regulations defines the following times for each of these periods:

Noise Protocol Time periods

Noise Protocol Time Periods	Time
Day	7am to 6pm Weekdays and Saturdays
Evening	6pm to 10pm Weekdays 7am to 10pm Sundays and Public Holidays
Night	10pm to 7am

Noise Protocol Limits

Step 1 – Zone Levels

Noise criteria for the Project have been established using the procedures from Part 1 of the Noise Protocol; the noise criteria are termed 'Noise limits'.

Step 1 in determining the Noise limits involves determining 'Zone Levels', based on the zoning of the land at the noise sensitive area and at the noise-emitting premises. The Zone Levels are read from Table B.1 of the Noise Protocol.

Referring to the relevant Planning Scheme, presented in the Appendix A, the proposed site is situated on land zoned *Green Wedge Zone (GWZ)* and it to be rezoned to *Comprehensive Development Zone Group B (CDZ)* as part of the Project.

The noise sensitive receptors located within the study area are Green Wedge Zone (GWZ) and Special Use Zone 9 (SUZ9).

For these land use zonings, i.e. noise-generating zone CDZ to receiving zone GWZ and SUZ9, from Table B.1 of Noise Protocol, the Zone Levels are as follows:

Noise Protocol Zone Levels

Noise Sensitive Area	Zone Levels L_{eq} dB(A)		
	Day	Evening	Night
South (Old Melbourne Road, Little River Road)	46	41	36
West (Little River Road)	46	41	36
North (Boadles Lane, Narraburra Road, Newtons Road)	46	41	36
East (Cherry Creek Youth Justice Detention Centre)	46	41	36

Step 2 – Distance-Adjusted Levels

Step 2 in determining the noise criteria is to adjust the Zone Levels based on the distance from the noise sensitive receiver to the boundary of the zone in which the noise-emitting premises is located.

The following shows the distances adjusted noise levels from the calculated zone levels.

Noise Protocol Distance Adjusted Levels

Noise Sensitive Area	Distance to Nearest Receptor (metres)	Distance Adjusted Levels L_{eq} dB(A)		
		Day	Evening	Night
South (Old Melbourne Road, Little River Road)	0	46	41	36
West (Little River Road)	300	43	38	33
North (Boadles Lane, Narraburra Road, Newtons Road)	200	44	39	34
East (Cherry Creek Youth Justice Detention Centre)	700	39	34	29

Step 3 – Base Noise Level Check

Step 3 in determining the criteria is the base noise level check. For each period, the greater of the distance adjusted noise levels and Environment Protection Regulations 'base noise levels' for rural areas are to be adopted. The base noise levels are as follows:

- Day period: 45
- Evening period: 37
- Night period: 32

Therefore, at this step in the limit derivation the 'zone levels' for each period is to be adopted.

Noise Protocol Base Noise Level Check

Noise Sensitive Area	Base Noise Level Check L_{eq} dB(A)		
	Day	Evening	Night
South (Old Melbourne Road, Little River Road)	46	41	36
West (Little River Road)	45	38	33
North (Boadles Lane, Narraburra Road, Newtons Road)	45	39	34
East (Cherry Creek Youth Justice Detention Centre)	**45**	**37**	**32**

Step 4 – Background Noise Level Check and Adjustment

The Noise Protocol also prescribes that if the noise sensitive area is determined to be a 'background-relevant area', a background noise assessment including background noise monitoring may be conducted.

The site was observed to be a background relevant area affected by high traffic noise levels as it is located one kilometre north of the Princes Highway which is a major freeway between Melbourne and Geelong. The background level assessment is undertaken as follows:

- Day period: $L_{90, Day}$ + 8 dB
- Evening period: $L_{90, Evening}$ + 5 dB
- Night period: $L_{90, Night}$ + 5 dB

A summary of the measured background noise levels is provided in Table 5.

Background Noise Monitoring Results

ID	Noise Sensitive Area	Average Measured L_{A90} Noise Level, dB		
		Day[2]	Evening[2]	Night[2]
L1	South	41	38	32
L2	West	39	36	31
L3	North	34	34	31
L4	East	40	39	33

The overall noise limit is the greater of the distance adjusted level or the calculated background level assessment. The following presents the overall noise limits for the Project:

Noise Protocol Noise Limits

Noise Sensitive Area	Noise limits L_{eq} dB(A)		
	Day[1]	Evening[1]	Night[1]
South (Old Melbourne Road, Little River Road)	49	43	37
West (Little River Road)	47	41	36
North (Boadles Lane, Narraburra Road, Newtons Road)	45	39	36
East (Cherry Creek Youth Justice Detention Centre)	48	44	38

The noise limits presented above apply to the noise emitted from the Project, outdoors within 10 metres of identified noise sensitive receptors.

Appendix D

VCAT Precedent Criteria

Victorian Civil & Administrative Tribunal (VCAT) Precedents for Rail Events

Date	VCAT #	Title	Rail Corridor	Applicable Noise Sources	Comment	Habitable room criterion	
						L_{eq} dB(A)	L_{max} dB(A)
2014 July 25	845	*AXF Group Pty Ltd v Whitehorse CC*	Belgrave, Lilydale lines. Near Box Hill Station. Passenger trains.	*…rail system...*	*L_{Amax} … maximum noise level not exceeded by 95% of trains…*	-	Bed 55dB Living 60dB
2014 May 5	513	*Strathelie Property Holdings Pty Ltd v Yarra CC*	Hurstbridge, South Morang lines Near Victoria Park Station Passenger trains.	*…Train station and …railway line,…*	*…with windows closed…*	-	Bed 50dB Living 60dB
2012 Mar 23	323	*Wang v Moreland CC*	Upfield Line Near Coburg Station. Passenger trains.	Trains … *train horns* … (boom gate)*…bells ... traffic…*	Stringent criterion applied to … *mitigate both the continuous rumble and the short sharp peaks.* *Residents can… choose to seal the doors and windows to minimise the external noise.*	-	Bed 50dB Living 60dB
2012 Aug 9	1180	*ACCC Pty Ltd tas AWC Property v Yarra CC* **(Red Dot)**	Alamein, Belgrave, Glen Waverley, Lilydale lines. Near Richmond Station. Passenger and freight trains.	*Trains…* (platform) … *announcements … horns*	Stringent criterion used *…Given only …4.5 hours* …(with)*…limited trains* …(and)… *no announcements or train horns…(which can be)… occasional, random and annoying…*	-	Bed 50dB

