

Bacchus Marsh Property Group Pty Ltd

Hopetoun Park Rezoning

Traffic Noise Impact Assessment

Reference: Report 02

Final | 9 June 2023



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1. Executive Summary

The following report is the updated traffic noise impact report for the proposed rezoning of 124, 150 Hopetoun Park Road and 62 Cowans Road (Subject Site). The primary aim of this report is to consider the current and future traffic noise from the Western Freeway and the predicted impact on residents of the proposed residential development by Bacchus Marsh Property Group.

This report is subsequent to Arup Australia Pty Ltd (Arup) report *AC01 v2-0 Hopetoun Park Traffic Noise Impact* which detailed Arup's findings in 2018 including site work, data analysis, noise modelling and reporting. The forementioned was developed in accordance with (VicRoads) Department of Transport and Planning (DTP) Traffic Noise Reduction Policy, February 2005 and DTP Requirements of Developers, 2004 (collectively DTP Policy), as was the State of knowledge at the time. A reduction in proposed site land has made it necessary to reevaluate the original results and suggested actions.

The Subject Site is approximately 150 m setback and adjacent to the Western Freeway on the northern interface. The Western Freeway is approximately 14 m lower than the Subject Site. The change in elevation creates a cutting shield which protects the Subject Site from traffic noise. The Subject Site's eastern and western interface both abut farming zone, whilst the southern interface is shared with a low density residential area. The existing freeway is the primary source of noise to potentially impact the Subject Site.

The EPA requested clarification in their documentation (REQ002884, 22 February 2023) in response to the Arup report *AC01 v2-0 Hopetoun Park Traffic Noise Impact*, in particular with regards to the *Noise of the Moorabool Planning Scheme Clause 13.05* which attaches policy documents; General Environmental Duty (GED) and Environmental Reference Standard (ERS). The GED and ERS provide ambient sound level objectives as a guide to achieve a *reasonable noise* environment, but do not specify source. As noted in the ERS Part 3.9 Table 3.3 of Gazette No. S245, these are typical ambient sound level values in metric $L_{Aeq,16hr}$ and not noise limits for traffic noise. Arup affirms *Traffic Noise Reduction Policy*, February 2005 as the leading policy on traffic noise limits and adherence to supports the ERS values of the ambient sound environment.

The DTP Policy details a Noise limit of 63 dB(A) $L_{10}(18hr)$ (measured between 6 am and midnight) (*Traffic Noise Reduction Policy*, February 2005) to be applied to the 2033 noise prediction model (Appendix D). The traffic noise modelling demonstrates that the Subject Site complies with DTP Policy noise limits. Additionally Arup affirms that no additional noise barriers or noise mitigation is required for the proposed dwellings at Subject Site.

Arup concludes that the traffic noise modelling developed according to the current State of Knowledge provides appropriate methodology to demonstrate that the traffic noise level will comply at the Subject Site. Traffic noise from the Western Freeway will not adversely impact future residential properties at the Subject Site.

2. Introduction

Bacchus Marsh Property Group Pty Ltd propose to rezone a parcel of land in the approved growth area of Hopetoun Park located in the Moorabool Shire Council. It is proposed to rezone farming land (FZ) to residential (NRZ).

The original work that was undertaken for this project related to land either side of Hopetoun Park Road, described as the eastern and western precincts. Both precincts were proposed to be rezoned to Neighbourhood Residential Zone via a Planning Scheme amendment and earlier Arup work considered potential noise impacts to both precincts. However, the land to the east of Hopetoun Park Road has recently been removed from the proposed amendment, due to challenges associated with infrastructure delivery as a result of land fragmentation, as well as some ecological challenges that have emerged during the planning process to date. Accordingly, it is now only the western precinct that forms part of the proposed amendment which includes small portions of various titles known as 62 Cowans Road and that is addressed in this report. Hereafter the Subject Site will only refer to 124, 150 Hopetoun Park Road and various portions of 62 Cowans Road.

The Subject Site is adjacent to the existing Western Freeway and may be affected by traffic noise. Bacchus Marsh Property Group Pty Ltd has commissioned Arup Australia Pty Ltd (Arup) to undertake a traffic noise impact assessment for the Subject Site. The Western Freeway is under the authority of DTP Department of Transport and Planning (DTP), as result DTP policies and guidelines apply. The Western Freeway was previously the governed by VicRoads as the Responsible Authority.

Acoustic terminology used throughout this report is presented in Appendix A.

3. Site Description

3.1 Existing Site

The existing site is currently zoned as Farming Zone (FZ) and contains associated residential dwellings. The properties within the Subject Site include 124 Hopetoun Road, 150 Hopetoun Road and 62 Cowans Road.

The property abutting the freeway to the north includes:

- 124 Hopetoun Road

The site is bounded by:

- North: The Western Freeway. The Freeway is governed by DTP. It is understood that VicRoads was the Responsible Authority.
- East: Hopetoun Park Road, followed by Farming Zone (FZ)
- South: Hopetoun Park Low Density Residential area (LDRZ)
- West: Farming Zone (FZ)

Both carriageways of the Western Freeway are approximately 14 m in cut along the north interface. The Subject Site is setback from the Western Freeway, is elevated when compared to the Western Freeway and has no direct line-of-sight from the Subject Site to the Western Freeway. The Western Freeway cutting shields the Subject Land from traffic noise emitted from the Western Freeway.

