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PROPOSED RESIDENTIAL LAND SUBDIVISION

176-194 THORNHILL ROAD
HIGHTON

Proposal to Rezone the Subject Land from Public Use Zone 1 to General Residential Zone 1

Consideration of Traffic Noise Impacts on Proposed Subdivision Site

Prepared for:
Barwon Water
C/- SMEC – Australia & New Zealand Division

Ref. 11837-6jg
November 2016

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1. INTRODUCTION:

It is proposed to subdivide the land described as 176-194 Thornhill Road, Highton.

The subdivision will be for residential purposes.

Due the proposed use of the land, the subject site will require rezoning from a Public Use Zone 1, to a General Residential Zone 1.

As part of the planning scheme amendment and planning permit application for the subject site, and given the close proximity to the nearby Geelong Ring Road, VicRoads has requested further information with regard to the existing and anticipated future traffic noise level impacts on the subject site.

In order to provide further information, Watson Moss Growcott has carried out an assessment at the site which included the following:

- Two attended site visits during which the attending engineer carried out hand held measurements at the subject site;
- Unattended noise logging at the subject site;
- Traffic noise modelling in accordance with 'Calculation of Road Traffic Noise' – Department of Transport Welsh Office (CoRTN) and the VicRoads Requirements of Developers.

This report outlines the results and findings of the assessment, and provides practical noise control treatments where appropriate.

2. NOISE ASSESSMENT TERMINOLOGY

The following terms are used in this report:

dB(A) Decibels recorded on a sound level meter, which has had its frequency response modified electronically to an international standard, to quantify the average human loudness response to sounds of different character.

L_{90} the level exceeded for 90% of the measurement period, which is representative of the typical lower levels in a varying noise environment. It is the noise measure defined by the EPA as the measure of the background noise level to use in determining noise limits.

L_{eq} the equivalent continuous level that would have the same total acoustic energy over the measurement period as the actual varying noise level under consideration. It is the noise measure defined by the EPA as the measure of the noise to use in assessing compliance with noise limits.

L_{10} Commonly described as the average of the higher levels of a range of noise levels. It is the value of a range of values exceeded for 10% of the observation period, *i.e.* the level exceeded for 6 minutes for every 60 minutes of observation.

$L_{10,18hr}$ The L10,18hour noise level is the arithmetic average of the hourly L10 noise levels measured between 6:00am and midnight.

3. SITE AND ENVIRONS

The subject site is located at the land described as 176-194 Thornhill Road, Highton.

