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# EDITHVALE AND BONBEACH LEVEL CROSSING REMOVAL PROJECTS

## ENVIRONMENT EFFECTS STATEMENT

## EES TECHNICAL REPORT H
## Noise and Vibration Impact Assessment

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LEVEL CROSSING REMOVAL AUTHORITY

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# Executive summary

The Victorian Government is removing 50 of Melbourne's most dangerous and congested level crossings. The Edithvale Road, Edithvale and Station Street/Bondi Road, Bonbeach level crossing removal projects were referred to the Minister for Planning who decided an Environment Effects Statement (EES) was required.

This report addresses the Scoping Requirements of the EES in relation to potential impacts to noise and vibration resulting from construction activities and physical changes to the rail corridor as a result of removing the level crossings. The Scoping Requirements require the noise and vibration to be addressed in an Environmental Management Framework.

### Noise and vibration context

This report provides a noise and vibration impact assessment for the Edithvale Road, Edithvale (Edithvale) and the Station Street/Bondi Road, Bonbeach (Bonbeach) level crossing removal projects.

Construction activities and operational rail movements are sources of noise and vibration emissions that can potentially impact on sensitive uses (such as residences).

### Method

Construction and operational activities are assessed using different processes for passenger rail projects in Victoria. Operational noise and vibration criteria are typically developed around human comfort and reducing levels of annoyance. For this project, the applicable criteria for operational noise and vibration are:

- *Passenger Rail Infrastructure Noise Policy* (PRINP, Vic, 2013) addresses operation rail noise. For redevelopment of rail infrastructure, this document requires the future $L_{Aeq}$ and $L_{Amax}$ noise levels for both day and night to be assessed against investigation thresholds.
- *State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No. N-1*(SEPP N-1) addresses noise from fixed infrastructure, eg electrical substations. This requires the predicted noise to be assessed against noise limits based on the existing noise level and the area zoning.
- *British Standard 6472:1 – 2008*. This Standard provides guidance on vibration levels within buildings that may result in an adverse comment or reaction from the occupants. These levels have been used as a guide in order to minimise potential vibration impacts after project opening.

Due to the nature of rail construction works, noise and vibration impacts during construction are typically higher than during operation of the rail corridor. For this project, applicable criteria for construction noise and vibration are:

- *Noise Control Guidelines, Publication 1254*. While not strictly applicable for public infrastructure projects, this publication gives guidance on construction noise limits.
- *German Standard DIN 4150-3*. This Standard provides structural damage vibration limits that should not be exceeded during construction in order to ensure that damage to buildings does not occur.

### Existing conditions

The existing noise environment is controlled by road traffic and rail noise. Noise levels are highest near the Nepean Highway and the Frankston rail line, and decrease with increasing distance.

Existing vibration levels (from both rail and road) are below thresholds at which they are likely to cause a loss of amenity at nearby sensitive locations.

### Impact Assessment

Noise from rail movements on the Frankston Line within the Edithvale and Bonbeach projects will come predominantly from freight and passenger trains.

Noise modelling undertaken in accordance with the Passenger Rail Infrastructure Noise Policy (PRINP) indicates that the PRINP investigation thresholds will not be exceeded and generally there will be a reduction in noise in the vicinity of the trench. Therefore, in accordance with the PRINP, noise should be considered a secondary matter and no further action need be considered.

Fixed infrastructure, including the substation and station public address (PA) systems will need to be designed to achieve SEPP N-1 noise limits. Vibration levels from train operations (both passenger rail and freight) are not expected to produce adverse impacts at nearby sensitive receivers.

Based on noise levels from typical construction equipment and processes, some residences near the project may be impacted by construction noise. *Publication 1254* has been used for development of Environmental Performance Requirements (EPRs). It is expected that construction noise will not be able to comply with the guideline levels in *Publication 1254* at all times. Where construction noise cannot achieve the guideline levels mitigation and management measures are included in the EPRs and would be implemented by the Alliance.

Construction vibration may also impact nearby residences. The most vibration intensive activities are expected to be earthworks, driven piling and dynamic pile testing. While it is not expected that vibration levels will be high enough to cause structural damage, perceptible vibration and annoyance is possible at locations close to construction activities.

## Environmental Performance Requirements

The following EPRs are recommended for the Edithvale and Bonbeach level crossing removal projects:

<table>
<tr><th>EPR ID</th><th>Environmental Performance Requirement</th><th>Stage</th></tr>
<tr><td>EPR_NV1</td><td>
Operational noise<br><br>
Design must ensure airborne noise generated by train movements at sensitive receptor locations is in accordance with the Passenger Rail Infrastructure Noise Policy.
<table>
<tr><th>Time</th><th>Type of Receiver</th><th>Investigation Thresholds</th></tr>
<tr><td>Day<br>(6am – 10pm)</td><td>Residential dwellings and other buildings where people sleep including aged persons homes, hospitals, motels and caravan parks.<br><br>Noise sensitive community buildings, including schools, kindergartens, libraries</td><td>65 $dBL_{Aeq}$ and a change in 3 dB(A) or more<br>or<br>85 $dBL_{Amax}$ and a change in 3 dB(A) or more</td></tr>
<tr><td>Night<br>(10pm – 6am)</td><td>Residential dwellings and other buildings where people sleep including aged persons homes. hospitals, motels and caravan parks</td><td>60 $dBL_{Aeq}$ and a change in 3 dB(A) or more<br>or<br>85 $dBL_{Amax}$ and a change in 3 dB(A) or more</td></tr>
</table>
Design fixed assets to achieve compliance with State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1.
</td><td>Operation</td></tr>
<tr><td>EPR_NV2</td><td>
Construction noise<br><br>
Prior to construction (excluding preparatory works), prepare a Construction Noise and Vibration Management Plan for the projects in consultation with EPA and Kingston City Council.<br><br>
Manage construction noise and vibration in accordance with EPA Publication 1254 Noise Control Guidelines unless otherwise specified in the Construction Noise and Vibration Management Plan prepared for the projects.<br><br>
The Construction Noise and Vibration Management Plan must be prepared prior to commencement of construction (excluding preparatory works) and include:<br><br>
a. the identification of sensitive receptors along the project alignment<br><br>
b. details of construction activities and an indicative schedule for construction works, including the identification of noise and/or vibration generating construction activities that have the potential to impact sensitive receptors<br><br>
c. Sets out measures to ensure effective monitoring of noise and vibration associated with construction.<br><br>
d. how construction noise (including truck haulage) and vibration will be minimised, including:<br><br>
i. the scheduling of noisy works to typical construction hours where feasible (i.e. Monday to Friday 07:00 am to 6:00 pm, and Saturday 07:00 am to 1:00 pm)<br><br>
ii. limiting night works outside of the main occupation periods
</td><td>Construction</td></tr>
</table>

| EPR ID | Environmental Performance Requirement | Stage |
|---|---|---|
| | iii. the planning of site works to limit vehicle movements to certain locations and time periods<br>iv. the substitution of noisy plant or processes with quieter options (e.g. broadband reversing and movement alarms instead of conventional beepers)<br>v. the provision temporary noise barriers where practicable<br>vi. monitoring of noise and/or vibration associated with construction<br>vii. notifying residents who may be impacted by noise and/or vibration in advance of the works<br>viii. a procedure for managing complaints.<br>The plan must outline airborne noise management levels and mitigation measures for evening and night time works. The management level is not a noise limit or target, but represents noise levels above which community reaction may be adverse and which should trigger mitigation actions to minimise the noise impact.<br>Depending on noise levels, noise mitigation measures may include offer of respite and relocation in accordance with a Respite and Relocation Policy (see EPR reference SC2) and Community and Stakeholder Engagement Management Plan (see EPR reference SC1). | |
| EPR_NV3 | **Construction vibration**<br>Identify potential sensitive receptors (including heritage places) and potential impacts from vibration during the construction period. Where relevant, conduct condition surveys and monitoring of sensitive receptors.<br>If impacts from vibration are anticipated, management and mitigation measures may include:<br>a. substituting high vibration plant or processes with lower vibration options<br>b. utilising vibration monitoring to inform management and mitigation<br>c. relocation of residents. (EPR reference SC2)<br>d. communication with potentially affected residents in accordance with the Community and Stakeholder Engagement Management Plan (EPR reference SC1) | Construction |
| EPR_SC1 | **Community and Stakeholder Engagement Management Plan**<br>Prior to construction (excluding preparatory works), prepare and implement a Community and Stakeholder Engagement Management Plan in consultation with Kingston City Council that includes the following:<br>a. identifies all project activities that potentially impact on community and business operations, and provides for a well-coordinated communication and engagement processes<br>b. consults with and addresses needs of vulnerable groups that would be impacted by the project such as the elderly, socio-economically disadvantaged groups and children<br>c. consults with and addresses needs of community facilities impacted by the project such as schools, child care, aged care, and caravan parks | Construction |

| EPR ID | Environmental Performance Requirement | Stage |
|---|---|---|
| | d. sets out processes and measures to provide advanced notice to key stakeholders and other potentially affected stakeholders of construction activities (including any staged works, early works, main works, or out of hours works), significant milestones, changed traffic conditions, interruptions to utility services, changed access and parking conditions, periods of predicted high noise and vibration activities, including contact details for enquiries/complaints<br>e. provides for any interested stakeholder to register their contact details to ensure they are automatically advised of planned construction activities, project progress, mitigation measures and intended reinstatement measures where applicable<br>f. documents a complaints management process (including processes and measures for registering, managing and resolving complaints) consistent with Australian Standard AS/NZS 10002: 2014 Guidelines for Complaint Management in Organisations. | |
| EPR_SC2 | **Respite and Relocation Policy**<br>Prior to construction (excluding preparatory works), prior to construction (excluding preparatory works), prepare and implement a Respite and Relocation Policy to be offered to residents whose amenity is significantly affected by construction activities (e.g. out of hours works or sustained loss of amenity during the day for residences with special circumstances such as shift workers) or who are subject to loss of access. The Respite and Relocation Policy will only apply during the period in which residents are (or are likely to be) affected.<br>The Policy must contain:<br>a. the criteria that must be met for relocation to be offered to affected residents<br>b. consideration of special circumstances such as language or cultural need, special needs related to health conditions or home businesses<br>c. the type and duration of out-of-hours work covered by the policy. | Construction |

# Abbreviations

| Term | Definition |
|---|---|
| dB | Decibels |
| EPA | Environment Protection Authority Victoria |
| eVDV | Estimated vibration dose value |
| GIS | Geographic information system |
| JV | AECOM-GHD Joint Venture |
| $L_{Aeq}$ | Equivalent A-weighted sound level |
| $L_{Amax}$ | Maximum A-weighted sound level |
| LXRA | Level Crossing Removal Authority |
| PRINP | Passenger Rail Infrastructure Noise Policy |
| VDV | Vibration dose value |

# 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 at low noise levels. |
| Day | Based on the definition in the PRINP, this is the 16 hour period from 6:00 am to 10:00 pm. |
| dB(A) | 'A'-weighted overall sound pressure level measured in decibels. |
| Decibel | A unit of measurement used to express the ratio between two values on a logarithmic scale. As the ear perceives sound energy logarithmically, the decibel is the unit used when referring to noise levels. |
| Estimated Vibration Dose Value (eVDV) | A predicted Vibration Dose Value determined from measurement of exposures and vibration levels and applied to a time period. Used to estimate Vibration Dose Values for residences exposed to multiple events of finite duration (such as passenger train movements). |
| $L_{Aeq}$ | Equivalent A-weighted continuous sound pressure level. It is the value of the sound pressure level of a continuous steady sound that has the same acoustic energy as a given time-varying sound pressure level when determined over the same measurement time interval. Often referred to as average sound pressure level. |
| $L_{Aeq,16hr}$ | 'A'-weighted equivalent continuous sound pressure level measured over the 16 hour period from 6:00 am to 10:00 pm. |
| $L_{Aeq,8hr}$ | 'A'-weighted equivalent continuous sound pressure level measured over the 8 hour period from 10:00 pm to 6:00 am. |
| $L_{Amax}$ | The maximum 'A'-weighted sound pressure level that occurs during a given measurement period. |
| Night | Based on the definition in the PRINP, this is the 8 hour period from 10:00 pm to 6:00 am. |
| Rail movement | A rail movement is the passage of a single train consist within the rail corridor. |
| Receiver | A receiver (also called a sensitive receiver) is a location at which noise or vibration is likely to impact upon a noise or vibration sensitive use. Residential premises are an example of sensitive receivers. |
| Sensitive use | A land use (as defined within the *Planning and Environment Act 1987*) that due to the type of use would be sensitive to either noise or vibration impacts. Residences are considered to be sensitive uses, but other uses (such as heritage structures, public recreation areas or places of worship) may also be considered sensitive. |
| Sound power level | The sound power level is used to describe the strength of a noise source. |
| Vibration dose value | A value derived using BS 6472-1:2008 used for determining the perceived impact of vibration levels on humans in buildings. Higher vibration dose values indicate increased levels of exposure to vibration. The units of vibration dose value are $m \cdot s^{-1.75}$ or $m/s^{1.75}$. |

# 1 Introduction

## 1.1 Purpose

The Victorian Government is removing 50 of Melbourne's most dangerous and congested level crossings, inclusive of the level crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach).

The removal of the level crossings at Edithvale and Bonbeach would improve transport safety in the Edithvale and Bonbeach by:

- removing the road-rail interface that may result in serious incidents and fatalities
- reduce traffic congestion in the Edithvale and Bonbeach areas
- facilitate additional train services on the Frankston railway line.

The Edithvale and Bonbeach level crossing removal projects were referred to the Minister for Planning on 9 March 2017. On 5 April 2017, the Minister issued a decision determining that an Environment Effects Statement (EES) is required for the projects due to the potential for a range of significant environmental effects.

The purpose of this report is to provide noise and vibration impact assessments for the Edithvale and the Bonbeach level crossing removal projects.

## 1.2 Why understanding noise and vibration is important

Rail movements are a source of noise and vibration emissions. Noise and vibration can impact some sensitive uses. It is important to quantify these emissions in order to understand the potential impacts on sensitive uses (such as residences).

During construction, noise and vibration emissions are likely to be increased. Management of noise and vibration is important to minimise impacts on affected sensitive uses, and prevent vibration-induced structural damage.

## 1.3 Project description

### 1.3.1 Overview

**Edithvale**

The Level Crossing Removal Authority proposes to remove the level crossing by lowering the Frankston railway line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level. The trench would be located between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length and 14 metres wide at its narrowest point, widening to up to 24 metres (including pile widths) at the new Edithvale station platforms.

