Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770
www.lgacoustics.com.au

Environmental Noise Assessment - Sand Extraction Quarry

Lots 300 & 301 Boomerang Road & Lot 6 Banksia Road, Oldbury

Reference: 24089353-01

Prepared for:
Urban Resources

Reference: 24089353-01

Lloyd George Acoustics Pty Ltd
ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923
www.lgacoustics.com.au

Contacts	General	Daniel Lloyd	Terry George	Matt Moyle
E:	info@lgacoustics.com.au	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au
P:	9401 7770	0439 032 844	0400 414 197	0412 611 330
Contacts	Rob Connolly	Hao Tran	Matt Nolan	
E:	rob@lgacoustics.com.au	hao@lgacoustics.com.au	matt.nolan@lgacoustics.com.au	
P:	0410 107 440	0438 481 207	0448 912 604	

Date	Rev	Description	Author	Verified
11/09/24	-	Issued to client	Daniel Lloyd	

CONTENTS

List of Tables

List of Figures

Appendices

EXECUTIVE SUMMARY

The noise emissions resulting from a proposed sand extraction and screening operations at Lots 300 & 301 Boomerang Road & Lot 6 Banksia Road, Oldbury, Western Australia, have been assessed by means of predictive noise modelling and the results compared against the assigned levels within the *Environmental Protection (Noise) Regulations 1997*.

The proposed hours of operation are 7.00 am to 7.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays. The site will be closed on Sundays and Public Holidays.

The works will be undertaken in four (4) stages starting in the southeast and heading northwest. Each phase of the operations includes: stripping of topsoil using a dozer (construction); extraction/screening of sand; loading trucks from stockpiles; and rehabilitation of completed stages.

The proposed plant required for the works includes:

- Screen
- Radial Stacker
- CAT D6 Dozer
- Komatsu WA600 Front End Loader
- Trucks moving at low speed

Based on the assumptions made, the noise predictions show that the operations will achieve compliance with the applicable assigned noise levels between 7.00 a.m. and 7.00 p.m. Monday to Saturday at all noise sensitive receivers, providing the recommended noise mitigation is put in place.

1. INTRODUCTION

Lloyd George Acoustics was engaged by Urban Resources to undertake an environmental noise assessment for a gravel extraction pit to be located at Lots 300 & 301 Boomerang Road & Lot 6 Banksia Road, Oldbury - refer Figures *1-1.* The subject site is located within the Peel Region.

Figure 1-1: Subject Site Location (Source: Google Earth)

With regard to noise emissions, consideration is given to the noise from extraction and screening plant on the site as well as trucks entering the site to cart the material away. The noise is assessed at neighbouring properties and compared to the prescribed standards of the *Environmental Protection (Noise) Regulations 1997.*

The quarry plant will consist of a mobile screen and front-end loader for extraction and loading and a dozer for topsoil removal. The product will extracted in four (4) stages as shown in *Figure 1-2*. The quarry floor will be at an RL (ground level) of 18.0 metres and will start from the southeast corner of the site working towards the northwest corner.

Trucks will arrive on site via Boomerang Road and will be loaded with sand. It is expected that between two and four trucks per hour will access the quarry.

Appendix A contains a description of some of the terminology used throughout this report.