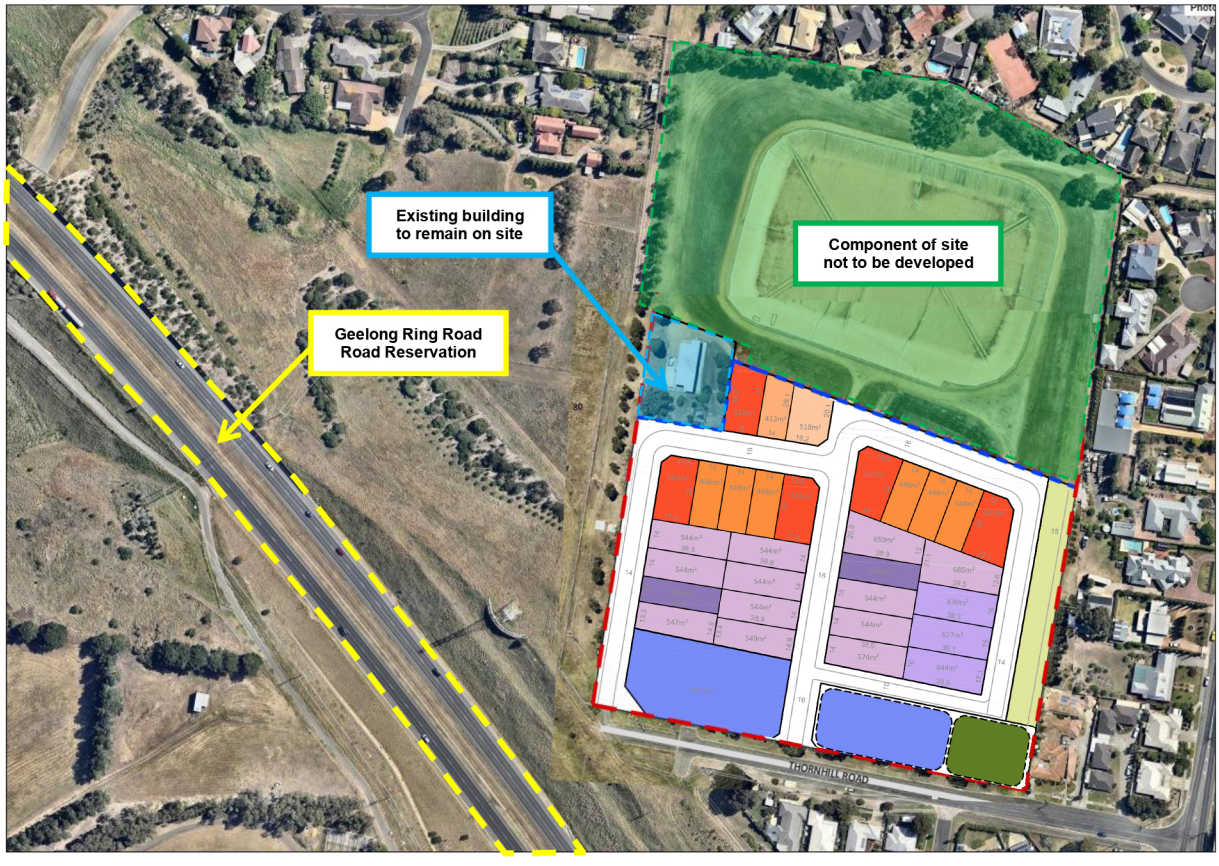
The land abuts existing residential land to the north, east and south, vacant land to the west, and the Geelong Ring Road to the south west.

The land subdivision will be located on the southern component of the land.

The northern component of the land is elevated above the subdivision land, and will remain.

The site land is elevated above the height of the ring road road height by in the order of 10-15 metres.

An aerial photo identifying the relevant components of the site, and the nearby ring road is attached below:



4. VICROADS TRAFFIC POLICY REQUEST FOR FURTHER INFORMATION

As part of the application for the project, VicRoads has requested further information as described below:

The site is located near the Geelong Ring Road, therefore VicRoads will require the applicant to undertake noise measurements and modelling to determine whether any proposed residential property is predicted to have a noise level exceeding 63 dB(A) ($L10_{18hr}$) based on predicted traffic volumes 10 years hence.

If the noise report indicates that noise levels would exceed the above level, a proposal for acoustic measures to be implemented as part of the development of the subdivision must be submitted to and approved by the Responsible Authority.

If the report suggests acoustic measures must be implemented this will be required to be undertaken prior to the certification of the plan of subdivision.

The words within the VicRoads request for further information relate to the VicRoads document entitled "Requirements of Developers".

This document includes the following clauses which are relevant to the assessment:

1. *No house be built in an area with future road traffic noise levels in excess of 70 dB(A) $L_{10,18hr}$ (free field); and*

2. *Noise amelioration be provided so that future road traffic noise levels, when measured one metre from a façade, should not exceed 63 dB(A) $L_{10,18hr}$.(applied to the facades at ground level)*

Where the developer decides, in consultation with VicRoads and Council that it is not desirable to erect high noise barriers then the following conditions should apply to the permits.

3. *The noise sensitive buildings adjacent to the Freeway must be designed and constructed to meet the desirable acoustic standards set out in AS 2107-2000 "Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors". It should be recognized that AS2107-2000 does not adequately consider peak noise levels. Due regard should also be given to the requirements set out in AS 3671-1989 "Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction".*

4. *The developer must provide a fence that visually screens the traffic from the view at the lowest habitable level of the development. This screen would be expected to screen out vehicles that are up to 3.5 metres high*.