3.2 Proposed Development

It is proposed that the Subject Site will be rezoned to cater for residential development. It is envisaged that the density of development will be greater than the existing Hopetoun Park community, but less than conventional residential densities, with typical lots sizes between 800 m² and 1500 m².

It is proposed to rezone the Subject Site from Farming (FZ) to Residential (NRZ). A detailed subdivision plan has not yet been developed.

4. Noise Criteria

4.1 Road Traffic Noise for Roads under DTP Authority

While Planning Permit conditions are not yet available, noise conditions are typically required to be in line with the (VicRoads) *DTP Traffic Noise Reduction Policy*, February 2005 and *DTP Requirements of Developers*, 2004 (collectively *DTP Policy*).

On this basis the road traffic noise from the Western Freeway must be mitigated by the developer to meet 63 dBL_{A10, 18 hour} or less 10-years after occupation, measured 1 m from the facade of a proposed residential dwelling. In accordance with DTP Policy, Year 2033 will be approximately 10 years from the first residential occupation is expected on the Subject Site.

4.2 Road Traffic Noise for Roads not under DTP Authority

Vicroads Requirements of Developers has been reviewed however does not apply to the residential allotments adjacent to Hopetoun Park Road, as they are not adjacent to a freeway under DTP control. As a result, it is common practise to consider Australian Standards to control road traffic noise. It is suggested to consider the following standards:

- *AS 2107 – 2016 Acoustics – Recommended design sound levels and reverberation times for building interiors*
- *AS 3671 – 1989 Acoustics – Road traffic noise intrusion – Building siting and construction.*

AS 3671¹ recommends that satisfactory indoor sound levels should be determined from AS 2107². AS 2107 provides guideline design criteria for conditions affecting the acoustic environment within occupied spaces. The ambient sound levels recommended should consider the function of the area(s) and apply to the sound level measured with the space when unoccupied but ready for occupancy. The Standard also provides methods of measuring the ambient sound level and reverberation time in occupied spaces in new and existing buildings.

The purpose of AS 3671 is to achieve compliance with AS 2107. Demonstrating compliance with AS 2107 is therefore equivalent to conformance with AS 3671. An extract of some of the recommended levels that are applicable to the proposed development is provided in Table 1. Section 7.2 of this report details our findings with regards to AS2107.

Table 1: From AS2107 – 2016, Table 1 - Recommended design sound levels in areas of houses and apartments near major roads.

Type of occupancy/activity	Recommended design sound level range, L _{Aeq,1t} dB(A)
Living areas	35 – 45
Sleeping areas	35 – 40
Work areas	35 – 40

4.3 Response to EPA Letter dated 22 February 2023

Arup understands that the Environment Protection Authority Victoria (EPA) has responded to documents prepared on behalf of Bacchus Marsh Property Group (*Hopetoun Park, Traffic Noise Impact Assessment, Report 02, dated 3 August 2021*). The following provides a considered response to comments raised by the EPA with regards to traffic noise criteria.

¹ AS3671-1989 *Acoustics – Road traffic Noise Intrusion – Building Siting and Construction.*

² AS2107-2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors*

4.3.1 Moorabool Planning Scheme

The EPA's response highlighted concern over the exclusion of the Moorabool Planning Scheme (MPS) noise management clause in the Arup assessment. Moorabool Planning Scheme provides framework to guide decisions about the use and development of land in the council area. Clause 13.05 of MPS specifies noise management on sensitive land uses and cites the following policy documents considered relevant:

- *Environment Protection Regulations* under the Environment Protection Act 2017
- *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues* (Publication 1826, Environment Protection Authority, May 2021)
- *Environment Reference Standard* (Gazette No. S 245, 26 May 2021)
- *Passenger Rail Infrastructure Noise Policy* (Victorian Government, 2013)
- *VicTrack Rail Development Interface Guidelines* (VicTrack, 2019)

4.3.2 Environmental Protection Act

The Environmental Protection (EP) legislation, the Environment Protection Act 2017 (the Act) as amended by the Environment Protection Amendment Act 2018 introduces and describes the General Environmental Duty (GED). The GED requires organisations to understand and minimise the risks of harm to human health and the environment from pollution and waste (including noise) from their activities. The relevant section of the Act for noise is Section 166 – Unreasonable noise, to provide a legislative control for any noise emitted from a place or premises.

Harm is defined as:

In this Act, harm, in relation to human health or the environment, means an adverse effect on human health or the environment (of whatever degree or duration) and includes—

- an adverse effect on the amenity of a place or premises that unreasonably interferes with or is likely to unreasonably interfere with enjoyment of the place or premises; or*
- a change to the condition of the environment so as to make it offensive to the senses of human beings; or*
- anything prescribed to be harm for the purposes of this Act or the regulations.*

(2) For the purposes of subsection (1), harm may arise as a result of the cumulative effect of harm arising from an activity combined with harm arising from other activities or factors.

