MARSHALL DAY Acoustics

SHEPPARTON NORTH EAST PSP
NOISE ASSESSMENT

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Project: **SHEPPARTON NORTH EAST PSP – NOISE ASSESSMENT**

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1.0 INTRODUCTION

Greater Shepparton City Council (GSCC) and the Victorian Planning Authority (VPA) are preparing a precinct structure plan (PSP) for the Shepparton North East area.

The PSP area includes approximately 177 hectares of land located approximately three kilometres north-east of the Shepparton CBD.

Marshall Day Acoustics has been commissioned to undertake a noise assessment of existing land uses and transportation in the vicinity of the proposed development.

This report provides details of relevant noise criteria, measurement surveys, predicted noise levels and recommended noise control treatments.

A glossary of acoustic terminology is provided in Appendix A.

2.0 SITE DESCRIPTION

The existing land uses within the PSP area are intensive horticulture, other agriculture, and ancillary uses. There are a small number of rural residential lots in the southwest corner of the PSP area along Verney Road.

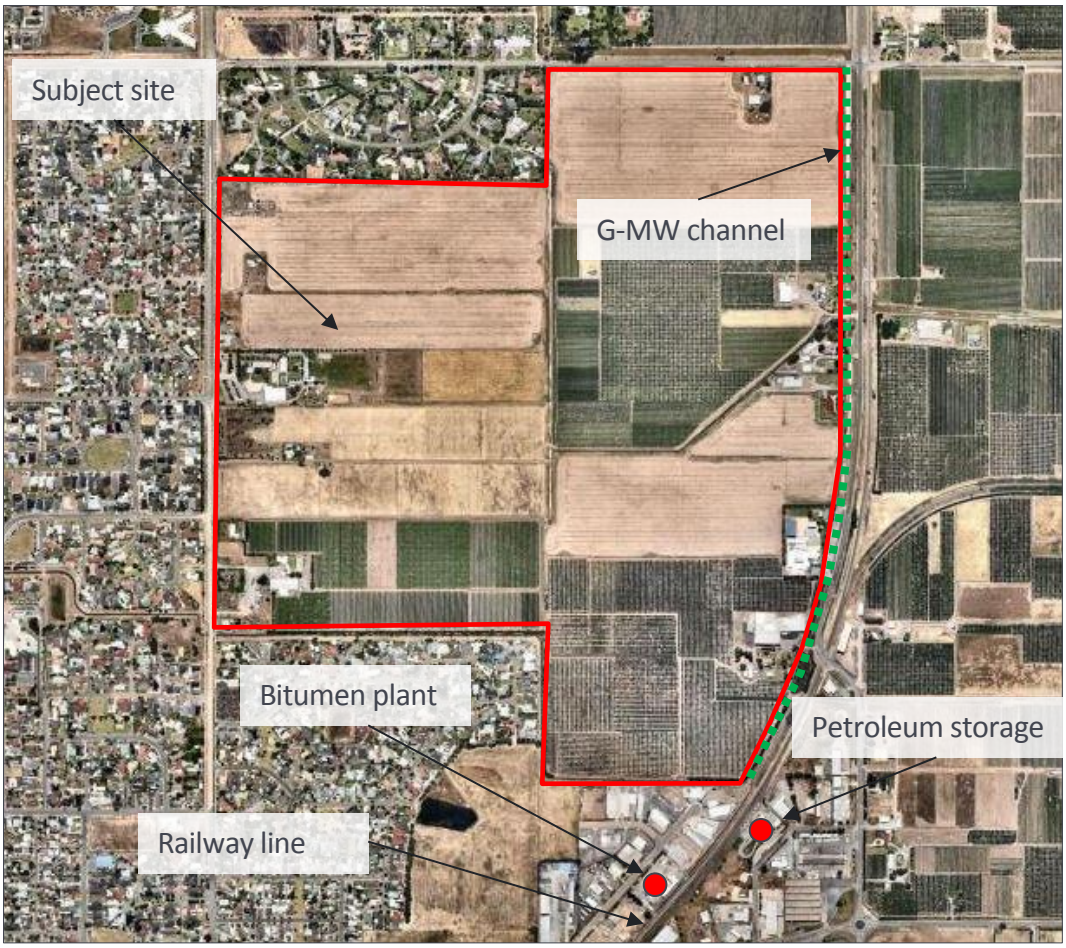
The PSP area is generally bounded by the following:

- Low-density 'Matilda Drive' residential development and Ford Road to the north
- A Goulburn-Murray Water (G-MW) channel, a railway line and the Shepparton Alternate Route (Grahamvale Road) to the east
- The G-MW Drain 3 and existing industrial areas to the south
- Verney Road to the west with residential dwellings beyond.

There are two industrial facilities to the south of the site. Specifically, a bitumen plant on Apollo Drive and a petroleum storage plant on McGill Drive.

An aerial photograph of the subject site and the surrounding environment is provided in Figure 1.

Figure 1: Aerial view of subject site (Source: NearMap)



The subject site is in a Farming Zone (F1Z) with Industrial 1 Zone (IN1Z), Public Use Zone (PUZ4), Road Zone Category 2 (RDZ2), Low Density Residential Zone (LDRZ) and Neighbourhood Residential Zone (NRZ1) in the immediate environs. The relevant planning map is provided in Appendix B.

3.0 LEGISLATION AND GUIDELINES

A range of guidelines and legislation is used in Victoria to assess environmental noise and vibration. This section provides an overview of the key documents and guidelines that are applicable to the proposed development.

3.1 Impacts on the development from the surrounding environment

The proposed residential development will be impacted by the following sources:

- Train noise from the adjacent railway line
- Traffic noise from nearby local roads
- Local commercial or industrial sites and associated operations (e.g. commercial deliveries or waste collection).

External rail and traffic noise insulation requirements to protect the amenity of future occupants will control the acoustic design of the building envelope. Noise from the other sources should comply with relevant statutory legislation or acceptable guidelines, as discussed herein.

3.1 Victorian Legislation

A summary of the relevant Victorian legislation is provided in Table 1. Refer to Appendix C for further details.

Table 1: Relevant Victorian noise legislation

Document	Overview
Environment Protection Act 1970 (the Act)	The Act provides the overarching legislative framework for the protection of the environment in Victoria. It establishes obligations for the control of environmental noise and applies to all types of noise sources except rail operations. The legislation does not specify noise limit values, but sets out legal requirements to comply with State environment protection policies and prescribed standards.
State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1)	SEPP N-1 defines mandatory noise limits for commercial, industrial or trade premises in the Metropolitan Region of Melbourne. The limits apply to the level of noise occurring at neighbouring sensitive receivers. The noise limits are determined on the basis of land zoning and background noise levels, and are separately defined for day, evening and night periods. Refer to Appendix C1 for further detail and noise limit derivation.

3.2 Guidelines

A summary of relevant guidelines referenced in Victorian noise assessments is presented in Table 2.

Table 2: Relevant Victorian references and guidelines

Reference	Overview
EPA Publications 1411-1413 *Noise from Industry in Regional Victoria* (NIRV)	Prescribes recommended maximum noise levels (RMNLs) for commercial, industrial or trade premises in regional Victoria. Under NIRV, when either the noise emitter or noise receiver is located within a major urban area, Recommended Maximum Noise Levels (RMNL's) are determined in accordance *with State Environment Protection Policy (Control of Noise from Commerce, Industry, and Trade) No. N-1 (SEPP N-1)*. In this case, local commercial enterprises to the south of the site are located within the boundary of the NIRV major urban zone for Greater Shepparton (the relevant map is shown in C2.22.2). As such, the assessment for this site would be performed in accordance with SEPP N-1. Refer to Appendix C1 for further detail.
Australian/New Zealand Standard AS/NZS 2107:2016 *"Acoustics - Recommended design sound levels and reverberation times for building interiors"* (AS 2107)	Provides recommendations for acceptable internal noise levels. Table 1 of AS 2107 presents the recommended internal noise levels for "houses and apartments near major roads", which is considered to be applicable to the development site. Refer to Appendix C3 for further detail.
Sleep disturbance criteria sourced from NSW Road Noise Policy 2011 (Sleep disturbance criteria)	The provisions of this document are often referred to in Victoria for general guidance on potential sleep disturbance. Based on a review of research into sleep disturbance, the NSW policy nominates maximum external night-time noise levels at noise sensitive locations which are unlikely to disturb sleep. Refer to Appendix C4 for further detail.
Victorian Passenger Rail Infrastructure Noise Policy	Released in April 2013. Section 5 of the policy sets out the conditions under which transport bodies must apply the policy. The policy sets 'investigation thresholds' for the assessment of noise. These are noise levels, which if exceeded, indicate that noise mitigation should be considered. Refer to Appendix C5 for further detail.
EPA Publication 1254 *Noise Control Guidelines* (EPA Guidelines)	Provides an overview of noise policies and legislation in Victoria for a range of different noise sources, and provides supplementary guidance for situations where there is no policy or legislation.

