APPENDIX 5

LGA Quarry Noise Assessment

Noise Impact Assessment

Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd Oldbury

Prepared For

Rocla

July 2009

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Date:	27 July 2009

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APPENDICES

1 INTRODUCTION

Rocla Quarry Products is proposing to develop a sand extraction pit on Lots 300 &301 Boomerang Road and Lot 6 Banksia Road, Oldbury, Western Australia. The location and outline of the project is shown in *Figures 1.1 and 1.2*.

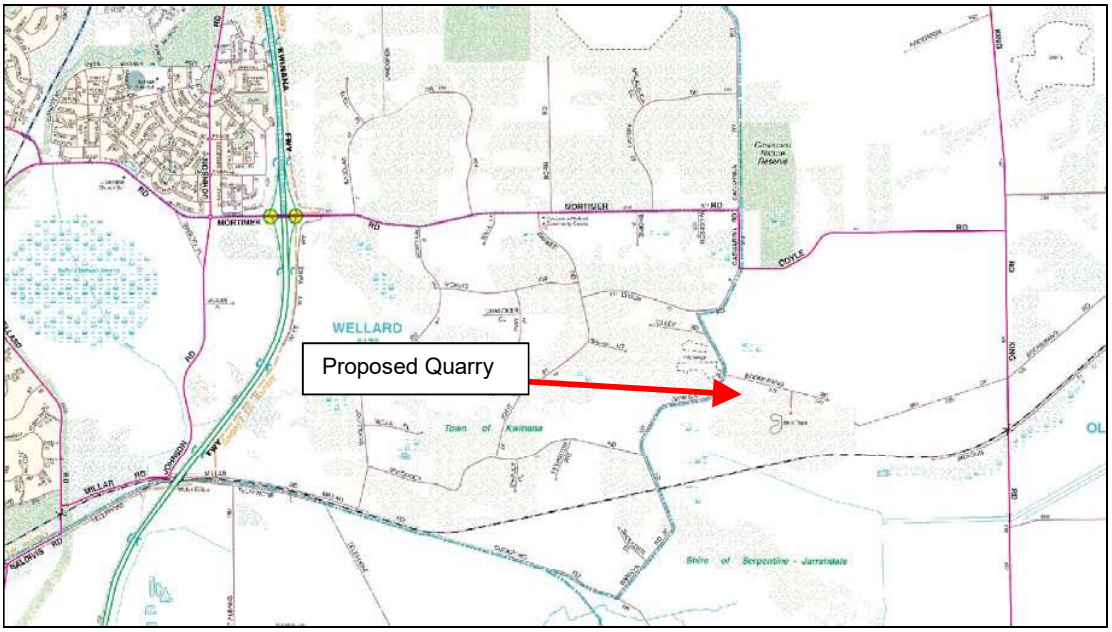


Figure 1.1 Proposed Quarry Locality

Figure 1.2 Proposed Quarry Extents

This assessment predicts the likely noise impacts from the quarry and compares the results against the *Environmental Protection (Noise) Regulations 1997*.

The quarry plant will consist of a mobile screen and front-end loader. 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.

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. Three phases have been assessed. These being:

- Phase 1 - Quarry face in southeast corner;
- Phase 2 - Quarry face at middle of site; and
- Phase 3 - Quarry face at northwest of site (Final).

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

2 CRITERIA

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

Regulation 7 defines the prescribed standard for noise emissions as follows:

"7. (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;

ii. Impulsiveness; and

iii. Modulation".

A "…noise emission is taken to *significantly contribute to* a level of noise if the noise emission exceeds a value which is 5dB below the assigned level…"

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics 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 after the adjustments of *Table 2.1* are made to the noise emission as measured at the point of reception.

Table 2.1 – Adjustments For Intrusive Characteristics

Tonality	Modulation	Impulsiveness
+ 5dB	+ 5dB	+ 10dB

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown below in *Table 2.2*.

Table 2.2 – Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise Sensitive[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[2]	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial	All hours	65	80	90

1. Applies within 15metres of a building associated with a noise sensitive use, as defined in Schedule 1, Part C.
2. Applies at a noise sensitive premises greater than 15metres from a building associated with a noise sensitive use.