Unreasonable noise means noise that:

- is unreasonable having regard to the following—
 - its volume, intensity or duration;
 - its character;
 - the time, place and other circumstances in which it is emitted;
 - how often it is emitted;
 - any prescribed factors; or
- is prescribed to be unreasonable noise;

Under the GED, anyone who is engaging in an activity that poses risk of harm to human health and the environment, from pollution or waste, must manage that risk. Noise is covered under this definition. Risks are required to be eliminated or reduced as far as reasonably practicable, by implementing appropriate controls.

Reasonably practicable is defined as:

“Reasonably practicable means putting in controls that are proportionate to the risk. It relates to the chance of harm occurring and potential impacts on the environment. It also relates to what controls are available, their cost, and considers what an industry generally knows about the risk and control options. This is termed the ‘state of knowledge’.”

4.3.3 Environment Reference Standard Gazette No. S 245

Part 3.9 Table 3.3 of Gazette No. S245 provides ambient sound objectives for land use category III (general residential). Although the ERS provides noise level objectives that are typical ambient sound levels, the noise levels are neither noise limits nor criteria.

Figure 1: ERS Gazette No.S245 Part 3.9

9 Indicators and objectives

- (1) For the ambient sound environment, for each land use category—
 - (a) the indicators are set out in column 2 of Table 3.3; and
 - (b) the objectives are set out in column 3 of Table 3.3.
- (2) For land that is classified as Category V, the qualitative indicator and objective set out for Category V in Table 3.3 apply irrespective of the planning zones that apply to that land.

Note

The objectives for each land use category are typical ambient sound level values and are neither noise limits nor noise design criteria.

Table 3.3: Indicators and objectives for the ambient sound environment

Column 1 Land use category	Column 2 Indicators	Column 3 Objectives
Category I	Outdoor $L_{Aeq,8h}$ from 10 p.m. to 6 a.m.	55 dB(A)
	Outdoor $L_{Aeq,16h}$ from 6 a.m. to 10 p.m.	60 dB(A)
Category II	Outdoor $L_{Aeq,8h}$ from 10 p.m. to 6 a.m.	50 dB(A)
	Outdoor $L_{Aeq,16h}$ from 6 a.m. to 10 p.m.	55 dB(A)
Category III	Outdoor $L_{Aeq,8h}$ from 10 p.m. to 6 a.m.	40 dB(A)
	Outdoor $L_{Aeq,16h}$ from 6 a.m. to 10 p.m.	50 dB(A)
Category IV	Outdoor $L_{Aeq,8h}$ from 10 p.m. to 6 a.m.	35 dB(A)
	Outdoor $L_{Aeq,16h}$ from 6 a.m. to 10 p.m.	40 dB(A)
Category V	Qualitative	A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape

ambient sound environment: means the external sound environment, it does not include the sound environment inside buildings or structures, but does include vibration;

4.3.4 State of Knowledge

The VicRoads Traffic Noise Reduction Policy 2005 provides guidance on traffic noise management to developers, it is our understanding this policy has not been superseded and remains relevant for the assessment of road traffic noise to residential properties.

The VicRoads Traffic Noise Reduction Policy 2005 requires developers of residential properties abutting future or existing freeways to ensure that traffic noise at future dwellings will not exceed the noise limit 63 dB(A) $L_{10}(18hr)$ measured between 06.00 hrs – midnight (6.00 am and midnight).

VicRoads Traffic Noise Reduction Policy 2005 is a compliance document that specifically applies noise limits to noise emitted from roads governed by VicRoads (DTP) to existing or future residential properties throughout Victoria. Adherence to this policy forms part of the current State of Knowledge that duty holders should take into account when meeting the GED.

Ambient noise objectives defined by the Environment Reference Standard Gazette No. S 245 2021 are measured in $L_{Aeq,8hr}$ 22.00 hrs – 06.00 hrs (10.00 pm to 6.00 am) and $L_{Aeq,16hr}$ 06.00 hrs – 22.00 hrs (6.00 am and 10.00 pm) which is not directly comparable to noise limits defined by VicRoads which are measured in $L_{10,18hr}$. As a result, the measured and predicted noise levels that address VicRoads policy *are not* directly comparable to variables or ambient noise levels presented in the ERS and on that basis the noise levels presented in the ERS are not to be considered to address road traffic noise from freeways governed by the DTP (incorporated the previous Responsible Authority) VicRoads.

It is our opinion that traffic noise limits shall remain defined as presented within the VicRoads *Traffic Noise Reduction Policy*, February 2005.

4.3.5 Assessment Methodology

Hopetoun Park Development will be located in the vicinity of Western Freeway and any residential developments are required by precedent to comply with VicRoads noise requirements and Arup have been engaged to undertake this scope of work.

Noise measurements and data analysis were conducted according to VicRoads Traffic Noise Measurement Requirements for Acoustic Consultants.