4.0 SITE NOISE SURVEYS

The following sections detail noise measurements taken in the vicinity of the site.

4.1 Background measurements

Background noise levels were measured at the south east corner of the site. The measurement location is shown in Appendix E and full details of the methodology are included in Appendix F.

The measured background noise levels at the site are detailed in Table 3.

Table 3: Measured background noise levels

	Day	Evening	Night
Background Noise Level, L_{A90}, dB	40	41	43

4.2 Traffic noise

Traffic noise levels have been measured at the east, west and north site boundaries. Train noise is assessed separately in the following section.

The measurement locations are shown in Appendix E and full details of the methodology are included in Appendix F. Measured traffic noise levels are detailed in Table 4.

Table 4: Traffic noise measurements, spectral and A-weighted results

Description	Octave band mid frequency								
	A	63	125	250	500	1k	2k	4k	Hz
Northern site boundary – Ford Road									
02 February 2017; 1716 – 1731 hrs									
L_{eq}	67	63	61	62	63	65	56	47	dB
L_{max}	85	86	80	82	83	84	75	71	dB
Eastern site boundary – Verney Road									
02 February 2017; 1741 – 1756 hrs									
L_{eq}	62	65	60	56	60	57	53	46	dB
L_{max}	90	89	83	79	92	82	73	69	dB
Western site boundary – Grahamvale Road - Daytime									
02 February 2017; 1654 – 1709 hrs									
L_{eq}	70	77	72	65	65	66	62	55	dB
L_{max}	87	99	96	88	84	82	79	77	dB
Western site boundary – Grahamvale Road – Night-time									
02 February 2017; 2228 – 2243 hrs									
L_{eq}	69	76	70	69	66	65	61	57	dB
L_{max}	90	97	91	96	88	84	79	81	dB

4.3 Railway noise

The VPRINP requires the assessment to be based on the 95th percentile of the maximum measured rail noise. The measurement locations are shown in Appendix E and full details of the methodology are included in Appendix G.

A summary of the maximum and average overall noise levels for all the individual train events measured during the night-time period is presented in Table 5.

Table 5: Summary of measured train noise levels

	Maximum noise level L_{Amax}, dB	Average noise level, L_{Aeq} dB
Train pass-by	94	49-54

The 95th percentile noise level was 78 dB L_{Amax}. A freight train pass-by was observed and measured from Grahamvale Road. The measured spectra of the freight train has been adjusted to meet the 95th percentile noise level and is presented in Table 6.

Table 6: Measured railway noise spectra

Source	Octave band centre frequency (Hz)								
Rail 95th Percentile L_{max}	**A**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**Hz**
Train movement	78	65	55	68	76	75	68	61	dB

4.4 Commercial activity noise

MDA have attended site on a weekday, a weekday night and over the weekend. In all cases it was noted that the petroleum storage facility were not audible at the boundary of the site.

Attended measurements of the batching plant were undertaken within the site during the day. The primary noise source on site is the mixing drum and associated burners. Trucks were observed to stay within the facility for approximately 30 minutes whilst being filled. A summary of the measured noise levels is provided in Table 7.

Table 7: Summary of measured batching plant noise levels

Operating condition	Average noise level, dB $L_{Aeq, 30mins}$
Batching plant operating normally at 60 m to the north	66

In addition, it was observed that noise from the bitumen plant was audible on Apollo Drive during the day but that it closed at approximately 1630 hrs.

5.0 PRELIMINARY TRAFFIC NOISE ASSESSMENT

5.1 Ford Road and Verney Road

Traffic noise exposure to the Ford Road and Verney Road sides of the development is considered to be moderate.

Standard facade and glazing treatment will be sufficient to achieve an appropriate level of acoustic amenity in dwellings fronting onto Ford Road and Verney Road. It is recommended that the construction details given in Section 5.2.3 be considered.

5.2 Grahamvale Road

The following sections detail preliminary noise control recommendations for the Grahamvale Road side of the development.

Three scenarios are presented which consider varying offset distances between the nearest future dwelling and the Road.

5.2.1 Dwellings at the boundary with the eastern G-MW channel

Traffic noise exposure to the Grahamvale Road side of the development is considered to be high.

Given that the measurement location (refer Appendix E) is the same distance from Grahamvale Road as the channel, it is recommended that future dwellings should not be built up to the boundary.

5.2.2 Dwellings with a 15 m offset to the eastern G-MW channel

The assessment has been based upon standard building materials, which are considered to be the minimum in terms of acoustic performance for achieving the relevant criteria.

Table 8: Construction materials - dwelling with 15m offset to G-MW channel

Description of Typical Construction to achieve Minimum Acoustic Rating			
External walls	**Roof-ceiling**	**Glazing**	**Doors**
$R_w > 45$	$R_w > 44$	$R_w > 39$	$R_w > 30$
Typically achieved with: -110 mm brick facade -90 mm stud framing -Minimum R2.0 insulation placed in cavity -10 mm thick plasterboard (7 kg/m^2) internal wall lining	Typically achieved with: - metal deck roofing (minimum BMT 0.48 mm) or roof tiles with sarking -Minimum R3.6 insulation in roof cavity -10 mm thick plasterboard (minimum 7 kg/m^2) internal ceiling lining Eaves to be sealed and treated to minimise noise break in via the roof space	Typically achieved with: 6/12/10 mm double glazing All windows and sliding glass doors shall incorporate full perimeter acoustic seals which form an airtight seal on closure.	Typically achieved with: Minimum 40 mm solid core with good-quality full perimeter acoustic grade seals which form an airtight seal on door closure

As is the case for any building that is exposed to significant external noise, the design criteria will not be achieved with windows open, however, the occupants have the option to close external windows and doors to significantly reduce noise intrusion.

Ventilation may be required in some rooms in order to allow the windows to remain closed. This should be addressed at detailed design stage.

The assessment assumes that non glazed portions of the facades including any lightweight walls and any roofs exposed to environmental noise shall have sound insulation performance significantly greater than that of the associated glazing system.

5.2.3 Dwellings with a 30 m offset to the eastern G-MW channel

The assessment has been based upon standard building materials, which are considered to be the minimum in terms of acoustic performance for achieving the relevant criteria.

Table 9: Construction materials - dwelling with 15m offset to G-MW channel

Description of Typical Construction to achieve Minimum Acoustic Rating			
External walls	**Roof-ceiling**	**Glazing**	**Doors**
$R_w > 41$ Typically achieved with: -Lightweight facade material, such as 75mm Hebel Power Panel XL (33 kg/m^2) -25 mm furring channel -90 mm stud framing -Minimum R2.0 insulation placed in cavity -10 mm thick plasterboard (7 kg/m^2) internal wall lining	$R_w > 44$ Typically achieved with: -Metal deck roofing (minimum BMT 0.48 mm) or roof tiles with sarking -Minimum R3.6 insulation in roof cavity -10 mm thick plasterboard (minimum 7 kg/m^2) internal ceiling lining Eaves to be sealed and treated to minimise noise break in via the roof space	$R_w > 35$ Typically achieved with: 6.76 mm laminated glazing All windows and sliding glass doors shall incorporate full perimeter acoustic seals which form an airtight seal on closure.	$R_w > 30$ Typically achieved with: Minimum 40 mm solid core with good-quality full perimeter acoustic grade seals which form an airtight seal on door closure

6.0 PRELIMINARY RAILWAY NOISE ASSESSMENT

Rail noise exposure to the Ford Road and Verney Road sides of the development is considered to be negligible whilst rail noise on Grahamvale Road of the site is high. Rail noise to the south east side of the site is considered to be moderate.