The intent of the VicRoads document is to allow residences to be built in areas with future road traffic noise levels in excess of 63 dB(A), but less than 70 dB(A) $L_{10,18hr}$, provided the internal acoustic adequate amenity of dwellings will be maintained.

5. TRAFFIC NOISE MEASUREMENTS AND NOISE LOGGING

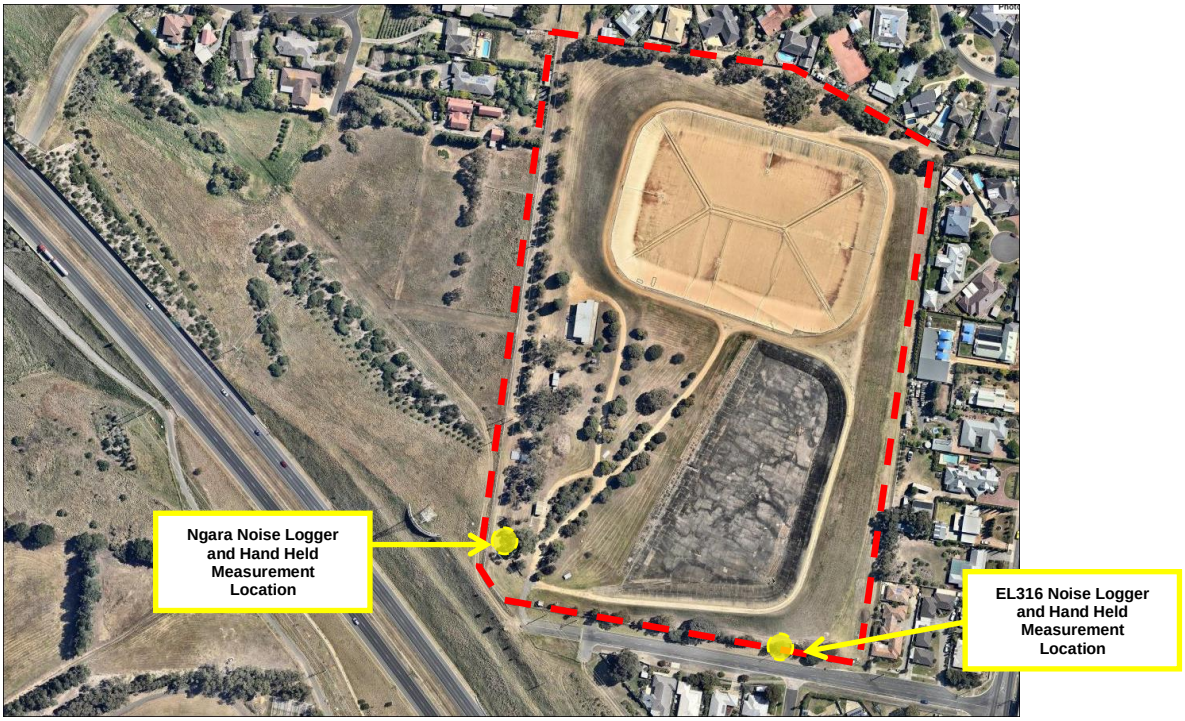
As part of the assessment, Watson Moss Growcott has carried out attended hand held noise measurements, and unattended noise logging at the subject site.

The attended and unattended noise measurements were carried out during the following times:

- Site attended noise survey including hand held measurements between 1:00pm and 2:30pm on Tuesday 1st March 2016.
- Unattended Noise Logging was carried out at the subject site in the period Tuesday 1st March to Monday 7th March 2016.

Handheld noise measurements carried out by the attending engineer were recorded using a RION NA27 Precision Sound Level.

Unattended noise logging was carried out using two separate noise loggers. The environmental noise loggers were one Australian Research Laboratories EL316 Noise Logger, and one Ngara Real Time Sound Acquisition System. A mark up on the assessment locations is attached below:



A summary of the measurement locations and noise measurement equipment is described below:

Noise Measurement Location	Latitude and Longitude of Microphone Position	Noise Logging Device
Location 1	Latitude: 38° 11'08.4" S Longitude: 144° 18'24.1" E	ARL Ngara Environmental Noise Logger
Location 2	Latitude: 38° 11'10.3" S Longitude: 144° 18'30.5" E	ARL 316 Environmental Noise Logger

Location 1 was selected as it is the point on the subject site which receives the greatest exposure to traffic noise associated with the Geelong Ring Road. Location 2 was selected to determine how noise associated with the Geelong Ring Road propagates at greater distances across the subject site.

