Specialist Noise, Blasting and Overpressure Report – Version C, 13 August 2007

Noise and Sound Services

Environmental Noise Impact Statement

For the Expansion of:-

Lubke Quarry, 'Cromer'
Hume Highway,
Holbrook, NSW.

March 2007

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Prepared at the request of:-

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C O N T E N T S

SUMMARY

This Noise Impact Statement considers a proposed expansion of the existing quarry operations at Lubke Quarry, "Cromer', Hume Highway Holbrook.

The site of the proposed expansion is bordered by the Hume Highway, bush and farmlands, with seven residences within a 2500 metre radius. The proposed expansion includes the use of plant such as; a mobile crusher, rock drill, excavators, loaders, compactors and trucks. The noise from blasting has been predicted and assessed.

Noise criteria provided by the NSW Government have been considered. These are the Industrial Noise Policy 2000 (INP), the ANZECC guidelines and the Environmental Noise Control Manual (1994) for blasting and the Environmental Criteria for Road Traffic Noise for on-road traffic noise. The assessment procedure covers both controlling intrusive noise impacts and maintaining noise level amenity.

The existing acoustical climate has been assessed using noise loggers located at the most sensitive available dwellings to the proposed expansion. The existing background noise levels (L_{A90}) were found to be between 30 dBA and 36 dBA. The existing ambient noise levels (L_{Aeq}) were found to be 43 dBA to 53 dBA.

A noise goal (L_{Aeq}) at the nearest residential properties has been set in accordance with INP criteria. This is generally 35 dBA in the day, evening and night time.

Acoustical modelling for the proposed expansion has been carried out. This uses methods given in the International Standard ISO 9613-2 (1996).

No significant noise impact is predicted from plant within the site for day time use. Mitigation measures are recommended if night time use is required. The on-road truck noise will not exceed the Road Traffic Criteria. The noise and vibration from blasting will also be met provided charge weights are restricted to those given in this report. Mitigation measures are recommended to minimise the impact from the blasting overpressure.

1. INTRODUCTION

Noise and Sound Services together with Ray Walsh and Associates was requested by Blueprint Planning & Development of 'Meringa' Tabletop Road, Tabletop NSW 2640, to carry out a Noise Impact Statement (NIS) for a proposed expansion of an existing quarry at Lubke Quarry, "Cromer', Hume Highway Holbrook, NSW. The NIS, which also includes vibration, is required as part of the Environmental Impact Statement (EIS) which is prepared by Blueprint Planning & Development for Bald Hill Quarries Pty Ltd. This NIS is in line with the requirements of the NSW Government's Industrial Noise Policy (2000).

The issues addressed in this NIS are the future noise emissions from plant, on-road traffic and blasting from the quarry.

2. SITE AND EXPANSION DESCRIPTION

This section describes the location site of the proposed expansion and provides a detailed description of the proposed working activity of the expansion.

2.1 Site Description

It is proposed to expand the existing quarry at Lot 1 DP 585233 ('Cromer') which is approximately 5 km northeast of Holbrook. The site is situated south of the Hume Highway with the proposed entrance approximately 1.2 km south of the junction with Rankin Road as shown in Figure A below. The surrounding area of the proposed expansion is a rural zone and is surrounded by bush and farmland.

There is also a residence on site but it is understood that this is owned and used by the quarry owner – hence it is not considered further in this NIS. A site plan is shown in Appendix A below. The nearest neighbouring residential properties and the approximate distances from the proposed expansion are shown in Table 1 below:-

TABLE 1 - ALL NEIGHBOURING RESIDENTIAL PROPERTIES WITHIN A 2,500 METRE RADIUS OF THE PROPOSED SITE

Neighbouring Property Name	Direction	Distance (metres)
'Beenly'	West	1,430
'Jerapoohl'	West	1,530
'Rockly Falls'	Southwest	1,610
'Wonga Park'	Northeast	1,360
'Wongalee'	Northeast	1,850
'Rankin Park'/'Milton'	Northwest	2,340
'Quambatook'	South	2,390

Note:- Distances are from the nearest boundary of the proposed quarry perimeter to 30 metres from the nearest wall of each resdience (to the nearest 10 metres)

2.1.2 Meteorological Conditions

Strong wind patterns do exist in the area. Temperature inversions are likely to occur between May and October with an average of six per month. The quarry will be in operation only in day and evening time (i.e. between 07:00 hours and 22:00 hours Monday to Friday and between 08:00 hours and 22:00 hours Saturdays and Sundays. In addition, most operations would only occur during daylight hours.

Temperature inversions are likely to occur on some nights between May and October however as the extraction works will only be in operation during day and evening time, from 07:00 hours until 22:00 hours, temperature inversions are not considered further. This is in line with the NSW Industrial Noise Policy (2000).

Wind speed and temperature gradients are not independent. For example, very large temperature and wind speed gradients cannot coexist. Strong turbulence associated with high wind speeds does not allow the development of marked thermal stratification.

2.2 Expansion Description

Details of the proposed quarry site expansion with working time periods are given below.

2.2.1 Construction

The construction involves an access road approximately 2 km long and includes a weighbridge. Works to provide sediment and erosion control will also be carried out. The works will involve topsoil and overburden removal, rock drilling and hydraulic hammer rock breaking. Construction works will only be carried out between 07:00 hours and 19:00 hours Monday to Friday and between 08:00 hours and 19:00 hours Saturdays for a period of approximately 4 weeks. No works on Sundays or Public Holidays

2.2.2 Plant Maintenance

Maintenance on plant and machinery will normally be carried out between 07:00 hours and 19:00 hours Monday to Saturday excluding Public Holidays; however in emergency situations maintenance works may be required at any time.