6.1 Offset to the railway

A 15 m offset has been assumed between the nearest future dwellings on Grahamvale Road and the G-MW channel (refer Section 5.2.1).

In addition there are potential future dwellings in the south east corner of the site will also have an interface with the railway.

The levels detailed in Table 5 indicate that noise to this area due to trains is lower than that on Grahamvale Road and therefore an offset between the nearest future dwellings and the G-MW channel is not required.

6.2 Sleep disturbance – Railway noise

The 95th percentile of the measured maximum noise levels during the night was 78 dB L_{Amax}.

The noise monitor was located on the boundary of the site. Therefore, no distance correction has been taken from the measured levels at the south east corner of the site. A distance correction of -2 dB has been taken for future dwellings on Grahamvale Road.

In both cases, predicted internal noise levels comply with the sleep disturbance criteria, based on the measured external noise levels and the constructions detailed in Section 5.2.3.

Note that compliance with the sleep disturbance criteria will not be achieved with doors or windows open.

6.3 Victorian Passenger Rail Infrastructure Noise Policy

Measured noise levels at the south east boundary of the site due to train pass-bys indicate that the investigation thresholds set down in the *Victorian Passenger Rail Infrastructure Noise Policy* are not exceeded.

It is considered therefore that no further action is required under the terms of that policy.

7.0 PRELIMINARY COMMERCIAL NOISE ASSESSMENT

The following sections present analysis of noise sources that are assessable under SEPP N-1.

7.1 NIRV Recommended Maximum Noise Levels

Table 10 details the indicative NIRV Recommended Maximum Noise Level for the day, evening and night periods. A full derivation is provided in Appendix D2.1.

It has been assumed that the site, currently zoned as Farming Zone (F1Z), will be zoned residential in the future.

Table 10: Recommended Maximum Noise Levels

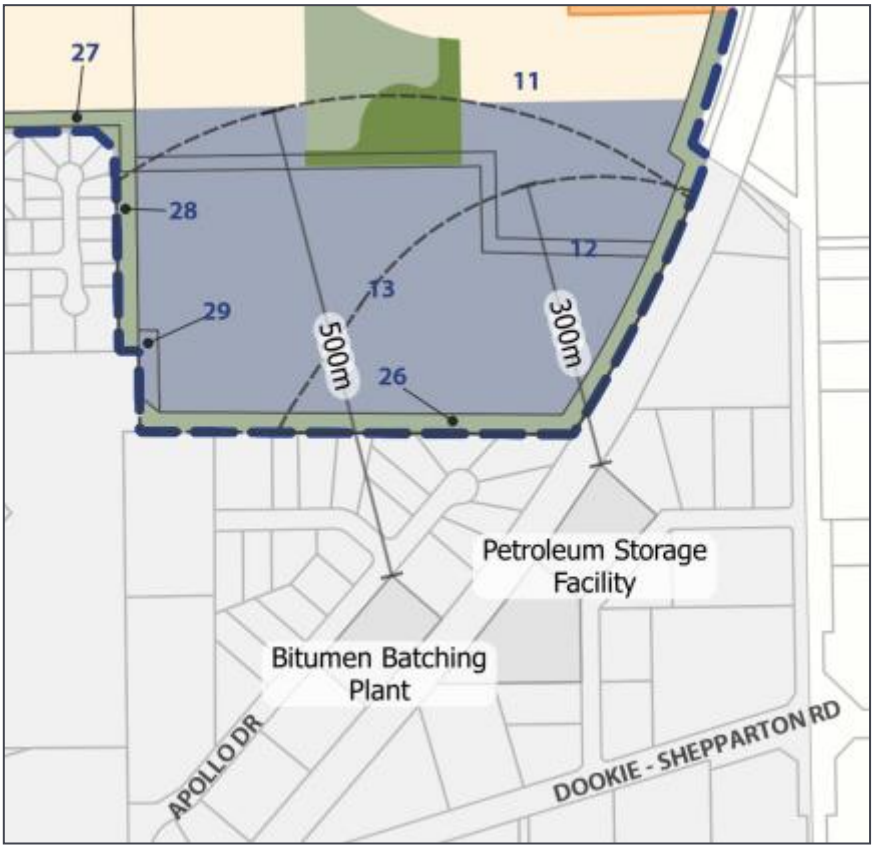
Period	RMNL, dB L_{eff}
Day	52
Evening	49
Night	46

7.2 Offset between existing commercial and future dwellings

7.2.1 Bitumen plant and petroleum storage

The preliminary site drawings specify an offset between the nearest future dwellings and existing industry to the south east on Apollo Drive and McGill Drive. The offsets are shown in Figure 2.

Figure 2: Extract from the current Land Use Budget



The noise level taken from the unattended monitoring location (refer Appendix E) at the time when a train is known to have passed the site (1654 hrs on 2 February) are significantly higher than those

taken immediately before and afterwards. In addition, the maximum measured level (L_{Amax}) was significantly higher than adjacent measurements.

A similar pattern is displayed throughout the data (higher L_{Aeq} and L_{Amax} in isolated measurement periods). This indicates that the peaks shown in Appendix H are due to train pass-bys.

Noise levels shortly before and after the bitumen plant is known to have closed do not vary significantly.

This would tend to indicate that local industry is not a significant component of the existing noise environment to the south east corner of the site.

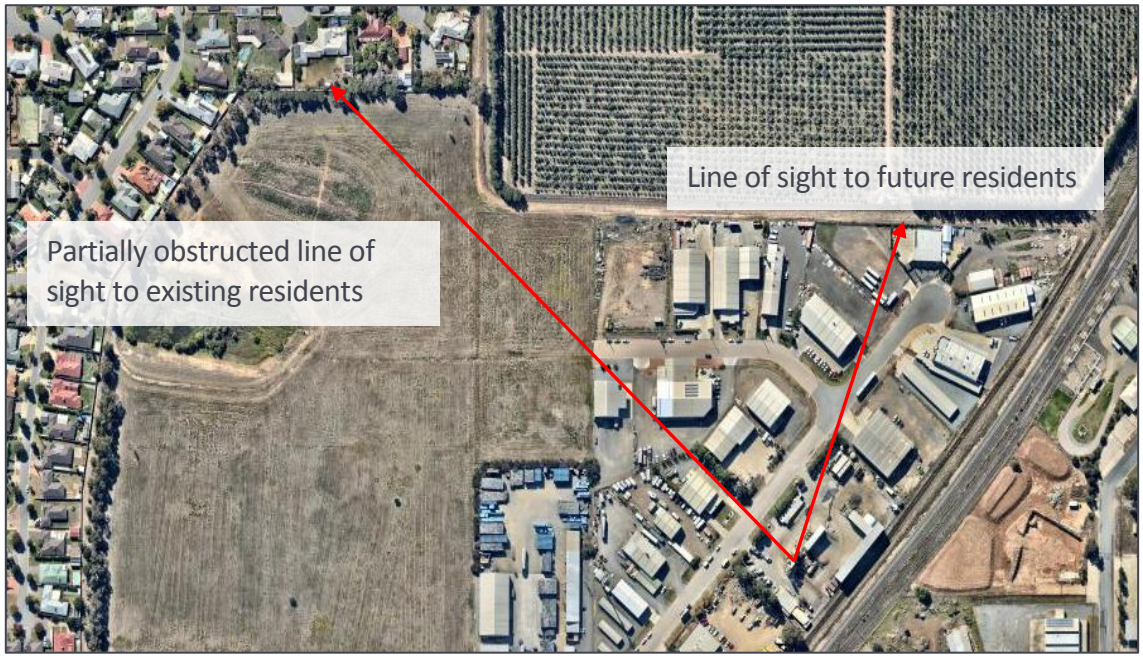
However, it is understood that there are times (approximately 6 weeks out of 12 months) when the batching plant is operated overnight. It was not possible to measure night-time activity from the batching plant as part of this exercise.