The rail track would be approximately eight metres below ground level, and sit above the trench base slab and infrastructure to collect and divert rain water from the trench. The maximum depth of the excavation would be 15 metres. Pile depths would be a maximum of 24 metres at the deepest point of the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent unauthorised access by vehicles or people. Decking above the rail trench would provide for the new station building, car parking and a new substation required to ensure sufficient power is available for passenger services on the Frankston railway line. New pedestrian bridges would be constructed to retain pedestrian access across the railway line. A new station is to be constructed with lift, ramp and stair access to the below-ground train platforms.

### Bonbeach

The Level Crossing Removal Authority proposes to remove the level crossing by lowering the Frankston railway line into a trench under Bondi Road while maintaining Bondi Road at the current road level. The trench would be located between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening to up to 24 metres (including pile widths) at the new Bonbeach station platforms.

The rail track would be approximately eight metres below ground level, and sit above the trench base slab and infrastructure to collect and divert rain water from the trench. The maximum depth of the excavation would be 15 metres. Pile depths would be a maximum of 24 metres at the deepest point of the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent unauthorised access by vehicles or people. Decking above the rail trench would provide for the new station building and car parking. New pedestrian bridges would be constructed to retain pedestrian access across the railway line. A new station building would be constructed with lift, ramp and stair access to the below-ground train platforms.

### 1.3.2 Construction

The key construction activities for the Edithvale and Bonbeach level crossing removal projects include:

- site establishment including:
  - clearing of vegetation and ground levelling
  - establishment of site fencing, staff facilities and temporary construction areas
- protection and/or relocation of utility services
- excavation for piling, foundations and the rail trench
- on site waste management including removal, management and appropriate disposal of excavated soil, rock, stormwater and groundwater
- transport of spoil, excavated material and groundwater offsite
- demolition of existing stations and removal of existing rail and road infrastructure
- construction of bridge/deck structures to support Edithvale Road and Station Street/Bondi Road where they cross the rail line
- construction of base slab and waterproofing, including stormwater tanks
- construction of new station infrastructure including platforms and buildings
- construction of pedestrian overpasses and decking over the rail trench
- installation and commissioning of new rail infrastructure including ballast, overhead line equipment and rail.

In preparation for the main rail occupation, the existing Edithvale and Bonbeach train stations would be closed approximately four weeks in advance. Both projects would be constructed concurrently under the same rail closure which is anticipated to take six weeks.

During the closure of the rail corridor, in order to minimise disruption to the rail line construction activities would occur 24 hours per day, seven days per week. Additional periodic road closures and lane closures would be required and access along adjacent streets could be restricted. Additional weekend rail shutdowns would likely be required prior to and after the main rail occupation. Construction is expected to be completed within an 18 month period.

### 1.3.3 Operations and maintenance

Following the construction of the Edithvale and Bonbeach level crossing removal projects, the key operation and maintenance phase activities would include:

- Operation – monitoring, controlling and operation of the asset in accordance with the rail and road network requirements
- Maintenance – routine inspection and monitoring of the condition of the asset, planned routine maintenance and refurbishment work, and unplanned intervention and repair of the asset.

Operation and maintenance activities would be consistent with existing practices and subject to the evolving operational demands of the road and rail networks.

### 1.3.4 Noise and vibration considerations

Noise from rail operations comes from two major sources:

- Noise created by the interaction of wheels and rail. This will vary with different train speeds, wheel and track conditions, and any special trackwork (such as crossovers)
- For non-electric trains and wagons, noise from engines, typically from exhausts located at the top of the train

Passenger trains on the Frankston Line are almost all electric trains. Noise from these trains is controlled by the wheel-rail interaction.

Freight trains consist of a number of locomotives and wagons. The noise emissions from freight trains broadly comprises emissions from locomotives and those from wagons. Noise from locomotives is generally shorter in duration, but higher in magnitude, due to engine noise. Noise from wagons is controlled by the wheel-rail interaction. The maximum noise level ($L_{Amax}$) during a freight rail movement is controlled by the locomotive, while the wagons control the equivalent noise level ($L_{Aeq}$).

## 1.4 Project area

### 1.4.1 Edithvale

The Edithvale Road, Edithvale level crossing project investigation area (Edithvale project area) extends from Lincoln Parade, Aspendale to Chelsea Road, Chelsea. It includes the rail corridor and all of Station Street and Nepean Highway to the east and west of the rail corridor, and small sections of adjacent road reserves. Refer to Figure 1.

### 1.4.2 Bonbeach

The Station Street/Bondi Road, Bonbeach level crossing removal project area (Bonbeach project area) extends from Chelsea Road, Chelsea to Patterson River, Bonbeach. It includes the rail corridor and all of Station Street and Nepean Highway located to the east and west of the rail corridor, and small sections of adjacent road reserves. Refer to Figure 2.

### 1.4.3 Temporary construction areas

Specific construction laydown areas have not been identified at this time. Temporary laydown areas would be used for site offices, storing materials, plant and equipment, parking for construction works and construction traffic standby.

### 1.4.4 Study area

Sensitive uses are primarily residential areas east and west of the rail corridor. This includes residences on both Nepean Highway and Station Street. The noise and vibration impact assessment will investigate noise and vibration impacts upon these sensitive areas.

Refer to Figure 3 (Edithvale) and Figure 4 (Bonbeach) for the study areas considered in this report.


Figure 1 Edithvale project area


Figure 2 Bonbeach project area


Figure 3 Edithvale study area

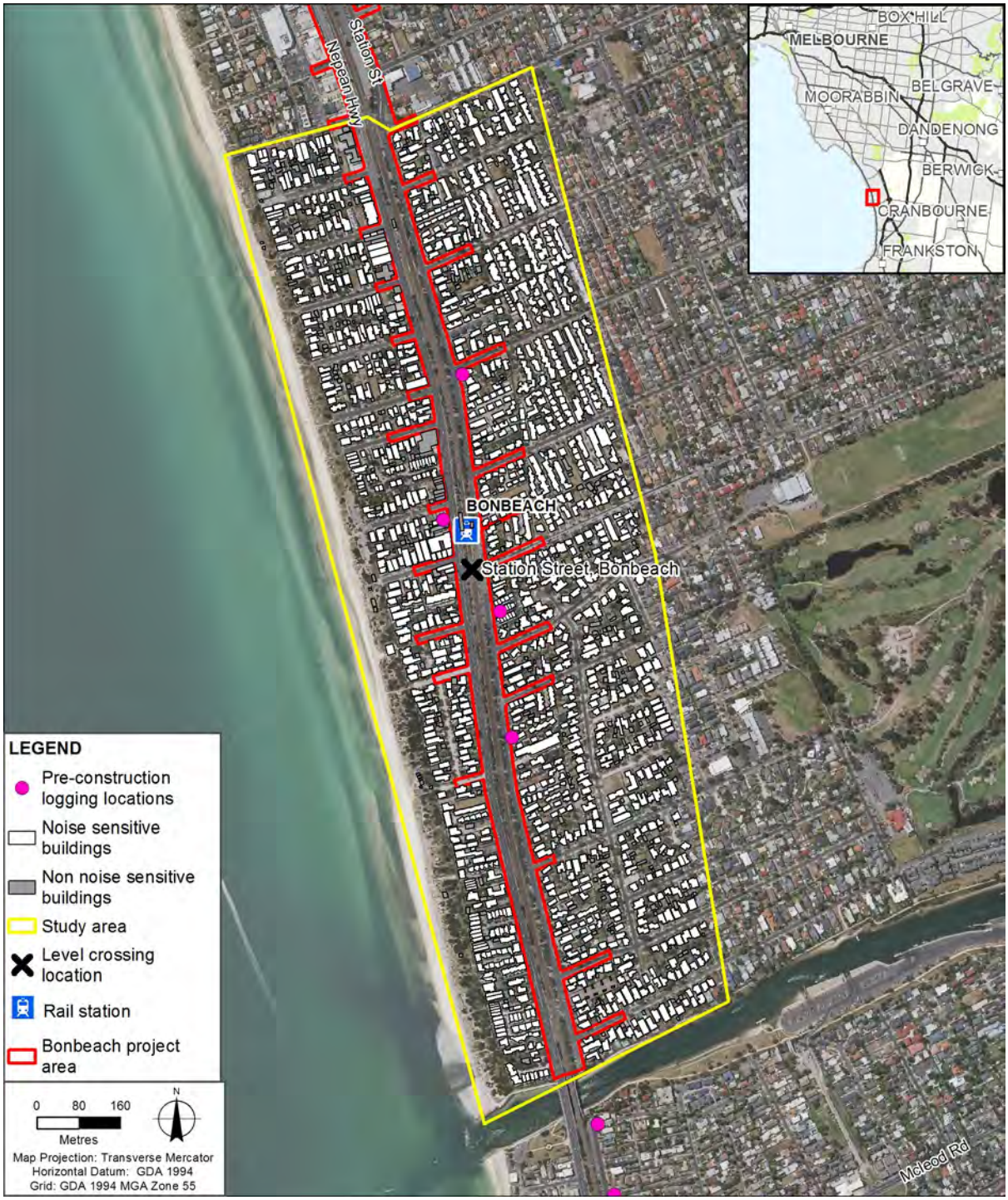


Figure 4 Bonbeach study area

# 2 Scoping Requirements

In order to meet statutory requirements, protect environmental values and sustain stakeholder confidence, the EES would include an Environmental Management Framework (EMF). The EMF would provide a transparent framework with clear accountabilities for managing and monitoring environmental effects and hazards associated with the construction and operational phases of the projects.

Section 3.5 of the Scoping Requirements (issued September 2017), states 'Environmental Performance Requirements (EPRs) should be clearly described in the EMF'. The proposed objectives, indicators and monitoring requirements' to be described that are relevant to this study are:

- noise
- vibration.

# 3 Legislation, policy, guidelines and criteria

Table 1 summarises the relevant primary legislation and guidelines that apply to the Edithvale and Bonbeach level crossing removal projects as well as the implications and required approvals.

Table 1 Primary legislation and associated information

| Legislation/policy/ guidelines | Key policies/strategies | Implications for the projects | Approvals required |
|---|---|---|---|
| **State** | | | |
| *Environment Effects Act 1978* | Passenger Rail Infrastructure Noise Policy (PRINP, Vic, 2013) | Sets investigation thresholds for management of noise impacts for redevelopment of existing rail infrastructure. Assessments under the *Environment Effects Act 1978* are required to implement the PRINP. | No |
| *Environmental Guidelines for Major Construction Sites (EPA Vic, 1996)* | | Provides a qualitative framework regarding construction noise and vibration from major construction sites, including infrastructure projects. Guidelines are provided by EPA for developers, contractors and government agencies involved with infrastructure projects. | No |
| *Environment Protection Act 1970* | Noise Control Guidelines, Publication 1254 (EPA Vic, 2008) | While applicable to commercial, industrial and some large-scale residential construction projects, the Noise Control Guidelines provides a basis for determining construction noise targets to reduce noise impacts. | No |
| *Environment Protection Act 1970* | State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No N-1 (SEPP N-1) | Applies to non-railway line items eg station buildings and electrical sub-station. | No |

| Legislation/policy/ guidelines | Key policies/strategies | Implications for the projects | Approvals required |
|---|---|---|---|
| **Global Standards** | | | |
| *British Standard BS 6472-1:2008* | Guide to evaluation of human exposure in buildings. (1 to 80 Hz) | Provides guidance on vibration levels for different sensitive uses in order to identify where vibration may cause annoyance. For residential uses, compliance with level of perception is typically used. | N/A |
| *DIN 4150-3:1999* | Vibration in buildings – Part 3: Effects on structures | Provides vibration limits that if complied with, structural damage would be avoided. Frequently used for the assessment of construction vibration in order to avoid damage to nearby structures. | N/A |

## 3.1 Noise and vibration criteria

### 3.1.1 Operational criteria

**Noise**

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. The PRINP applies to the operational rail noise from the realigned section of rail line associated with each level crossing that is removed.

PRINP provides investigation thresholds to guide transport bodies and planning authorities when assessing the impacts of rail noise on noise-sensitive areas, which are outlined in Table 2. For the purpose of selecting the investigation thresholds from PRINP, the level crossing removal projects are considered to be a 'redevelopment of existing passenger rail infrastructure'.

The investigation thresholds are not limits on allowable noise emissions, rather where rail noise levels are predicted to exceed the investigation thresholds, then 'noise impacts should be considered a primary matter' and options for avoiding, minimising and mitigating rail noise should be considered.

If an assessment shows the investigation thresholds are not exceeded, noise impacts should be considered a secondary matter. This means no further action need be considered under the PRINP.

### Table 2 PRINP investigation thresholds for redevelopment of existing passenger rail infrastructure[1]

| Time | Type of receiver | Investigation thresholds |
|---|---|---|
| Day<br>(6:00 am to 10:00 pm)<br>dB(A) External | Residential dwellings and other buildings where people sleep including aged person homes, hospitals, motels and caravan parks.<br>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<br>**or**<br>85 dB(A) $L_{Amax}$ **and** change in $L_{Amax}$ of 3 dB(A) or more |
| Night<br>(10:00 pm to 6:00 am)<br>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<br>**or**<br>85 dB(A) $L_{Amax}$ **and** change in $L_{Amax}$ of 3 dB(A) or more |

[1] *Source: Table C, Attachment 2 of PRINP*

The PRINP states that noise from freight rail activity should be considered in the assessment where a passenger corridor is also used for freight rail operations. As the Frankston rail line contains freight movements, noise from freight rail activity has been included in the assessment against the PRINP investigation thresholds.

Noise from fixed infrastructure, e.g. substations and stations, associated with the rail line is required to comply with the Victorian State Environment Protection Policy (SEPP N-1) limits. SEPP N-1 prescribes procedures for determining the statutory environmental noise limits which apply at noise sensitive locations, such as residential areas.

The Environment Protection Authority (EPA) has developed the SEPP N-1 noise assessment procedure with an aim of protecting people from industry noise that may affect normal domestic and recreational activities, including sleep at night. SEPP N-1 balances the need for operation of industry with the protection of sensitive uses, which is why different levels apply depending on the planning land-use zoning and the amount of background noise in the area.

The SEPP N-1 noise limits are dependent on:

- Zoning Levels, based on the planning scheme zoning types within 70 metre and 200 metre radii of the noise sensitive area.
- The time of day i.e. different limits apply at different times of the day.
- The background noise level (LA90) in the noise sensitive area.

Under SEPP N-1, noise from the source under consideration is measured so as to determine its impact over a continuous 30-minute period. Adjustments to the measured noise level are applied to account for the effects of duration, tonality, intermittency and impulsiveness.

There are two proposed locations for the substation; the SEPP N-1 noise limits were determined for the nearest noise sensitive receptors to each proposed location on each side of the rail corridor. The noise limits were calculated based on the measured background noise levels in the vicinity of these nearby receptors, and on the zoning levels that were determined using the relevant planning scheme.

The calculated SEPP N-1 noise limits are presented in Table 3 and Table 4, below.