2.2.3 Blasting

Blasting will only be carried out between 10:00 hours and 15:00 hours Monday to Friday excluding Public Holidays. The frequency of blasting is approximately one per month.

2.2.4 Crushing, Stockpiling, Blending, and Pre-Coating

Crushing, stockpiling, blending, and pre-coating will be carried out between 07:00 hours and 22:00 hours Monday to Saturday excluding Public Holidays. Crushing plant includes a 42 x 30 STRB mobile primary jaw crusher, a 1200 mobile secondary cone crusher, 2 deck screens, a VSI mobile tertiary crusher, a 16 x 6 mobile triple deck screen and stockpiling conveyers and a 700kVA trailer mounted diesel genset. A front end loader with 5 m^3 capacity *'Komatsu WA 500-1'* will be used for quarry pit and crushing plant feed.

2.2.5 Loading and Hauling Product for Delivery to the Customer

Loading and hauling product for delivery to the customer is required to be carried out at any time between Monday and Friday excluding Public Holidays. A front

end loader with 4 m^3 capacity *'Hyundai HL770'* will be used for sales and stockpiling.

2.2.6 Mobile Plant Movements

The proposed quarry is not expected to extract more than 200,000 tonnes of material each year *(see Traffic Impact Statement (TIS) prepared by Garry Gaffney dated January 2007).* Typical heavy vehicle trips would be 25 trucks per day (hence 50 heavy vehicle movements per day in the peak delivery period). In the TIS a worst-case scenario of five times the average is assumed. This gives a peak hour traffic generation of 20 outbound trucks per hour. Movements are estimated equally north and south along the Hume Highway, hence 10 truck movements in each direction. Only one employee will be on site with four employees during crushing operations. In addition, contractors would access the site where specialist operations such a blasting, drilling or maintenance are required.

The 'peak delivery period' would be for the next 3-5 years (2007-2010/2012) and would occur during daylight hours when AbiGroup and Lleyton Contractors operate (a worst-case-scenario 6.00 am - 6.00 pm is assumed).

3. CRITERIA

Noise criteria are provided by the NSW Government and were published by the Environment Protection Authority, (EPA) division of the Department of Environment and Climate Change (DECC). The criteria are generally in line with criteria given in other States of Australia and many Countries of the World. This includes the Industrial Noise Policy (2000), the Environmental Criteria for Road Traffic Noise (1999) and the EPA Environmental Noise Control Manual (1994). These cover noise in urban, suburban and rural areas. Although specific local conditions can affect the criteria, convincing justification must be given for any variation to NSW Government guidelines.

3.1 Industrial Noise Policy

The assessment procedure for industrial noise sources given in the Industrial Noise Policy (2000) has two components:-

- **Controlling intrusive noise impacts; and**
- **Maintaining noise level amenity;**

In assessing the noise impact of industrial or commercial noise sources all components must be taken into account for residential receivers, but, in most cases, only one will become the limiting criterion. The project-specific noise

goals reflect the most stringent noise level requirement. It is derived from intrusive and amenity criteria and this is used to set a benchmark against which noise impacts and the need for noise mitigation are assessed.

3.1.1 Intrusive Noise Impacts

The NSW Government in their Industrial Noise Policy (2000) states that:- *'The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor) measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB.'* Thus, when considering the environmental consequence of noise from a specific source, any increase above the background sound pressure level, which exceeds 5 dB, may be offensive.

The perception of noise and its level of offensiveness depends greatly on the broader situation within which it occurs. Noise that might intrude into a resting or sleeping place may be found offensive whereas the same noise occurring in a market place or noisy working area may pass unnoticed. The concept of *'background + 5 dB'* derives from this consideration.

The NSW Government state that where the existing background noise level at the receptor is less than 30 dBA, as may occur in a quiet suburban or rural area, then 30 dBA should be assumed to be the existing background noise level.

Where the noise source contains characteristics such as prominent tonal components, impulsiveness, intermittency, irregularity or dominant low-frequency, content adjustments to the measured level are applied to allow for the increase in the annoyance value.

3.1.2 Protecting Noise Amenity

In the Industrial Noise Policy it is stated that *'To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1."*

The relevant parts of the NSW Government's recommended levels are given in Table 2 below:-

TABLE 2 – RECOMMENDED NOISE LEVELS FROM INDUSTRIAL NOISE SOURCES

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level (dBA)	
			Acceptable	Extreme
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50
Residence	Urban/Industrial Interface – for existing situations only	Day	65	70
		Evening	55	60
		Night	50	55
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Hence the acceptable noise level ANL (L_{Aeq}) for rural areas is **50 dBA** day time; **45 dBA** evening time and **40 dBA** night time. Day time is defined as 07:00 to 18:00 hours, evening is 18:00 to 22:00 hours and night time is defined as 22:00 hours to 07:00 hours. Modifications are made to the ANL to account for the existing level of industrial noise. These are shown in Table 3 below:-

TABLE 3 – MODIFICATIONS TO THE ACCEPTABLE NOISE LEVEL TO ACCOUNT FOR THE EXISTING LEVEL OF INDUSTRIAL NOISE.