Therefore attended measurements were taken within the batching plant site with the facility operating normally. It is noted that there are existing residential dwellings on John Findlay Place and Ross Alan Drive which is located approximately 380 m to the north west of the batching plant. The batching plant is therefore obliged to meet the Recommended Maximum Noise Levels at these properties at present. It is noted that there are dwellings with an obstructed line of sight to the primary noise source at a distance of 500 m. Therefore the closest of these, 2 Malvern Court, has been taken as the worst case.

The nearest boundary of the subject site is approximately 150 m from the north boundary of the batching plant and approximately 240 m from the primary source of noise. It should be noted that whilst there are several commercial buildings between the batching plant and the subject site, there are portions of the subject site which have a direct line of sight. Therefore no correction has been taken for attenuation due to screening.

Sightlines from future and existing residences to the batching plant are illustrated in Figure 3.

Figure 3: Sightlines to the batching plant



Measured noise levels were taken within the batching plant site at a distance of approximately 60 m. Therefore predicted noise levels due to the existing operation of the batching plant at the nearest existing and potential future dwelling is provided in Table 11.

Table 11: Predicted batching plant noise levels at existing and future dwellings

Normal operation	Existing dwellings	Future dwellings
Measured noise level to the north of the batching plant, dB L_{Aeq}	66	66
Correction for distance, dB	-20	-12
Correction for shielding from existing buildings, dB	-5	0
Effective noise level at boundary of nearest dwelling, dB L_{eff}	41	54
RMNL (D/E/N), dB L_{eff}	52/49/46	52/49/46
Compliance?	**Yes**	**No**

It can be seen that the existing operation of the batching plant is likely to comply with the NIRV RMNLs at existing dwellings in all time periods.

In addition it can be seen that the existing operation of the batching plant is unlikely to comply with the NIRV RMNLs at future dwellings along portions of the south boundary of the site in all time periods.

It is considered that there are several possible solutions to reducing noise from the batching plant at future residential dwellings:

- Retain the buffer distance detailed in Figure 2. It is acknowledged that existing residences may be closer, however, these are screened from the batching plant by the existing commercial buildings in the vicinity
- Develop the area nearest to the south boundary of the subject site as light industry to provide a buffer between future residential and the batching plant. The built form will provide adequate attenuation to allow the RMNLs to be met at future residents
- Install a noise barrier to the north and north west boundary of the batching plant site to a height of at least 5 m as detailed in Figure 4

Figure 4: Noise barrier to batching plant

- Alternatively, if the future dwellings are to be single storey, then a noise barrier could be installed to the south site boundary to a height of at least 3 m and to the extent detailed in Figure 5. If future dwellings are to be double storey then a higher barrier could be required. This depends on the proximity of the dwelling to the boundary.

Figure 5: Noise barrier to south boundary of site

MDA considers that, with the appropriate mitigation in place, noise from the batching plant can comply with the NIRV RMNLs at the subject site. Therefore, upgraded facade or glazing treatments to dwellings on the south boundary of the site will not be required for acoustic reasons.

7.2.2 Future batching plant operations

It is understood that the batching plant may wish to increase the capacity of the facility in the future. Discussions with the operator suggest that this could involve replacement of the existing equipment with more modern versions and that these units are generally quieter than the existing plant.

If an expansion of this nature was to occur then the mitigation measures detailed in Section 7.2.1 would assist the future operations to comply with NIRV but it is anticipated that a full acoustic assessment would be required.

7.2.3 Small industry on Apollo Drive

Inspection of the site in conjunction with websites associated with the various enterprises indicates that operations in the immediate vicinity of the PSP site generally occur during the day.

The exception is number 45 Apollo Drive which appears to operate at after 2200 hrs. However commercial noise was not audible in the vicinity when Apollo Drive was inspected at night.

Small commercial tenancies immediately to the south of the PSP site are not considered likely to present a high risk in terms of noise impact due to their size and nature. However, short-term noise events do have the potential to disturb future residents.

Therefore, in the case that dwellings are built to the boundary, it is recommended that provision be made in the design to allow for a noise barrier along the interface with existing industry on Apollo Drive in order to reduce noise from localised activities in the small commercial tenancies along that interface.

7.3 Future commercial tenancies on the site

Commercial tenancies could be located to the south east corner of the site adjacent to existing industry on Apollo Drive.

As detailed layouts and specific area uses have not been provided, commercial tenancies warrants further analysis during the detailed design stage of the project, however ultimately it will be the responsibility of the future tenant to comply with NIRV.

8.0 SUMMARY

Marshall Day Acoustics (MDA) has been commissioned to undertake a noise assessment of existing land uses in the vicinity of the proposed Shepparton North East area precinct structure plan (PSP).

MDA has carried out environmental noise assessment of the proposed development in accordance with the relevant Victorian EPA legislation, guidelines and accepted industry practice.

This assessment has been based on:

- Existing noise conditions determined from a measurement surveys at the site;
- Limits determined in accordance with the relevant Victorian EPA legislation, guidelines and accepted industry practice.

It is considered that appropriate acoustic treatment can be implemented in the design in order to comply with the applicable noise and criteria.

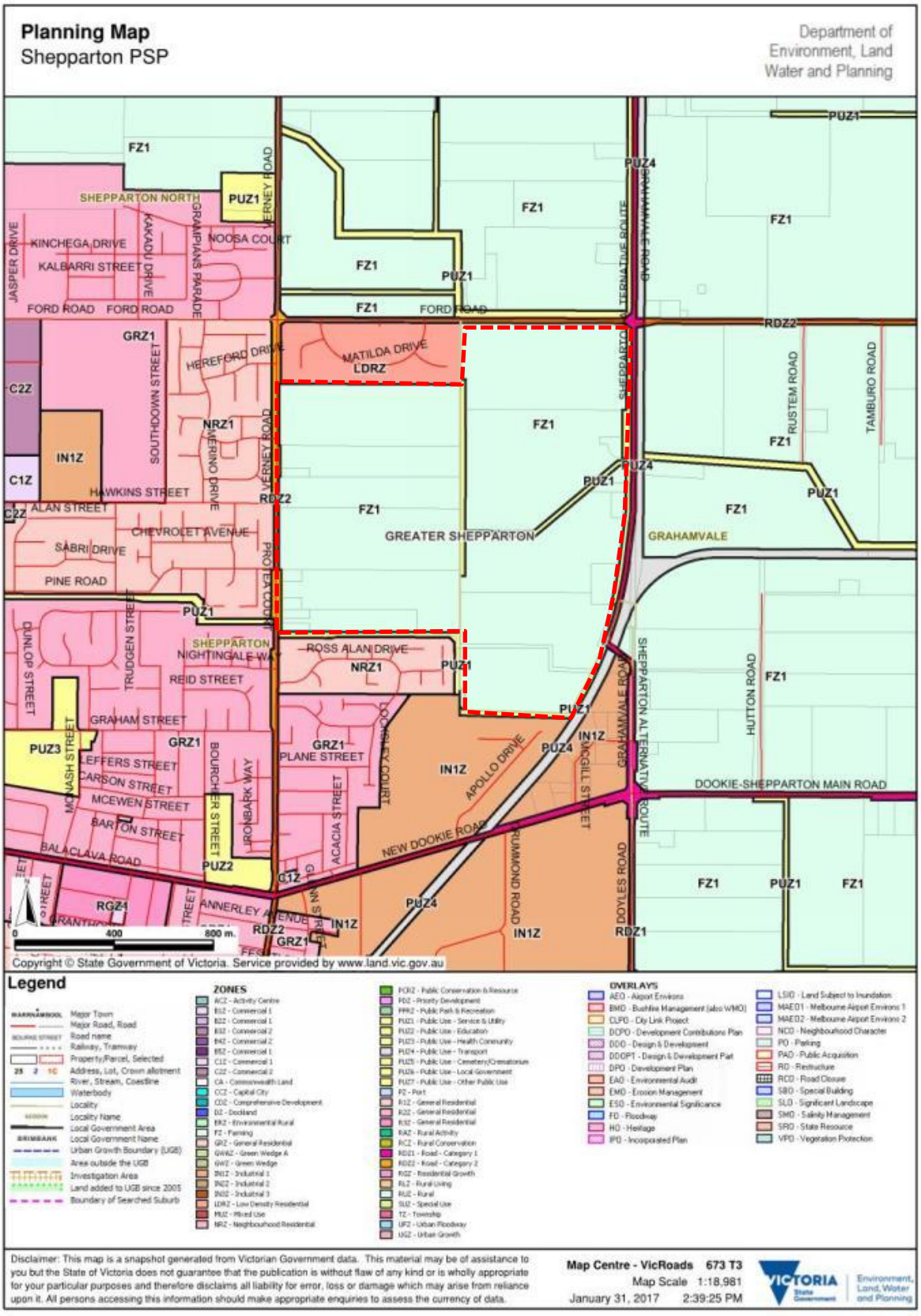
The assessment concludes that:

- A minimum offset of 15 m between the existing G-MW channel and future residential dwellings on Grahamvale Road be considered due to traffic noise
- Glazing and facade constructions for future dwellings on Ford Road and Verney Road be generally in accordance with the details given in Section 5.2.3
- Glazing and facade constructions for future dwellings to the south east of the site with an interface to the railway be generally in accordance with the details given in Section 5.4
- From an acoustic perspective, the offset zones shown in Figure 2 for the petroleum depot are not required
- With the appropriate mitigation in place, noise from the batching plant can comply with the NIRV RMNLs at the subject site (refer Section 7.2.1)
- It is recommended that provision be made in the design to allow for a noise barrier along the interface with industry on Apollo Drive in order reduce noise from localised activities in the small commercial tenancies along that interface.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dB	Decibel The unit of sound level.
L_{A90}	The noise level exceeded for 90% of the measurement period, measured in dB. This is commonly referred to as the background noise level.
$L_{A10\,(t)}$	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Aeq}	The equivalent continuous sound level. This is commonly referred to as the average noise level and is measured in dB.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Sound Insulation	When sound hits a surface, some of the sound energy travels through the material. 'Sound insulation' refers to ability of a material to stop sound travelling through it.
R_w	Weighted Sound Reduction Index A single number rating of the sound insulation performance of a specific building element. Rw is measured in a laboratory. Rw is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.
Hertz (Hz)	Vibration can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. The frequency of vibration and sound is measured in hertz (Hz). Once hertz is one cycle per second. Structural Vibration is generally measured over the frequency range from 1Hz to 500Hz (0.5kHz).

APPENDIX B PLANNING MAP



APPENDIX C LEGISLATION AND GUIDELINES

C1 SEPP N-1

C1.1 Application

State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1) sets noise limits that apply to commercial, industrial and trade premises within the Melbourne metropolitan region. Compliance with SEPP N-1 is mandatory under section 46 of the Environment Protection Act 1970.

SEPP N-1 defines a 'commercial, industrial and trade premises' as:

> *any premises except:*
>
> *(a) residential premises as defined in section 48A of the [Environment Protection] Act;*
>
> *(b) a street or road, including every carriageway, footpath, reservation and traffic island on any street or road;*
>
> *(c) a tram, light rail or railway line not being a siding, marshalling yard or maintenance depot of any tram, light rail or railway line; and*
>
> *(d) [land situated at Luna Park, St Kilda].*
>
> *Section 48A of the Act defines residential premises as:*
>
> *any building or part of a building used as or for the purposes of a private residence or residential flat.*

C1.2 Assessment methodology

SEPP N-1 is a policy and technical document. The Policy prescribes the methodology and measurement procedure used to determine applicable noise limits and assessment of compliance.

The Policy requires that proposed commercial premises be designed to comply with SEPP N-1 noise limits. Clause 16 of the Policy states:

> *Where it is planned to develop new commercial, industrial or trade premises, the premises shall be designed so that the noise emissions do not exceed the noise limits*

Further, the occupier of commercial, industrial or trade premises has an ongoing obligation to meet the SEPP N-1 noise limits. Clause 15 of the Policy states:

> *where noise emissions from existing commercial, industrial or trade premises exceed the requirements set out in the Policy, steps shall be taken by the occupier to reduce the level of these noise emissions to, or below, the relevant Policy noise limits.*

SEPP N-1 defines a 'noise sensitive area' as an area of land within 10m outside the external walls of:

> *a dwelling or residential building*
>
> *a dormitory, ward or bedroom of a caretaker's house, hospital, hotel, institutional home, motel, reformative institution, tourist establishment or work release hostel.*

The assessment of noise from the subject site under SEPP N-1 is based on the calculation of a noise limit at a receiver position, taking into account a zoning noise level derived from the land zoning types in the surrounding area and the background noise level.

Once a noise limit is established, the noise level (L_{Aeq}) due to the commercial premises is measured or predicted. If necessary, the L_{Aeq} noise level is adjusted for noise character and duration to give the effective noise level (L_{eff}). If the L_{eff} level exceeds the noise limit, then remedial action is required.

C2 Noise from Industry in Regional Victoria (NIRV)

The relevant guidelines for noise from commercial premises in regional Victoria are the EPA Publications 1411-1413 *Noise from Industry in Regional Victoria (NIRV).*

Under NIRV, when either the noise emitter or noise receiver is located within a major urban area, noise criteria is determined in accordance with *State Environment Protection Policy (Control of Noise from Commerce, Industry, and Trade) No. N-1* (SEPP N-1).

In this case, the subject site and nearby dwellings are located inside the boundary of the NIRV major urban zone for Greater Shepparton and NIRV defines the applicable noise criteria.

The NIRV document is a non-statutory guideline. Accordingly, the recommended levels are only legally binding when applied through statutory instruments, such as a planning permit or notice.

C2.1 Calculation of Recommended Maximum Noise Levels (RMNLs)

For the subject site the NIRV RMNL's are calculated in accordance with SEPP N-1 and take into account land 'zoning types' within a 70 m and 200 m radius of a noise sensitive building. Zoning types are categorised as type 1, 2 or 3.[1] A prescribed formula is used to calculate a corresponding Zoning Level. In general, zone type designations are as follows.