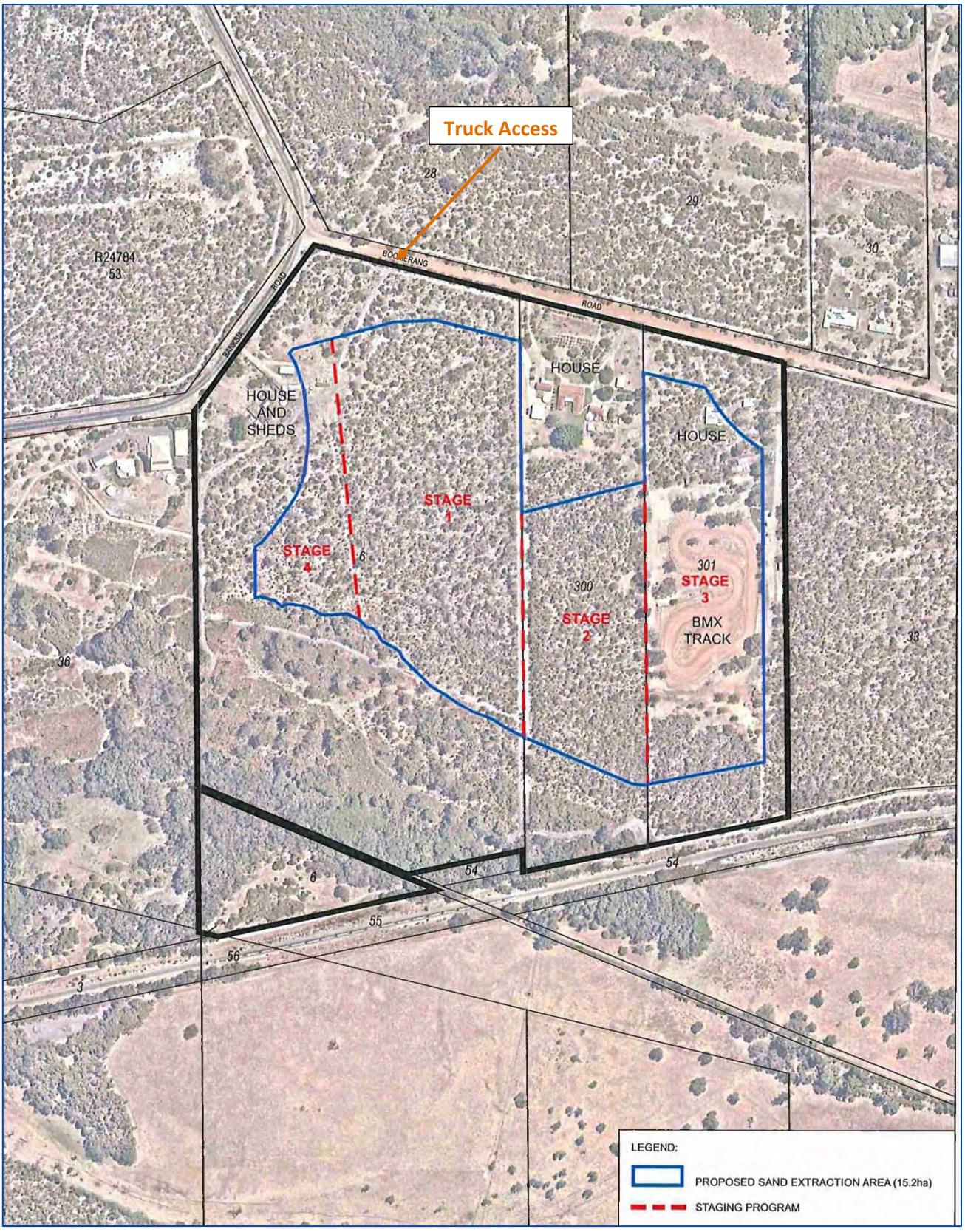


Figure 1-2: Subject Site Layout

2. CRITERIA

2.1. Construction Works

Construction activities are covered under Regulation 13 of the *Environmental Protection (Noise) Regulations 1997, (the Regulations)* and provide the noise requirements that are to be satisfied. Regulation 13 is considered appropriate for the removal of topsoil, which means that the normally prescribed assigned noise levels under regulation 7 of the *Regulations* are not applicable to this phase of the operations as described below.

Regulation 7 does not apply to noise emitted from a construction site as a result of construction work carried out between 0700 hours and 1900 hours on any day which is not a Sunday or public holiday if the occupier of the premises … shows that –

a) The construction work was carried out in accordance with control of environmental noise practices set out in section 4 of AS 2436-2010 Guide to noise and vibration control on construction, maintenance and demolition sites; and

b) The equipment used on the premises was the quietest reasonably available; and

c) If the occupier was required to prepare a noise management plan … in respect of the construction site –

i. The noise management plan was prepared and given in accordance with the requirement, and approved by the Chief Executive Officer; and

ii. The construction work was carried out in accordance with the noise management plan, excluding any ancillary measure.

2.2. Extraction & Crushing Works

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

2.2.1. Regulations 7, 8 & 9

This group of regulations provide the prescribed standard for noise as follows:

"7. Prescribed standard for noise emissions

(1) Noise emitted from any premises or public place when received at other premises –

(a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) must be free of –

(i) tonality; and

(ii) impulsiveness; and

(iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix A*). Under regulation 9(3), *"Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -*

(a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] … are made to the noise emission as measured at the point of reception."

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music*			Where Noise Emission is Music	
Tonality	**Modulation**	**Impulsiveness**	**No Impulsiveness**	**Impulsiveness**
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noise present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2 Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

While there are no currently major or secondary roads, or commercial/industrial land uses adjacent to the noise sensitive premises surrounding the proposed quarry, once approved, the quarry land would be considered 'Type A Industrial'.

In calculating the influencing factor, attention is drawn to Schedule 3, clause 2(3) of the regulations which states:

If land within either circles:

(a) is land in which mining operations are carried on, and

(b) Is categorised on the land use map as used for purposes other than for industrial or utility purposes,

The land within the circles including the mining operation is to be taken as Type A land for the purposes of subclause (1)

Based on the above, the assigned levels at each of the noise sensitive receivers, as shown in *Figure 2-1,* during the times when the quarry is operational is shown in *Table 2-3.*

Table 2-3 Assigned Levels at Noise Sensitive Receivers

Address	Percentage Industrial Land		Assigned Level (dB)		
	100m	450m	L_{A10}	L_{A1}	L_{Amax}
95 Banksia Road, Wellard	0	0	45	55	65
102 Banksia Road, Oldbury	0	0	45	55	65
144 Banksia Road, Wellard	0	14	46	56	66
145 Banksia Road, Oldbury	0	0	45	55	65
315 Boomerang Road, Oldbury	0	0	45	55	65
350 Boomerang Road, Oldbury	0	4	45	55	65
360 Boomerang Road, Oldbury	0	7	46	56	66
372 Boomerang Road, Oldbury	0	16	47	57	67