Total existing L_{Aeq} noise level from Industrial sources, dBA	Maximum L_{Aeq} noise level from new sources alone, dBA
Acceptable noise level plus 2	Existing noise level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
Acceptable noise level minus 6	Acceptable noise level

3.1.3 Modifying Factor Adjustments

Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same sound pressure level.

TABLE 4 – MODIFYING FACTOR CORRECTIONS

Factor	Assessment/ Measurement	When to Apply	Correction	Comments
Tonal Noise	One-third octave band or narrow band analysis	Level of one third octave band exceeds the level of the adjacent bands by 5 dB or more (above 400 Hz)	+ 5 dB	Narrow band frequency analysis may be required to precisely detect occurrence
Low Frequency Noise	Measurement of C-weighted and A-weighted Level	Measure/assess C and A-weighted levels over same time period. Correction to be applied if the difference between the two is 15 dB or more	+ 5 dB	C-weighted is designed to be more responsive to low frequency noise
Impulsive Noise	Time weighting fast and impulse	If the difference in the A weighted maximum levels between 'fast' and 'impulse' are greater than 2 dB	Apply the difference in measured levels as the correction up to a maximum of 5 dB	Impulse time weighting is characterised by a short rise time (35msec) compared to 125msec for 'fast'.
Intermittent Noise	Subjectively Assessed	Level varies by more than 5 dB	+ 5 dB	Adjustment to be applied for night time only

A correction should be applied to both the intrusive and the amenity measurement before a comparison is made with the criteria. An abbreviated version of the correction factors is shown in Table 4 above.

3.2 Sleep Disturbance

The NSW Government recognises that many short-term high-level noises which occur at night may comply with noise criteria (as given above) and yet be undesirable because of the sleep disturbance or arousal effect. However as no night time work is predicted, sleep disturbance or arousal effect are not considered further.

3.3 N SW Government Criteria for Road Traffic Noise

The NSW Government has produced criteria for on-road traffic noise *'Environmental Criteria for Road Traffic Noise'* (May 1999). This provides criteria for land use expansions with potential to create additional traffic on local roads. Here the criteria ($L_{Aeq,\ 1\ hour}$) are **55 dBA for day time** (7:00 hours until 22:00 hours) and **50 dBA for night time** (22:00 hours until 07:00 hours). For land use expansions with potential to create additional traffic on freeways/arterials roads the criteria are **60 dBA for day time** ($L_{Aeq,\ 15\ hour}$) and **55 dBA for night time** ($L_{Aeq,\ 15\ hour}$) and for land use expansions with potential to create additional traffic on collector roads the criteria ($L_{Aeq,\ 1\ hour}$) are **60 dBA for day time** and **55 dBA for night time**.

In all cases, traffic arising from the expansion should not lead to an increase in existing noise levels of more than 2 dB.

3.4 Construction Site Noise

N The NSW Government are currently reviewing their policy for noise from construction sites. The new policy is likely to emphasize better work practices in a qualitative way. However until the new policy is issued the only guidance is given in the 'Environmental Noise Control Manual' (1994), Chapter 171. This states:-

"Where there is likelihood of annoyance due to noise from construction sites, conditions such as the following may be specified in a development consent or building application.

This applies particularly to non-scheduled premises such as commercial buildings where a long construction time is not likely.

Variation should be made according to local conditions.

Level Restrictions

i. Construction period of 4 weeks and under.
The L_{10} level measured over a period of not less that 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).

ii. Construction period greater than 4 weeks and not exceeding 26 weeks.
The L_{10} level measured over a period of not less that 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).

Time Restrictions

Monday to Friday, 7 am to 6 pm, Saturday, 7 am to 1 pm if inaudible on residential premises, otherwise 8 am to 1 pm.
No construction work to take place on Sundays or Public Holidays

Silencing - ***A****ll possible steps should be taken to silence construction site equipment."*

3.5 Noise and Vibration Blasting Criteria

3.5.1 ANZECC Guidelines

The Australian and New Zealand Environment Conservation Council (ANZECC) provide guidelines in *'Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration'* (1990). These are:-

- The recommended maximum level for air blasts is 115 dB Linear Peak;
- The level of 115 dB Linear Peak may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the levels should not exceed 120 dB Linear Peak at any time;
- The recommended maximum peak particle velocity (ppv) for ground vibration is 5 mm/s. It is recommended that a level of 2 mm/s be considered as a long term regulatory goal;
- The peak particle velocity magnitude of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. . However, the magnitude should not exceed 10 mm/s at any time;
- Blasting should only generally be permitted during the period between 09:00 hours and 17:00 hours Monday to Saturday;
- Blasting should generally take place no more than once per day.

3.5.2 Environmental Noise Control Manual

The EPA provides guideline criteria for the control of blasting impact at residences in chapter 154 of the Environmental Noise Control Manual (1994). This states that:-

"Blasting operations should, in most cases, be confined to the periods Monday to Saturday, 9 am to 3 pm. Blasting outside of those times should be approved only where blasting during the preferred times is clearly impracticable, and should be limited in number. Blasting at night should be avoided unless it is absolutely necessary".

The limiting criteria for the control of blasting impact at residences are shown in Table 5 below.

TABLE 5 – THE LIMITING CRITERIA FOR THE CONTROL OF BLASTING IMPACT AT RESIDENCES.