As there are no major or secondary roads, or commercial/industrial land uses adjacent to the noise sensitive premises surrounding the proposed quarry, the influencing factor has been calculated as 0 dB. Therefore the baseline assigned levels would be used in this assessment.

In addition, as there are no other industries in the immediate vicinity, the noise from the proposed quarry would not be considered to '*significantly contribute'* to the existing noise environment.

3 ASSESSMENT METHODOLOGY

Computer modelling has been used to predict the noise from the proposed quarry operations. The software used is *SoundPLAN 6.5* with the CONCAWE algorithms selected. These algorithms have been selected as they are one of the few that include the influence of wind and atmospheric stability. Input data required in the model are:

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

3.1.1 Meteorological Information

Meteorological information utilised is based on that specified in EPA *Guidance for the Assessment of Environmental Factors No.8 Environmental Noise draft*, and are shown below in *Table 3.1*.

Table 3.1 –Modelling Meteorological Conditions

Parameter	Night (1900-0700)	Day (0700-1900)
Temperature (^{o}C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	3	4
Wind Direction*	All & Prevailing	All & Prevailing
Pasquil Stability Factor	F	E

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

Note that the above conditions approximate the typical worst-case for enhancement of sound propagation. The EPA policy is that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

At wind speeds greater than those shown above, 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.

3.1.2 Topographical Data

Topographical data was based on that provided by Rocla Quarry Products, which is from the Department of Land Information (DLI). The contours are in 1-metre intervals and cover the noise sensitive premises of concern.

Buildings have also been included as these can provide barrier attenuation when located between a source and receiver, much the same as a hill.

Additional topography was also included to represent the pit or stockpiles etc.

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). As this is a rural setting, a value of 1.0 has been used for the study area.

3.1.4 Source Sound Levels

Table 3.2 shows the sound power levels used in the modelling.

Table 3.2 – Source Sound Power Levels, dB(A)

Description	One-third or Centre Octave Band Frequency (Hz)								Overall
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Front-end Loader	86	97	101	105	105	101	95	85	**110**
Mobile screen	69	76	79	86	95	97	94	88	**106**
	82	85	80	91	97	96	92	85	
	80	77	84	92	99	96	91	81	
Truck	93	90	93	92	96	94	84	70	**106**
	89	92	90	90	94	96	91	79	
	94	91	92	93	95	95	87	76	