VicRoads documents are:

- *VicRoads Traffic Noise Reduction Policy, February 2005*
- *VicRoads Requirements of Developers, 2004 (collectively VicRoads Policy).*

The Subject Site is not a noise emitter and, on that basis, traffic noise from the Western Freeway was assessed in accordance with relevant policy. An assessment in accordance with *Noise Protocol* (EPA Publication 1826.4), *Passenger Rail Infrastructure Noise Policy* (PRINP) and VicTrack guidelines did not form part of the assessment.

4.4 Criteria Summary

VicRoads *Traffic Noise Reduction Policy 2005* is the industry standard to assess traffic noise impacts to residential properties abutting future or existing freeways. The forementioned policy provides specific limits and framework which support noise objectives and goals outlined by Environment Reference Standard Gazette No. S 245 2021 and the General Environmental Duty under the EPA Act 2017.

VicRoad's traffic noise limit of 63 dB(A) $L_{10}(18hr)$ (measured between 6 am and midnight) forms part of the current 'State of Knowledge' and was the framework for Arup's assessment of 'reasonable noise' (as referenced by GED) from the Western Freeway on the proposed development.

5. Traffic Noise Monitoring

Arup deployed long-term noise monitoring devices at seven (7) locations along the northern boundary of the Subject Site and the eastern neighbouring site. The locations are presented on the aerial image in Appendix B.

A summary of the average measured levels is provided in Table 2.

Table 2: 2018 Measured Traffic Noise Levels

Location Number	Logger Serial Number	Measured Traffic Noise Level, $L_{A10,18hr}$ dB	Measured Short Term Noise Level, L_{A10} dB	
1	8780E8	-	52	
2	8780E5	-	56	
3	878107	61	58	
4	8780E7	61	60	
5	8780E6	-	61	
6	8780D1	62	-	
7	8781AD	60	-	

Unattended noise monitors with serial numbers 8780E8 and 8780E5 (Location 1 and 2) were no longer in position when Arup staff expected to collect the devices. Noise monitor 8780E6 (Location 5) did not collect adequate data to demonstrate an appropriate trend of noise levels.

Short term attended measurements were undertaken at Locations 1 to 5 to verify the unattended measurements. L_{A10} noise levels are presented in Table 2. Where possible the long-term unattended and short term attended traffic noise correlate within 1-3 dB. This is within the acceptable range, as the unattended traffic noise level demonstrates a long-term average for each location.

Due to change in site scope and data availability the most appropriate noise monitoring data from two (2) devices (locations 3 and 4) were used to complete site calibration of the traffic noise model. Based on Arup's previous experience with traffic noise modelling, the captured data is sufficient to adequately calibrate the noise model.

Further information and discussion of the noise measurements is presented in Appendix C.

6. Traffic Noise Modelling

The computer software package SoundPLAN version 8.0, implementing the CoRTN³ noise prediction methodology has been used to predict the $L_{A10, 18 \text{ hour}}$ road traffic noise levels on the Subject Site.

The noise model includes the design elevation data, and Year 2033 traffic volumes. Year 2033 traffic volumes have been determined based on Year 2023 traffic volumes using a percentage growth in traffic volumes as specified by DTP data on their website, for the sections of road.

The noise model has been calibrated by comparing the 2018 predicted noise levels with the 2018 existing measured traffic noise levels. The calibration procedure has been provided in Section 5.1. The inputs used to create the acoustic model are identified in Table 3 below.

Table 3: Noise model input sources

File Name	Description	Source	Date
18619_contour-0.5m.dxf	5 m contour drawing file	Hansen Partnership	Received 19 December 2018
Hopetoun park north ownership plan.pdf	Existing property boundaries	Hansen Partnership	Received 14 December 2018
Existing traffic volumes	http://vicroadsopendata.vicroadsmaps.opendata.arcgis.com/datasets/	DTP	25 May 2023

The following assumptions have been incorporated in the noise modelling:

- The existing Western Freeway has been modelled with a -1 dB road surface correction, assuming a stone mastic asphalt finish, in accordance with VicRoad's Road Design Note 06-01 – July 2010
- Receiver height: 1.5 m above ground level
- Facade reflection: +2.5 dB
- Ground absorption: 70 % absorptive, as determined during the calibration process.
- A factor of 0.95% has been used to convert AADT traffic volumes to 18-hour traffic volumes

The existing and future traffic volumes are identified in Table 4 below.

³ Department of Transport Welsh Office HMSO, *Calculation of Road Traffic Noise (CoRTN)*, April 1988

Table 4: Traffic volumes for modelling

Year 2023			
Road Name	Direction	AADT	Percentage (%) Heavy Vehicles
Eastern Freeway between Hopetoun Park Road and Bacchus Marsh-Gisborne Road	East Bound	20000	19
Western Freeway between Hopetoun Park Road and Bacchus Marsh-Gisborne Road	West Bound	20000	15
Year 2033			
Road Name	Direction	AADT	Percentage Heavy Vehicles
Eastern Freeway between Hopetoun Park Road and Bacchus Marsh-Gisborne Road	East Bound	27140	19
Western Freeway between Hopetoun Park Road and Bacchus Marsh-Gisborne Road	West Bound	23906	15

6.1 Noise Modelling Calibration

The traffic noise model has been calibrated by comparing the predicted noise levels from the noise model using existing traffic volumes with the measured road traffic noise levels provided in Section 5. The average measured noise level and the predicted noise level are presented in Table 5.