### Table 3 SEPP N-1 Noise Limits for Nearest Receptors to Proposed Substation Location at Chainage 31850

| Period | | Background Noise Level [$L_{A90}$, dB(A)]* | Zoning Level [dB(A)] | Noise Limit [dB(A)] |
|---|---|---|---|---|
| **230 Station Street, Edithvale (East Side of Rail Corridor)** | | | | |
| Day | 7am to 6pm Weekdays<br>7am to 1pm Saturdays | 51 | 55 | 57 |
| Evening | 6pm to 10pm Weekdays<br>1pm to 10pm Saturdays<br>7am to 10pm Sundays and Public Holidays | 50 | 49 | 53 |
| Night | 10pm to 7am Weekdays<br>10pm to 7am Weekends and Public Holidays | 40 | 44 | 44 |
| **280 Nepean Highway, Edithvale (West Side of Rail Corridor)** | | | | |
| Day | 7am to 6pm Weekdays<br>7am to 1pm Saturdays | 51 | 57 | 57 |
| Evening | 6pm to 10pm Weekdays<br>1pm to 10pm Saturdays<br>7am to 10pm Sundays and Public Holidays | 50 | 51 | 53 |
| Night | 10pm to 7am Weekdays<br>10pm to 7am Weekends and Public Holidays | 40 | 46 | 46 |

** Background noise levels measured for one week at 231 Station Street.*

### Table 4 SEPP N-1 Noise Limits for Nearest Receptors to Proposed Substation Location at Chainage 31950

| Period | | Background Noise Level [LA90, dB(A)]* | Zoning Level [dB(A)] | Noise Limit [dB(A)] |
|---|---|---|---|---|
| **239 Station Street, Edithvale (East Side of Rail Corridor)** | | | | |
| Day | 7am to 6pm Weekdays<br>7am to 1pm Saturdays | 50 | 53 | 56 |
| Evening | 6pm to 10pm Weekdays<br>1pm to 10pm Saturdays<br>7am to 10pm Sundays and Public Holidays | 49 | 47 | 52 |
| Night | 10pm to 7am Weekdays<br>10pm to 7am Weekends and Public Holidays | 37 | 42 | 42 |
| **293 Nepean Highway, Edithvale (West Side of Rail Corridor)** | | | | |
| Day | 7am to 6pm Weekdays<br>7am to 1pm Saturdays | 50 | 53 | 56 |
| Evening | 6pm to 10pm Weekdays<br>1pm to 10pm Saturdays<br>7am to 10pm Sundays and Public Holidays | 49 | 47 | 52 |
| Night | 10pm to 7am Weekdays<br>10pm to 7am Weekends and Public Holidays | 37 | 42 | 42 |

** Background noise levels measured for one week at 239 Station Street.*

The noise limits were determined in accordance with Schedule B1 of SEPP N-1, which states that:

> *"For the day period the background level is neutral when it is at least 6 dB, and no more than 12 dB, below the zoning level. For other periods the background level is neutral when it is at least 3 dB, and no more than 9 dB, below the zoning level."*
>
> When the background levels are neutral, the noise limits are the Zoning Levels.

Schedule B3 applies to areas with 'high' background noise levels, which prescribes that:

> *"When the background level plus 6 for the day period exceeds its respective zoning level, then the noise limit shall be the background level plus 6 dB(A). When the background level plus 3 exceeds the zoning level for the evening period or night period then the noise limit shall be the background level plus 3 dB(A)."*

### Vibration

There are no statutory limits for vibration from rail movements during operation in Victoria. Across Australia where vibration has been considered, a number of approaches have been used by regulatory agencies to assess vibration impacts of infrastructure projects. Historically, Australian Standard AS 2670.2:1990 has been used to quantitatively assess annoyance due to vibration. This standard was withdrawn and superseded by Australian Standard AS 2631.2:2014. However, this new standard does not include a mechanism for quantitatively assessing annoyance. Since that time, many infrastructure projects across Australia have used British Standard BS 6472-1:2008[1], the latest version of the Standard on which the method used in AS 2670.2:1990 was based. Note that the NSW Department of Environment and Conservation *Assessing Vibration: a technical guideline* (2006) method is consistent with the approach in BS 6472-1.

British Standard BS 6472-1:2008 provides a framework for the assessment of human response to vibration impacts. Vibration dose value (VDV), based on both the amplitude and times of exposure is used to determine vibration exposures and whether these would be likely to result in adverse comment. These VDV levels are shown in Table 5.

Table 5 Vibration dose values from BS 6472-1:2008 which might result in various probabilities of adverse comment within residential buildings

| Time | Low probability of adverse comment | Adverse comment possible | Adverse comment probable |
|---|---|---|---|
| Day<br>(6:00 am to 10:00 pm) | 0.2 to 0.4 $m \cdot s^{-1.75}$ | 0.4 to 0.8 $m \cdot s^{-1.75}$ | 0.8 to 1.6 $m \cdot s^{-1.75}$ |
| Night<br>(10:00 pm to 6:00 am) | 0.1 to 0.2 $m \cdot s^{-1.75}$ | 0.2 to 0.4 $m \cdot s^{-1.75}$ | 0.4 to 0.8 $m \cdot s^{-1.75}$ |

[1] BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*, June 2008

### 3.1.2 Construction criteria

#### Noise

There are no statutory noise limits which apply to construction work in Victoria. However, the Environment Protection Authority Victoria (EPA Vic) provides guidance on construction noise in the document Noise Control Guidelines, Publication 1254, October 2008 (EPA Victoria Guidelines; EPA Vic 2008). The EPA Victoria Guidelines are applicable to industrial, commercial and some residential projects; and are not mandatory (either statutory or otherwise) for infrastructure projects.

The Guidelines have been adopted for this project in order to assist in managing construction noise impacts through providing a basis for determining construction noise targets for infrastructure works.

The noise limits from Section 2 of the EPA Victoria Guidelines (Construction and Demolition) are provided in Table 6.

Table 6 Construction noise limits from Section 2 of the Noise Control Guidelines, Publication 1254

| Time | Noise limits |
|---|---|
| Normal working hours<br>• 7:00 am to 6:00 pm Monday to Friday<br>• 7:00 am to 1:00 pm Saturday | No specific limits |
| Weekend and evening hours<br>• 6:00 pm to 10:00 pm Monday to Friday<br>• 1:00 pm to 10:00 pm Saturday<br>• 7:00 am to 10:00 pm Sunday | 10 dB(A) above existing background levels up to 18 months<br>5 dB(A) above existing background levels after 18 months |
| Night period<br>• 10:00 pm to 7:00 am Monday to Sunday | Noise must be inaudible within a habitable room of any residential premises |

The night period requirement of inaudibility inside habitable rooms would depend not only on the construction noise level outside but also on its character and the sound insulation properties of the building. Distinctive sounds such as reversing beepers and the low frequency noise from construction equipment may be audible even at lower noise levels than the internal background noise level. As a guide, outdoor construction noise levels at least 5-10 dB(A) lower than the outdoor background noise level would typically be required to achieve inaudibility of the construction noise inside a residence at night.

### Vibration

The vibration limits provided in Table 5 for operational vibration are also applicable for minimising loss of amenity during construction due to vibration. However, as construction activities generally produce much higher levels of vibration than train movements, it is not always practical to achieve vibration levels for human comfort.

The German Standard DIN 4150-3:1999[2] is commonly adopted in Australia for prevention of damage to structures caused by construction vibration. DIN 4150-3 states that where vibration levels comply with the guideline values, experience indicates that damage would not occur. These guideline levels are provided in Table 7.

Note: The units in the British and German standards are not the same.

Table 7 DIN 4150-3:1999 vibration limits for damage to structures in mm/s

| Type of structure | Vibration at the foundation | | | Vibration at horizontal plane of highest floor |
|---|---|---|---|---|
| | 1 Hz to 10 Hz | 10 Hz to 50 Hz | 50 Hz to 100 Hz | |
| Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| Residential dwellings and buildings of similar design and/or occupancy | 5 | 5 to 15 | 15 to 20 | 15 |
| Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value | 3 | 3 to 8 | 8 to 10 | 8 |

[2] DIN 4150-3:1999 Vibration in buildings – Part 3: Effects on structures

# 4 Method

This section describes the method that was used to assess the potential impacts of the Edithvale and Bonbeach level crossing removal projects.

A systematic risk based approach was applied to understand the existing environment, potential impacts of the projects and how to avoid, minimise or manage the risk of impact.

The iterative nature of the assessment is illustrated in Figure 5.

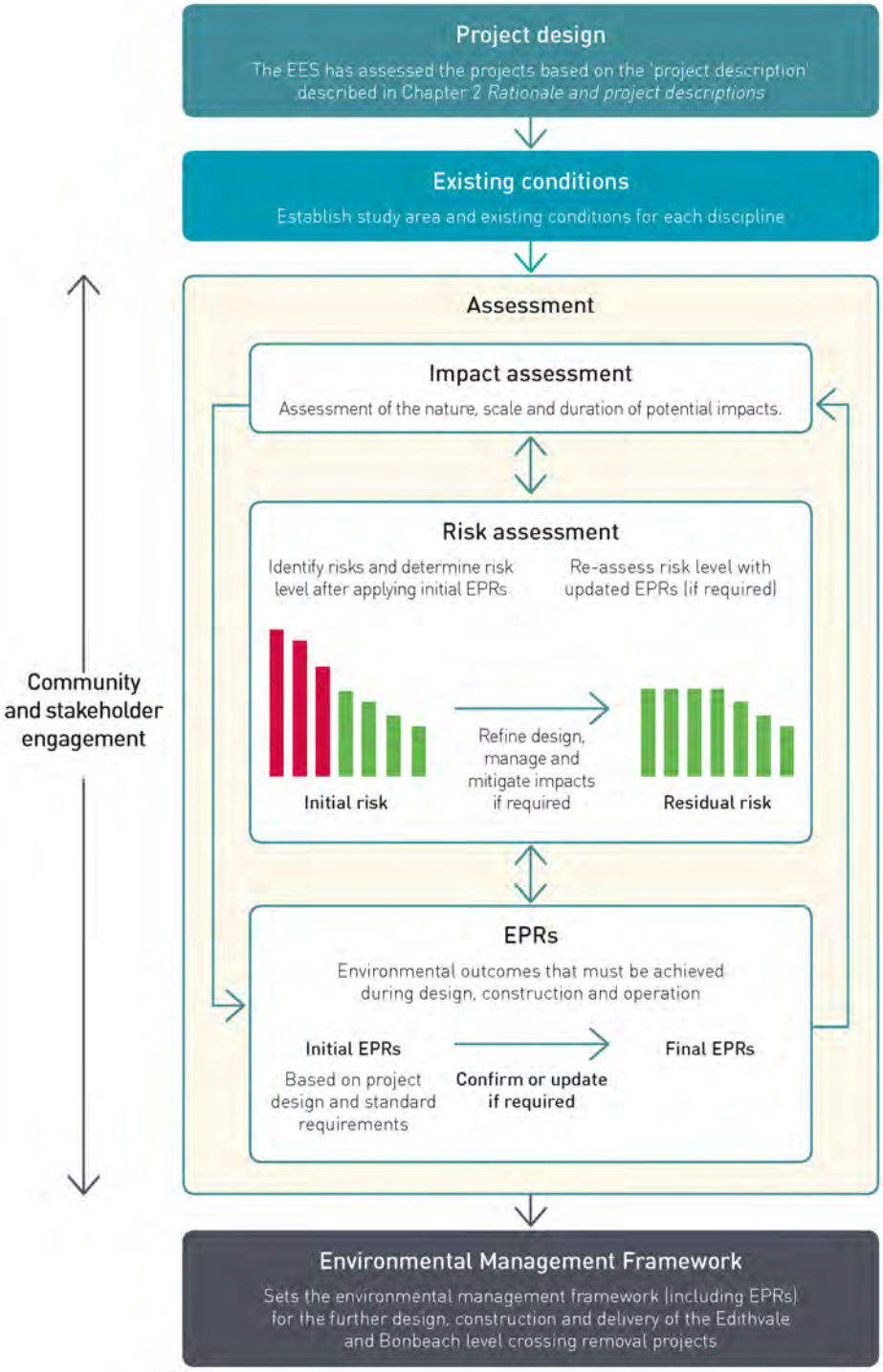


Figure 5 Overview of impact and risk assessment process

The following sections outline the methodology for the noise and vibration impact assessment.

## 4.1 Existing conditions assessment

The existing noise and vibration conditions within the study area have been determined through both attended and unattended measurements, as outlined in Section 5.

Noise measurements have been taken at a number of locations near Bonbeach and Edithvale for use as part of the assessment process.

In order to determine existing vibration levels, measurements of electric train movements were taken on the Frankston rail line. Additionally, measurements of a diesel freight train (including locomotive and wagons) on the Frankston line were taken for determining current vibration levels.

## 4.2 Risk assessment method

A risk-based approach is integral to the EES as required by Section 3 of the Scoping Requirements for the EES.

The risk management approach adopted for the Edithvale and Bonbeach EES is consistent with AS/NZS ISO 31000:2009 Risk Management Process and involves the following steps:

- establishment of the context of the risk assessment – this identifies the boundaries of the projects including the project definition, the duration of construction and operation, the design and environmental controls that would be in place (initial Environmental Performance Requirements (EPRs) – refer to Section 8), and the location of the projects
- risk identification – identification of risk pathways by specialists in each relevant discipline area
- risk analysis – assessment of risk for each risk pathway, whereby risk is a combination of:
    - the likelihood of an event and its associated consequences occurring
    - the magnitude of potential consequences of the event.
- risk evaluation – review key risks posed by the projects to focus effort in terms of impact assessment and mitigation.
- risk treatment – identification of additional management and mitigation where required to reduce risk levels where possible.

An initial risk assessment was undertaken to assess potential risks to the environment arising from the implementation of the projects. Where risks were minor or above, further mitigation was explored. Risks were re-assessed to determine the residual risk based on further mitigation.

A more detailed description of each step in the risk assessment process is provided in EES Attachment II *Environmental Risk Report*.

This technical report describes the risks associated with the projects on noise and vibration.

## 4.3 Impact assessment methods

### 4.3.1 Operational noise and vibration

Noise modelling of the existing conditions and proposed design was undertaken to determine if the PRINP investigation thresholds would be exceeded.

Modelling of the operational rail noise was performed using SoundPLAN environmental noise modelling software.

Operational rail noise levels were predicted using the Nordic Rail Traffic Noise Prediction Method as given in Kilde Report 130 (Ringheim, 1984). This method has been widely used for predicting rail traffic noise in Australia, and is suitable in the context of this assessment as it includes algorithms to predict both the $L_{Aeq}$ and the $L_{Amax}$ sound pressure levels, which are required by PRINP.

The project was modelled to assess noise from the redeveloped rail system, including noise from the passenger rail services and freight trains.