Date	VCAT #	Title	Rail Corridor	Applicable Noise Sources	Comment	Habitable room criterion	
						L_{eq} dB(A)	L_{max} dB(A)
2012 Jul 10	906	*Lend Lease Apartments (Armadale) Pty Ltd v Stonnington CC*	Cranbourne, Frankston, Pakenham lines. Near Toorak Station. Passenger and freight trains.	*… rail system…*	L_{eq} dB(A) criterion introduced to address any future increases in freight train numbers	Bed 35dB (hourly)	Bed 55dB
2012 Jan 23	-	*Regional Rail Link Section 2 Noise Impacts And Mitigation Advisory Committee Report*	West of Werribee and Deer Park Passenger trains. (possible future provision for freight)	Trains	-	Bed 40dB (10pm-7am) Living 45dB (7am-10pm)	All 65dB
2011 Nov 8	2175	*Richmond Icon Pty Ltd v Yarra CC*	Alamein, Belgrave, Glen Waverley, Lilydale lines. Near Richmond Station. Passenger and freight trains.	Trains (passenger and freight)	*…maximum noise level not exceeded by 95% of train…* *Each case …assessed on…merits…* (with regard to)*…number of tracks…trains… types… nature of noise on the tracks...* This instance involved frequent trains thumping over rail points.	-	Bed 50dB

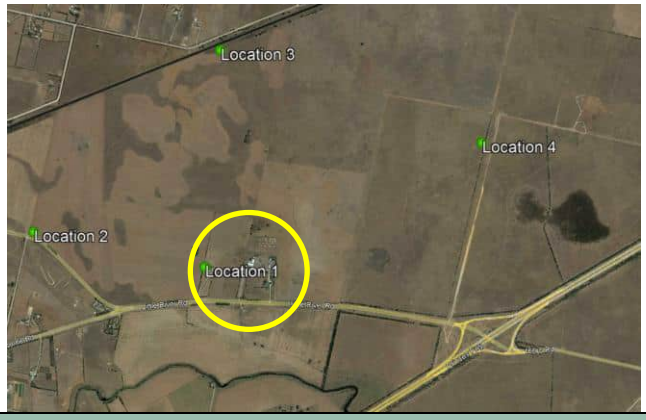
Date	VCAT #	Title	Rail Corridor	Applicable Noise Sources	Comment	Habitable room criterion	
						L_{eq} dB(A)	L_{max} dB(A)
2011 Mar 22	475	*Pomeroy Pacific Pty Ltd v Moreland CC No. 2*	Craigieburn line. Near Pascoe Vale Station. Passenger trains.	Trains	-	-	Bed 55dB Living 60dB
2004 Mar 16	2470	*Kilker v Stonnington*	Glen Waverley Line	Trains	*… it is recommended that a more appropriate criterion would be for maximum noise levels of trains not to exceed 55dBA in bedroom areas and 60dBA in living room areas"*	-	Bed 55dB Living 60dB