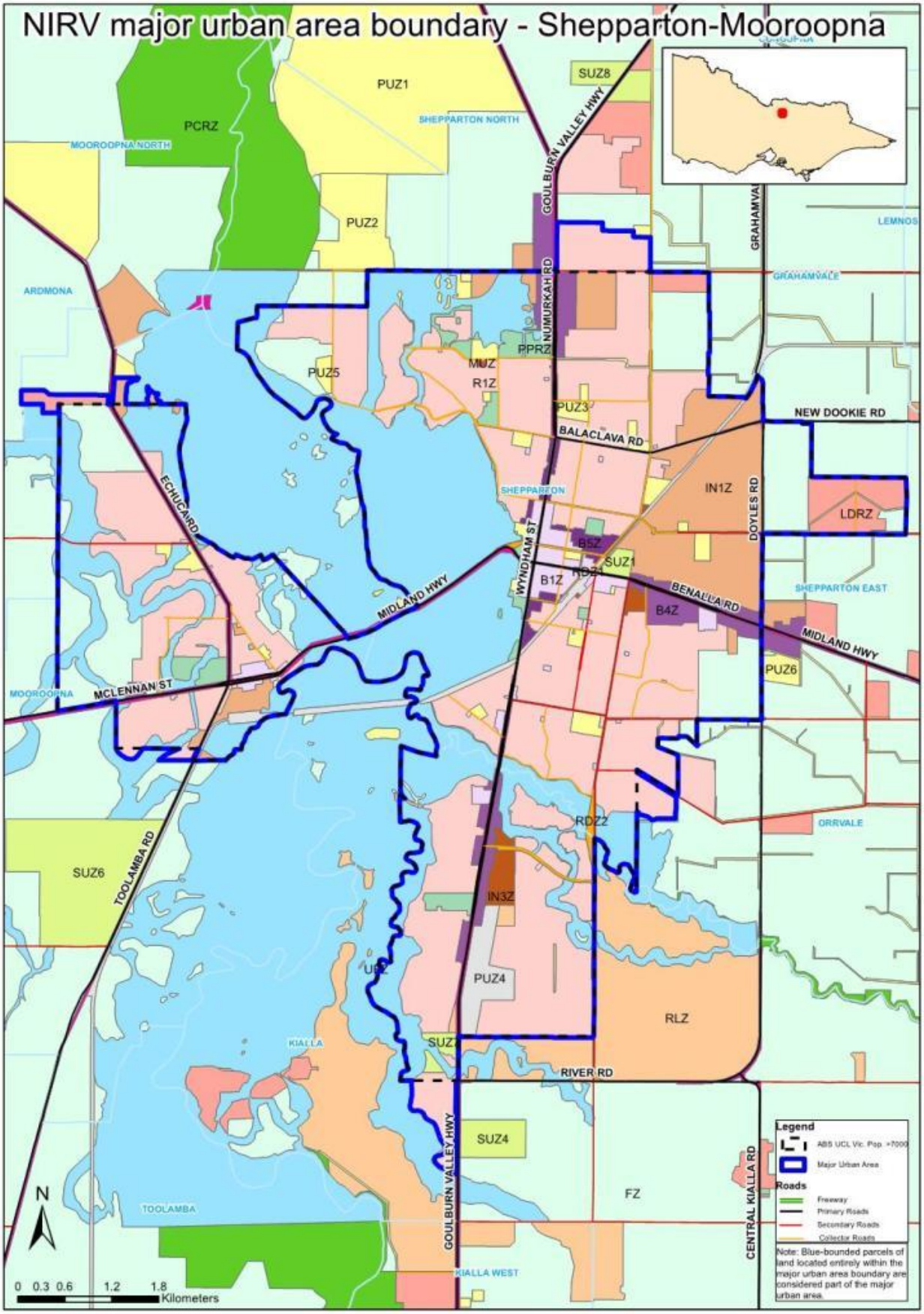
- areas such as residential, rural and open space are type 1;
- areas such as commercial, business and light industry are type 2; and
- areas such as general industry and major roads are type 3.

Greater areas of type 2 and 3 land within a 200m radius of a noise sensitive site result in higher Zoning Levels than a site with respectively larger areas of type 1 land.

The RMNLs are equal to the 'zoning level' unless the background level at the noise sensitive site is categorised as low or high according to Clause B3 of the Policy. If the background level is low or high, the RMNL is calculated from a formula taking into account the Zoning Level and the Background Level.

[1] EPA Publication no.: 316a, 17 February 2000, *Designation of Types of Zones and Reservations in the Metropolitan Region Planning Schemes for the Purposes of State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* <http://www.epa.vic.gov.au/our-work/publications/publication/2000/february/316a>

C2.2 NIRV major Urban Area boundary map



The RMNLs for the subject site have been calculated in accordance with SEPP N-1 and are provided in Table 12.

Table 12: NIRV time periods and RMNLs

Period	Day of week	Start time	End time	Measured background, L_{A90} dB	Zoning level, dB	Background relative to zoning level	RMNL, L_{eff} dB
Day	Monday-Friday	0700 hrs	1800 hrs	40	55	Low	52
	Saturday	0700 hrs	1300 hrs				
Evening	Monday-Friday	1800 hrs	2200 hrs	41	49	Neutral	49
	Saturday	1300 hrs	2200 hrs				
	Sunday, Public holidays	0700 hrs	2200 hrs				
Night	Monday-Sunday	2200 hrs	0700 hrs	43	44	High	46

To comply with SEPP N-1, the total noise level from all plant, equipment and commercial vehicles at the site, assessed over a 30 minute period, must not exceed the above noise limits in the day, evening, and night-time periods.

C3 Environmental noise

Australian Standard 2107-2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors* provides recommendations for acceptable internal noise levels. Table 9 shows the recommended internal design sound levels stated in AS2107 for "*houses and apartments in inner city areas or entertainment districts or near major roads*", which is considered to be applicable to the proposed development.

Table 13: AS2107 recommended internal noise levels

Area	Recommended design sound level range, dB L_{Aeq}
Living areas	35-45
Sleeping areas	35-40
Work areas	35-45
Apartment common areas (eg, lobbies)	45-50

Compliance with the lower level is preferred, but compliance with the maximum noise level is considered to be acceptable.

AS2107 does not specify the measurement procedure to determine whether compliance has been achieved but does state the following:

> *In situations where traffic (or other) noise levels may vary widely over a 24-hour period, measurements to assess compliance with this Standard should be taken at the relevant time according to the area of occupancy or activity in the building.*

Given the above, it could be argued that compliance measurements for bedrooms should be made during the period between 2200-0700 hrs (commonly referred to as the night period), although this does not allow for those occupants who may be shift workers or such like that may have a

requirement to sleep during the day. For living and dining rooms, the compliance measurement should be made during the period between 0700-2200 hrs (commonly referred to as the day/evening period).

Further, AS2107 does not specify the noise measurement duration. It is recommended that compliance generally be assessed based on the typical worst-case 15-minute L_{Aeq} noise level throughout the relevant time period (eg, night-time for bedrooms).

Higher quality developments should obviously aim to achieve lower levels of traffic noise intrusion. MDA's project experience shows that if internal noise levels in bedrooms or living areas exceed an hourly average of approximately 40dB L_{Aeq} that the level of occupant dissatisfaction is likely to be relatively high.

An internal level of 35 dB L_{Aeq} within bedrooms at night has been selected in this case.

Australian Standard 3671-1989 *Acoustics – Road traffic noise intrusion* (AS3671) provides recommended minimum façade constructions based on measured road traffic noise levels. Four categories of construction, determined by the amount of traffic noise reduction (TNR) expected, are identified. Table 14 details the AS3671 construction categories.

Table 14: AS3671 construction categories

Category	Description	Expected TNR – dB (A)
1	Standard construction; openings, including open windows and doors may comprise up to 10% of the exposed façade.	10
2	Standard construction, except for lightweight elements such as fibrous cement, metal cladding or all-glass façades. Windows, doors and other openings must be closed.	25
3	Special construction, windows, doors and other openings must be closed.	25-35
4	Specialist acoustic advice should be sought	>35

C4 Sleep Disturbance

The NSW Road Noise Policy 2011 produced by the NSW EPA, provides guidance on potential for sleep disturbance. While the Policy applies strictly only in NSW, the provisions of the document are often referred to in Victoria for general guidance on potential sleep disturbance.

The NSW policy notes that from the research on sleep disturbance to date it can be concluded that:

- *maximum internal noise levels below 50–55dB L_{Amax} are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65–70dB L_{Amax}, are not likely to affect health and wellbeing significantly.*

C5 Railway noise

The *Victorian Passenger Rail Infrastructure Noise Policy* was released in April 2013. Section 5 of the policy sets out the conditions under which transport bodies must apply the policy.

The policy sets 'investigation thresholds' for the assessment of noise. These are noise levels, which if exceeded, indicate that noise mitigation should be considered. It states that:

> *In considering changing land use near an existing passenger rail corridor, transport bodies and planning authorities should consider the receivers set out in Table B in Attachment 2. Transport bodies and planning authorities should consider whether the noise level produced at these receivers will exceed the investigation thresholds for the periods specified in Table B in Attachment 2.* [Table B of Attachment 2 is reproduced below as Table 15 in this report.]
>
> *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 this policy.*

The investigation thresholds are defined in terms of:

- $L_{Aeq,16h}$ – equivalent continuous daytime (0600-2200 hrs) noise level
- $L_{Aeq,8h}$ – equivalent continuous night-time (2200-0600 hrs) noise level
- L_{Amax} – maximum noise level.