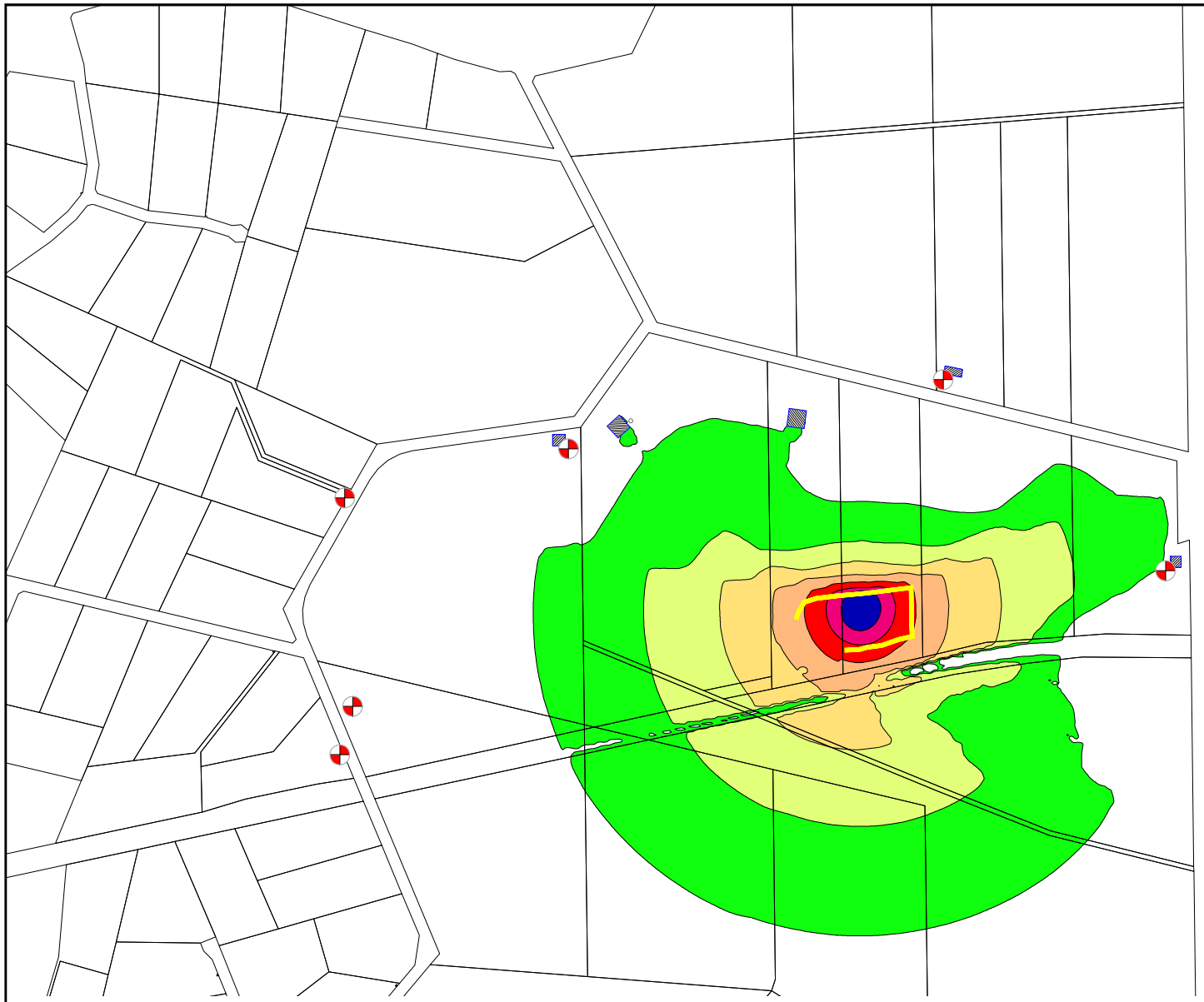
With regards to the above, please note the following:

- Source of data was from measurements undertaken at a similar sized Rocla Quarry Products 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 at the quarry face as shown in the noise contour maps.

4 RESULTS

The results of the noise modelling are presented in *Figures 4.1 to 4.4.*

Figure 4.1



Noise level
L_{A10} dB

<= 45	Compliant With Regulations
<= 50	Exceeds Regulations
<= 55	
<= 60	
<= 65	
<= 70	
<= 75	
> 75	

Signs and symbols

- Property Boundaries
- Point source
- Buildings
- Quarry edge
- Point receiver

N

Length Scale

0 50 100 200 300 400 m

Rocla Quarry Products - Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Phase 1 - Predicted L_{A10} Noise Level Contours (Adjusted by +5 dB for Tonality) - Wind From All Directions