5.1 WEATHER CONDITIONS DURING UNATTENDED NOISE MONITORING

Noise logging was carried out at the site in the period Tuesday 1st March to Monday 7th March 2016.

VicRoads traffic noise measurement guidelines for acoustic consultants requires that a minimum of three days are recorded as part of any noise measurement assessment.

In addition, the document indicates that wind speeds during noise level measurements 'shall not exceed 3 m/s for any significant period/s during the conduct of the measurements'.

In practice, satisfying each of these requests is challenging.

For the subject site, weather conditions during the logging period were dry. Wind speeds during the early morning and late evening were lower than during the middle of the day and early afternoon.

These conditions are consistent with many other sites across Victoria where higher wind speed conditions typically occur in the middle of the day.

During two of the seven days of logging, the weather conditions typically satisfied the VicRoads request, however there were periods where wind speeds were higher than the VicRoads requirement.

During these periods, the wind direction was assisting propagation of noise associated with the ring road in the direction of the subject site. The measured values at the subject site during these periods were consistent with the values measured during periods when breezes were within the acceptable VicRoads range.

Based on discussions with VicRoads, and given that the breezes were assisting propagation of noise toward the subject site, the measured values during these periods will be acceptable.

In order to satisfy the intent of the VicRoads request and collect a third day of noise logging data, Watson Moss Growcott has combined suitable periods during the afternoon and evening between 1:00pm and midnight on Tuesday 2nd March, and the morning period between midnight and 1:00pm on Wednesday 2nd March 2016.

Based on consideration of the above, a summary of the weather conditions at Geelong during the dates considered suitable for traffic noise analysis are described below:

Date	Time	Wind Speeds (m/s)	Direction of Wind
Wednesday 2nd March 2016	9:00am	1.9	NW
Tuesday 1st March 2016	3:00pm	3.6	N
Thursday 3rd March 2016	9:00am	4.5	SSE
	3:00pm	4.5	SSE
Friday 4th March 2016	9:00am	1.9	S
	3:00pm	3.6	SSE

5.2 MEASUREMENT DATA RECORDED AS PART OF UNATTENDED NOISE LOGGING

The measured noise levels were dominated by noise associated with vehicle movements along the Geelong Ring Road, which is located to the south west of the site.

The measured noise levels have been measured as one hour dB(A) L_{eq} and dB(A)L_{10} values.

The following summarising data has been attached in appendix 8.1:

- Measured Hourly dB(A) L_{eq} and dB(A) L_{10} values;
- Measured dB(A) $L_{10\ 18\ Hour}$ (Arithmetic Average 6am to Midnight);
- Measured dB(A) $L_{eq\ 15\ Hour}$ (Logarithmic Average 7am to 10pm);
- Measured dB(A) $L_{eq\ 16\ Hour}$ (Logarithmic Average 6am to 10pm)
- Measured dB(A) $L_{eq\ 9\ Hour}$ (Logarithmic Average 10pm to 7am)
- Measured dB(A) $L_{eq\ 8\ Hour}$ (Logarithmic Average 10pm to 6am)

6. ROAD TRAFFIC NOISE PREDICTIONS

The VicRoads document requires achieving the design objective noise limits at the facades of future residences for predicted traffic flows 10 years after the opening of the development for sale.

A further VicRoads requirement is for traffic predictions to be made using procedures described in Calculation of Road Traffic Noise- Department of Transport Welsh office (CoRTN)

For this assessment, the CoRTN method was implemented using PEN3D2000 (PEN3D) environmental noise modelling software.