Investigation thresholds for the redevelopment of land near existing rail infrastructure are presented in Table 15.

Table 15: Investigation thresholds for changing allowable land use near an existing rail corridor

Time	Type of receiver	Investigation thresholds		
Daytime (0600-2200hrs)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep. Noise sensitive community buildings including schools, kindergartens, libraries	65 dB $L_{Aeq,16h}$	or	85 dB L_{Amax}
Night-time (2200-0600hrs)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep.	60 dB $L_{Aeq,8h}$	or	85 dB L_{Amax}

The investigation thresholds are not design criteria. However, should the investigation thresholds be exceeded, then the following internal design criteria are recommended:

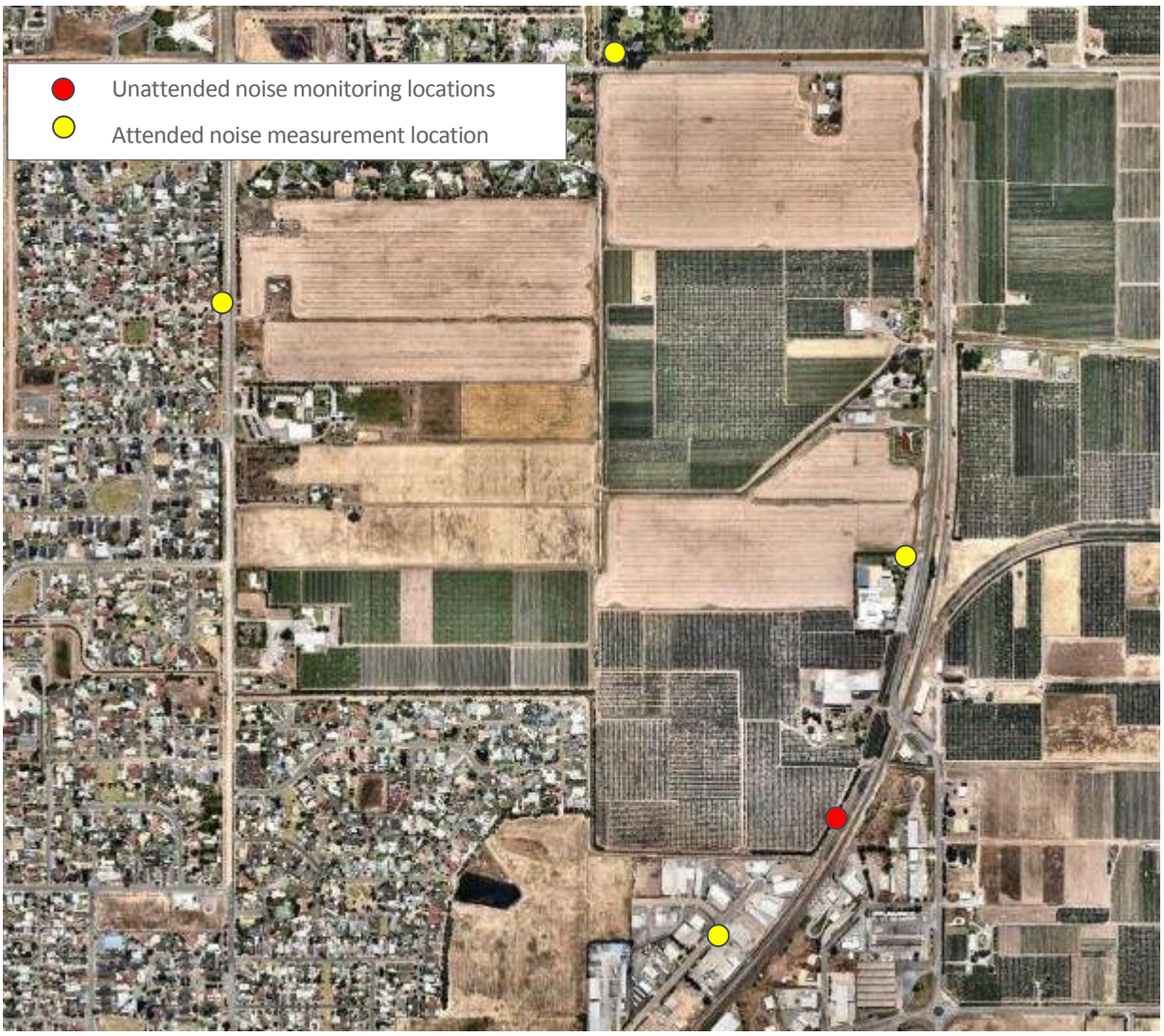
- Bedrooms: 55 dB L_{Amax}
- Other living areas: 60 dB L_{Amax}

These limits are based on a precedent set in the Victorian Civil and Administrative Tribunal (VCAT) regarding acceptable internal noise levels for residences adjacent to Tramway lines (Reference No. P2470/2003). In this case, a decision to grant a permit was made on the basis that the noise level of trains was not to exceed 55 dB L_{Amax} in bedrooms and 60 dB L_{Amax} in living areas. These levels were based on the commonly-used criteria for sleep disturbance taken from the *NSW Road Noise Policy* discussed in Section 6.5.

Since 2003, there have been two VCAT decisions which have recommended an internal noise limit of 50 dB L_{Amax} in bedrooms. However, there is no compelling case for the lower criterion as the decisions were not based on objective evidence presented to the Tribunal and are, in MDA's opinion, unnecessarily restrictive. 55 dB L_{Amax} is very close to the threshold of onset for noise-related sleep disturbance, and there is almost no significant difference (<1%) in reported levels of sleep disturbance between 55 dB L_{Amax} and 50 dB L_{Amax}.

The 55 dB L_{Amax} criterion has now been accepted by Public Transport Victoria (PTV) in a letter dated 18 October 2012, in relation to a residential development in Braybrook. Further details can be provided upon request.

APPENDIX D NOISE MEASUREMENT LOCATIONS



APPENDIX E ATTENDED NOISE MEASUREMENT SUMMARY

Traffic and train noise levels were measured on Grahamvale Road, Ford Road and Verney Road using a Brüel and Kjær Type 2250 precision integrating sound level meter fitted with a windshield.

The microphone was mounted on a tripod at a height of approximately 1.5 m above local ground level under free-field conditions. The measurement locations are shown in Appendix E.

Measurements were obtained using the 'F' response time and A-weighting frequency network. The equipment was checked before and after the survey and no significant calibration drifts were observed.

A summary of the measured noise levels is presented in Table 14.

Table 16: Summary of attended noise measurements

Start Time	Comment	Maximum noise level, L_{Amax}, dB	Average noise level, L_{Aeq} dB
2/02/2017 16:23	Batching Plant, Apollo Drive - nothing audible	61	47
2/02/2017 16:33	Daytime traffic on Grahamvale Road	85	69
2/02/2017 16:48	Daytime traffic on Grahamvale Road	89	71
2/02/2017 16:54	Freight train pass-by on Grahamvale Road	100	83
2/02/2017 16:54	Daytime traffic on Grahamvale Road	87	70
2/02/2017 17:16	Daytime traffic on Ford Road	85	67
2/02/2017 17:41	Daytime traffic on Verney Road	90	62
2/02/2017 22:28	Night-time traffic on Grahamvale Road	90	69
2/02/2017 22:45	Night-time traffic on Grahamvale Road	86	67
4/05/2017 12:29	Batching plant idling at 60 m to the north	84	66
4/05/2017 12:55	Batching plant operating normally at 60 m to the north	79	66

It was observed that traffic noise is the dominant source in each location. However traffic flows on Ford Road and Verney Road were significantly lower than Grahamvale Road.

Train pass-bys were the dominant source of noise on Grahamvale road at times when they were observed to occur.