Appendix E

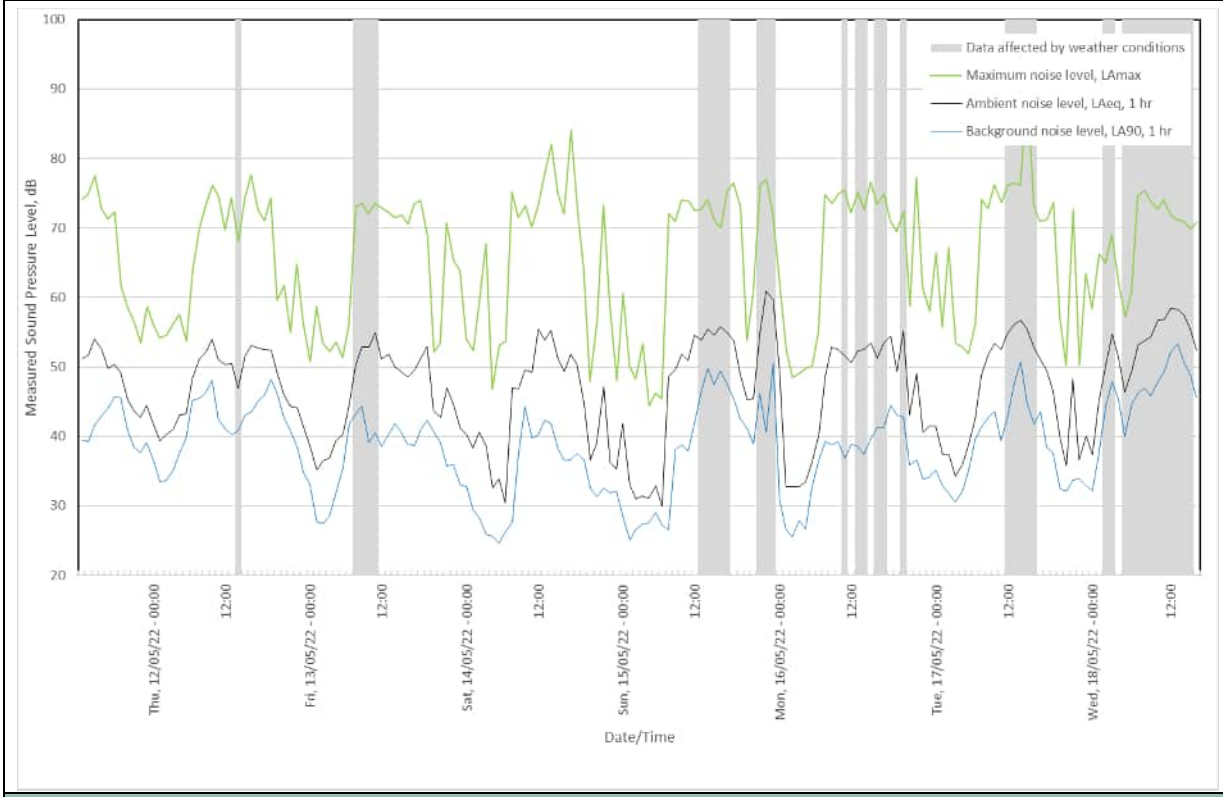
Noise Monitoring

Location 1, Little River, 3211

Noise monitor in-situ



Full monitoring results

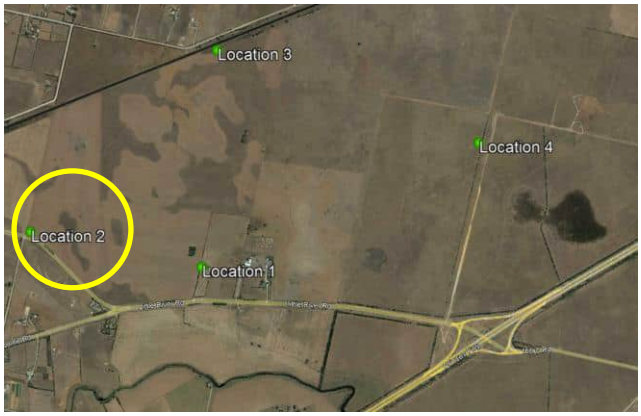


Summary, dB

Period	Background, L_{A90}			Ambient, L_{Aeq}			Maximum, L_{Amax}		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Day	37	44	41	52	54	52	74	104	N/a
Evening	34	44	38	45	51	49	71	84	N/a
Night	28	40	32	36	49	41	61	77	N/a

Location 2, Little River, 3211

Noise monitor in-situ



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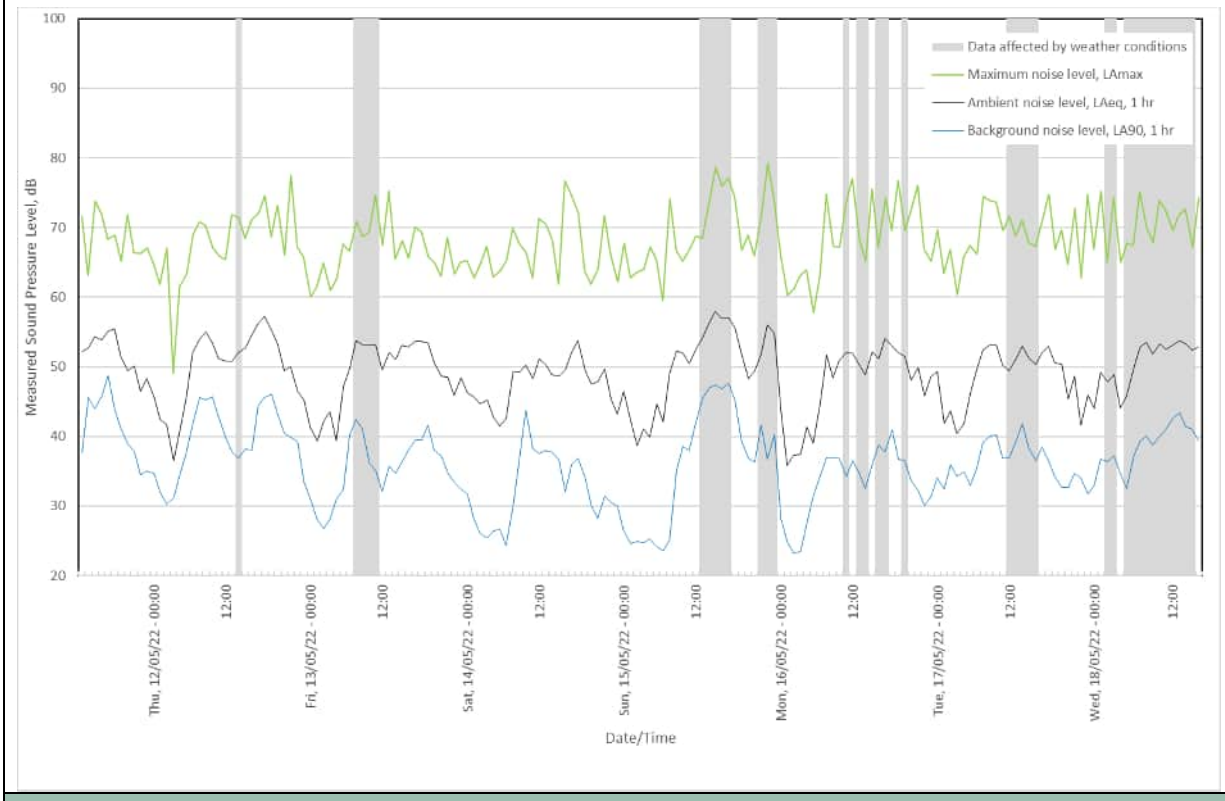
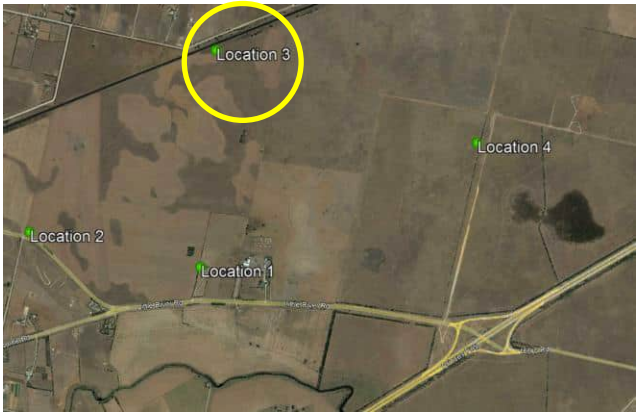


Summary, dB

Period	Background, L_{A90}			Ambient, L_{Aeq}			Maximum, L_{Amax}		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Day	37	43	39	50	54	52	71	96	N/a
Evening	34	42	36	49	54	51	69	79	N/a
Night	26	35	31	43	49	46	67	79	N/a