6.1 TRAFFIC NOISE MODELLING

PEN3D's CoRTN implemented noise model requires the following inputs:

1. Traffic flow volumes (vehicles per 18-hours)
2. Proportion of heavy vehicles
3. Traffic speeds
4. Ground surface contour information
5. Road surface contour information
6. Road surface type
7. Location and elevation of road carriageways
8. Location and elevation of user defined noise receptor points
9. Location and elevation of existing and proposed noise barriers

Information regarding the traffic flow volumes, proportion of heavy vehicles, traffic speeds, and road surface types have been provided by VicRoads.

The adopted traffic volumes have been based on data provided for 2013 which included 16000 vehicle movements in each direction in a 24 hour period.

This value was used to determine the 2016 traffic volumes as well as the 2027 future traffic volumes.

All other information has been based on site observations, and information provided by the client.

6.1.1 2016 Traffic Noise Prediction Calibration (CoRTN Modelling Input Data)

The results of the traffic noise measurements at the subject site were used as a basis for calibrating the noise model for predicting traffic noise levels across the subject site 10 years into the future.

Based on information provided by VicRoads, Watson Moss Growcott adopted a linear traffic growth rate of 3% per year.

Furthermore VicRoads has indicated that the existing road surface at the subject site is 14/7 stone seal. The relevant adjustment for this road surface will be +3dB(A).

Based on the above, the following data was used as part of the 2016 modelling process to correlate the measured 2016 values with the predicted 2016 values:

Traffic Volumes (2016) – 18 hour	Northbound – 16568 vehicles Southbound – 16568 vehicles
Traffic Speed	Northbound – 100 kp/h Southbound – 100 kp/h
Traffic Composition	Percentage Heavy Vehicles – 9%
Road Surface	14/7 Stone Seal – +3 dB(A) Adjustment

The 2016 'modelled' noise levels at the most exposed noise logger location 1 were in the order of 62.5 dB(A) $L_{10\ (18hour)}$. The 2016 'measured' values including façade reflection during each of the three assessment days were in the order of 58.5-59.5 dB(A) $L_{10\ (18hour)}$

An adjustment of -3 dB(A) was therefore made to the noise model to correlate the predicted values with the measured values, as a basis for determining the noise levels across the subject site 10 years into the future.

6.1.2 2027 Traffic Noise Prediction (CoRTN Modelling Input Data)

In accordance with the information provided by VicRoads, the traffic volumes predicted during 2027 have been based on a linear traffic growth rate of 3% per year.

The road surface adjustment will remain consistent with what is currently located nearby to the site, and will therefore be treated as a 14/7 stone seal (+3 dB(A) adjustment).

Based on consideration of the above, the following data was used to predict the future traffic noise levels across the subject site during 2027:

Traffic Volumes (2027) – 18 hour	Northbound – 21584 vehicles Southbound – 21584 vehicles
Traffic Speed	Northbound – 100 kp/h Southbound – 100 kp/h
Traffic Composition	Percentage Heavy Vehicles – 9%
Road Surface	14/7 Stone Seal – +3 dB(A) Adjustment

6.2 FUTURE TRAFFIC NOISE LEVEL PREDICTIONS

Increased traffic noise levels at the subject site will relate directly to the traffic flow increases along the Geelong Ring Road carriageway, as well as any changes to the road surface along the Geelong Ring Road carriageway.

It's been indicated by VicRoads that the 14/7 stone seal will remain along the carriageway, therefore the only increase in noise level across the subject site will be due to the linear traffic growth rate of 3% per year.

Based on the above, a summary of the predicted noise levels at the most exposed location on the subject site (Noise logger location 1) is described below:

2016 Measured Values (Including Adjustment for façade reflection)	59.5 dB(A) $L_{10\ (18hour)}$
Adjustment due to increase in traffic volumes up to 2027 (Linear traffic growth rate of 3% per year)	+1.1 dB(A)
Predicted Noise Levels at Most Noise Sensitive Locations on Subject Site with Existing Road Surface Type (14/7 Stone Seal)	60.6 dB(A) $L_{10\ (18hour)}$
VicRoads Noise Level Requirement	63 dB(A) $L_{10\ (18hour)}$

Based on consideration of the input parameters adopted for the 2016 and 2027 noise modelling, and the existing road surface of the ring road, the predicted noise levels across the subject site in the absence of noise shielding barriers will be in the order of 60.6 dB(A) $L_{10,18hr}$.