GIS datasets including elevation data, cadastral data, and aerial photographs were utilised to build each of the rail noise models. The future rail alignment was based on the preliminary design as developed by the Technical Advisor.

Inputs for the modelling are provided in Table 8 below. Note that the down track refers to trains moving away from the Melbourne CBD. Similarly, the up track refers to trains moving towards the Melbourne CBD.

Table 8 Noise modelling inputs – at and before project opening

| Vehicle Type | Length | Speed | Down track movements | | Up track movements | |
|---|---|---|---|---|---|---|
| | | | Day | Night | Day | Night |
| Electric Multiple Unit | 143 m | 95 km/hr | 96 | 13 | 97 | 14 |
| Diesel Multiple Unit | 26 m | 95 km/hr | 0 | 1 | 1 | 0 |
| Freight train | 650 m | 65 km/hr | 2 | 1 | 2 | 1 |

Noise predictions were carried out to determine the risk of day and night time noise levels exceeding limits leading to loss of amenity at noise sensitive uses within the study area (**risk NV14** and **risk NV18**). In order to assess this, $L_{Aeq}$ and $L_{Amax}$ noise levels were predicted for both the day and night time periods for the following scenarios, in accordance with the requirements of the PRINP.

- **Scenario 1 - Base case**
  - One day prior to project opening – representing the existing conditions.
- **Scenario 2 - Redeveloped rail (day 1)**
  - One day after project opening.

Operational vibration impacts have been assessed using the method outlined within the US Federal Transit Administration (US FTA) Transit Noise and Vibration Impact Assessment report.

This document is widely used to predict vibration from rail operations, and provides methods for prediction of vibration impacts at different distances from rail corridors.

### 4.3.2 Construction noise and vibration

The impacts from construction noise have been calculated assuming simple geometric spreading of sound from each noise source. This is typically used for construction noise modelling at an early stage, when detailed construction staging information is not available, and the assessment distances are close to the construction work.

Construction vibration is typically a community concern; however, the specific construction equipment and methodology have a big influence on the vibration level. Without a high level of detail on the specific equipment to be used by the contractor, a quantitative assessment of construction vibration is not possible. A qualitative assessment has been carried out based on typical construction equipment and activities.

## 4.4 Environmental Performance Requirements

The environmental outcomes that must be achieved during design, construction and operation of the projects are referred to throughout the EES as Environmental Performance Requirements (EPRs). EPRs must be achieved regardless of the construction methodology or design solutions adopted. Measures identified in this EES to avoid or minimise environmental impacts have formed part of the recommended EPRs for the projects.

The development of a final set of EPRs for the project has been iterative.

### 4.4.1 Initial EPRs

Environmental performance requirements were identified to inform the assessment of initial risk ratings (where appropriate). These initial EPRs were based on compliance with legislation and standard requirements that are typically incorporated into the delivery of construction contracts for rail projects.

### 4.4.2 Confirm or update EPRs

The risk assessment either confirmed that these EPRs were adequate or identified the need for further refinement.

EPRs were updated or new EPRs were developed for any initial risk that could not be appropriately managed by standard requirements. The risk and impact assessment processes confirmed the effectiveness of new or updated EPRs to determine the residual risk rating.

### 4.4.3 Final EPRs

The EPRs recommended for the projects are outlined in Section 8 of this report and are included in the EES Environmental Management Framework.

The EPRs are applicable to the final design, construction approach and operation and provide certainty regarding the environmental performance of the projects.

## 4.5 Linkage to other technical reports

This report relies on, or informs the following technical assessments:

- EES Technical report L *Social*

# 5 Existing conditions

## 5.1 Existing noise conditions

The noise sensitive receivers closest to the existing alignment are predominantly residential receivers which are located along Station Street and Nepean Highway.

This assessment includes consideration of noise from the project at all sensitive receivers in the vicinity of the project, including dwellings and child care as required by the PRINP.

The local noise environment is largely dominated by road traffic noise from Station Street and Nepean Highway, as well as rail traffic noise generated by train movements along the Frankston rail line.

There are 228 train movements per day on the Frankston rail line, the majority of which are electric. There are up to six diesel freight train movements on weekdays and four movements on weekends, and two Sprinter movements once per week on a weekday (typically movement is a single car out of the two car set, rotated between Frankston stabling and the Melbourne maintenance yard).

### 5.1.1 Edithvale

Noise monitoring was undertaken from 27 May to 28 June 2016 and 29 September to 17 October 2016.

Noise monitoring was undertaken at eight sites in the vicinity of the Edithvale level crossing. These sites are shown in Figure 3 and are listed below (note that site numbers are not sequential as they incorporate all noise monitoring sites along the Frankston rail line):

- Site 10, 231 Station Street, Edithvale
- Site 11, 239 Station Street, Edithvale
- Site 15, 250 Station Street, Edithvale
- Site 21, 1/205 Station Street, Edithvale
- Site 23, 303 Nepean Highway, Edithvale
- Site 24, 211 Station Street, Edithvale
- Site 25, 288 Nepean Highway, Edithvale
- Site 31, 194 Station Street, Edithvale.

Noise monitoring data was post-processed to calculate the following descriptors:

- $L_{Aeq,16hr}$ – the A-weighted equivalent daytime noise level (6 am to 10 pm). This is a value that provides guidance on typical noise levels during the day, and is influenced by the types and number of noise sources present in the day, and variability in the noise environment.
- $L_{Aeq,8hr}$ – the A-weighted equivalent night time noise level (10 pm to 6 am). Like the $L_{Aeq,16hr}$, this is a value that represents typical noise levels during the night.
- $L_{Amax}$ – the maximum A-weighted noise level (either during the day or night). This value represents the 95$^{th}$ percentile of the loudest sound pressures reached during the day and night, and does not provide an indication of how noise levels may vary over time. This is consistent with the definition of $L_{Amax}$ under the PRINP.

The post-processed values are presented in Table 9.

Table 9 Pre-construction noise monitoring results, A-weighted decibel (dB(A))

| Site | Address | Day | | Night | |
|---|---|---|---|---|---|
| | | $L_{Aeq,16hr}$ | $L_{Amax}$ | $L_{Aeq,8hr}$ | $L_{Amax}$ |
| 10 | 231 Station Street, Edithvale | 59 | 88 | 56 | 83 |
| 11 | 239 Station Street, Edithvale | 55 | 80 | 51 | 74 |
| 15 | 250 Station Street, Edithvale | 57 | 88 | 52 | 79 |
| 21 | 1/205 Station Street, Edithvale | 62 | 87 | 58 | 81 |
| 23 | 303 Nepean Highway, Edithvale | 61 | 89 | 55 | 81 |
| 24 | 211 Station Street, Edithvale | 63 | 82 | 56 | 77 |
| 25 | 288 Nepean Highway, Edithvale | 64 | 87 | 58 | 81 |
| 31 | 194 Station Street, Edithvale | 59 | 87 | 54 | 81 |

### 5.1.2 Bonbeach

Noise monitoring was undertaken between 27 May to 28 June 2016 and 29 September to 17 October 2016.

Noise monitoring was undertaken at four sites in the vicinity of the Bonbeach level crossing. Due to the fact that access to many properties could not be gained at Bonbeach, monitoring was undertaken at fewer sites at Bonbeach than at Edithvale. However, four sites is considered to be a sufficient number of sites to investigate the existing noise conditions around the Bonbeach project. These sites are shown in Figure 4 and are listed below (note that site numbers are not sequential as they incorporate all noise monitoring sites along the Frankston rail line):

- Site 6, 529 Nepean Highway, Bonbeach
- Site 7, 390 Station Street, Bonbeach
- Site 9, 12/422 Station Street, Bonbeach
- Site 14, 438 Station Street, Bonbeach.

Noise measurement data was post-processed to calculate $L_{Aeq,16hr}$, $L_{Aeq,8hr}$ and $L_{Amax}$ noise descriptors. These are presented in Table 10.

Table 10 Pre-construction noise monitoring results, A-weighted decibels (dB(A))

| Site | Address | Day | | Night | |
|---|---|---|---|---|---|
| | | $L_{Aeq,16hr}$ | $L_{Amax}$ | $L_{Aeq,8hr}$ | $L_{Amax}$ |
| 6 | 529 Nepean Highway, Bonbeach | 61 | 83 | 57 | 79 |
| 7 | 390 Station Street, Bonbeach | 63 | 85 | 58 | 81 |
| 9 | 12/422 Station Street, Bonbeach | 53 | 83 | 47 | 73 |
| 14 | 438 Station Street, Bonbeach | 58 | 88 | 52 | 81 |

## 5.2 Existing vibration conditions

Vibration measurements were undertaken at a representative location close to the Frankston Line (close to Argyle Avenue level crossing in Chelsea) to determine the train passby vibration levels. 36 EMU train passbys were measured, including a mixture of trains on both the city bound and Frankston bound lines. Additionally, vibration measurements of a freight train on the Frankston Line were also taken. Measurements were made six metres from the Frankston bound track.

Train vibrations vary from train to train. For this reason the vibration goals are typically expressed in terms of the '5% exceedance level' which represents the highest one in 20 train events. Generally, this is accounted for by processing the measured source vibration and basing the analysis on the 95th percentile train event.

### 5.2.1 Results and assessment

The measured vibration levels in the range up to 400 Hz are shown in Figure 6 below:

- city bound trains are shown in red
- Frankston bound trains are shown in green
- freight trains are shown in navy blue

The elevated low frequency vibration (less than 10 Hz) levels shown in Figure 6 are likely due to high levels of wind impinging on the accelerometer and cables. However, this noise did not alter the results of the measurements, as the train vibration levels were controlled by vibration between 10 and 200 Hz.

The measured train vibration levels were used to predict estimated Vibration Dose Value (eVDV) levels at the closest sensitive uses to the rail line at residences on the Nepean Highway, which are at a distance of 27 metres. The predicted eVDV values are presented in Table 11. Note that eVDVs do not combine additively to produce a total eVDV.

Table 11 Estimated Vibration Dose Values at closest sensitive uses

| Scenario | Day | Night |
|---|---|---|
| EMUs and DMUs | 0.016 | 0.010 |
| Freight | 0.005 | 0.004 |
| All train movements | 0.016 | 0.010 |

Vibration caused by train passbys is unlikely to be perceptible at sensitive uses, and people are not expected to be impacted by the existing rail vibration levels.

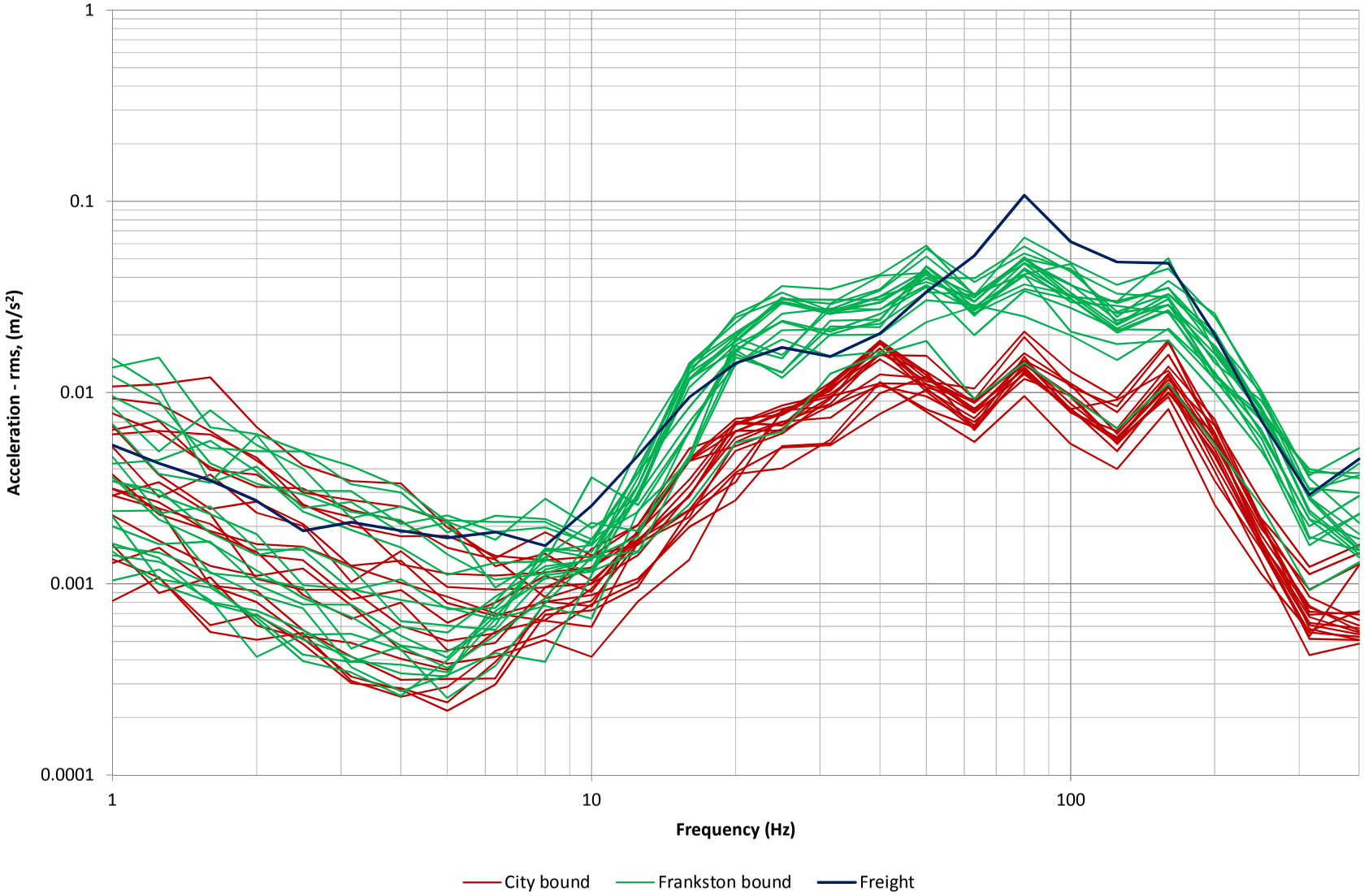


Figure 6 Measured vibration levels – 6 metres from track

# 6 Risk assessment

A risk assessment of project activities was performed in accordance with the methodology described in Section 4.2. Risks were assessed for the construction and design/operation phases (where relevant).

The residual noise and vibration risks associated with the projects are listed in Table 12. The likelihood and consequence ratings applied during the risk assessment process are provided in Appendix B. There was no change in the initial risk and final risk levels for noise.