Location 3, Little River, 3211

Noise monitor in-situ



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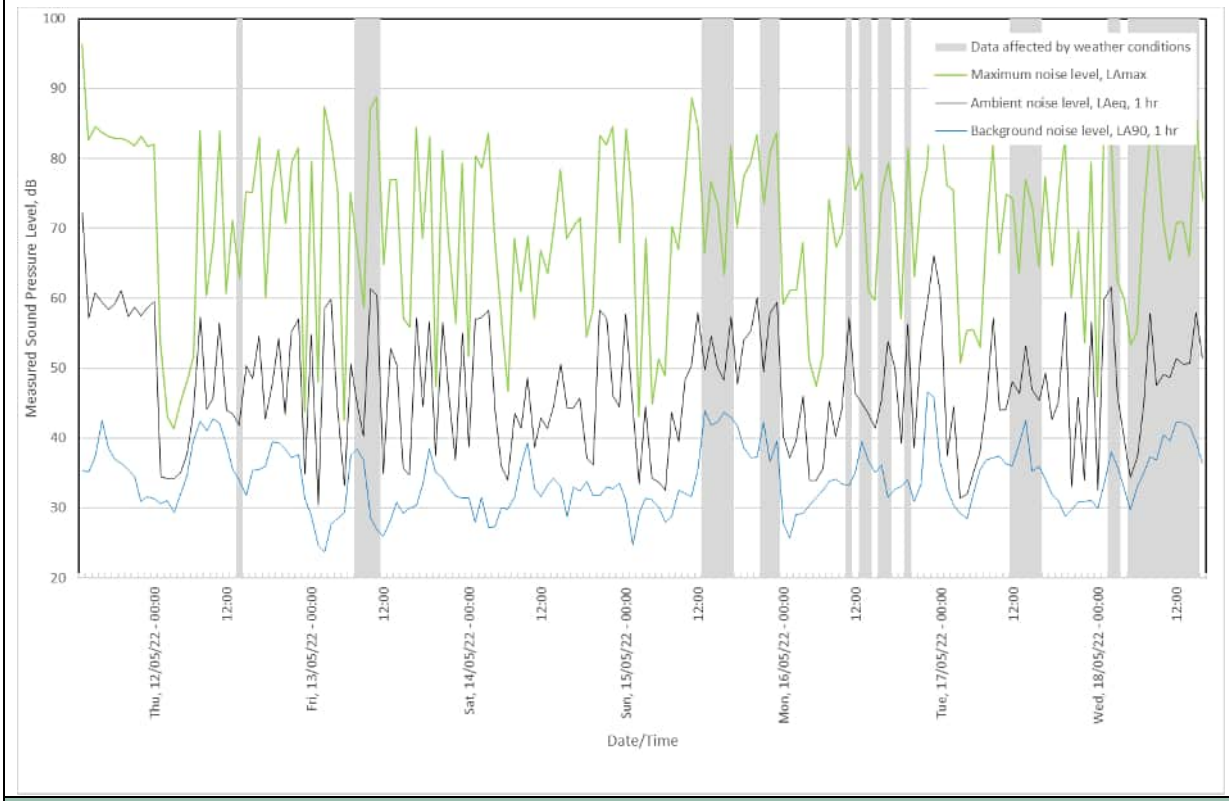
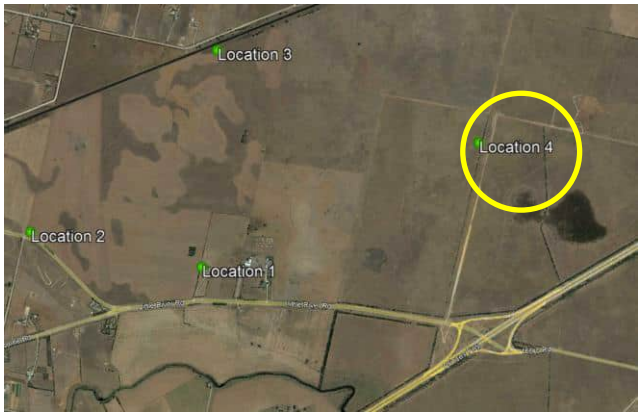