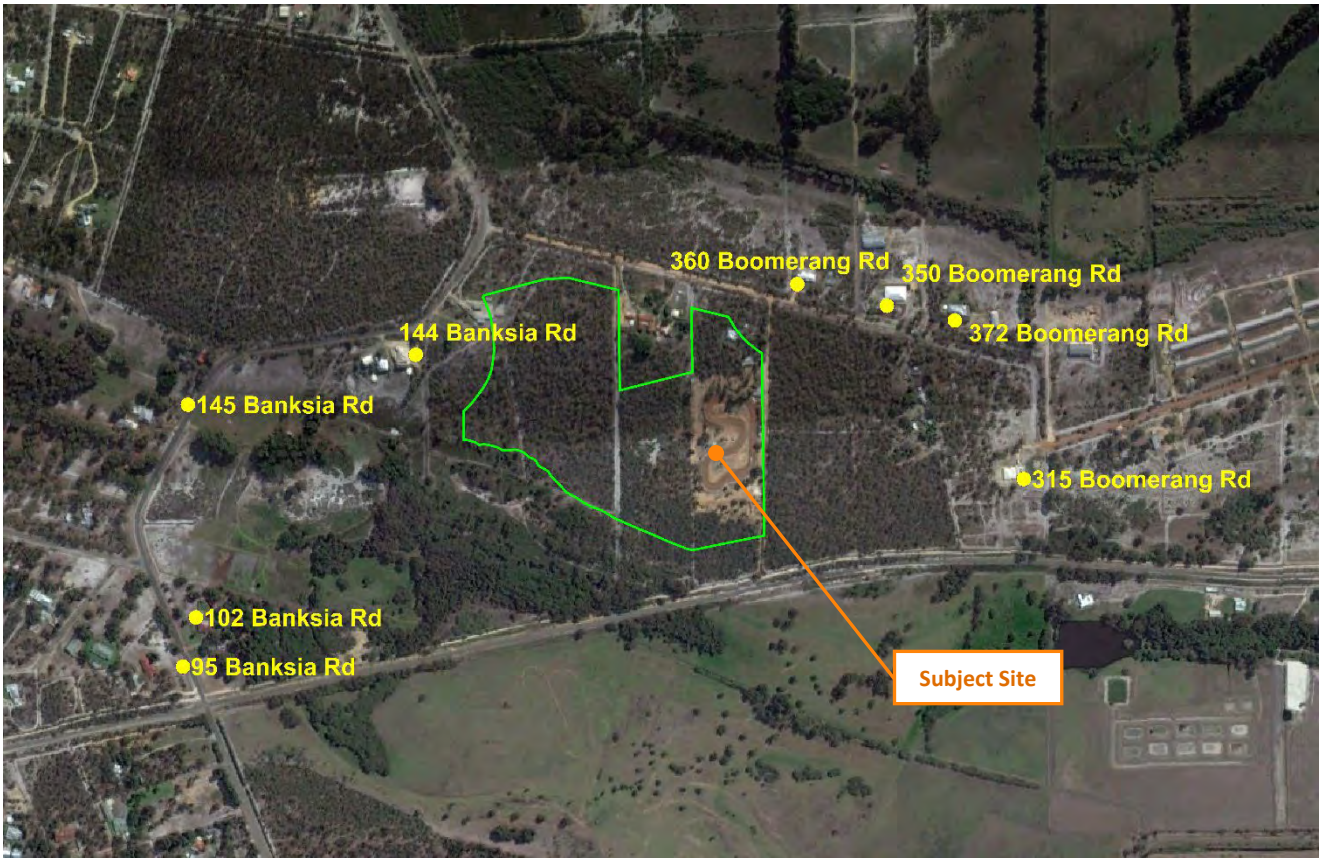


Figure 2-1: Noise Sensitive Receiver Locations

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces. Where this was not possible to be achieved due to the close proximity of existing buildings and/or fences, the noise emissions were assessed at a point within 1 metre from building facades and a -2 dB adjustment was made to the predicted noise levels to account for reflected noise.

The assigned levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as "*a period of time of not less than 15 minutes, and not exceeding 4 hours*, *determined by* an *inspector* or *authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission"*. An inspector or authorised person is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

2.2.2. Regulation 3

*"**3. Regulations do not apply to certain noise emissions***

(1) Nothing in these regulations applies to the following noise emissions –

(a) Noise emissions from the propulsion and braking systems of motor vehicles operating on a road;"

noise emissions from —

(b) a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment;

If -

it is a requirement under another written law that such an alarm be fitted; and

it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these regulations;

It is considered that any reversing alarms fitted to the mobile plant and transport trucks are not necessarily exempt under the Regulations, since they are not specifically required under another written law.

The commonly used fixed noise output tonal reversing alarms also known as 'reversing beeper' emit, by their very nature, tonal and modulating noise at high levels. As such, this type of reversing alarm generally cannot comply with the Regulations even at distant receivers. Alternative alarms such as broadband alarms are commonly used to minimise the impact.

3. METHODOLOGY

3.1. Noise Modelling

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the CONCAWE algorithms (ISO 171534-3 improved method) selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.2.1* to *Section 3.2.4*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm)[2]
Temperature (°C)	20
Humidity (%)	50
Wind Speed (m/s)	4
Wind Direction[1]	All
Pasquil Stability Factor	E

Notes:
1. The modelling package allows for all wind directions to be modelled simultaneously.
2. The conditions above are as defined in *Guideline: Assessment of Environmental Noise Emissions*; May 2021

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.1.2. Topographical Data

Topographical data was from the Department of Land Information (DLI). The contours are in 1-metre intervals and cover the noise sensitive premises of concern.

3.1.3. Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, as it is a rural location, a value of 1.0 has been used outside of the quarry area and 0.3 for within the quarry.

3.1.4. Source Sound Levels

The source sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2: Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	31.5	63	125	250	500	1k	2k	4k	
CAT D6 Dozer	102	106	113	109	106	106	104	99	**111**
Komatsu WA600 Front-end Loader	74	86	97	101	105	105	101	95	**110**
Mobile Screen	113	110	102	95	98	102	100	95	**106**
Truck moving at low speed	115	116	113	106	97	92	92	89	**102**

The following is noted in relation to *Table 3-2*:

- Sources are assumed to be 2m above the ground;
- Data obtained from manufacturer's data and from measurements of similar sized quarry operation;
- The front-end loader and screen will be operating for more than 10% of the time and represents the L_{A10} noise level. The truck movements will be present for less than 10% of the time and represents the L_{A1} noise level; and
- Location of screen and loader is shown in the noise contour maps.