Time of Blasting	Blast Overpressure Level (dB(linear))		Ground Vibration Peak Particle Velocity (mm/s)	
	95%	100%	95%	100%
Monday to Saturday, 9 am to 3 pm	115	120	5	10
Monday to Saturday, 6 am to 9 am and 3 pm to 8 pm	105	120	2	10
Sunday. Public Holiday, 6 am to 8 pm Any Day, 8 pm to 6 am	95	120	1	10

Similar criteria are given in the Australian Standard *'AS 2187 Explosives – Storage, transport and use -Part 2 Use of explosives'*.

4. NOISE MEASUREMENTS AND SOURCE NOISE LEVELS

4.1 Existing Background and Ambient Noise Measurements

This section describes the instrumentation used for the existing background and ambient noise measurements, the measurement procedure and the results. The measurement locations shown in Figure A, see Appendix A, were chosen to be representative of the nearest residential properties for the proposed quarry site.

4.1.1 Instrumentation

The instrumentation used during the background noise survey consisted of three 'Acoustic Research Laboratories Pty Ltd' - Type 1 environmental noise loggers. The serial numbers are 15-199-417 194569 and 194550.

The loggers conform to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) as type 2 precision sound level meters and have an accuracy suitable for field use.

The logger calibration was checked before and after the measurement period with a Brüel and Kjær acoustical calibrator model 4230. No significant system drift occurred over the measurement periods.

4.1.2 Measurement Procedure

The measurements commenced between Friday, 2 February 2007 and Saturday, 10 February 2007. The environmental noise loggers where placed at the closest available residences to the southwest, the northwest and the northeast. These were residences known as 'Rockly Falls', 'Rankin Park'/'Milton' and 'Wongalee' respectively.

The full results are shown in graphical form in Appendix B. The 'fast' time weighting and 'A' frequency weighting were used. All measurements were taken at a height of approximately 1.2 metres. The results are necessarily a "snapshot" of the noise levels on the particular days of the survey. Noise levels can vary with time due to different weather or traffic conditions, also low level measurements can be affected by animal or insect noises. However, during the noise survey it was understood that the noise levels were typical and the weather did not have an adverse effect on the measurements. It is normal practice to mount loggers away from trees where wind in the leaves can affect background levels. However, this site is partly bush areas and all properties relevant to the quarry are in the vicinity of trees. It is recognised that the background measurements are affected by the noise of wind blowing through leaves, but, in this case this is considered to be part of the normal background acoustic climate.

4.1.3 Measurement Results

The assessment background noise level ABL (L_{A90}) is determined by the tenth percentile method for each period (i.e. day, evening and night) and for each day is shown in Tables 6, 8 and 10 below. The rating background noise levels RBL (L_{A90}) over the monitoring period is found from the median ABL value for the day time, evening time, and night time respectively. This is shown in Tables 7, 9,

and 11 below together with the logarithmic average of the existing ambient noise (L_{Aeq}).

TABLE 6 – EXISTING NOISE LEVELS – 'WONGALEE'

Date	Time of Day	Assessment Background Noise Levels (L_{A90})	Existing Ambient Noise Levels (L_{Aeq})
2/02/07	Day	35	45
2/02/07	Evening	36	52
2-3/02/07	Night	32	54
3/02/07	Day	34	46
3/02/07	Evening	33	50
3-4/02/07	Night	30	49
4/02/07	Day	34	46
4/02/07	Evening	36	53
4-5/02/07	Night	31	51
5/02/07	Day	35	46
5/02/07	Evening	38	52
5-6/02/07	Night	32	53
6/02/07	Day	33	47
6/02/07	Evening	41	52
6-7/02/07	Night	33	55
7/02/07	Day	36	48
7/02/07	Evening	40	53
7-8/02/07	Night	35	55
8/02/07	Day	34	47
8/02/07	Evening	36	51
8-9/02/07	Night	34	51
9/02/07	Day	34	47
9/02/07	Evening	39	53
9-10/02/07	Night	32	52
10/02/07	Day	36	49

Note - all levels rounded to the nearest whole decibel

The full statistical noise measurement results are shown in graphical form in Appendix B.

TABLE 7 – SUMMARY OF EXISTING NOISE LEVELS – 'WONGALEE'

Time of Day	Rating Background Noise Levels (L_{A90})	Log Average Existing Ambient Noise Levels (L_{Aeq})
Day	**34**	**47**
Evening	**36**	**52**
Night	**32**	**53**

TABLE 8 – EXISTING NOISE LEVELS – 'RANKIN PARK'/'MILTON'

Date	Time of Day	Assessment Background Noise Levels (L_{A90})	Existing Ambient Noise Levels (L_{Aeq})
2/02/07	Day	28	39
2/02/07	Evening	28	37
2-3/02/07	Night	32	44
3/02/07	Day	28	48
3/02/07	Evening	28	37
3-4/02/07	Night	27	37
4/02/07	Day	29	44
4/02/07	Evening	28	33
4-5/02/07	Night	28	40
5/02/07	Day	29	47
5/02/07	Evening	31	41
5-6/02/07	Night	30	44
6/02/07	Day	28	45
6/02/07	Evening	33	42
6-7/02/07	Night	30	41
7/02/07	Day	29	46
7/02/07	Evening	30	42
7-8/02/07	Night	30	41
8/02/07	Day	28	40
8/02/07	Evening	29	53
8-9/02/07	Night	32	49
9/02/07	Day	28	44
9/02/07	Evening	29	35
9-10/02/07	Night	29	39
10/02/07	Day	30	45

Note - all levels rounded to the nearest whole decibel

The full statistical noise measurement results are shown in graphical form in Appendix B.