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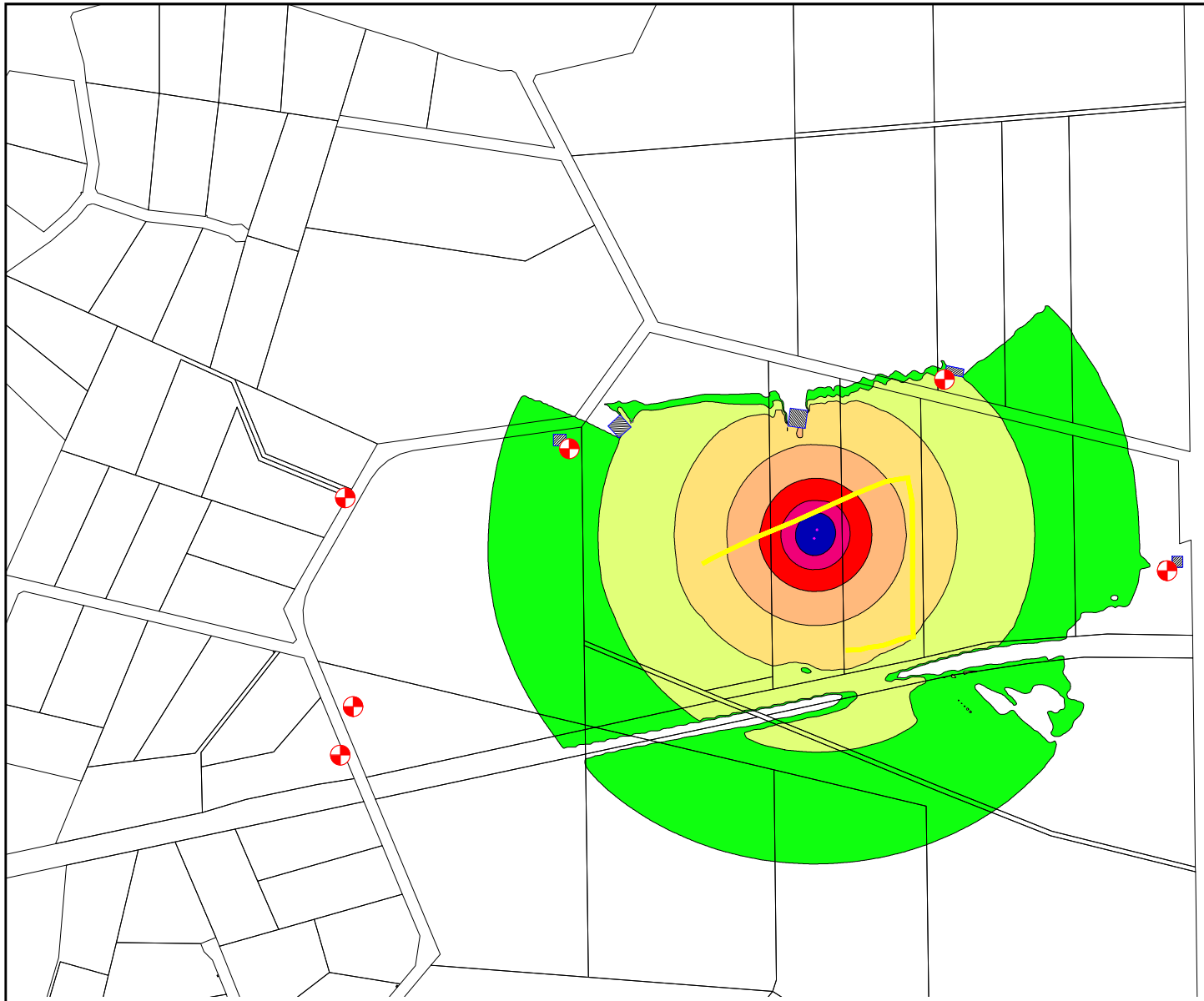
Figure 4.2



Noise level
L_{A10} dB

<= 45	Compliant With Regulations
<= 50	Exceeds Regulations
<= 55	
<= 60	
<= 65	
<= 70	
<= 75	
> 75	

Signs and symbols

- Property Boundaries
- Point source
- Buildings
- Quarry edge
- Point receiver

N

Length Scale

0 50 100 200 300 400 m

Rocla Quarry Products - Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Phase 2 - Predicted L_{A10} Noise Level Contours (Adjusted by +5 dB for Tonality) - Wind From All Directions