Table 5: Measured and predicted traffic noise level

Location No.	2018 - Road Traffic Noise Level dBL _{A10,18hr}	
	Average Measured	Predicted
Location 3	61	64
Location 4	61	65

The information provided in Table 2 and the result presented in Table 5 assists in verifying and calibrating the traffic noise model. Noise monitoring locations 4, 5 and 6 are ideally positions for calibrating the noise model, since there is no barrier or minimal topographical obstacles between the Western Freeway and noise logger position.

In most cases, the traffic noise model over-predicts with respect to measured noise level by an average of 3 dB. Therefore, a correction factor of minus (-) 3 dB has been applied to the traffic noise model to accommodate for local conditions.

Location 3 traffic noise monitoring data has been excluded in the traffic noise model calibration process. The device at Location 3 was impacted by local traffic noise along Hopetoun Park Road. Hopetoun Park is not assessed in accordance with DTP policies and has been excluded from the calibration process.

The predicted noise levels in Table 5 exclude a plus (+) 2.5 dB façade correction.

Note the above figures in Table 5 are only used to calibrate the 2033 noise model.

6.2 Noise Model Limitations

This assessment includes limitations to accuracy, scope and detail due to the environmental circumstances of a new development and available design information, this includes the accuracy of the ground model, and traffic volume data used in the noise model.

These limitations are considered and addressed as part of this assessment. In many cases, the limitations and associated risks have been mitigated by calibration of the acoustic model.

7. Summary of Results

7.1 ERS Review

The EPA has requested for a comparison against the Environment Reference Standard Gazette No. S 245 2021 objectives are measured in $L_{Aeq,16hr}$ 06.00 hrs – 22.00 hrs (6.00 am and 10.00 pm).

Presented in Table 6 are the measured noise levels in the metric stated by ERS No. S 245 2021. The complete data set may be found in Appendix C.

Table 6: 2018 Measured noise levels in $dBL_{Aeq,16hr}$

Location No.	Measured Noise Levels $dBL_{Aeq,16hr}$
Location 3	60
Location 4	60

Based on the site noise monitoring data and analysis there is a 1 – 2 difference between the $L_{eq\ 16\ hr}$ and $L_{10\ 18\ hr}$ for the allocated noise monitoring positions. This information may assist the EPA in assessing Subject Site based on existing conditions and future scenarios.

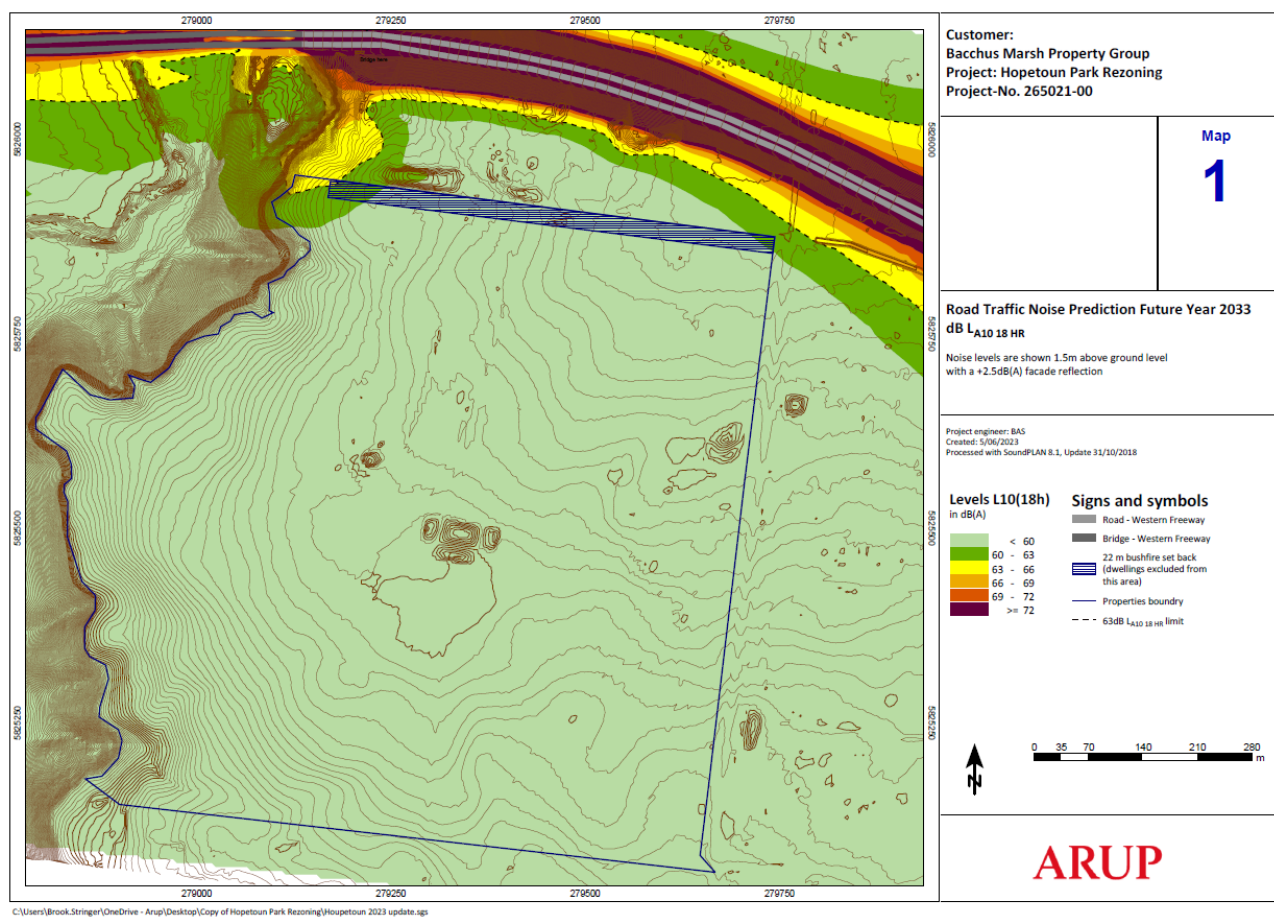
Arup maintains current noise limits to be below 63 dB $L_{A10,18hr}$ as outlined in the VicRoads *Traffic Noise Reduction Policy 2005*. The overall assessment will be driven by the measured data in the metric $L_{A10,18hr}$.