TABLE 9 – SUMMARY OF EXISTING NOISE LEVELS – 'RANKIN PARK'/'MILTON'

Time of Day	Rating Background Noise Levels (L_{A90})	Log Average Existing Ambient Noise Levels (L_{Aeq})
Day	**28**	45
Evening	**29**	45
Night	**30**	43

TABLE 10 – EXISTING NOISE LEVELS – 'ROCKLY FALLS'

Date	Time of Day	Assessment Background Noise Levels (L_{A90})	Existing Ambient Noise Levels (L_{Aeq})
2/02/07	Day	31	53
2/02/07	Evening	30	46
2-3/02/07	Night	31	51
3/02/07	Day	31	54
3/02/07	Evening	29	46
3-4/02/07	Night	29	52
4/02/07	Day	31	53
4/02/07	Evening	34	49
4-5/02/07	Night	30	53
5/02/07	Day	32	57
5/02/07	Evening	36	49
5-6/02/07	Night	30	52
6/02/07	Day	28	56
6/02/07	Evening	28	53
6-7/02/07	Night	31	53
7/02/07	Day	31	59
7/02/07	Evening	41	58
7-8/02/07	Night	32	53
8/02/07	Day	30	50
8/02/07	Evening	33	63
8-9/02/07	Night	32	64
9/02/07	Day	32	51
9/02/07	Evening	37	48
9-10/02/07	Night	31	53
10/02/07	Day	36	52

Note - all levels rounded to the nearest whole decibel

The full statistical noise measurement results are shown in graphical form in Appendix B.

TABLE 11 – SUMMARY OF EXISTING NOISE LEVELS – 'ROCKLY FALLS'

Time of Day	Rating Background Noise Levels (L_{A90})	Log Average Existing Ambient Noise Levels (L_{Aeq})
Day	**31**	53
Evening	**33**	51
Night	**31**	53

4.2 Quarry Equipment Noise Levels

Sample sound pressure measurements were taken by Ray Walsh and Associates at the Wilkinson Quarry, Tumbarumba, NSW 2653 during a normal operation of the quarry. It is understood that the equipment measured at this quarry will be relocated to the subject site. Measurements were taken on Friday 16 February 2007 at varying distances from the equipment using a calibrated Brüel and Kjær sound level meter model 2260 (serial no. 2163202).

The measurements were taken at a height of approximately 1.5 metres in the free field and the 'A' frequency weighting. Real time 1/3 octave bands and the 'fast' time weighting were used exclusively. It is understood that each process was operated under normal conditions throughout the survey and all results are considered to be representative of typical daily activity. Not all of the individual pieces of equipment could be isolated from the other plant in the quarry; hence a simple addition of all the plant would lead to an overestimate of the total noise.

This section provides typical 'A' frequency weighted sound pressure levels in decibels re 20 μPa from the measurements at a standardised distance of 7 metres. These are then converted to octave band sound power levels in decibels re 10^{-12} Watts, the 'A' frequency weighted sound power levels in decibels re 10^{-12} Watts. The source noise levels for the quarry are shown in Table 12 below.

TABLE 12 – NOISE LEVELS OF QUARRY EQUIPMENT

Source	Sound Power Levels (dB) Octave Band Centre Frequency (Hz)								Sound Power Level	Sound Pressure Level ($L_{Aeq, 15\ minutes}$) at 7 metres
	63	125	250	500	1k	2k	4k	8k	dBA	dBA
Primary Jaw Crusher	121	117	114	117	116	113	108	101	120	95
Secondary Cone Crusher	120	113	113	115	114	113	110	102	119	94
VSI Mobile Crusher	119	107	104	102	100	102	99	94	108	83
Screener	113	102	95	97	97	98	99	93	105	80
Komatsu PC300 Excavator	102	110	101	100	100	96	91	86	104	79
Hyundai HL770 Loader	105	107	107	96	94	92	85	77	102	77
Komatsu WA 500 Loader	107	113	106	98	101	96	90	83	105	80
Kenworth 97T900 Tipper Truck	103	107	107	102	102	99	92	85	106	81
Diesel Genset (Exhaust Side)	123	109	108	110	109	107	103	96	114	89
From Noise and Sound Services Data Base										
Air Track Drill	111	111	106	108	113	117	116	108	122	97

4.3 Blasting Vibration Magnitudes

It was not possible to carry out test blasting within the time frame given to complete this report. Typical drilling and blasting operations for Holbrook Quarry as given by Wilkinson Quarry are shown in Table 14 below.

TABLE 14 – TYPICAL DRILLING AND BLASTING OPERATIONS

Typical Drilling and Blasting Operations	
Quantity of rock blasted	15 000 - 20 000 tonnes
No. of holes	40
Hole depth	16 metre
Hole diameter	89 mm
Hole pattern	3.0 m burden x 3.5 m spacing
Stemming	1.8 metre
Sub drill	1.0 metre
Frequency of blasting	Approximately 1 per month
Max Instantaneous charge	114 kg
Rock type	Micro granite

5. NOISE GOALS

It is important to note that the goals given below are for the noise level solely from the facilities in question and do not include extraneous noise from other sources.

5.1 Intrusive Noise Goals

For intrusive noise the goal is 5 dB plus the background noise level (L_{A90}) and these are shown in Tables 15 to 17 below.