Summary, dB

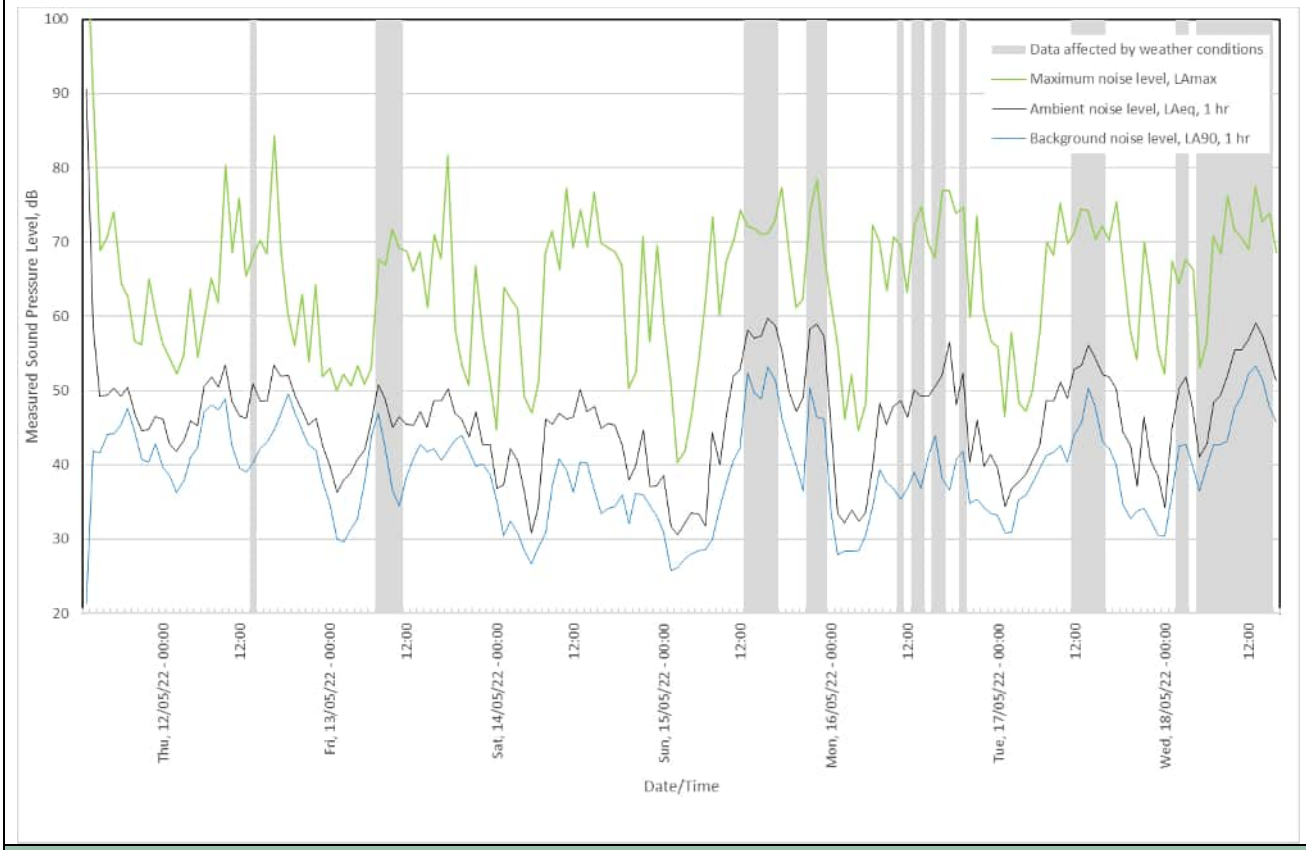
Period	Background, L_{A90}			Ambient, L_{Aeq}			Maximum, L_{Amax}		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Day	31	38	34	44	55	50	69	96	N/a
Evening	30	39	34	52	59	54	81	89	N/a
Night	30	35	31	49	58	54	83	96	N/a

Location 4, Little River, 3211

Noise monitor in-situ



Full monitoring results



Summary, dB

Period	Background, L_{A90}			Ambient, L_{Aeq}			Maximum, L_{Amax}		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Day	37	44	40	47	52	50	76	114	N/a
Evening	34	46	39	44	55	48	63	77	N/a
Night	29	41	33	35	52	43	61	78	N/a

Appendix F

Operational Noise Modelling Assumptions

Operational Noise Assessment Inputs and Assumptions

Item	Number	Location	Comments / assumptions	% of time operational in 30-minute period	Operational hours (Day / Evening / Night)
Industrial Assessment – Project Opening 2029					
Idling trains (3x locomotives)	4	Holding Lines	-	100	24 hours
Idling trains (3x locomotives)	2	Holding Lines	-	100	24 hours
Idling trains (2x locomotives)	1	Locomotive Provisioning	-	100	24 hours
Container knocks	100	Double Stack Processing	+3 dB intermittency adjustment applied for Day +5 dB intermittency adjustment applied for Evening / Night	100	24 hours
Idling trucks	44	Truck Processing	Each truck idling for 2 minutes	7	7am – 6pm
Idling trucks	44	Double Stack Processing	Each truck idling for 2 minutes at one of seven points within Double Stack Processing	7	7am – 6pm
Truck movements	44	Double Stack Processing	-	100	7am – 6pm
Idling trucks	18	Truck Processing	Each truck idling for 2 minutes	7	6pm – 7am
Idling trucks	18	Double Stack Processing	Each truck idling for 2 minutes at one of seven points within Double Stack Processing	7	6pm – 7am
Truck movements	18	Double Stack Processing	-	100	6pm – 7am
Rail movements	1	Internal to site (flyover to holding lines)	Speed: 20km /h Length: 1800 metres Flyover height: 10 metres above ground	100	24 hours

Item	Number	Location	Comments / assumptions	% of time operational in 30-minute period	Operational hours (Day / Evening / Night)
			Flyover Radius: < 300 metres		
Industrial Assessment – Project Opening 2050					
Idling trains (3x locomotives)	4	Holding Lines	-	100	24 hours
Idling trains (3x locomotives)	2	Holding Lines	-	100	24 hours
Idling trains (2x locomotives)	1	Locomotive Provisioning	-	100	24 hours
Commercial power Washer	2	IMEX / MT Park	-	100	24 hours
Refrigerated container	100	IMEX / MT Park	Stacked 4 high with empty containers stacked 5 high surrounding.	100	24 hours
Forklift	6	MT Park	-	100	24 hours
Container knocks	142	IMEX / MT Park	+3 dB intermittency adjustment applied for Day +5 dB intermittency adjustment applied for Evening / Night	100	24 hours
Container knocks	100	Double Stack Processing	+3 dB intermittency adjustment applied for Day +5 dB intermittency adjustment applied for Evening / Night	100	24 hours
Idling trucks	66	Truck Processing	Each truck idling for 2 minutes	7	7am – 6pm

AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 165 330 660 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- 2029 Point Sources
- 2029 Truck Movements
- Container Bangs (2029)
- Rail Movements
- Shipping Containers (2029)
- Site Boundary

R53 R54 R52 R51 R47 R48 R49 R50 R46 R44 R45 R39 R40 R41 R43 R42 R26 R25 R24 R23 R22 R21 R20 R8 R9 R10 R7 R6 R5 R4 R3 R55 Youth Justice Centre

Locomotives Idling

Trucks Idling

Newtons Road

Narraburra Road

Boadles Lane

Devines Road

Little River Road

Princes Freeway

SUZ6 PUZ1 GWZ

Little River Logistics Precinct

Noise Source Locations - 2029
$L_{eq,30min}$ Operational Assessment

PROJECT:	60677282
CREATED BY:	GR
LAST MODIFIED:	30/05/2023
VERSION:	2

F-1

A3 size

AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 165 330 660 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- 2050 Point Sources
- 2050 Truck Movements
- Refrigerated Containers
- Container Bangs (2050)
- Rail Movements
- Buildings
- Shipping Containers (2050)
- Site Boundary