The predicted value for this scenario will therefore achieve the VicRoads, 63 dB(A) $L_{10,18hr}$ requirement without any specific noise control treatments.

For completeness, noise level contour information has been attached in appendix 8.2 and 8.3 of this report.

7. OVERVIEW

A new residential subdivision is proposed at the site described as 176-194 Thornhill Road, Highton.

Given the close proximity of the subject site to the Geelong Ring Road, VicRoads has requested further information with regard to the existing and anticipated future traffic noise level impacts on the subject site.

The basis for the request relates to the VicRoads document entitled "Requirements of Developers".

The document includes external noise level requirements to be achieved on the subject site 10 years after the opening of the development for sale.

In response to the request, Watson Moss Growcott has carried out attended noise level surveys, and unattended noise logging at the subject site.

The measured noise level values at the subject site, in combination with information provided and approved by VicRoads have been used as a basis for predicting traffic noise impacts on the subject site 10 years into the future.

Noise level prediction modelling was carried out in accordance with procedures described in Calculation of Road Traffic Noise- Department of Transport Welsh office (CoRTN).

Based on the noise prediction modelling, residual noise associated with the Geelong Ring Road when considered at the subject site will be below the VicRoads 63 dB(A) $L_{10,18hr}$ requirement without any specific noise control treatments.