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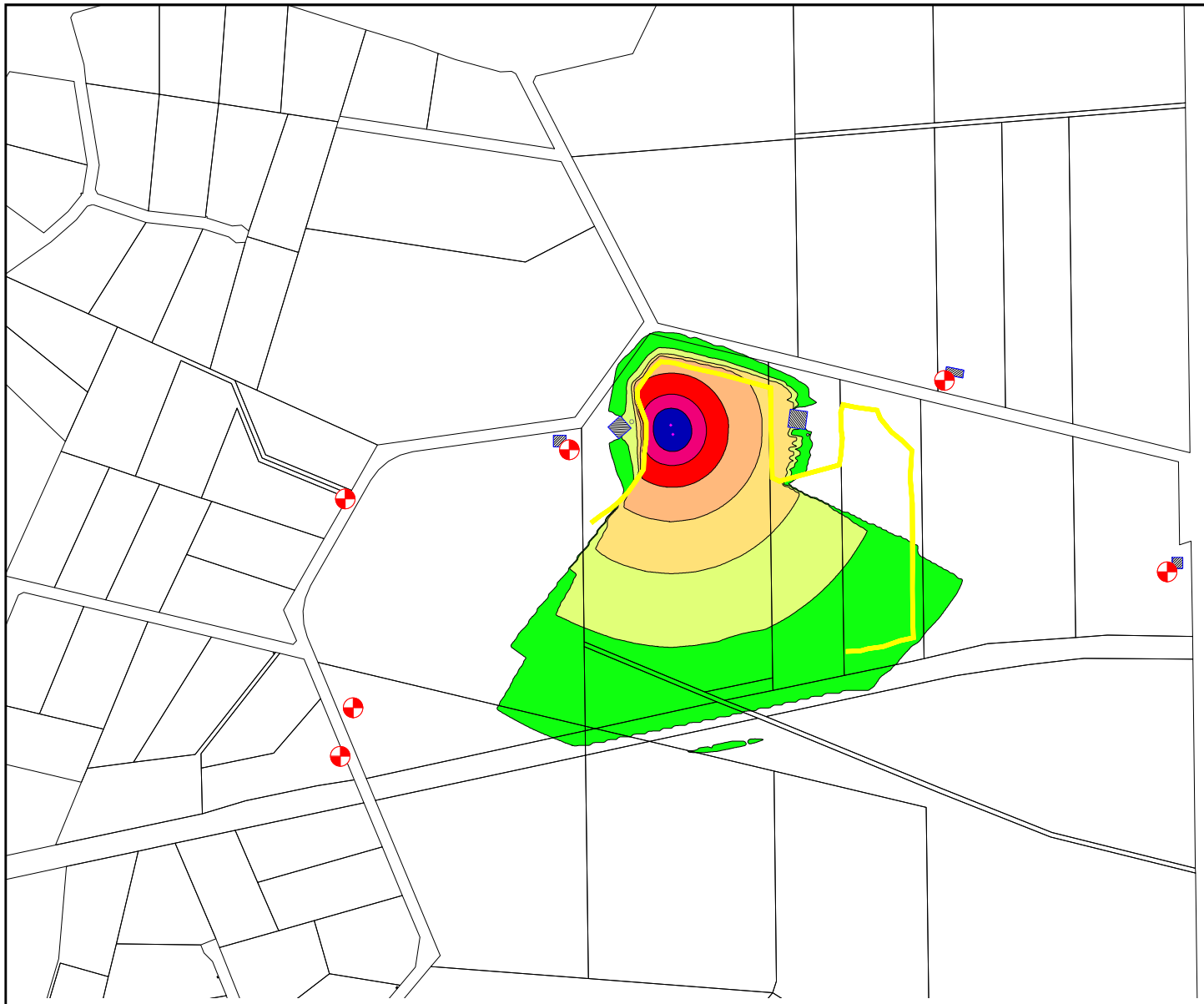
Figure 4.3



Noise level
L_{A10} dB

<=	45	Compliant With Regulations
<=	50	Exceeds Regulations
<=	55	
<=	60	
<=	65	
<=	70	
<=	75	
>	75	

Signs and symbols

- Property Boundaries
- Point source
- Buildings
- Quarry edge
- Point receiver

N

Length Scale

0 50 100 200 300 400 m

Rocla Quarry Products - Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Phase 3 - Predicted L_{A10} Noise Level Contours (Adjusted by +5 dB for Tonality) - Wind From All Directions