Table 12 Noise and vibration risks

| Risk ID | Event name | Potential impact pathway | EPR ID | Risk level |
|---|---|---|---|---|
| **Operational risks** | | | | |
| NV 14 | Night-time operational noise | Night-time noise during operation exceeds limits causing loss of amenity at sensitive receptors. | EPR NV1 Operational noise | Negligible |
| NV 18 | Day time operational noise | Day-time noise during operation exceeds limits causing loss of amenity at sensitive receptors | EPR NV1 Operational noise | Negligible |
| NV 20 | Vibration (amenity) | Vibration exceeds limits resulting in loss of amenity. | No EPR required | Negligible |
| **Construction risks** | | | | |
| NV 15 | Night-time construction noise | Night-time noise during construction exceeds limits causing loss of amenity at sensitive receptors. | EPR NV2 Construction noise and vibration<br>EPR SC1 Community and Stakeholder Engagement Management Plan<br>EPR SC2 Respite and Relocation Policy | Moderate |

| Risk ID | Event name | Potential impact pathway | EPR ID | Risk level |
|---|---|---|---|---|
| NV 16 | Night-time construction noise (unplanned) | Unplanned night-time work during construction exceeds noise limits causing loss of amenity at sensitive receptors. | EPR NV2 Construction noise and vibration<br>EPR SC1 Community and Stakeholder Engagement Management Plan | Minor |
| NV 17 | Day-time construction noise | Day-time noise during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors. | EPR NV2 Construction noise and vibration<br>EPR SC1 Community and Stakeholder Engagement Management Plan<br>EPR SC2 Respite and Relocation Policy | Minor |
| NV 19 | Day-time construction noise (unplanned) | Unplanned day-time work during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors. | EPR NV2 Construction noise and vibration<br>EPR SC1 Community and Stakeholder Engagement Management Plan | Negligible |
| NV 20 | Vibration (amenity) | Vibration exceeds limits resulting in loss of amenity. | EPR NV2 Construction noise and vibration<br>EPR NV3 Pre-construction Condition Surveys<br>EPR SC1 Community and Stakeholder Engagement Management Plan | Minor |
| NV 21 | Vibration (structure damage) | Vibration during construction results in structural damage. | EPR NV3 Pre-construction Condition Surveys | Negligible |

For further details refer to the EES Attachment II *Environmental Risk Report* which includes the full risk register, with initial EPRs and the final EPRs assigned to each risk.

# 7 Impact assessment

## 7.1 Operational impacts

### 7.1.1 Operational noise

Noise predictions were carried out to determine the risk of planned day and night time noise levels exceeding limits leading to loss of amenity at noise sensitive uses within the study area (**risk NV14** and **risk NV18**).

Predicted noise contours for these scenarios are attached in Appendix A.

Noise modelling undertaken in accordance with the PRINP indicates that the investigation thresholds will not be exceeded.

***Passenger rail movements***

Due to shielding of noise provided by the trench walls, passenger rail noise levels at the majority of receiver locations are generally reduced for both the opening and future scenarios, typically by around 5 dB(A). A 5dB reduction in noise is expected to be clearly noticeable to the human ear. Passenger rail movements represent more than 95% of the total rail movements on the Frankston line.

The largest reduction in noise from passenger rail movements occurs at the deepest points of the trench, around Bonbeach and Edithvale stations.

***Freight rail movements***

Where freight locomotives are moving up the gradient to exit the trench, noise is increased due to the need for a higher locomotive notch (or throttle) setting. However, this effect does not meet the investigation thresholds in the PRINP because it only occurs for two train movements during the day, and one movement at night, in each direction, representing less than 5% of total train movements for both the day and night time periods. Noise from freight wagons is not affected by the gradient to exit the trench and is generally decreased by shielding from the trench.

***Overall assessment***

Both $L_{Aeq}$ and 95$^{th}$ percentile $L_{Amax}$ during the daytime scenarios are controlled by noise from passenger rail movements. Due to fewer passenger rail movements during the night time period, the 95$^{th}$ percentile $L_{Amax}$ is controlled by freight rail movements. Modelling indicates that no residences are above the investigation threshold under the PRINP, and therefore no further investigation is required.

***Substation noise***

Two potential locations have been proposed for the substation at Edithvale. Typically substations contain one large transformer, and a number of smaller ancillary transformers, with the largest transformer controlling noise emissions from the site. An assessment of noise impacts under SEPP N-1 was performed based on a single transformer with a sound power level of 70 dB(A), consistent with a 3220 kVA 3 Phase transformer. Transformers of this type typically exhibit tonal noise emission at a frequency of 100 Hz. Therefore, the transformer was modelled with a Sound Power Level of 70 dB(A) at a frequency of 100 Hz.

Noise levels at the nearest residences to the location of the proposed Substation were calculated with modelled receivers positioned:

- 1 metre in front of the most exposed façade of each building
- 1.8 m above ground level to represent the ground floor
- 4.6 m above ground level to represent the first floor

All ground in the model was modelled to be 100% acoustically reflective, due to the ground in the vicinity of the site predominantly comprising asphalt.

It is predicted that the highest noise level due to the operation of the Substation will be 26 dB(A).

In accordance with SEPP N-1, an adjustment is required to account for the tonal nature of the Substation noise emission. The transformer noise will have a prominent tonal character, therefore in accordance with Schedule A4 of SEPP N-1, *Measurement Procedures for Minor Premises*, an adjustment of +5 dB must be added to the predicted noise level.

Therefore, the SEPP N-1 Effective Noise Level at the nearest residence, based on the predicted noise level and the applicable tonal adjustment, is determined as follows:

- **Predicted Substation Noise Level:** 26 dB(A)
- **Tonal Adjustment:** +5 dB(A)
- **Effective Noise Level:** 31 dB(A)

The calculated Effective Noise Level is compliant with all of the Night period SEPP N-1 noise limits provided in Section 3.1.1. Consequently, mitigation measures are not required for the substation to comply with SEPP N-1.

***Station noise***

Noise from stations also needs to comply with the noise limits under SEPP N-1. The primary source of emissions from stations will be from public address (PA) systems. The PA system will be designed to comply with the requirements of SEPP N-1. This will include designing the system to have an appropriate number of speakers to ensure speech intelligibility throughout the station, while keeping levels below limits at nearby houses. Lower noise levels may be required for the PA system at night to ensure compliance with limits.

#### Management and mitigation

The project will be designed in accordance with the requirements of the PRINP in order to manage impacts from planned operational day and night time noise (**EPR_NV1**).

Based on the results of the findings, there is a negligible risk of planned operational daytime and night time noise exceeding the PRINP investigation thresholds.

### 7.1.2 Operational vibration

As train movements along the rail line are a key source of vibration in the area, they have the potential to affect the amenity at nearby receptors (**risk ID NV20**). However the rail line will not be relocated closer to sensitive uses, and therefore future operational vibration levels should not be increased by the project.

In order to understand the quantitative levels of vibration with the project, an operational vibration assessment has been conducted using the US FTA method as referenced in Section 4.3.1. This method provides base vibration levels for freight and rapid transit, and adjustments in order to predict vibration impacts on buildings.

Using the US FTA method, eVDVs have been predicted for comparison against noise criteria from BS 6472-1. As part of this process, efficient propagation of vibration has been assumed, which would normally occur through clay type soils, which is a conservative approach. While it is noted that the study area is predominantly sandy; this has been assumed in order to account for any local soil conditions that may cause some areas to experience higher vibration levels. These eVDV levels incorporate all train movements on the Frankston rail line; that is, both passenger and freight rail. Figure 7 presents the predicted operational vibration levels after

project opening. The calculations are based on the completed projects comprising rail on ballast within the concrete trenches.

At distances beyond 15 metres, the vibration levels are predicted to be below the threshold for low probability of adverse comment. As the closest receivers to the projects are at setbacks of at least 27 metres or more, operational vibration impacts are not expected to result from these projects. It is therefore unlikely that vibration from rail operations will lead to a loss of amenity at nearby vibration sensitive uses and the risk rating would be negligible. Therefore no EPR is required.

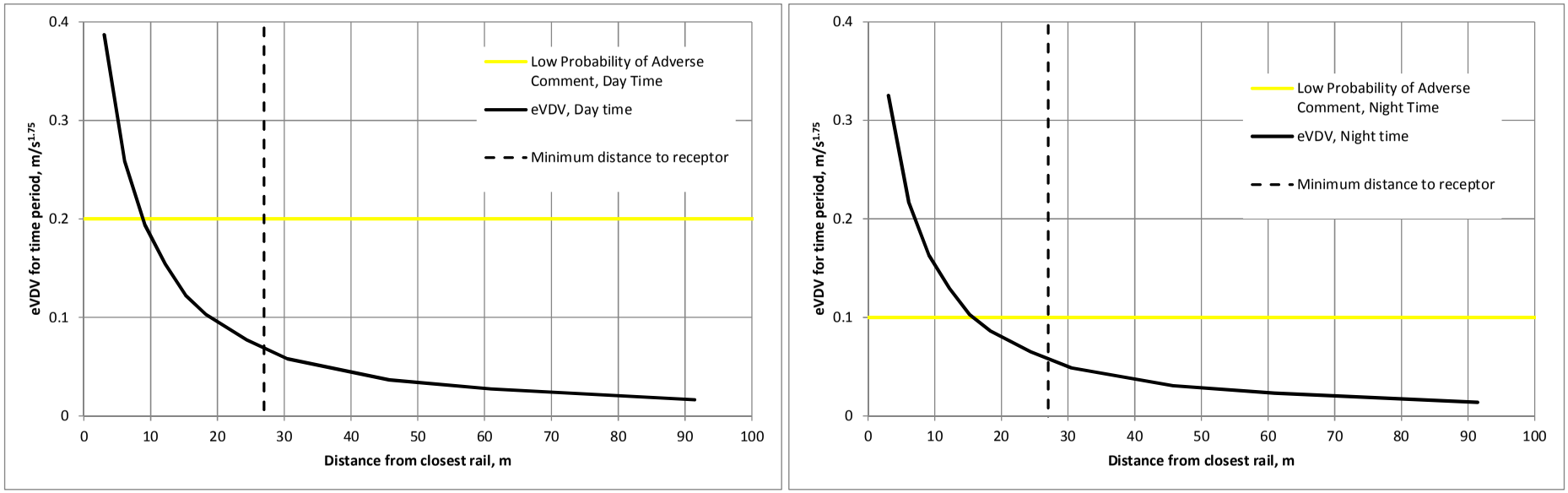


Figure 7 Day and night time estimated vibration dose value for all rail movements versus distance

## 7.2 Construction impacts

### 7.2.1 Construction noise

Noise generated by construction activities has the potential to exceeds limits or significantly change the existing noise environment, resulting in a perceived loss of amenity at sensitive receptors (**risk ID NV15**, **risk ID NV16**, **risk ID NV17** and **risk ID NV19**).

Typical plant that would be used during construction and noise levels emitted by each of these are presented in Table 13. This is based on measurements of different construction equipment and stages for similar projects, and the Constructability Report.

Table 13 Typical construction plant noise levels

| Plant | Sound power level, dB(A) re $10^{-12}$W | $L_{Aeq}$ at specified distance, dB(A) | | | |
|---|---|---|---|---|---|
| | | 10 m | 20 m | 50 m | 100 m |
| **Corridor clearing** | | | | | |
| Small bulldozer | 115 | 87 | 81 | 73 | 67 |
| 45 T tracked excavator | 108 | 80 | 74 | 66 | 60 |
| Chainsaw | 114 | 86 | 80 | 72 | 66 |
| Tub grinder & mulcher | 116 | 88 | 82 | 74 | 68 |
| Front end loader | 113 | 85 | 79 | 71 | 65 |
| Dump truck | 108 | 80 | 74 | 66 | 60 |
| Cherry picker | 105 | 77 | 71 | 63 | 57 |
| **Structures** | | | | | |
| Bored piling rig | 116 | 88 | 82 | 74 | 68 |
| Power pack | 103 | 75 | 69 | 61 | 55 |
| Mobile crane | 113 | 85 | 79 | 71 | 65 |
| Concrete pump | 105 | 77 | 71 | 63 | 57 |
| Concrete vibrator | 103 | 75 | 69 | 61 | 55 |
| Welding equipment | 105 | 77 | 71 | 63 | 57 |
| 45 T tracked excavator | 108 | 80 | 74 | 66 | 60 |
| Pneumatic jackhammer | 113 | 85 | 79 | 71 | 65 |
| Concrete truck | 109 | 81 | 75 | 67 | 61 |
| Delivery truck | 108 | 80 | 74 | 66 | 60 |

| Plant | Sound power level, dB(A) re $10^{-12}$W | $L_{Aeq}$ at specified distance, dB(A) | | | |
|---|---|---|---|---|---|
| | | 10 m | 20 m | 50 m | 100 m |
| **Earthworks and drainage** | | | | | |
| Small bulldozer | 115 | 87 | 81 | 73 | 67 |
| Large bulldozer | 117 | 89 | 83 | 75 | 69 |
| Scraper | 110 | 82 | 76 | 68 | 62 |
| 45 T tracked excavator | 108 | 80 | 74 | 66 | 60 |
| Line driller | 114 | 86 | 80 | 72 | 66 |
| Grader | 105 | 77 | 71 | 63 | 57 |
| Vibratory roller | 114 | 86 | 80 | 72 | 66 |
| Spreader | 95 | 67 | 61 | 53 | 47 |
| Vibratory rammer | 108 | 80 | 74 | 66 | 60 |
| Vibrating plates | 101 | 73 | 67 | 59 | 53 |
| Dump truck | 108 | 80 | 74 | 66 | 60 |
| Truck | 108 | 80 | 74 | 66 | 60 |
| Compactor | 113 | 85 | 79 | 71 | 65 |
| Water cart | 107 | 79 | 73 | 65 | 59 |
| **Rail construction** | | | | | |
| Compound saw | 113 | 85 | 79 | 71 | 65 |
| Oxy-cutter | 93 | 65 | 59 | 51 | 45 |
| Front end loader | 113 | 85 | 79 | 71 | 65 |
| Regulator | 115 | 87 | 81 | 73 | 67 |
| Ballast tamper | 111 | 83 | 77 | 69 | 63 |
| Ballast wagon | 108 | 80 | 74 | 66 | 60 |

Based on typical receiver distances of 20 metres and beyond, construction noise levels during daytime work are likely to lie within a range that would be considered reasonable for short periods (noting that there are no set limits prescribed by the EPA for daytime construction work). Construction noise levels during the night and evening are generally predicted to exceed the guideline limits recommended by the EPA.

Construction works would also take place within laydown areas (which have not yet been confirmed). Depending on the proximity to noise and vibration sensitive receivers, impacts may also be possible from these locations.

### Management and mitigation

The project should minimise construction noise impacts upon sensitive receptors in accordance with the requirements of the EPA Victoria Publication 1254, and where EPA Victoria Publication 1254 can not be met, in accordance with **EPR_NV2**. Measures to achieve this should include:

- scheduling noisy works to the typical construction hours where feasible
- limiting night works outside of the main occupation period
- planning site works to limit vehicle movements to certain locations and time periods.