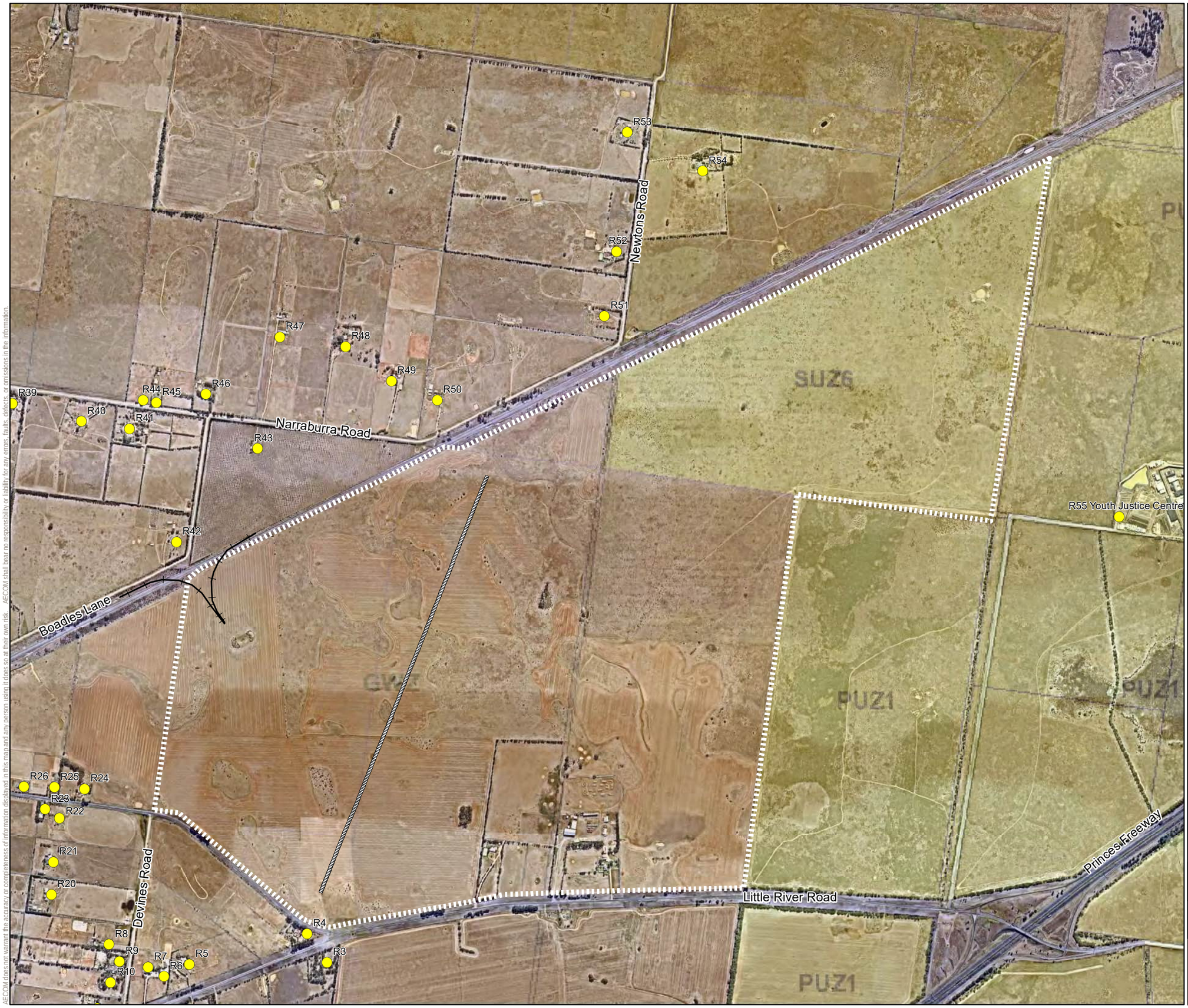
Little River Logistics Precinct

Noise Source Locations - 2050
$L_{eq,30min}$ Operational Assessment

PROJECT:	60677282
CREATED BY:	GR
LAST MODIFIED:	30/05/2023
VERSION:	2

F-2

A3 size



AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 165 330 660 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- Rail Flyover
- Shipping Containers (2029)
- Site Boundary

Little River Logistics Precinct

Noise Source Locations
L_{max} Flyover Assessment

PROJECT:	60677282
CREATED BY:	GR
LAST MODIFIED:	30/05/2023
VERSION:	2

F-3

A3 size

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DATUM GDA 1994, PROJECTION MGA ZONE 55

0 165 330 660 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- Locomotive Accelerating
- Brake Squeal / Wagon Bunching
- L_{max} Point source
- Buildings
- Shipping Containers (2050)
- Site Boundary