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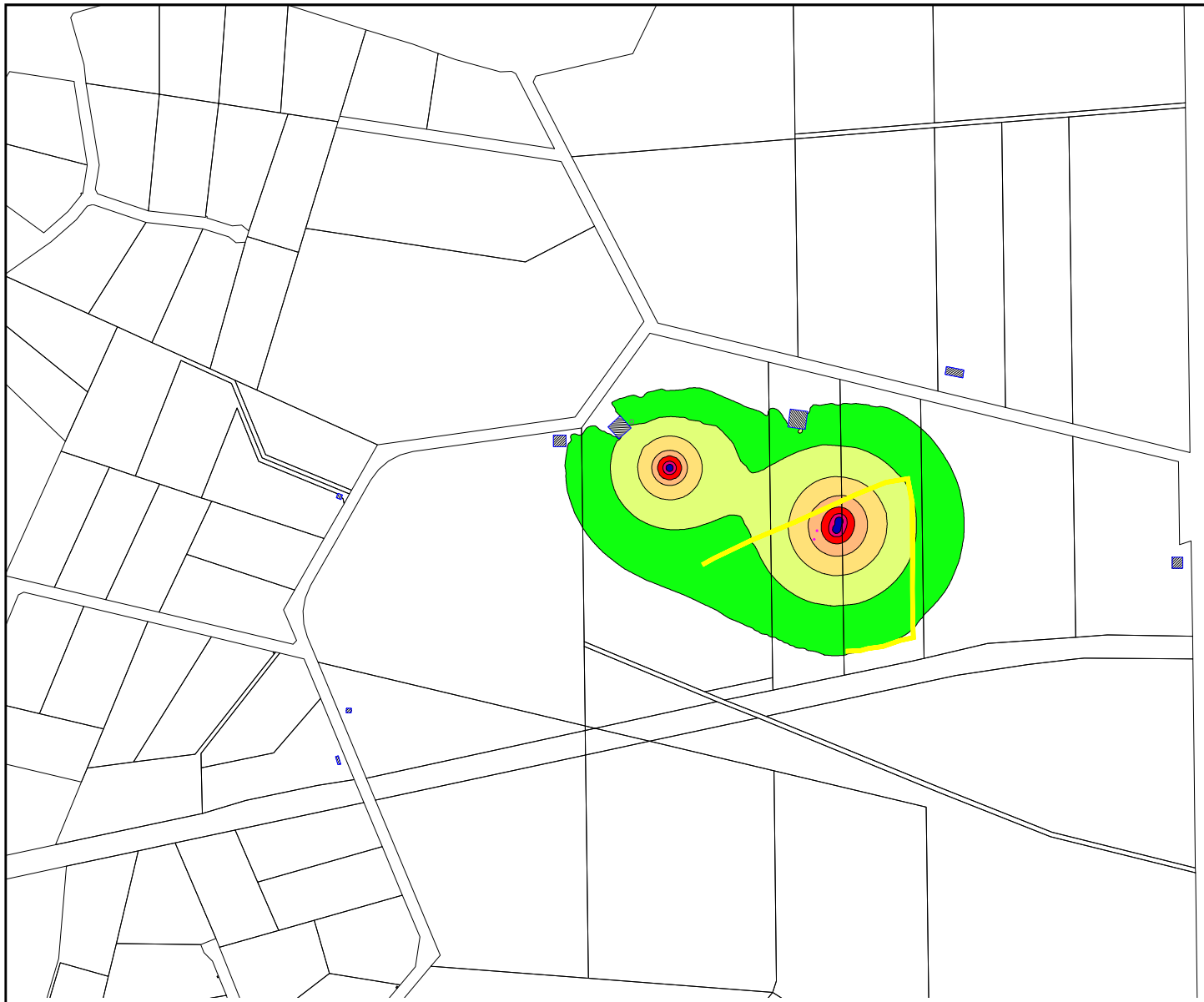
Figure 4.4



Noise level
L_{A1} dB

<=	50	Compliant With Regulations
<=	55	Exceeds Regulations
<=	60	
<=	65	
<=	70	
<=	75	
<=	80	
>	80	

Signs and symbols

- Property Boundaries
- Point source
- Buildings
- Quarry edge

N

Length Scale

0 50 100 200 300 400 m

Rocla Quarry Products - Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Phase 2 - Predicted L_{A1} Noise Level Contours - Wind From All Directions

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5 ASSESSMENT

There were no noise sources that are considered to be modulating or impulsive, however tonality is likely to be present. It is considered that the tonality cannot be practicably removed and as such, the predicted L_{A10} noise levels in *Figures 4.1 to 4.3* have been adjusted by + 5 dB in accordance with *Table 2.1*.

During the initial phase of the operations (phase 1), the operations are far enough away for the noise sensitive receivers to achieve compliance with the Regulations during the daytime period.