Table 14 presents an analysis of the potential noise mitigation and management options that may be available to the project, which could be considered by the Alliance formed to deliver the project.

Reduction of the night and evening construction noise levels to comply with the guideline limits is unlikely to be possible at certain times using practical noise mitigation methods, in particular the requirement that no noise must be audible within a habitable room of a residence between 10pm and 7am. To mitigate this, when unavoidable noisy work is to be carried out during the night and evening, a Respite and Relocation Policy would be in implemented to relocate eligible residents (**EPR_SC2**). The Policy would provide residents affected by night time noise during construction to be relocated during certain noisy works to minimise the amenity impacts of the Projects.

In addition, a community and stakeholder engagement management plan would be implemented to notify residents of potential noise impacts in advance, and should include a procedure for handling and investigating complaints (**EPR_SC1**). For further information, refer to EES Technical Report L *Social*.

Table 14 Analysis of noise mitigation and management options for construction works

| Options | Pros | Cons |
|---|---|---|
| **Elimination** | | |
| Limit works to normal construction hours only i.e. Monday to Friday 07:00 am to 18:00 pm, and Saturday 07:00 am to 13:00 pm. | Elimination of all night works would avoid the need to implement further mitigation measures for most locations. | Would increase the duration of the works. Not practical for work during an occupation. |
| Limit night works to program-critical activities only, and restrict other works to normal construction hours as far as practicable. | Minimisation of night works may reduce extent of further noise mitigation measures required and may not have a significant impact on project timeline. | Would increase the duration of the works. |
| **Substitution** | | |
| Substitute noisy plant or processes with quieter options. | The choice of the lowest noise construction method would reduce impacts to residents and may reduce the extent of engineered noise mitigation measures required (such as temporary noise barriers). | A substitution approach is unlikely to achieve sufficient noise reduction to satisfy the noise criteria without further mitigation measures.<br>In many cases, there is unlikely to be any alternative lower-noise equipment that can be used unless smaller plant is |

| Options | Pros | Cons |
|---|---|---|
| | | substituted.<br>The use of smaller equipment or different processes may result in slower rate of progress or may not have the required capacity. |
| Use broadband reversing and movement alarms instead of conventional (tonal) beepers. | At a distance, broadband alarms are masked better by general ambient noise than tonal beepers. Studies have shown them to generally be less annoying than tonal beeper alarms. This may eliminate some potential complaints. | Most plant with movement alarms is likely to have a beeper alarm as standard and would therefore require a broadband alarm to be specially fitted for the project. This would have a (minor) time and cost implication.<br>Onsite enforcement of this requirement would be necessary to ensure that all subcontractor plant is also fitted with broadband alarms.<br>Site health and safety inductions would need to advise site staff that broadband alarms are in use instead of tonal beepers. |
| **Engineering** | | |
| Provide temporary noise barriers along the parts of the project adjacent to residents. | Likely to be the only practical method of reducing construction noise levels received by residents. | Additional time would be required at the start and end of the project to construct the barriers; however, this may be able to be done prior to the full occupation.<br>Requires additional space at edge of project area that may not be available given the limited rail reserve.<br>Will limit access to site. |
| **Isolation** | | |
| Relocate residents exposed to high noise levels to alternative accommodation for the duration of certain work activities. | Could be implemented on a complaints-driven basis, as required. | It is unlikely to be practical to relocate all affected residents.<br>Residents may not want to move, but may still be dissatisfied with the level of noise. |
| **Administration** | | |
| Notify residents in advance of the works e.g. via a mail-out to the local area. | Residents are less likely to complain if they are well informed and know to expect some noise for a known duration. | - |
| Limit vehicle and plant movements onsite at night as | May eliminate some noise | Requires enforcement onsite. |

| Options | Pros | Cons |
|---|---|---|
| far as practicable. | disturbances. | |
| Plan vehicle routes on site such that they are forward in/forward out movements. | Limits the need for reversing vehicles on site (and the noise associated with reversing alarms). | Areas with tight access may prohibit forward in/forward out movements. |
| Plan site access routes for general site traffic, deliveries, and spoil disposal to avoid/minimise use of residential streets as far as practicable. | May eliminate some noise disturbances. | Site constraints may require the use of residential streets. |
| Follow good construction practices such as not yelling across the site, limiting the use of music and radios, placing tools down instead of dropping them, not leaving vehicles idling unnecessarily, etc. | May eliminate some noise disturbances. | Requires enforcement onsite.<br>No effect on noisy equipment. |
| Noise monitoring. An automated construction noise monitor could be set up to activate warning lights or send an SMS to a supervisor if a pre-set limit is exceeded. Some plant could then be shut down or activities modified to reduce noise levels where possible. | May assist in identifying and eliminating particular activities causing disturbance.<br>May assist in promoting more active participation in noise management by site staff.<br>Viewed positively by the community. | Shutting down equipment or modifying processes may result in slower rate of progress. |
| Provide residents with a contact number for complaints/comments, and implement a procedure for dealing with complaints. | Provides a line of communication so that any issues can be dealt with immediately before they become a major concern.<br>Provides residents with the comfort that they can contact someone if they have an issue. | |

With the implementation of the EPRs, the likelihood of noise criteria being exceeded is generally reduced and the risk of amenity being affected would be negligible to minor. During the main occupation period however, some noisy works during night time periods would be unavoidable. Therefore, the risk associated with this night-time noise affecting amenity has been assessed as moderate given that a Relocation Policy would be in place and clear timely information regarding noisy works would be provided.

### 7.2.2 Construction vibration

Construction activities have the possibility of causing vibration impacts upon sensitive receivers within the study area (**risk ID NV20**) and to affect structural amenity of buildings (**risk ID NV21**). The activities with the greatest potential for causing vibration impacts upon receivers are piling, and dynamic pile testing.

At this stage, the exact details of the piling method are yet to be determined; however, driven piles are likely to have vibration impacts at nearby receivers. Dynamic pile testing would also potentially impact nearby properties. Given setback distances from the trench, it is unlikely that structural damage limits would be exceeded, but vibration monitoring should be conducted to enable assessment and implementation of measures to ensure compliance with the limits.

Other construction activities that may cause vibration impacts include earthworks and ground compaction. While levels of vibration may be above perceptible levels at nearby receivers, it is unlikely that structural damage limits would be exceeded.

### Management and mitigation

Use of non-driven piles (such as bored or continuous flight auger piles) would produce lower vibration levels than driven piles. However, should driven piles be required, hammer drop height and weight would need to be considered. Monitoring should be installed when piling is started in an area to ensure that vibration levels would remain below structural damage limits. Monitoring should be repeated during dynamic pile testing if this occurs close to sensitive locations.

Prior to vibration intensive works, dilapidation surveys should be completed within areas likely to be impacted by construction vibration, This will include documentation and recording of conditions in nearby sensitive structures, including photographs of any pre-existing cosmetic or structural damage (**EPR_NV3**).

Many of the management approaches to construction noise are also applicable to construction vibration. Table 15 presents an analysis of the potential vibration mitigation and management options that may be available to the project to minimise vibration impacts.

Table 15 Analysis of vibration mitigation and management options for construction works

| Options | Pros | Cons |
|---|---|---|
| **Substitution** | | |
| Substitute high vibration plant or processes with lower vibration options. | The choice of the lowest vibration construction method would reduce impacts to residents. | A substitution approach may not be safe if ground conditions do not support it (for example bored piles may not be possible due to ground conditions).<br>The use of smaller equipment or different processes may result in slower rate of progress. |
| **Isolation** | | |
| Relocate residents exposed to high vibration levels to alternative accommodation for the duration of certain work activities. | Could be implemented on a complaints-driven basis, as required. | It is unlikely to be practical to relocate all affected residents.<br>Residents may not want to move, but may still be dissatisfied with the level of vibration. |
| **Administration** | | |
| Notify residents in advance of the works e.g. via a mail-out to the local area. | Residents are less likely to complain if they are well informed and know to expect some vibration for a known duration. | - |

| Options | Pros | Cons |
|---|---|---|
| Vibration monitoring. An automated construction vibration monitor could be set up to activate warning lights or send an SMS to a supervisor if a pre-set limit is exceeded. Some plant could then be shut down or activities modified to reduce vibration levels where possible. | May assist in identifying and eliminating particular activities causing disturbance.<br><br>May assist in promoting more active participation in vibration management by site staff.<br><br>Viewed positively by the community. | Shutting down equipment or modifying processes may result in slower rate of progress. |
| Provide residents with a contact number for complaints/comments, and implement a procedure for dealing with complaints. | Provides a line of communication so that any issues can be dealt with immediately before they become a major concern.<br><br>Provides residents with the comfort that they can contact someone if they have an issue. | |

# 8 Environmental Performance Requirements

The EPRs required for the projects to achieve acceptable environmental outcomes are summarised in Table 16. The EPRs are applicable to the final design and construction approach and provide certainty regarding the environmental performance of the projects.

Table 16 Edithvale and Bonbeach environmental performance requirements

<table>
<tr><th>EPR ID</th><th>Environmental Performance Requirement</th><th>Stage</th></tr>
<tr><td>EPR_NV1</td><td>Operational noise<br>Design must ensure airborne noise generated by train movements at sensitive receptor locations is in accordance with the Passenger Rail Infrastructure Noise Policy.
<table>
<tr><th>Time</th><th>Type of Receiver</th><th>Investigation Thresholds</th></tr>
<tr><td>Day<br>(6am – 10pm)</td><td>Residential dwellings and other buildings where people sleep including aged persons homes, hospitals, motels and caravan parks.<br>Noise sensitive community buildings, including schools, kindergartens, libraries</td><td>65 $dBL_{Aeq}$ and a change in 3 dB(A) or more<br>or<br>85 $dBL_{Amax}$ and a change in 3 dB(A) or more</td></tr>
<tr><td>Night<br>(10pm – 6am)</td><td>Residential dwellings and other buildings where people sleep including aged persons homes. hospitals, motels and caravan parks</td><td>60 $dBL_{Aeq}$ and a change in 3 dB(A) or more<br>or<br>85 $dBL_{Amax}$ and a change in 3 dB(A) or more</td></tr>
</table>
Design fixed assets to achieve compliance with State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1.</td><td>Operation</td></tr>
<tr><td>EPR_NV2</td><td>Construction noise<br>Prior to construction (excluding preparatory works), prepare a Construction Noise and Vibration Management Plan for the projects in consultation with EPA and Kingston City Council.<br>Manage construction noise and vibration in accordance with EPA Publication 1254 Noise Control Guidelines unless otherwise specified in the Construction Noise and Vibration Management Plan prepared for the projects.<br>The Construction Noise and Vibration Management Plan must be prepared prior to commencement of construction (excluding preparatory works) and include:<br>a. the identification of sensitive receptors along the project alignment<br>b. details of construction activities and an indicative schedule for construction works, including the identification of noise and/or vibration generating construction activities that have the potential to impact sensitive receptors<br>c. Sets out measures to ensure effective monitoring of noise and vibration associated with construction.<br>d. how construction noise (including truck haulage) and vibration will be</td><td>Construction</td></tr>
</table>

| EPR ID | Environmental Performance Requirement | Stage |
|---|---|---|
| | minimised, including:<br>i. the scheduling of noisy works to typical construction hours where feasible (i.e. Monday to Friday 07:00 am to 6:00 pm, and Saturday 07:00 am to 1:00 pm)<br>ii. limiting night works outside of the main occupation periods<br>iii. the planning of site works to limit vehicle movements to certain locations and time periods<br>iv. the substitution of noisy plant or processes with quieter options (e.g. broadband reversing and movement alarms instead of conventional beepers)<br>v. the provision temporary noise barriers where practicable<br>vi. monitoring of noise and/or vibration associated with construction<br>vii. notifying residents who may be impacted by noise and/or vibration in advance of the works<br>viii. a procedure for managing complaints.<br>The plan must outline airborne noise management levels and mitigation measures for evening and night time works. The management level is not a noise limit or target, but represents noise levels above which community reaction may be adverse and which should trigger mitigation actions to minimise the noise impact.<br>Depending on noise levels, noise mitigation measures may include offer of respite and relocation in accordance with a Respite and Relocation Policy (see EPR reference SC2) and Community and Stakeholder Engagement Management Plan (see EPR reference SC1). | |
| EPR_NV3 | **Construction vibration**<br>Identify potential sensitive receptors (including heritage places) and potential impacts from vibration during the construction period. Where relevant, conduct condition surveys and monitoring of sensitive receptors.<br>If impacts from vibration are anticipated, management and mitigation measures may include:<br>a. substituting high vibration plant or processes with lower vibration options<br>b. utilising vibration monitoring to inform management and mitigation<br>c. relocation of residents. (EPR reference SC2)<br>d. communication with potentially affected residents in accordance with the Community and Stakeholder Engagement Management Plan (EPR reference SC1). | Construction |
| EPR_SC1 | **Community and Stakeholder Engagement Management Plan**<br>Prior to construction (excluding preparatory works), prepare and implement a Community and Stakeholder Engagement Management Plan in consultation with Kingston City Council that includes the following:<br>a. identifies all project activities that potentially impact on community and business operations, and provides for a well-coordinated communication and engagement processes<br>b. consults with and addresses needs of vulnerable groups that would | Construction |

| EPR ID | Environmental Performance Requirement | Stage |
|---|---|---|
| | be impacted by the project such as the elderly, socio-economically disadvantaged groups and children<br>c. consults with and addresses needs of community facilities impacted by the project such as schools, child care, aged care, and caravan parks<br>d. sets out processes and measures to provide advanced notice to key stakeholders and other potentially affected stakeholders of construction activities (including any staged works, early works, main works, or out of hours works), significant milestones, changed traffic conditions, interruptions to utility services, changed access and parking conditions, periods of predicted high noise and vibration activities, including contact details for enquiries/complaints<br>e. provides for any interested stakeholder to register their contact details to ensure they are automatically advised of planned construction activities, project progress, mitigation measures and intended reinstatement measures where applicable<br>f. documents a complaints management process (including processes and measures for registering, managing and resolving complaints) consistent with Australian Standard AS/NZS 10002: 2014 Guidelines for Complaint Management in Organisations. | |
| EPR_SC2 | **Respite and Relocation Policy**<br>Prior to construction (excluding preparatory works), prepare and implement a Respite and Relocation Policy to be offered to residents whose amenity is significantly affected by construction activities (e.g. out of hours works or sustained loss of amenity during the day for residences with special circumstances such as shift workers) or who are subject to loss of access. The Respite and Relocation Policy will only apply during the period in which residents are (or are likely to be) affected.<br>The Policy must contain:<br>a. the criteria that must be met for relocation to be offered to affected residents<br>b. consideration of special circumstances such as language or cultural need, special needs related to health conditions or home businesses<br>c. the type and duration of out-of-hours work covered by the policy. | Construction |

# 9 Conclusion

A noise and vibration impact assessment has been undertaken for the Edithvale and Bonbeach level crossing removal projects to determine the impacts of noise and vibration as a result of the projects and to identify management and mitigation options in order to reduce potential risks of the projects.