7.2 Results

Arup has completed the 2033 (10 year) traffic noise modelling assessment for the Subject Site. The results of the assessment demonstrate that the land proposed for residential development at 124 Hopetoun Park Road, 150 Hopetoun Park Road and 62 Cowans Road is predicted to be below the 63 dB $L_{A10,18hr}$ contour in 2033. Demonstrating that traffic noise levels at the Subject Site will continuously comply with DTP noise limits without additional noise mitigation. This is illustrated in the contour plot presented in Figure 2 and Appendix D.

Further, internal noise levels presented in Table 1 and in accordance with AS2107 will be achieved with conventional dwelling façade, roofing, and glazing construction.

Figure 2 2033 Noise Contour Plot



8. Conclusions

Arup has completed an assessment of exiting site conditions and road traffic noise levels impacting the land proposed for residential development.

A calibrated traffic noise model has been used to predict road traffic noise levels emanating from the Western Freeway in the Year 2033 to the proposed residential land. A traffic noise assessment has been completed in accordance with DTP' noise policies and guidelines.

Land located at 124 Hopetoun Park Road, 150 Hopetoun Park Road and 62 Cowans Road will not require specific noise mitigation to comply with DTP noise limits. The results of the assessment suggest traffic noise will not adversely impact the amenity of the proposed residential development.

Appendix A

Acoustic Terminology

A.1 Acoustic Terminology

dB(A)

The unit generally used for the measurement of environmental, transportation or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). The A-weighting is based on the frequency response of human hearing (for a given sound pressure level, low frequency sounds do not seem as loud as mid or high frequency sounds) and has been found to correlate well with human subjective reaction to various sounds.

An A-weighting network is built into sound level measuring instrumentation such that sound levels can be read directly from the meter in dB(A). An increase or decrease in sound level of approximately 10 dB(A) corresponds to a subjective doubling or halving in loudness. A change in sound level of 2 to 3 dB(A) is subjectively just noticeable.

Statistical Indices (L90, L10 etc)

Noise levels that vary with time may also be analysed using statistical indices. The L10 index represents the noise level that is exceeded for 10% of the measurement period. It was developed for use in the assessment of the potential for time varying noise to interfere with speech communication and represents an “intrusive noise level”. The L90, the level exceeded for 90% of the measurement time, represents the background noise level.

A-weighted statistical levels are denoted LA10, LA90 etc.

LA10,18hr

The hourly LA10 value is the noise level exceeded for 6 minutes in that hour. The LA10, 18hr level is determined by averaging the hourly LA10 value for each hour from 6am until midnight.

Appendix B

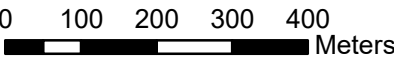
Maps



Legend

- NML 3 & 4
- NML 1,2,5,6 & 7
- Area

01	17/05/2023	BAS	KF	KF
Issue	Date	By	Chkd	Appd



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Client
Bacchus Marsh Property Group Pty Ltd

Job Title
Hopetoun Park North

Figure Title
Noise Monitoring Locations

Scale at A4 1:10,000	Figure Status Rev0
--------------------------------	------------------------------

Coordinate System
GDA 1994 MGA Zone 55

Job No 265021	Figure No
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COMMERCIAL IN CONFIDENCE

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Appendix C

Noise Survey

C.1 Noise Monitoring Methodology

Noise monitoring was undertaken between 15 November and 6 December 2018 at five (5) locations in general accordance with VicRoads *Traffic Noise Measurement Requirements for Acoustic Consultants*, September 2011.