Little River Logistics Precinct

Noise Source Locations - 2050
L_{max} Operational Assessment

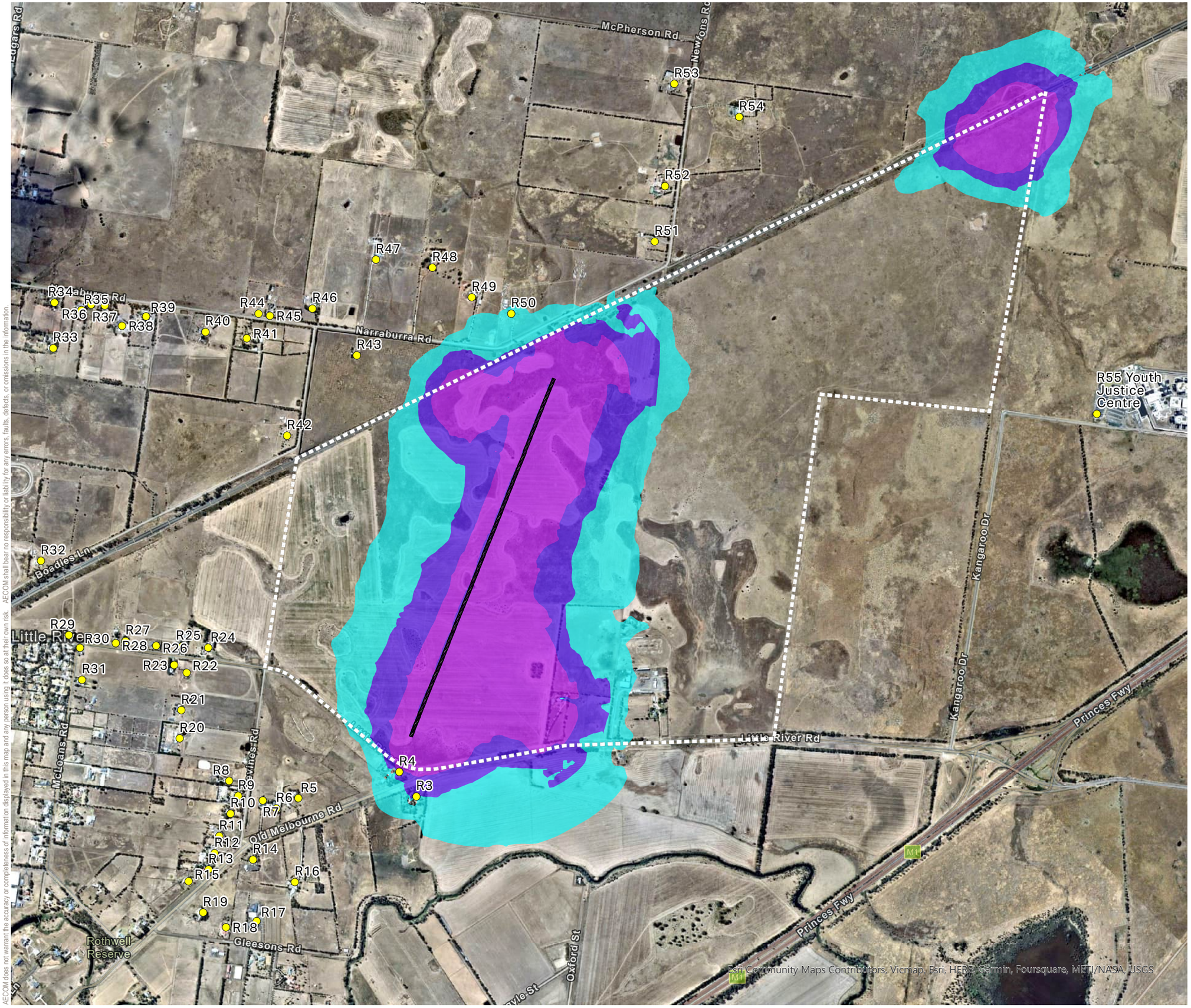
PROJECT:	60677282
CREATED BY:	GR
LAST MODIFIED:	30/05/2023
VERSION:	2

F-4

A3 size

Appendix G

Noise Contour Maps



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N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 120 240 480 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- Shipping Containers (2029)
- Site Boundary

Noise Levels

- < 36 dB(A)
- 36 - 40 dB(A)
- 40 - 44 dB(A)
- > 44 dB(A)