4. RESULTS

4.1. Construction Phase

The predicted noise levels during the construction phase of stripping the topsoil using a CAT D6 dozer, are provided in *Table 4-1*.

Table 4-1: Predicted Levels during Construction Phase, dB(A)

Receiver	Predicted Nosie Level L_{A10} dB
95 Banksia Road, Wellard	35-39
102 Banksia Road, Oldbury	36-41
144 Banksia Road, Wellard	44-59
145 Banksia Road, Oldbury	36-43
315 Boomerang Road, Oldbury	33-42
350 Boomerang Road, Oldbury	38-47
360 Boomerang Road, Oldbury	40-51
372 Boomerang Road, Oldbury	35-57

4.2. Extraction, and Loading Phases

The noise levels were predicted to affected noise sensitive premises for a typical scenarios using the proposed plant. As the plant is likely to contain annoying characteristics, in particular, tonality, the predicted noise levels need to be adjusted by +5 dB (*Table 2-1*).

The results, provided in *Table 4-2,* presents the noise emissions during the four stages of the works. The predictions assume that a Komatsu WA600 front-end loader and a screen are operating simultaneously.

It should be noted that shaded cells indicate where the noise level exceeds the relevant criterion.

Trucks will be accessing the site during loading times. The trucks will arrive on site via Boomerang Road and will be travel to the pit floor and loaded with sand. It is expected that between two and four trucks per hour will access the quarry. Based on this, the time that truck noise will be present is less than 10% of any 4-hour period and therefore it is the L_{A1} criterion that is relevant.

The predicted noise level at each sensitive receiver from the truck movements, which includes the extraction plant operating, is provided in *Table 4-3.*

Table 4-2: Predicted (Adjusted) L_{A10} Noise Levels during Extraction and Loading, dB(A)

Receiver	Adjusted* Noise Level L_{A10} dB				Criterion L_{A10} dB
	Stage 1	Stage 2	Stage 3	Stage 4	
95 Banksia Road, Wellard	27	44	31	39	45
102 Banksia Road, Oldbury	28	45	30	40	45
144 Banksia Road, Wellard	40	52	36	46	46
145 Banksia Road, Oldbury	29	41	29	31	45
315 Boomerang Road, Oldbury	25	39	37	38	45
350 Boomerang Road, Oldbury	28	40	40	45	45
360 Boomerang Road, Oldbury	30	42	42	40	46
372 Boomerang Road, Oldbury	33	45	44	38	47

Notes: *Adjusted +5 dB for tonality

Table 4-3: Predicted L_{A1} Noise Levels from Truck Movements, dB(A)

Receiver	Predicted Nosie Level L_{A1} dB	Criterion L_{A1} dB
95 Banksia Road, Wellard	39	55
102 Banksia Road, Oldbury	40	55
144 Banksia Road, Wellard	48	56
145 Banksia Road, Oldbury	38	55
315 Boomerang Road, Oldbury	36	55
350 Boomerang Road, Oldbury	37	55
360 Boomerang Road, Oldbury	39	56
372 Boomerang Road, Oldbury	42	57

5. ASSESSMENT

From the results presented in *Table 4-2*, it can be seen that with the addition of a +5 dB penalty, noise levels resulting from the extraction and loading works, during the hours 7.00 a.m. to 7.00 p.m. Monday to Saturday, are predicted to exceed the assigned level at 144 Banksia Road, Wellard during Stage 2 of the works.

To address this, it is recommended that a 3.0m high noise bund be installed, as shown in *Figure 5-1.*

The predicted noise levels for each stage, assuming the noise bund has been constructed, is provided in *Figures 5-2 to 5-5.*

The L_{A1} noise levels, shown in *Figure 5-6*, are from the truck movements together with extraction during Stage 2, being the most critical in terms of overall compliance. The results show that the assigned levels are met during the daytime period, when the truck is at the closest point to the nearest noise sensitive receiver. In reality, as the truck is moving, the noise will diminish quickly as the truck moves further away from the receiver.