Wind speed was recorded as above VicRoads recommendations for some periods during the measurement period used as part of this assessment, however based on review of the historical wind speed data, these wind speeds are typical for December, with wind speeds rarely dropping below the VicRoads recommended wind speed (less than 5% of the time).

Noise loggers were installed on the Subject Site at locations on the northern boundaries of the existing properties. A layout of measurement locations is presented in Appendix B.

A summary of the measured $L_{A10, 18hr}$ noise level is provided in Table 7 below.


Table 7: Summary of measured noise levels

Location	Logger serial number	Noise Level Metric, dB(A)				
		$L_{10, 18hr}$	$L_{eq, 15hr}$	$L_{eq, 16hr}$	$L_{eq, 9hr}$	$L_{eq, 8hr}$
1	8780E5	-	-	-	-	-
2	8780E8	-	-	-	-	-
3	878107	61	60	60	55	54
4	8780E7	61	59	59	56	55
5	8780E6	-	-	-	-	-
6	8780D1	62	62	62	59	58
7	8781AD	60	59	59	55	54


Loggers 8780E8 and 8780E5 were stolen, and no noise data was able to be collected at these locations. The data associated with Logger 8780E6 was not considered appropriate for use and has been excluded from the assessment.

C.2 Noise Monitoring Details

C.2.1 Location 3

Description	Details
Noise Logger	Acoustic Research Laboratories Ngara Noise Logger, S/N 878107
Location	Attached to fence west of Hopetoun Park Road
Coordinates (Latitude, Longitude)	-37.688672, 144.501859
	

C.2.2 Location 4

Description	Details
Noise Logger	Acoustic Research Laboratories Ngara Noise Logger, S/N 8780E7
Location	Attached to fence north of 97 Hopetoun Park Road, between the property boundary and the earth berm adjacent to the freeway offramp
Coordinates (Latitude, Longitude)	-37.688700, 144.504997
	

C.3 Hourly Noise Measurement Results

C.3.1 Location 3

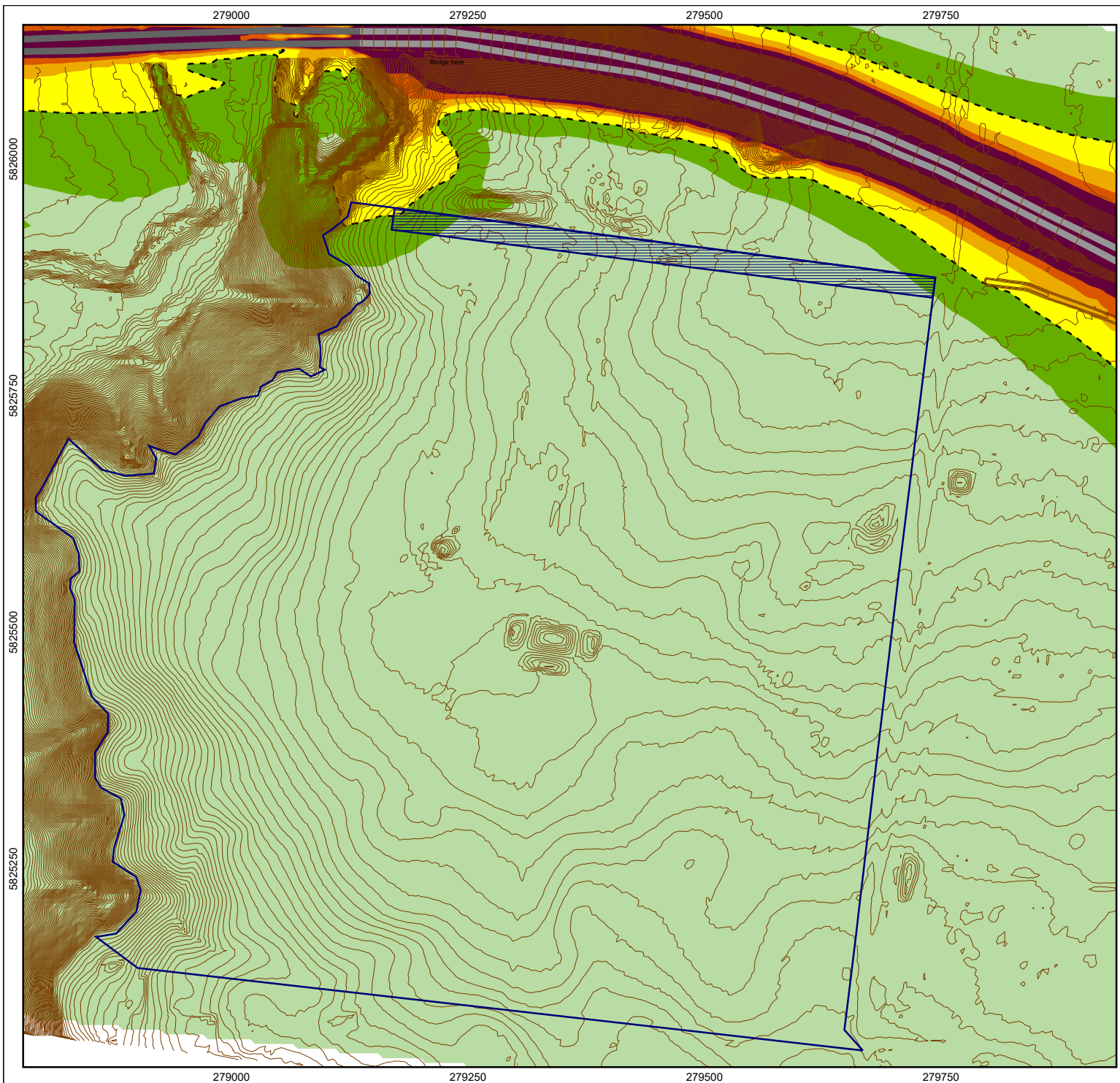
Date			Tuesday		Wednesday		Thursday	
			20 Nov 2018		21 Nov 2018		22 Nov 2018	
Time (hrs)			L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
			(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
00:00	-	01:00	53	55	55	55	53	55
01:00	-	02:00	56	58	55	57	52	54
02:00	-	03:00	55	58	56	56	50	52
03:00	-	04:00	54	58	52	54	47	49
04:00	-	05:00	57	59	51	52	50	51
05:00	-	06:00	60	62	55	54	55	55
06:00	-	07:00	62	63	60	60	61	62
07:00	-	08:00	61	63	59	60	61	64
08:00	-	09:00	61	64	59	62	61	64
09:00	-	10:00	62	65	59	64	62	65
10:00	-	11:00	59	62	57	60	58	61
11:00	-	12:00	57	60	58	59	56	58
12:00	-	13:00	59	61	58	59	56	58
13:00	-	14:00	58	61	56	56	58	60
14:00	-	15:00	59	61	58	59	59	61
15:00	-	16:00	61	63	58	60	59	63
16:00	-	17:00	64	67	61	63	60	65
17:00	-	18:00	63	67	59	62	60	64
18:00	-	19:00	62	65	61	64	61	65
19:00	-	20:00	60	64	60	64	61	65
20:00	-	21:00	58	61	59	61	59	61
21:00	-	22:00	57	59	59	62	58	59
22:00	-	23:00	54	54	56	57	58	58
23:00	-	00:00	53	53	58	56	56	57
L _{Aeq} , 16 hour (dB)			61		59		60	
L _{A10} , 18 hour (dB)				62		60		62