TABLE 15 – INTRUSIVE NOISE GOALS – 'WONGALEE'

Time of Day	Rating Background Noise Levels (L_{A90})	Intrusive Noise Level Goal (L_{Aeq})
Day	**34**	**39**
Evening	**36**	**41**
Night	**32**	**37**

TABLE 16 – INTRUSIVE NOISE GOALS – 'RANKIN PARK'/'MILTON'

Time of Day	Rating Background Noise Levels (L_{A90})	Intrusive Noise Level Goal (L_{Aeq})*
Day	**28**	**35**
Evening	**29**	**35**
Night	**30**	**35**

**Note: based on the minium 30 dBA background plus 5 dB.*

TABLE 17 – INTRUSIVE NOISE GOALS – 'ROCKLY FALLS'

Time of Day	Rating Background Noise Levels (L_{A90})	Intrusive Noise Level Goal (L_{Aeq})
Day	**31**	**36**
Evening	**33**	**38**
Night	**31**	**36**

5.2 Noise Amenity Goals

For the amenity noise the goal is dependent upon the existing ambient noise level (L_{Aeq}) from other industrial sources. As there are no other industrial sources in the immediate area the 'Rural' amenity criteria apply. These are shown in Table 18 below.

TABLE 18 – SUMMARY OF EXISTING NOISE LEVELS – ALL LOCATIONS

Time of Day	Amenity Noise Level Goal (L_{Aeq})
Day	**50**
Evening	**45**
Night	**40**

5.3 Overall Project Specific Noise Goals

In summary, the project specific noise goals (worst-case-scenario) are as shown for all relevant locations in Table 19 below:-

TABLE 19 – OVERALL PROJECT SPECIFIC NOISE GOALS

Period	Intrusive Criterion	Amenity Criterion
Day	**35 dB $L_{Aeq, 15\ minutes}$ (30 + 5)**	50 dB $L_{Aeq, Days}$
Evening	**35 dB $L_{Aeq, 15\ minutes}$ (30 + 5)**	45 dB $L_{Aeq, Evening}$
Night	**35 dB $L_{Aeq, 15\ minutes}$ (30 + 5)**	40 dB $L_{Aeq, Night}$

Note: The goals in bold apply.

5.4 Construction Noise Goal

The day time construction goal (worst-case-scenario) for short-term noise (i.e. 4 weeks) is 50 dBA (i.e. 30 dBA plus 20 dB) when measured at a distance of 30 metres outside of any neighbouring residential facade.

5.5 Blasting Overpressure Goal

The site specific blasting overpressure goal for air blasts is **115 dB** linear peak maximum. This is when measured at a distance of 3 metres from any window of any residential dwelling.

5.6 Vibration Goal

A site specific peak particle velocity vibration goal (worst-case-scenario) of 2 mm/s is required when measured at the foundation of any residential dwelling.

6. NOISE AND VIBRATION MODELLING AND ASSESSMENT

This section provides details of the noise modelling procedure and gives an assessment of the predicted noise levels.

6.1 Noise Modelling Specifications

The source noise has been modelled using the International Standard ISO 9613-2 (1996(E)) '*Acoustic – Attenuation of sound during propagation outdoors Part 2 General method of calculation*'. This Standard specifies methods for the description of noise outdoors in community environments. The method described in the Standard is general in the sense that it may be applied to a wide variety of noise sources, and covers the major mechanism of attenuation. The method allows for downwind propagation conditions namely:-

- wind direction within an angle of ± 45° of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and

- wind speed between approximately 1 m/s and 5 m/s measured at a height of 3 m to 11 m above the ground.

6.2 Basic Noise Modelling Equations

The equivalent continuous downwind sound pressure level (L_{Aeq}) at each receiver point has been calculated for each point source using the equation below:-

$$\mathbf{L_{Aeq} = L_w + D_c - A}$$

Where:

L_w	is the sound power level of the noise source;
D_c	is directivity correction; and
A	is the attenuation that occurs during the propagation from source to receiver.

The attenuation term A in the equation above is given by:-

$$\boldsymbol{A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}}$$

Where:

A_{div}	is the attenuation due to geometric divergence;
A_{atm}	is the attenuation due to atmospheric absorption;
A_{gr}	is the attenuation due to the ground effects;
A_{bar}	is the attenuation due to a barrier; and
A_{misc}	is the attenuation due to miscellaneous other effects.

With quarries and landfill sites the noise attenuation due to barriers (A_{bar}) is a variable and is dependent upon the stage of the works. It can range from almost zero, where a direct line of sight is applicable, to 15 dB or even as much as 25 dB where plant is in operation near to the lower parts of the quarry or landfill.

The last term (A_{misc}) generally refers to miscellaneous propagation through foliage, industrial sites and areas of houses. The miscellaneous terms are not regarded as significantly applicable for the site in question and are not applied in this NIS, therefore a worst-case-scenario is assumed.

6.3 Prediction of Plant Noise

The assessment results for constant operation of the proposed plant, at the nearest residential receivers are shown in Table 20 below.

TABLE 20 – PREDICTED QUARRY PLANT NOISE LEVELS AT THE NEAREST RESIDENCES

Neighbouring Property Name	Direction	Distance (metres)	Predicted Sound Pressure Level ($L_{Aeq, 15\ minutes}$)
'Beenly'	West	1430	40
'Jerapoohl'	West	1530	39
'Rockly Falls'	Southwest	1610	39
'Wonga Park'	Northeast	1360	26
'Wongalee'	Northeast	1850	22
'Rankin Park'/'Milton'	Northwest	2340	33
'Quambatook'	South	2390	33

Notes:

1. *All level are rounded to the nearset whole decibel*
2. *In the Northeast direction a barrier effect of 15 dB is assumed due to the existing topography.*
3. *All Predictions have an 95% uncertainly of +2/-5 dB*

6.4 Construction Noise

The highest level of construction noise will be from rock drilling and hydraulic hammer rock breaking. Here the sound power level will not exceed 112 dBA. The level at the nearest residential property is predicted to be 47 dBA.