Figure 5-1

Signs and symbols
- Sensitve receiver
- Noise Bund

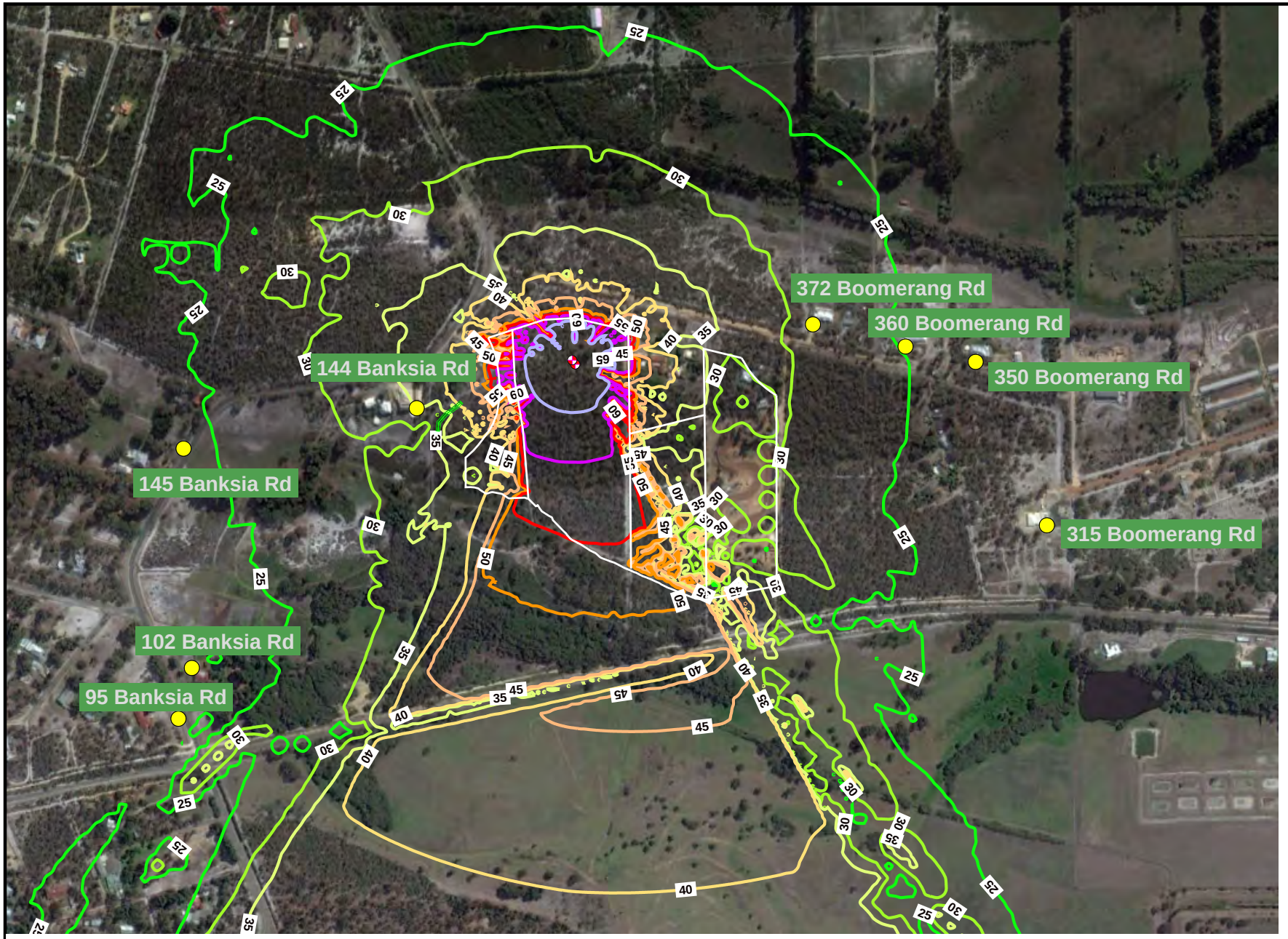
N

Length Scale
0 20 40 80 120 160 m

Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Noise Bund Details

Lloyd George Acoustics
www.lgacoustics.com.au
(08) 9401 7770

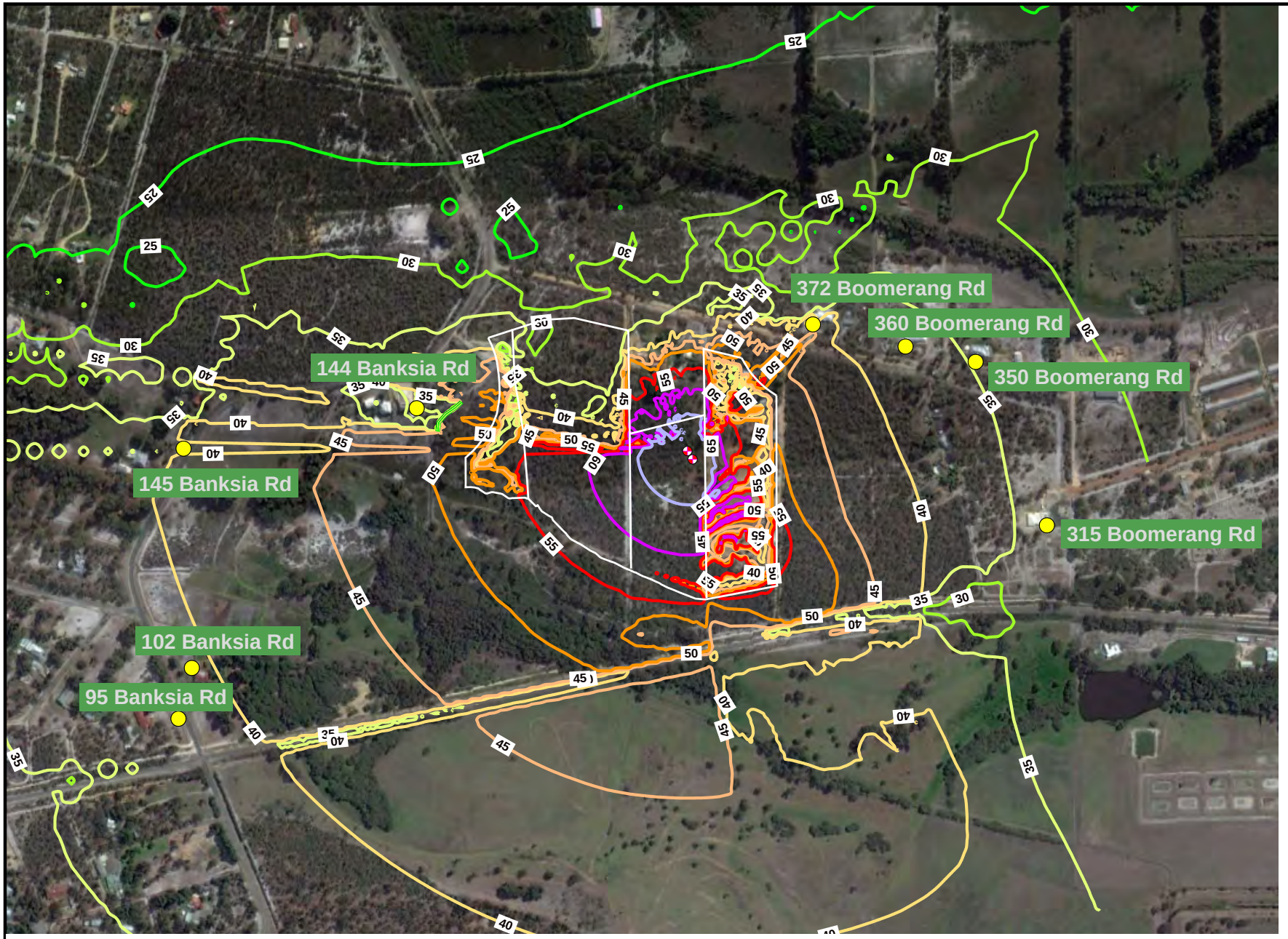
Figure 5-2



Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Predicted L_{A10} Noise Levels from Stage 1 Quarry Operations
Wind from All Directions

Lloyd George Acoustics
www.lgacoustics.com.au
(08) 9401 7770

Figure 5-3

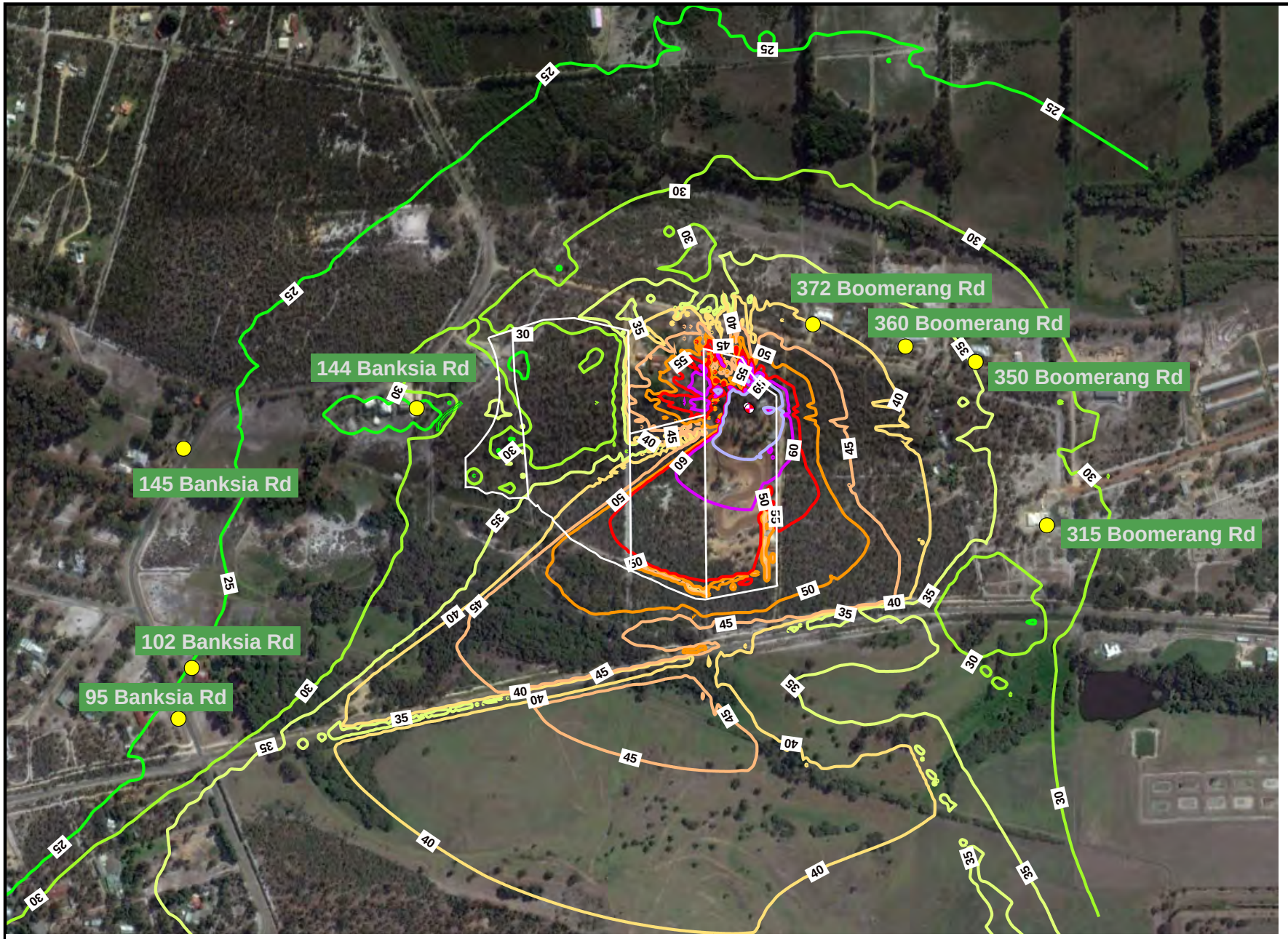


Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Predicted L_{A10} Noise Levels from Stage 2 Quarry Operations
Wind from All Directions