### Existing conditions

Both study areas in Edithvale and Bonbeach are currently exposed to noise from both passenger and freight rail. Measurements were conducted in both areas to determine the existing noise levels, which would guide construction noise criteria in accordance with Noise Control Guidelines, Publication 1254 (EPA Vic, 2008).

Vibration measurements of electric multiple units and freight trains along the Frankston rail line, indicated that at nearby residences, vibration levels of passenger rail movements would be below the threshold of human perception.

### Impact assessment

After project opening, it is not expected that passenger or freight rail movements would cause adverse vibration impacts upon sensitive uses. No sensitive receivers are predicted to exceed the noise investigation thresholds under the PRINP.

Construction noise and vibration is likely to impact upon sensitive uses within the study area. Piling activities have the largest potential for causing noise and vibration impacts, should impact or vibratory piling be undertaken. Where possible, noise and vibration impacts can be reduced using a lower impact vibration piling method, such as continuous flight-augured piling; however this may not be possible due to soil conditions.

### Residual risk

To address the residual risk construction noise and vibration should be managed throughout the construction phase in order to minimise impacts on sensitive uses near the project. This may include careful scheduling of activities likely to cause higher levels of disturbance, community consultation, and selection of methods with lower impacts. Construction vibration monitoring could also be carried out during the construction phase to ensure that vibration levels do not exceed structural damage limits.

# 10 References

British Standards (2008). BS 6472-1:2008, Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting, 2008, British Standards, United Kingdom.

EPA Victoria (2001).State Environment Proteciton Policy (Control of Noise From Industry, Commerce and Trade) No. N-1. Environment Protection Authority Victoria.

EPA Victoria (2008). Noise Control Guidelines, Publication 1254. Environment Protection Authority Victoria.

United States Federal Transit Administration (2006). Transit Noise and Vibration Assessment, Federal Transit Administration, United States of America

German Institute for Standardisation (1999). DIN 4150-3 (1999-02) Structural vibration – Effects of vibration on structures, German Institute for Standardisation, Germany

Ringheim, M. (1984). Kilde Report 130, 1984, Stockholm.

Victorian Government (2013). Passenger Rail Infrastructure Noise Policy (PRINP). Victoria: Department of Economic Development, Jobs, Transport and Resources.

# Appendix A – Predicted Noise Contours

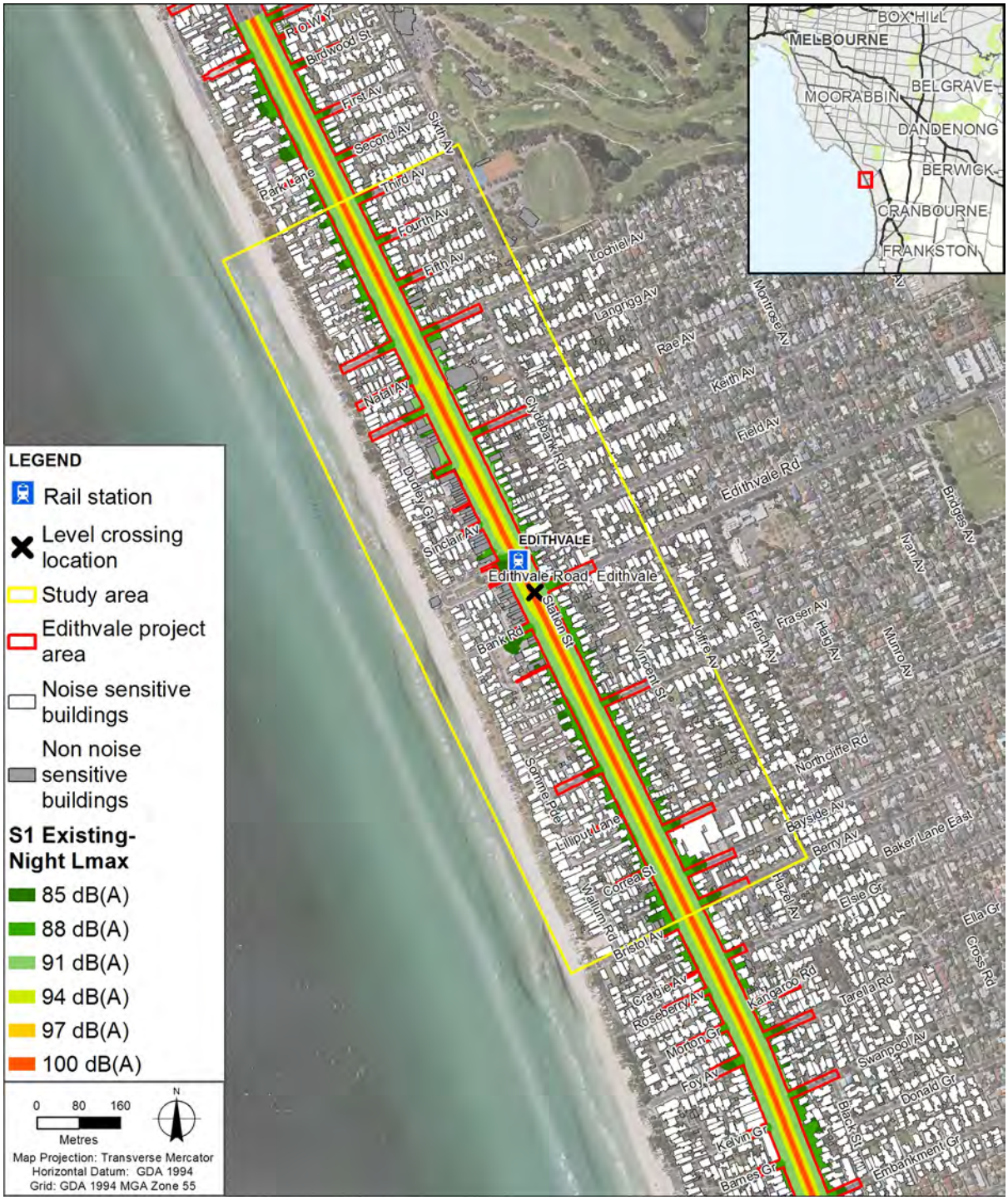


Figure 8 Edithvale night-time $L_{max}$ (existing)


Figure 9 Edithvale night-time $L_{eq}$ (existing)


Figure 10 Edithvale day-time $L_{max}$ (existing)


Figure 11 Edithvale day-time $L_{eq}$ (existing)

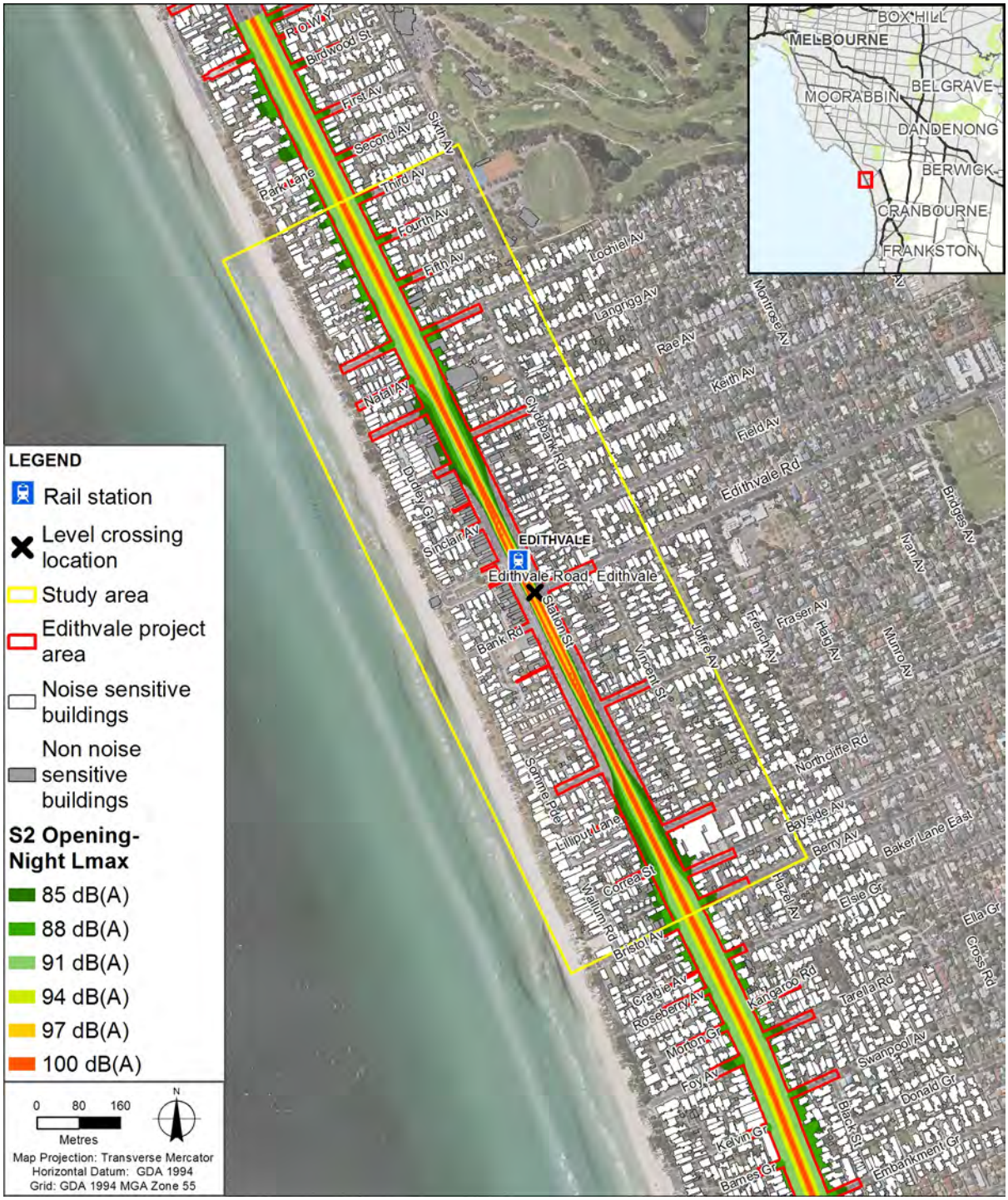


Figure 12 Edithvale night-time $L_{max}$ (predicted)


Figure 13 Edithvale night-time $L_{eq}$ (predicted)


Figure 14 Edithvale day-time $L_{max}$ (predicted)


Figure 15 Edithvale day-time $L_{eq}$ (predicted)

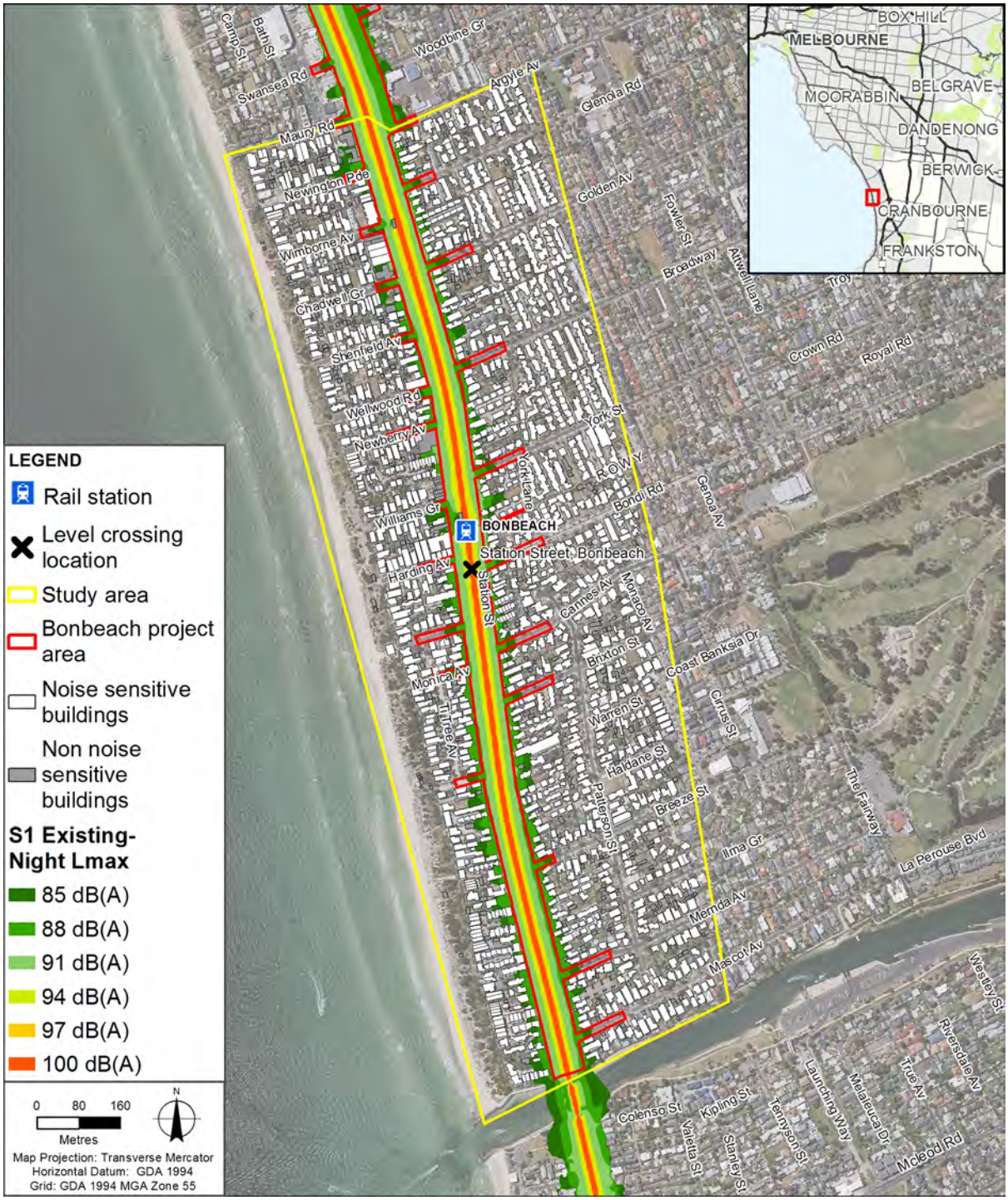


Figure 16 Bonbeach night-time $L_{max}$ (existing)


Figure 17 Bonbeach night-time $L_{eq}$ (existing)


Figure 18 Bonbeach day-time $L_{max}$ (existing)


Figure 19 Bonbeach day-time $L_{eq}$ (existing)