6.5 Temperature Inversion and Wind Effects

The predictions in Table 20 above are for average propagation under a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm early morning periods. This is line with the INP weather conditions. High wind conditions, in unfavourable directions, will increase the predicted noise levels given in Table 20 above; however this is unlikely to occur for more than 10% of the time when the quarry is in operation and should therefore not be a factor in setting the licensing limits.

6.6 Assessment of Plant Noise

It can be seen from Table 20 above that the industrial noise goal ($L_{Aeq, day}$) will be met at the majority of neighbouring residential properties. However this goal could be exceeded at the three closest properties to the west and southwest of the site. This takes into account all plant in operation simultaneously.

The rock drilling could also exceed the noise goals, however as this only occurs three days per month on average no significant noise impact is predicted. To ensure the impact is minimised good community relations, including informing

all local residents of times of drilling is essential. It is also essential that drilling only occurs in day time hours (07:00 hours to 18:00 hours) Monday to Friday.

Reversing alarms can be the cause of complaint even if the sound levels are well below the existing background noise level. Alternative, low noise, systems such as close-circuit television, radar or sonar should be investigated provided that they meet on-site safety requirements.

6.7 Prediction of On-Road Traffic Noise

This section gives predictions of noise levels from road traffic, using the Hume Highway, applying formulae given in the Calculation of Road Traffic Noise (CoRTN) from the UK Department of Transport and Welsh Office (1988**).** The calculation procedure given in CoRTN is untested for small traffic flows. Therefore a calculation based on the sound exposure level for one truck has also been carried out.

6.7.1 Quarry On-Road Traffic

Based on the reported 200,000 tonnes of material per year *(see Traffic Impact Statement prepared by Garry Gaffney dated January 2007)* which results in a maximum of 50 truck movements per day (day time only) and an average of 6 per hour (i.e. 50/12 hours) with a peak and 4 trucks per hour in each direction. In worst-case scenario 20 trucks movements are predicted in a peak hour. For 20 truck movements per hour CoRTN gives noise level ($L_{Aeq,\ 1\ hour}$) prediction of **61 dBA** at 15 metres from the nearest boundary (this assumes a vehicle speed of 50 km/hr and a small (2%) gradient). Based on a measured truck sound exposures level (L_{AE}) at 15 metres of 85 dBA the hourly level ($L_{Aeq,\ 1\ hour}$) is **60 dBA** (from $L_{Aeq,\ 1\ hour} = L_{AE} - 10\ \log_{10}(T) + 10\ \log_{10}(N)$ where T is one hour in seconds and N is the number of trucks (i.e. 10 in this case)). This meets the noise gaol but cases, traffic arising from the expansion is likely to lead to an increase in existing noise levels of more than 2 dB.

6.7.2 Assessment

Road traffic from the quarry is predicted at 60 dBA at 15 metres. This could occur as trucks pass through Holbrook Township where there are residences. This exceeds the day time NSW Government guidelines for road traffic noise.

6.8 Prediction of On-Site Traffic Noise

Based on the information as given in section 6.7 above, the on-site traffic noise at 1430 metres based on a measured truck sound exposures level (L_{AE}) at 15 metres of 85 dBA the hourly level ($L_{Aeq,\ 1\ hour}$) is **26 dBA** (from $L_{Aeq,\ 1\ hour} = L_{AE} - 10 \log_{10}(T) + 10 \log_{10}(N) - 5$ where T is one hour in seconds and N is the number of trucks (i.e. 10 in this case) and 5 dB is for ground attenuation). On-site traffic noise will not contribute to the overall predicted levels at any residential dwelling.

6.9 Prediction of Vibration from Blasting

The independent variables involved in the prediction of vibration peak particle velocity (mm/s) from blasting includes the energy released by the explosion (per delay) which is dependant upon the charge weight (kg) per delay 'W', the distance from the explosion (range in metres) 'R'; the seismic velocity of the rock mass and the density of the rock mass. Since the density for a rock mass does not vary by more than 20% and the seismic velocity does not vary more than a factor of 2, the variation in 'W' and 'R' are much more significant than the density and the seismic velocity. The peak particle velocity is proportional to 'W' and inversely proportional to 'R'. When both 'W' and 'R' vary, scaling of distance is necessary to predict peak particle velocity.

The two most popular approaches are square root ($R/W^{1/2}$) scaling and cube root ($R/W^{1/3}$) scaling. Square root scaling produces higher predicted vibration magnitudes than cube root scaling at the distances under consideration in this assessment. Therefore only square root scaling is considered in further detail.

Equations for predicting peak particle velocity (ppv) from square root scaling have been developed in the United States by Dowding (1985) and Hendron and Oriard (1972). The equation is:-

$$ppv = a\ (R/W^{1/2})^{-1.57}$$

There are many systematic causes of scatter in plots of peak particle velocities. The most important of these are type of explosive, geometry of the shot, stemming, direction of blast initiation, delay-time variations, burden in front of the first row of holes, spacing of holes, and free surface reflection. It has been shown in practical results from blasts that the factor 'a' in the above equation can therefore vary between approximately 125 and 1250. Therefore a statistical approach to the prediction of ppv is required. The 95% confidence approach is normally adopted giving a prediction of the ppv that will not be exceeded for 95 out of 100 blasts and is given by the equation below:-

$$ppv = 1125\ (R/W^{1/2})^{-1.57}$$

Based on the proposed maximum instantaneous charge weight of 114 kg the ppv vibration goal of 2 mm/s for 95% of blasts will be met at a distance of approximately **650 metres** from the blast position.