The critical time is during the middle of the pit life (phase 2) when the quarry is moving closer to the residences located to the north. At this stage, assuming the quarry face runs straight across the site, the barrier effect from the quarry walls is insufficient to achieve compliance with the Regulations and an exceedance of up to 5 dB is likely during downwind conditions.

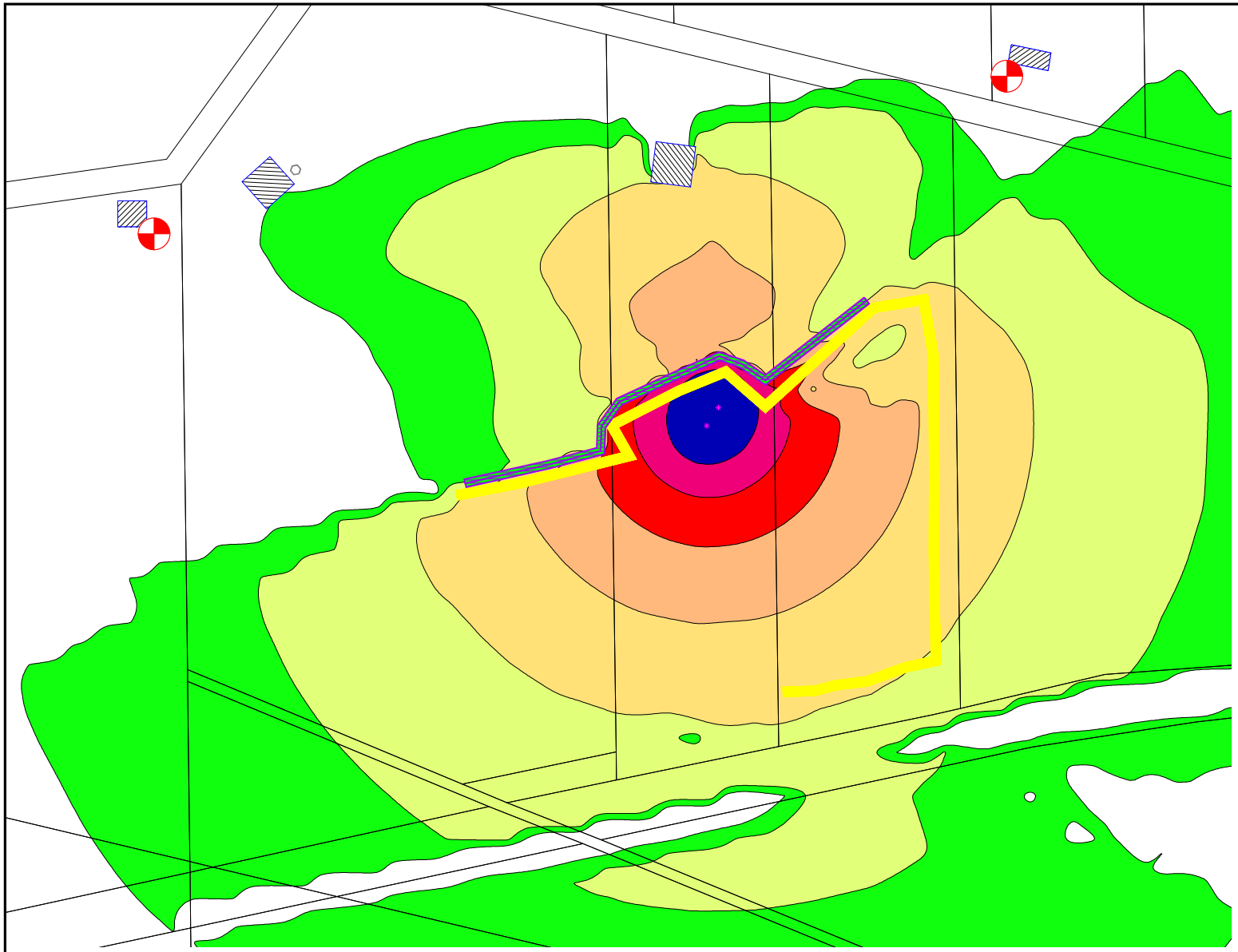
As the quarry moves into the final phases (phase 3), the walls of the quarry are high enough for the barrier effect to achieve compliance with the Regulations during the daytime period.