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8. APPENDICES

8.1 SUMMARY OF NOISE LEVEL DATA RECORDED BY UNATTENDED NOISE LOGGERS

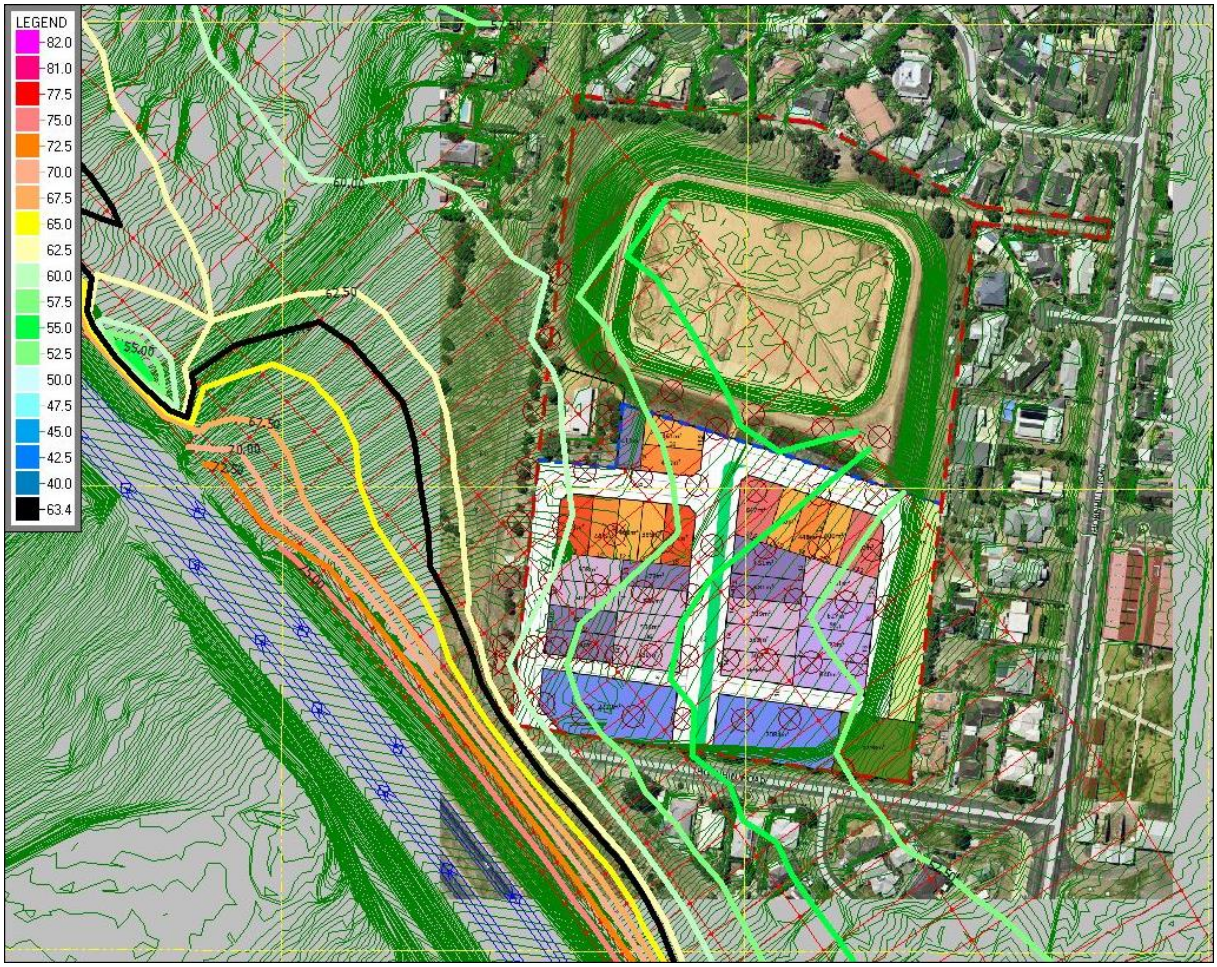
Combination of Tuesday 1st March and Wednesday 2nd March 2016	Measurement Location 1		Measurement Location 2	
	Measured Noise Level			
	dB(A) L_{10}	dB(A) L_{eq}	dB(A) L_{10}	dB(A) L_{eq}
Wednesday 2nd March (00:00 – 01:00)	50	46	40	39
Wednesday 2nd March (01:00 – 02:00)	49	45	41	40
Wednesday 2nd March (02:00 – 03:00)	50	46	40	39
Wednesday 2nd March (03:00 – 04:00)	51	47	42	40
Wednesday 2nd March (04:00 – 05:00)	54	51	46	43
Wednesday 2nd March (05:00 – 06:00)	57	55	46	44
Wednesday 2nd March (06:00 – 07:00)	61	59	51	50
Wednesday 2nd March (07:00 – 08:00)	62	60	53	52
Wednesday 2nd March (08:00 – 09:00)	62	60	52	50
Wednesday 2nd March (09:00 – 10:00)	58	56	49	52
Wednesday 2nd March (10:00 – 11:00)	55	53	46	53
Wednesday 2nd March (11:00 – 12:00)	56	54	45	47
Wednesday 2nd March (12:00 – 13:00)	57	54	48	51
Tuesday 1st March (13:00 – 14:00)	54	51	46	48
Tuesday 1st March (14:00 – 15:00)	59	56	51	54
Tuesday 1st March (15:00 – 16:00)	59	56	49	48
Tuesday 1st March (16:00 – 17:00)	59	57	52	51
Tuesday 1st March (17:00 – 18:00)	59	57	53	52
Tuesday 1st March (18:00 – 19:00)	58	56	51	49
Tuesday 1st March (19:00 – 20:00)	58*	56*	51	49
Tuesday 1st March (20:00 – 21:00)	54	52	49	48
Tuesday 1st March (21:00 – 22:00)	53	50	46	44
Tuesday 1st March (22:00 – 23:00)	55	52	42	41
Tuesday 1st March (23:00 – 24:00)	53	50	39	38
Overall Measured L10 $_{18\ Hour}$ Value (Arithmetic 6am to midnight)	57		48	
Overall Measured Leq $_{15\ Hour}$ Value (Logarithmic 7am to 10pm)		56		51
Overall Measured Leq $_{16\ Hour}$ Value (Logarithmic 6am to 10pm)		56		50
Overall Measured Leq $_{9\ Hour}$ Value (Logarithmic 10pm to 7am)		53		43
Overall Measured Leq $_{8\ Hour}$ Value (Logarithmic 10pm to 6am)		50		41

*Note: Measured values were higher than those documented, however the acoustic environment was dominated by noise associated with insects located nearby to the microphone location. Insect noise has been removed from the measured noise level spectrum to determine the actual measure traffic noise level values.