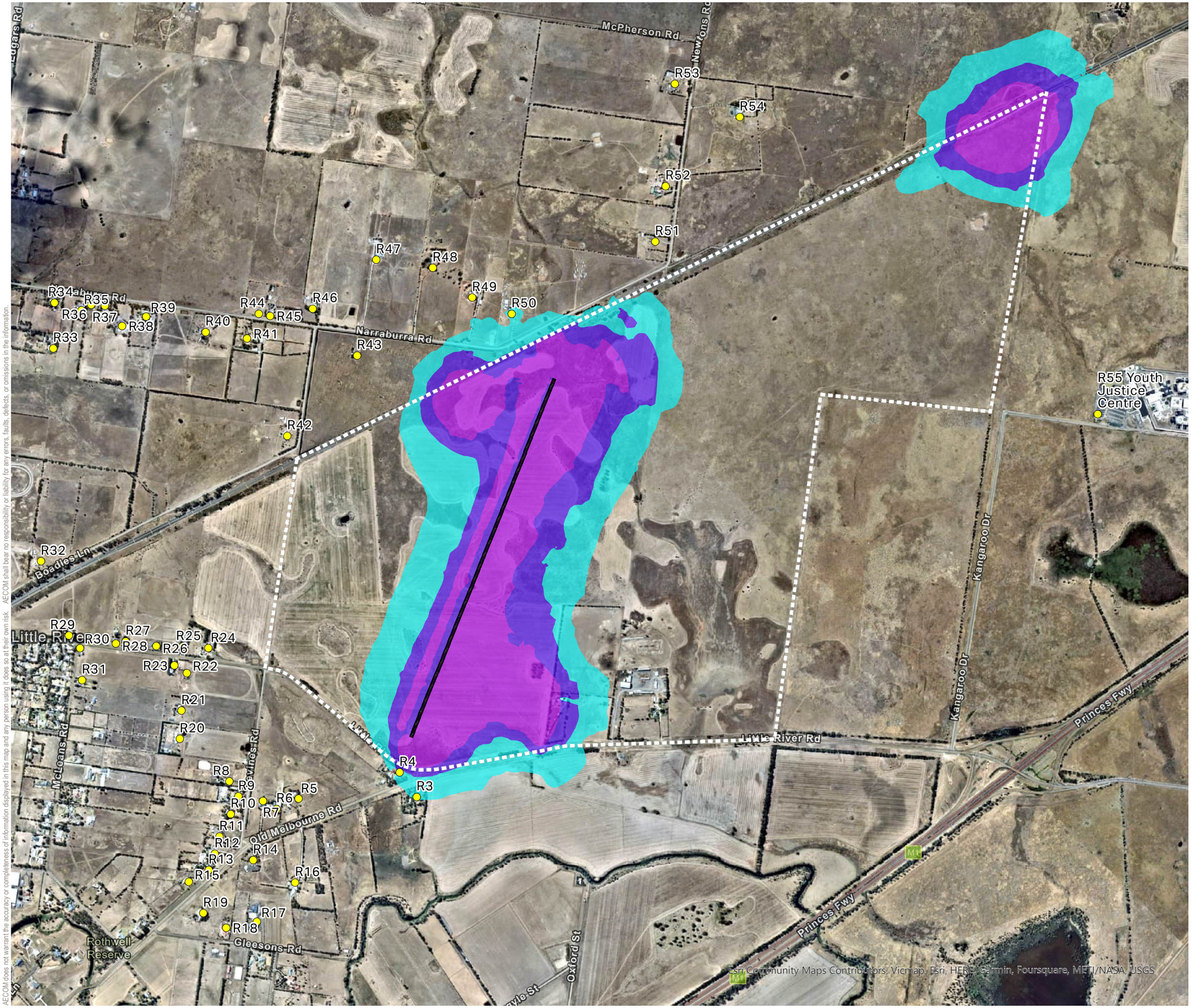
Little River Logistics Precinct

Noise Contour Map - 2029 Operational $L_{eq,30min}$ Assessment (Day period)

PROJECT #:	60677282
CREATED BY:	PD
LAST MODIFIED:	30/05/2023
VERSION:	3

G-1

A3 size



AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 120 240 480 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- Shipping Containers (2029)
- Site Boundary

Noise Levels

- < 36 dB(A)
- 36 - 40 dB(A)
- 40 - 44 dB(A)
- > 44 dB(A)

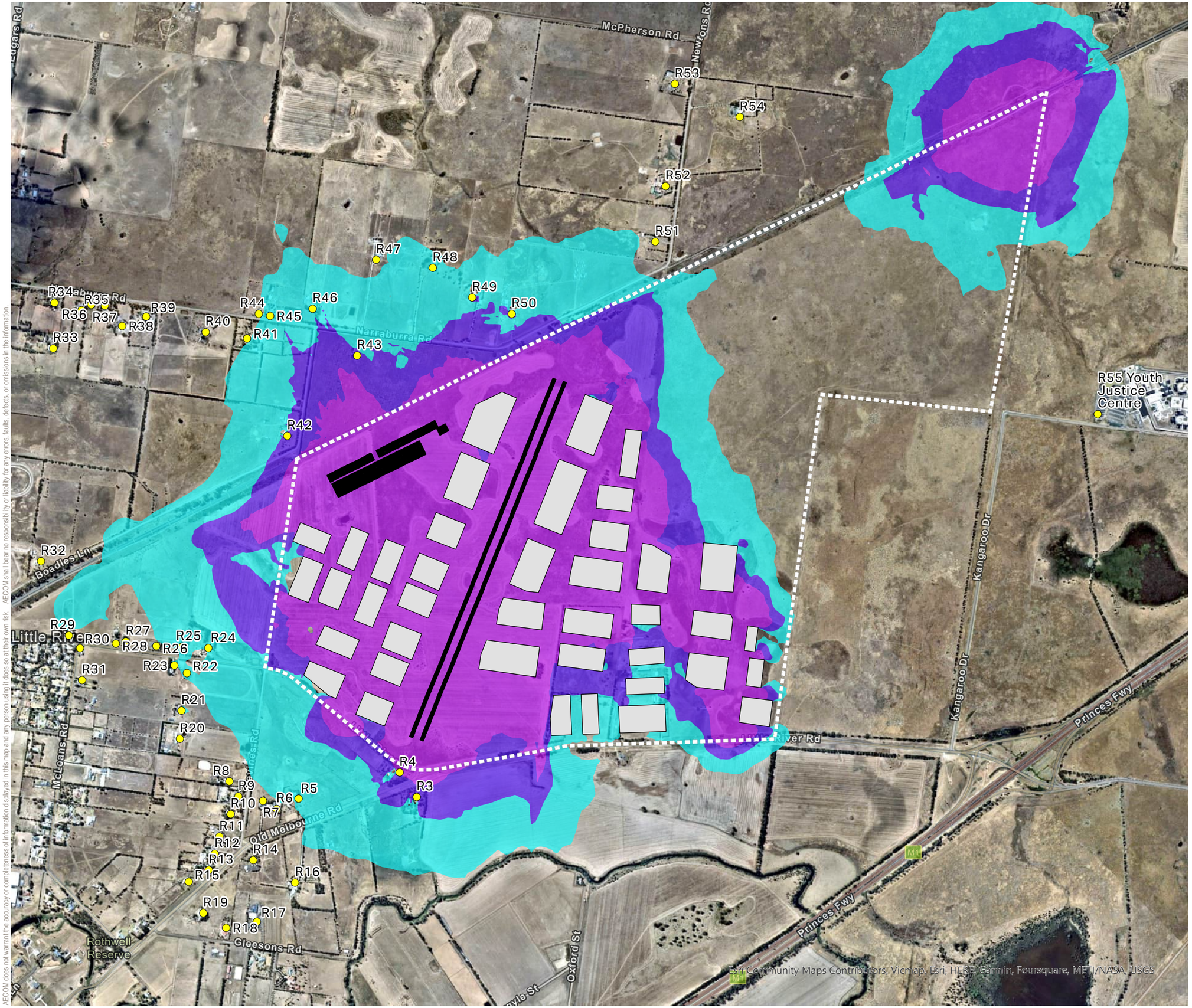
Little River Logistics Precinct

Noise Contour Map - 2029 Operational $L_{eq,30min}$ Assessment (Eve / Night period)

PROJECT #:	60677282
CREATED BY:	PD
LAST MODIFIED:	30/05/2023
VERSION:	3

G-2

A3 size



AECOM

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 120 240 480 Meters

(when printed at A3)

Legend

- Sensitive Receptor
- Buildings
- Shipping Containers (2050)
- Site Boundary

Noise Levels

- < 36 dB(A)
- 36 - 40 dB(A)
- 40 - 44 dB(A)
- > 44 dB(A)

Little River Logistics Precinct

Noise Contour Map - 2050 Operational $L_{eq,30min}$ Assessment Day period)

PROJECT #:	60677282
CREATED BY:	PD
LAST MODIFIED:	30/05/2023
VERSION:	3

G-3

A3 size