The L_{A1} noise levels, shown in *Figure 4.4*, are from the truck movements. This shows compliance with the assigned levels 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.

6 RECOMMENDATIONS

To comply with the Regulations during the daytime period, a 5 dB reduction is required to the overall L_{A10} noise level when the project reaches phase 2. To achieve this, the barrier effect of the quarry walls needs to be increased and it is recommended to construct a bund along the quarry wall with an RL of 25.0 metres at the top of the bund. In addition, the profile of the quarry wall should be such that the screen is enclosed on three sides. The effect of these noise control measures is presented in *Figure 6.1*.

Figure 6.1



Noise level
L_{A10} dB

<= 45	Compliant With Regulations
<= 50	Exceeds Regulations
<= 55	
<= 60	
<= 65	
<= 70	
<= 75	
> 75	

Signs and symbols

- Property Boundaries
- Point source
- Buildings
- Quarry edge
- Noise Bund
- Point receiver

N

Length Scale

0 20 40 80 120 160 m

Rocla Quarry Products - Proposed Quarry at Lots 300 & 301 Boomerang Rd and Lot 6 Banksia Rd, Oldbury
Phase 2 with RL 25m Bund - Predicted L_{A10} Noise Level Contours (Adjusted by +5 dB for Tonality)
Wind From All Directions

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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 and sound power 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 levels 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 time weighting as specified in AS1259.1-1990. 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 time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.

L_{APeak}

This is the maximum reading in decibels using the A frequency weighting and P time weighting AS1259.1-1990.

L_{Amax}

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

L_{A1}

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

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" 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.

L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" 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 20 000 Hz inclusive.

L_{Amax} assigned level

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

L_{A1} assigned level

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

L_{A10} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% 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 tonality 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;
>
> (b) is present for at least 10% of the representative

Impulsive Noise

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

> a variation in the emission of a noise where the difference between $L_{A\ peak}$ and $L_{A\ Max\ slow}$ 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.

Influencing factor

$$= \frac{1}{10}\left(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}\right) + \frac{1}{20}\left(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450}\right)$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

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.

Background Noise

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise

Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Satisfactory Design Sound Level

The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

Maximum Design Sound Level

The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

Reverberation Time

Of an enclosure, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.

RMS

The root mean square level. This is used to represent the average level of a wave form such as vibration.

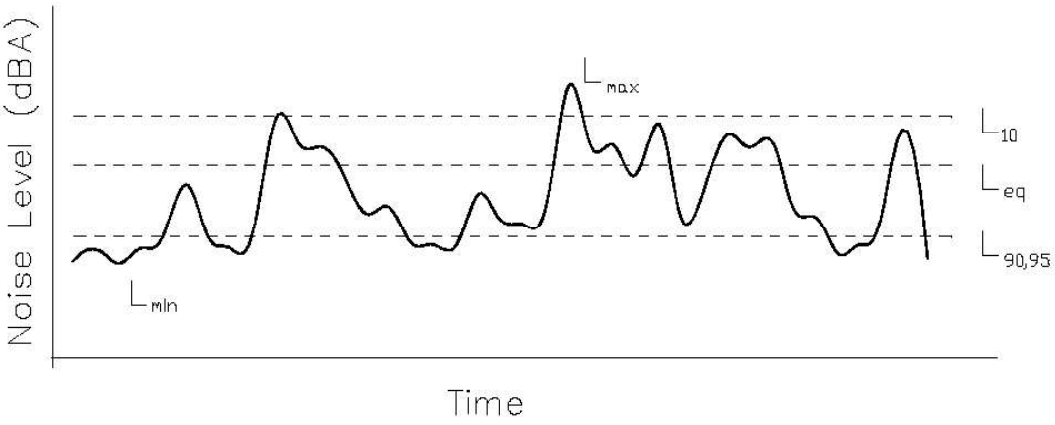
Vibration Velocity Level

The RMS velocity of a vibration source over a specified time period. Units are mm/s.

Peak Velocity

Level of vibration velocity measured as a non root mean square (r.m.s.) quantity in millimetres per second (mm/s).

Chart of Noise Level Descriptors



Typical Noise Levels