APPENDIX F UNATTENDED NOISE MEASUREMENT SUMMARY

Railway noise levels at the site were measured using a Rion NL-31 precision integrating sound level meter fitted with a weatherproof windshield.

The microphone was mounted on a pole at a height of approximately 1.5m above local ground level under freefield conditions. A photograph of the noise monitor in-situ is presented as Figure 6.

Figure 6: Noise monitor in-situ

Measurements were obtained using the 'F' response time and A-weighting frequency network. The equipment was calibrated before and after the survey and no significant calibration drifts were observed.

Consecutive one minute measurements of environmental noise levels were obtained between 1300 hrs on Thursday 2 and 1200 hrs on Sunday 12 February 2017. The measurement location is shown in Appendix E.

The prevailing environment was characterised by typical rural noise sources. Distant traffic on surrounding roads was audible. Train pass-bys on the adjacent rail line were dominant when they occurred. Measured noise levels are summarised in Tables 14, 15 and 16 and are presented graphically in Appendix H.

Table 17: Measured ambient noise levels

Period	Highest Ambient Noise Level, $L_{Aeq,15\ mins}$ dB		
	Day	Evening	Night
Thursday, 02 February 2017	57	51	64
Friday, 03 February 2017	75	56	56
Saturday, 04 February 2017	58	58	57
Sunday, 05 February 2017	64	57	63
Monday, 06 February 2017	66	55	54
Tuesday, 07 February 2017	61	58	65
Wednesday, 08 February 2017	57	59	53
Thursday, 09 February 2017	60	55	64
Friday, 10 February 2017	54	53	65
Saturday, 11 February 2017	52	52	61
Sunday, 12 February 2017	53	-	-
Maximum	**75**	**59**	**65**

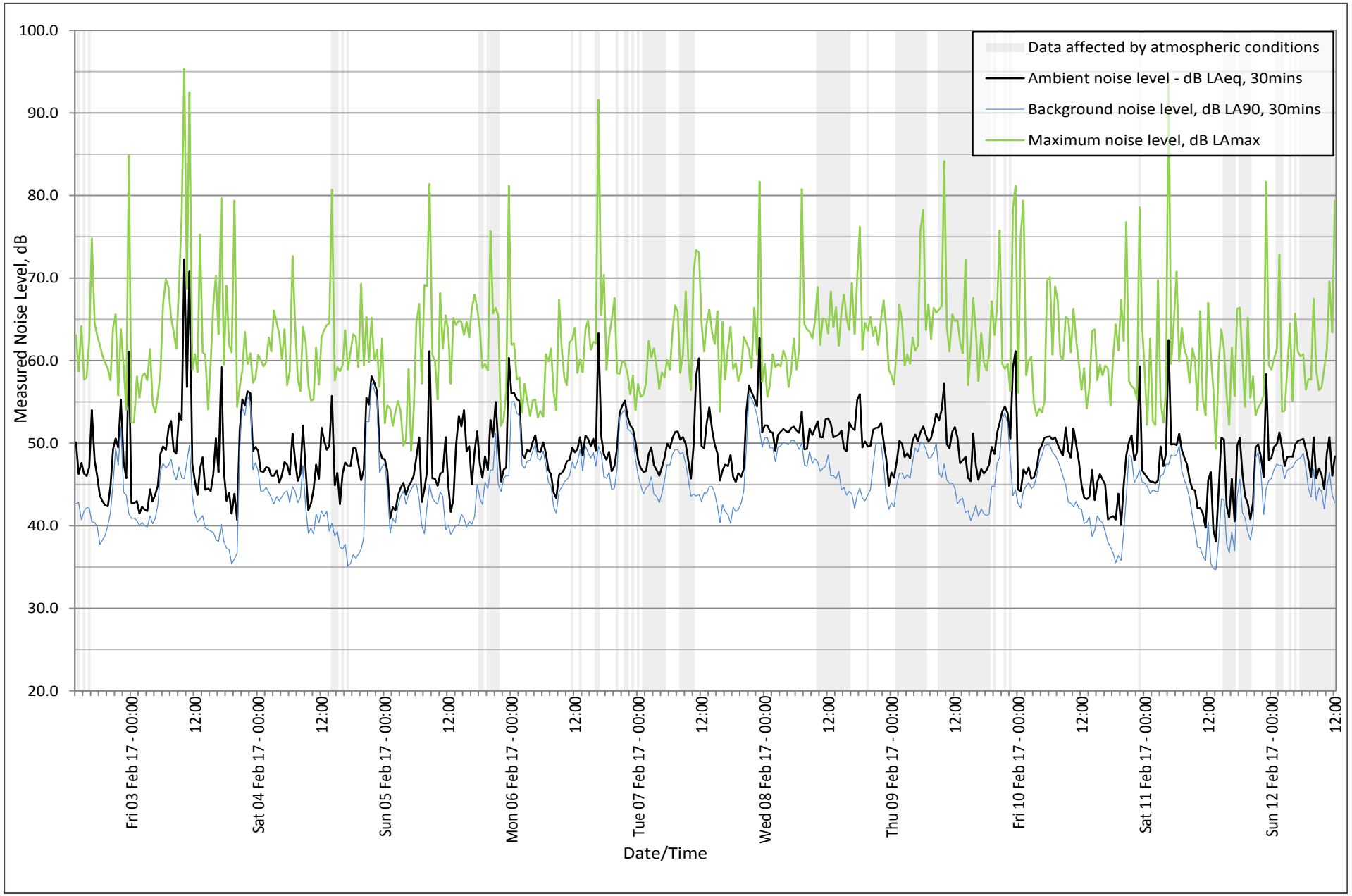
Table 18: Measured railway noise levels

Period	Rail Noise Level, $L_{Aeq,8hr}$ dB		
	Day	Evening	Night
Thursday, 02 February 2017	N/a	N/a	51
Friday, 03 February 2017	N/a	N/a	50
Saturday, 04 February 2017	N/a	N/a	50
Sunday, 05 February 2017	N/a	N/a	53
Monday, 06 February 2017	N/a	N/a	49
Tuesday, 07 February 2017	N/a	N/a	54
Wednesday, 08 February 2017	N/a	N/a	49
Thursday, 09 February 2017	N/a	N/a	53
Friday, 10 February 2017	N/a	N/a	53
Saturday, 11 February 2017	N/a	N/a	51
Sunday, 12 February 2017	N/a	N/a	-
Maximum	**N/a**	**N/a**	**54**

Table 19: Measured maximum noise levels

Period	Maximum Noise Level, L_{Amax} dB		
	Day	Evening	Night
Thursday, 02 February 2017	75	66	85
Friday, 03 February 2017	95	79	73
Saturday, 04 February 2017	81	69	67
Sunday, 05 February 2017	81	76	81
Monday, 06 February 2017	92	68	64
Tuesday, 07 February 2017	73	63	82
Wednesday, 08 February 2017	81	76	78
Thursday, 09 February 2017	84	76	81
Friday, 10 February 2017	69	77	94
Saturday, 11 February 2017	67	66	82
Sunday, 12 February 2017	79	-	-
Maximum	**95**	**79**	**94**

APPENDIX G UNATTENDED NOISE MEASUREMENT RESULTS


Data affected by atmospheric conditions
Ambient noise level - dB LAeq, 30mins
Background noise level, dB LA90, 30mins
Maximum noise level, dB LAmax
Measured Noise Level, dB
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
Fri 03 Feb 17 - 00:00
12:00
Sat 04 Feb 17 - 00:00
12:00
Sun 05 Feb 17 - 00:00
12:00
Mon 06 Feb 17 - 00:00
12:00
Tue 07 Feb 17 - 00:00
12:00
Wed 08 Feb 17 - 00:00
12:00
Thu 09 Feb 17 - 00:00
12:00
Fri 10 Feb 17 - 00:00
12:00
Sat 11 Feb 17 - 00:00
12:00
Sun 12 Feb 17 - 00:00
12:00
Date/Time