Lloyd George Acoustics

www.lgacoustics.com.au
(08) 9401 7770

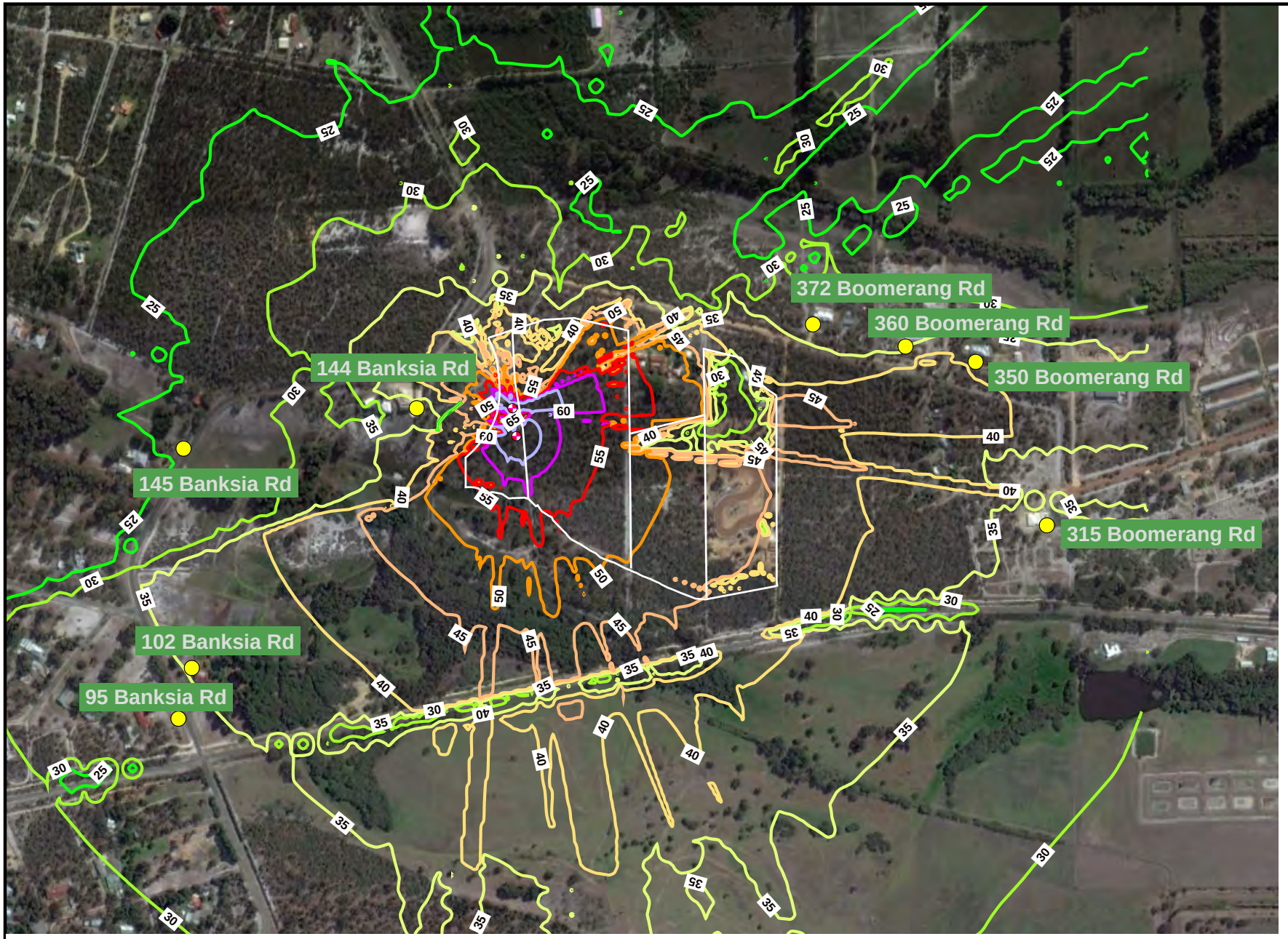
Figure 5-4



Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Predicted L_{A10} Noise Levels from Stage 3 Quarry Operations
Wind from All Directions