C.3.2 Location 4

Date			Tuesday		Wednesday		Thursday	
			20 Nov 2018		21 Nov 2018		22 Nov 2018	
Time (hrs)			L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
			(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
00:00	-	01:00	57	60	55	59	58	62
01:00	-	02:00	57	60	54	57	56	60
02:00	-	03:00	55	59	53	57	55	59
03:00	-	04:00	53	57	52	56	53	57
04:00	-	05:00	57	61	54	57	54	58
05:00	-	06:00	61	64	56	59	59	62
06:00	-	07:00	64	66	59	61	62	64
07:00	-	08:00	64	66	59	62	63	65
08:00	-	09:00	64	66	59	61	63	65
09:00	-	10:00	64	66	57	60	63	65
10:00	-	11:00	63	65	55	58	60	62
11:00	-	12:00	60	63	55	58	59	62
12:00	-	13:00	60	63	55	58	57	60
13:00	-	14:00	61	64	55	58	55	58
14:00	-	15:00	60	63	57	60	58	61
15:00	-	16:00	61	64	58	61	60	63
16:00	-	17:00	62	64	60	63	57	60
17:00	-	18:00	61	64	61	64	58	61
18:00	-	19:00	61	64	62	65	61	63
19:00	-	20:00	60	63	62	65	59	62
20:00	-	21:00	56	58	61	64	59	61
21:00	-	22:00	55	58	60	63	58	61
22:00	-	23:00	55	58	59	62	58	61
23:00	-	00:00	54	57	58	61	55	58
L _{Aeq} , 16 hour (dB)			62		58		60	
L _{A10} , 18 hour (dB)				63		61		62

Appendix D

Noise Contour Plot



Customer:
Bacchus Marsh Property Group
Project: Hopetoun Park Rezoning
Project-No. 265021-00

Map

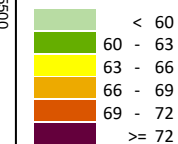
1

Road Traffic Noise Prediction Future Year 2033
dB L_{A10} 18 HR

Noise levels are shown 1.5m above ground level
 with a +2.5dB(A) facade reflection

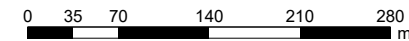
Project engineer: BAS
 Created: 5/06/2023
 Processed with SoundPLAN 8.1, Update 31/10/2018

Levels L10(18h)
 in dB(A)



Signs and symbols

- Road - Western Freeway
- Bridge - Western Freeway
- 22 m bushfire set back
(dwellings excluded from this area)
- Properties boundary
- 63dB L_{A10} 18 HR limit



ARUP