Thursday 3rd March 2016 **Time Period**	**Measurement Location 1**		**Measurement Location 2**	
	Measured Noise Level			
	dB(A) L_{10}	dB(A) L_{eq}	dB(A) L_{10}	dB(A) L_{eq}
00:00 – 01:00	52	50	45	43
01:00 – 02:00	50	48	42	40
02:00 – 03:00	47	44	41	39
03:00 – 04:00	48	55	43	53
04:00 – 05:00	53	51	50	48
05:00 – 06:00	55	53	48	46
06:00 – 07:00	57	55	52	51
07:00 – 08:00	58	56	53	52
08:00 – 09:00	58	57	56	55
09:00 – 10:00	59	57	56	55
10:00 – 11:00	58	56	52	50
11:00 – 12:00	59	57	54	53
12:00 – 13:00	58	56	52	50
13:00 – 14:00	58	56	52	50
14:00 – 15:00	58	56	52	51
15:00 – 16:00	58	55	53	51
16:00 – 17:00	59	57	53	51
17:00 – 18:00	59	57	54	53
18:00 – 19:00	59	57	54	53
19:00 – 20:00	58	56	52	50
20:00 – 21:00	57	55	51	49
21:00 – 22:00	55	53	49	47
22:00 – 23:00	53	51	48	45
23:00 – 24:00	52	49	46	43
Overall Measured L10 $_{18\ Hour}$ Value (Arithmetic 6am to midnight)	57		52	
Overall Measured Leq $_{15\ Hour}$ Value (Logarithmic 7am to 10pm)		56		52
Overall Measured Leq $_{16\ Hour}$ Value (Logarithmic 6am to 10pm)		56		52
Overall Measured Leq $_{9\ Hour}$ Value (Logarithmic 10pm to 7am)		51		45
Overall Measured Leq $_{8\ Hour}$ Value (Logarithmic 10pm to 6am)		50		44

Friday 4th March 2016 **Time Period**	**Measurement Location 1**		**Measurement Location 2**	
	Measured Noise Level			
	dB(A) L_{10}	dB(A) L_{eq}	dB(A) L_{10}	dB(A) L_{eq}
00:00 – 01:00	51	48	45	42
01:00 – 02:00	50	47	43	41
02:00 – 03:00	49	46	43	41
03:00 – 04:00	50	48	44	42
04:00 – 05:00	53	50	47	44
05:00 – 06:00	56	54	50	48
06:00 – 07:00	58	56	52	50
07:00 – 08:00	58	57	53	52
08:00 – 09:00	59	57	54	52
09:00 – 10:00	58	56	52	52
10:00 – 11:00	54	52	49	50
11:00 – 12:00	54	52	47	48
12:00 – 13:00	54	52	47	46
13:00 – 14:00	54	51	48	50
14:00 – 15:00	54	52	47	47
15:00 – 16:00	56	54	52	51
16:00 – 17:00	59	57	53	51
17:00 – 18:00	59	58	54	53
18:00 – 19:00	60	58	55	53
19:00 – 20:00	59	57	53	52
20:00 – 21:00	58	56	51	49
21:00 – 22:00	55	53	48	46
22:00 – 23:00	55	53	47	46
23:00 – 24:00	52	51	44	42
Overall Measured L10 $_{18\ Hour}$ Value (Arithmetic 6am to midnight)	56		50	
Overall Measured Leq $_{15\ Hour}$ Value (Logarithmic 7am to 10pm)		55		51
Overall Measured Leq $_{16\ Hour}$ Value (Logarithmic 6am to 10pm)		56		51
Overall Measured Leq $_{9\ Hour}$ Value (Logarithmic 10pm to 7am)		50		43
Overall Measured Leq $_{8\ Hour}$ Value (Logarithmic 10pm to 6am)		50		42

8.2 2016 Predicted Noise Level Contours (Existing Road Surface Conditions and Traffic Volumes)



8.3 2027 Predicted Noise Level Contours (Existing Road Surface Type and Increased Traffic Volumes – No Barrier)