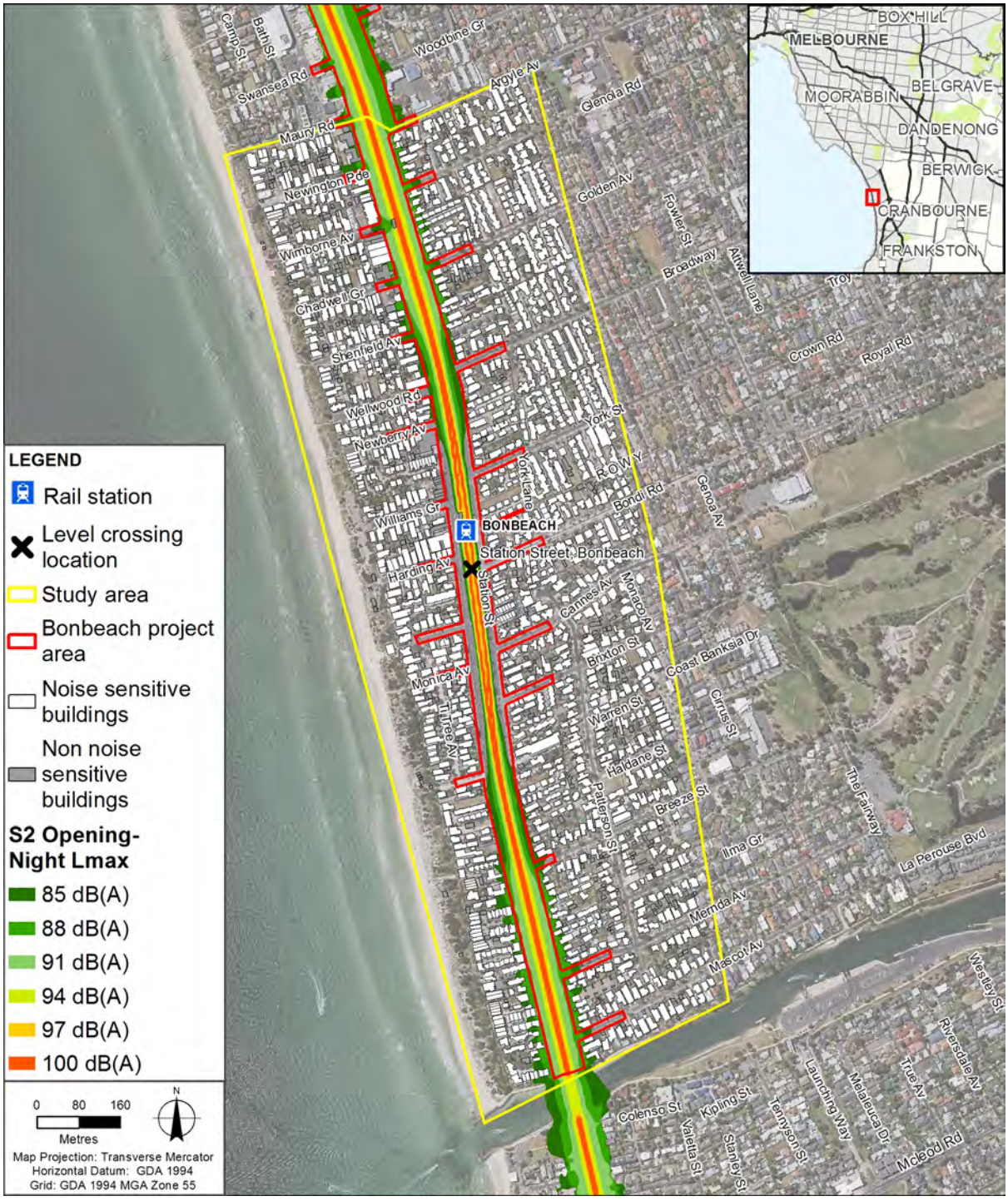


Figure 20 Bonbeach night-time $L_{max}$ (predicted)


Figure 21 Bonbeach night-time $L_{eq}$ (predicted)

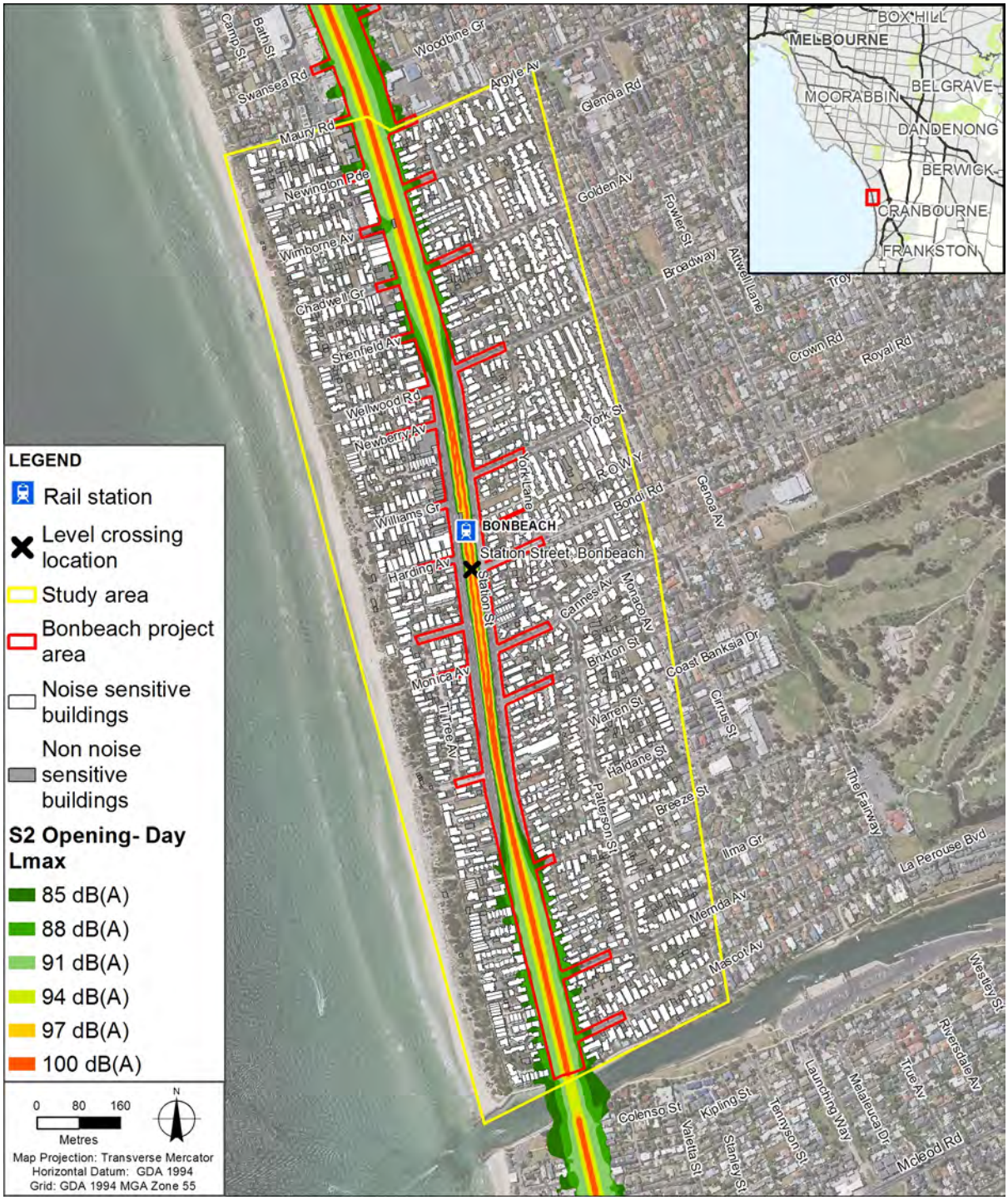


Figure 22 Bonbeach day-time $L_{max}$ (predicted)


Figure 23 Bonbeach day-time $L_{eq}$ (predicted)

# Appendix B – Risk Assessment

### Table B1 Guide to quantification of likelihood

| Qualitative descriptions | Probability over a given time period | Basis |
|---|---|---|
| A. Certain | 1 (or 0.999, 99.9%) | Certain, or as near to as makes no difference |
| B. Almost certain | 0.2 – 0.9 | One or more incidents of a similar nature has occurred here |
| C. Highly probable | 0.1 | A previous incident of a similar nature has occurred here |
| D. Possible | 0.01 | Could have occurred already without intervention |
| E. Unlikely | 0.001 | Recorded recently elsewhere |
| F. Very unlikely | $1 \times 10^{-4}$ | It has happened elsewhere |
| G. Highly improbable | $1 \times 10^{-5}$ | Published information exists, but in a slightly different context |
| H. Almost impossible | $1 \text{ X } 10^{-6}$ | No published information on a similar case |

*Source: Bowden, A.R., Lane, M.R. and Martin, J.H., 2001, Triple Bottom Line Risk Management – Enhancing Profit, Environmental Performance and Community Benefit, Wiley and Sons, New York, 314 pp.*

## Table B2 Consequence table

| Qualitative descriptor | Negligible | | Minor | | Moderate | | Major | | Extreme |
|---|---|---|---|---|---|---|---|---|---|
| **Consequence description** | **Minimal, if any impact for some communities. Potentially some impact for a small number (<10) of individuals** | | **Low level impact for some communities, or high impact for a small number (<10) of individuals** | | **High level of impact for some communities, or moderate impact for communities area-wide** | | **High level of impact for communities area-wide** | | **High level of impact State-wide** |
| | **0.1** | **0.3** | **1** | **3** | **10** | **30** | **100** | **300** | **1000** |
| **SOCIAL Noise** | **Construction** - noise is just audible.<br>**Operation** - no increase in noise level. | | **Construction** - noise is audible but within project noise criteria.<br>**Operation** - noise levels increase but comply with project criteria. | | **Construction** - noise is occasionally above project criteria at sensitive receptors.<br>**Operation** - noise levels increase slightly and are greater than project criteria. | | **Construction** - noise levels above project criteria for extended periods of time at sensitive receptors.<br>**Operation** - noise levels increase significantly and are greater than project criteria. | | **Construction** - not applicable.<br>**Operation** - noise levels significantly above criteria on a permanent basis. |
| **SOCIAL Vibration** | **Construction** - vibration is within applicable limits - no damage to structures.<br>**Operation** - vibration is within applicable limits - no damage to structures. | | **Construction** - isolated exceedances of project limits - no damage to structures.<br>**Operation** - isolated exceedances of project limits - no damage to structures. | | **Construction** - extended periods of exceedances of project limits - superficial damage to structures.<br>**Operation** - extended periods of exceedances of project limits - superficial damage to <3 structures. | | **Construction** - long-term exceedances of project limits - structural damage.<br>**Operation** - long-term exceedances of project limits - superficial damage to >3 structures, structure damage to <3 structures, damage to heritage structure. | | **Construction** - vibration causes widespread structural damage.<br>**Operation** - vibration levels significantly above project limits on a permanent basis. Vibration causes widespread structural damage. |

| Qualitative descriptor | Negligible | Minor | Moderate | Major | Extreme |
|---|---|---|---|---|---|
| **SOCIAL**<br>**Amenity**<br>**(Traffic/ air/noise/odour/visual impacts)** | Short term impacts that alter perception of area as a high amenity place to live / visit. | Short term (months) localised impacts that alter perception of area as a high amenity place to live / visit. | Medium term (1-2 years) regional impacts that alter perception of area as a high amenity place to live / visit. | Community perception that the area is significantly damaged. | Community perception that the area has experienced major damage. |
| | Region still seen as attractive place to live. | Region not locally seen as attractive place to live. | Region not widely seen as attractive place to live. | Area loses appeal as residential area.<br>Recovery > 2 yrs. | Area is a place to be avoided.<br>Recovery, if at all, >10 yrs. |

Table B3 Noise and vibration risks

| Risk ID | Risk name | Risk pathway | EPR ID (initial) | Initial risk | | | EPR ID (final) | Residual risk | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Risk | | Likelihood | Consequence | Risk |
| **Construction risk** | | | | | | | | | | |
| NV 15 | Night-time construction noise | Night-time noise during construction exceeds limits causing loss of amenity at sensitive receptors. | EPR NV2 Construction noise<br>EPR SC1 Community and Stakeholder Engagement Management Plan<br>EPR SC2 Respite and Relocation Policy | Almost certain | Moderate | Moderate | As initial EPR | Almost certain | Moderate | Moderate |
| NV 16 | Night-time construction noise (unplanned) | Unplanned night-time work during construction exceeds noise limits causing loss of amenity at sensitive receptors. | EPR NV2 Construction noise<br>EPR SC1 Community and Stakeholder Engagement Management Plan | Highly probable | Moderate | Minor | As initial EPR | Highly probable | Moderate | Minor |
| NV 17 | Day-time construction noise | Day-time noise during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors. | EPR NV2 Construction noise<br>EPR SC1 Community and Stakeholder Engagement Management Plan<br>EPR SC2 Respite and Relocation Policy | Highly probable | Moderate | Minor | As initial EPR | Highly probable | Moderate | Minor |
| NV 19 | Day-time construction noise (unplanned) | Unplanned day-time work during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors. | EPR NV2 Construction noise<br>EPR SC1 Community and Stakeholder Engagement Management Plan | Possible | Moderate | Negligible | As initial EPR | Possible | Moderate | Negligible |

| Risk ID | Risk name | Risk pathway | EPR ID (initial) | Initial risk | | | EPR ID (final) | Residual risk | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Risk | | Likelihood | Consequence | Risk |
| NV 20 | Vibration (amenity) | Vibration exceeds limits resulting in loss of amenity. | EPR NV2 Construction noise<br>EPR NV3 Pre-construction Condition Surveys<br>EPR SC1 Community and Stakeholder Engagement Management Plan | Certain | Minor | Minor | As initial EPR | Certain | Minor | Minor |
| NV 21 | Vibration (structure damage) | Vibration during construction results in structural damage. | EPR NV3 Pre-construction Condition Surveys | Very unlikely | Minor | Negligible | As initial EPR | Very unlikely | Minor | Negligible |
| **Operation risk** | | | | | | | | | | |
| NV 14 | Night-time operational noise | Night-time noise during operation exceeds limits causing loss of amenity at sensitive receptors. | EPR NV1 Operational noise | Almost impossible | Moderate | Negligible | As initial EPR | Almost impossible | Moderate | Negligible |
| NV 18 | Day time operational noise | Day-time noise during operation exceeds limits causing loss of amenity at sensitive receptors | EPR NV1 Operational noise | Almost impossible | Negligible | Negligible | As initial EPR | Almost impossible | Negligible | Negligible |
| NV 20 | Vibration (amenity) | Vibration exceeds limits resulting in loss of amenity. | No EPR required | Very unlikely | Minor | Negligible | No EPR required | Very unlikely | Minor | Negligible |