Lloyd George Acoustics
www.lgacoustics.com.au
(08) 9401 7770

Figure 5-5



Signs and symbols
- Point source
- Sensitve receiver

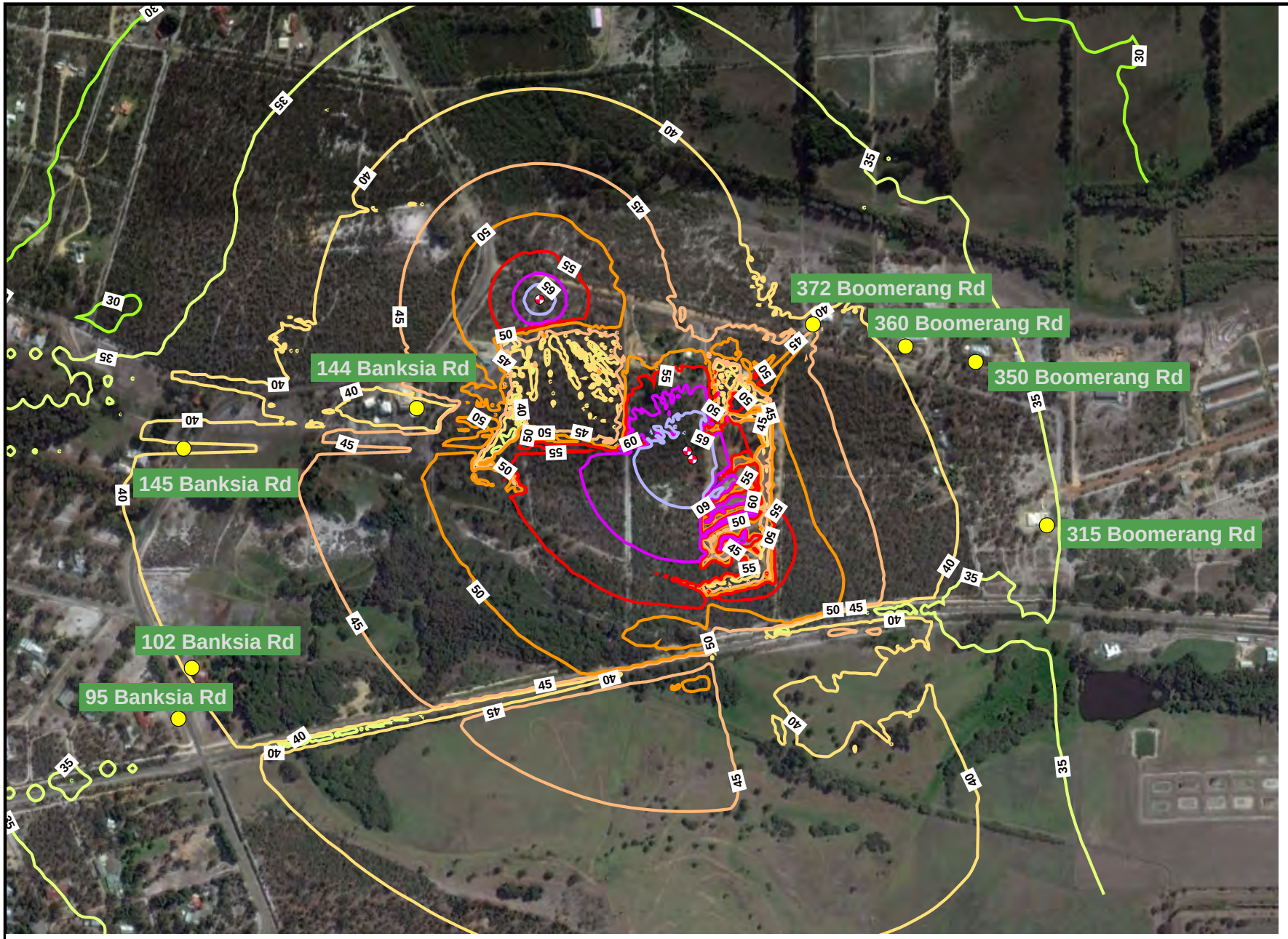
N

Length Scale
0 45 90 180 270 360 m

Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Predicted L_{A10} Noise Levels from Stage 4 Quarry Operations
Wind from All Directions

Lloyd George Acoustics
www.lgacoustics.com.au
(08) 9401 7770

Figure 5-6



Signs and symbols

- Point source
- Sensitve receiver

Length Scale

0 45 90 180 270 360 m

Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Predicted L_{A1} Noise Levels from Truck Movements during Stage 2 Quarry Operations
Wind from All Directions

Lloyd George Acoustics
www.lgacoustics.com.au
(08) 9401 7770

6. CONCLUSION

The noise emissions resulting from the proposed sand and limestone extraction and crushing operations at Lots 300 & 301 Boomerang Road & Lot 6 Banksia Road, Oldbury, Western Australia, have been assessed by means of predictive noise modelling and the results compared against the assigned levels within the *Environmental Protection (Noise) Regulations 1997*.

Based on the assumptions made, it is concluded that compliance with the applicable assigned noise level can be achieved at all noise sensitive receivers between 7.00 a.m. and 7.00 p.m. Monday to Saturday, providing the noise mitigation recommended in this assessment is implemented.

In addition, the following best practices should be implemented to minimise noise impacts where practicable:

- Stockpiles should be located to provide acoustic screening to the residents, wherever practicable;
- If reversing alarms are deemed necessary, all plant should to be fitted with broadband reversing alarms; and
- The road required for loading of trucks should be designed such that the trucks are not required to reverse, this ensures truck reversing alarms are minimised.

Appendix A – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- **L_{ASlow}**

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- **L_{AFast}**

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” noise level.

- **L_{A90}**

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the “background” noise level.

- **L_{Aeq}**

The equivalent steady state A-weighted sound level (“equal energy”) in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the “average” noise level.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

- **Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

– the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

- **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

– a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band; and

(b) is present for at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible.

- **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

– a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

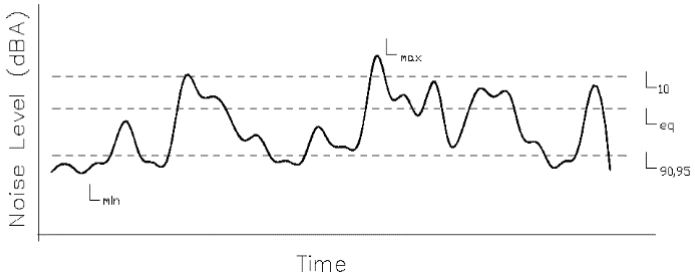
- **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

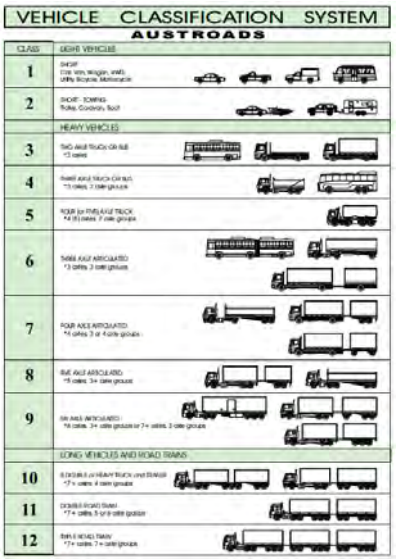
- **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**