6.10 Prediction of Overpressure from Blasting

The overpressure from blasting is normally predicted in terms of pressure in units of pascals (Pa) or on the decibel scale (dB(linear)).

Equations for predicting overpressure (p) from logarithmic scaling have been developed by Noise and Sound Services from quarry blast data given by Siskind in the United States by Dowding (1980). The equation is:-

$$L_{peak} = 136 - 16 \log_{10} (R/W) \text{ dBL}$$

Based on the proposed maximum instantaneous charge weight of 114 kg the overpressure goal of 115 dB for 95% of blasts will be met at direct line of sight distances of **2300 metres** from the blast position. The 120 dB limit will be met at distances of approximately **1200 metres**. Residences to the northeast are likely to be shielded by the natural topography of the site. No residences are likely to be exposed to overpressure levels exceeding the 120 dB limit. Only three residences are likely to exceed the overpressure goal of 115 dB for 95% of blasts. These are 'Beenly', 'Jerapoohl' and 'Rockly Falls', as identified at Table 1 above.

7. MITIGATION

7.1 Quarry Plant

It can be seen from Table 20 below that the industrial noise goal ($L_{Aeq, day}$) will be met at the majority of neighbouring residential properties. However could be exceeded at the three closest properties to the west and southwest of the site. The jaw crushing equipment (primary jaw crushing and secondary cone crushing) is by far the predominant noise source. The construction of an acoustic barrier, close to the jaw crushing equipment, which fully prevents line-of-sight to the three closest properties to the west and southwest, will result in a noise reduction of approximately 5 dB. This is providing that the barrier is kept close to the noise source (i.e. within 10 metres) the rarefaction effect of adverse wind conditions will not be significant.

TABLE 20 – PREDICTED QUARRY PLANT NOISE LEVELS AT THE NEAREST RESIDENCES WITH BARRIER.

Neighbouring Property Name	Direction	Distance (metres)	Predicted Sound Pressure Level ($L_{Aeq, 15\ minutes}$)
'Beenly'	West	1430	35
'Jerapoohl'	West	1530	34
'Rockly Falls'	Southwest	1610	34

Notes:

1. All level are rounded to the nearset whole decibel
2. All Predictions have an 95% uncertainly of +2/-5 dB.

The barrier can be constructed, for example of earth mounds and could untilse natuarl topogarhy where practicable.

The barrier must be located close to the jaw crushing equipment and fully prevents line-of-sight from the highest point of the equipment to the three closest properties to the west and southwest, at all times. If the location of the jaw crushing equipment moves, the barrier must be extended or relocated along with the equipment.

7.2 Blasting Overpressure

All residents with a 3,000 metre distance of the proposed quarry should be kept fully informed, well in advance of any blasting to be carried out at the site.

Where winds are significant (i.e. over 3 km/hour and in a south, west or southwest direction) the charge weight should be restricted to 30 kg for winds between 3 km/hour and 5 km/hour. Blasting should be avoided when winds in the south or southwest directions exceed 5 km/hour. No blasting should take place at night-time (22:00 hours to 07:00 hours).

8. CONCLUSIONS

It can be seen from the assessment results that:-

- the NSW Government noise criteria will be met for the onsite plant noise from the proposed expansion (based on an existing day-time background noise level of 30 dBA). Possible exceptions are for 'Beenly', 'Jerapoohl' and 'Rockly Falls'. Here a significnat noise impact is only predicted if night time use is required. Mitigation measures are recommended for night time use of the jaw crushers and diesel gen set.

- the NSW Government noise criteria for road traffic from the proposed expansion will be met for the future traffic using the Hume Highway/Freeway.

- the noise criteria for vibration from blasting at the proposed expansion will be met providing charge weights of explosives given in Table 14 above are adhered to.

- the noise criteria for overpressure from blasting at the proposed expansion will be met providing charge weights of explosives given in Table 14 above are adhered to. Possible exceptions are for 'Beenly', 'Jerapoohl' and 'Rockly Falls' and mitigation measures are recommended.

Date	Prepared by:	Status
20 February 2007	Ken Scannell MSc MAAS MIOA	Draft
4 March 2007	Ken Scannell MSc MAAS MIOA	Final
9 June 2007	Ken Scannell MSc MAAS MIOA	Final Rev A
13 August 2007	Ken Scannell MSc MAAS MIOA	Final Rev B
13 August 2007	Ken Scannell MSc MAAS MIOA	Final Rev C
Date	**Checked by:**	**Status**
22 February 2007	Matthew Harwood AAAS	Draft
27 February 2007	James Laycock BUrbRegPlan, MBA, MPIA, CPP	Final
13 August 2007	James Laycock BUrbRegPlan, MBA, MPIA, CPP	Final Rev C

Important Note. *All products and materials suggested by 'Noise and Sound Services' are selected for their acoustical properties only. All other properties such as airflow, aesthetics, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, smoke, ventilation, etc are outside of 'Noise and Sound Services' field of expertise and* ***must be*** *checked with the supplier or suitably qualified specialist before purchase.*

APPENDIX A

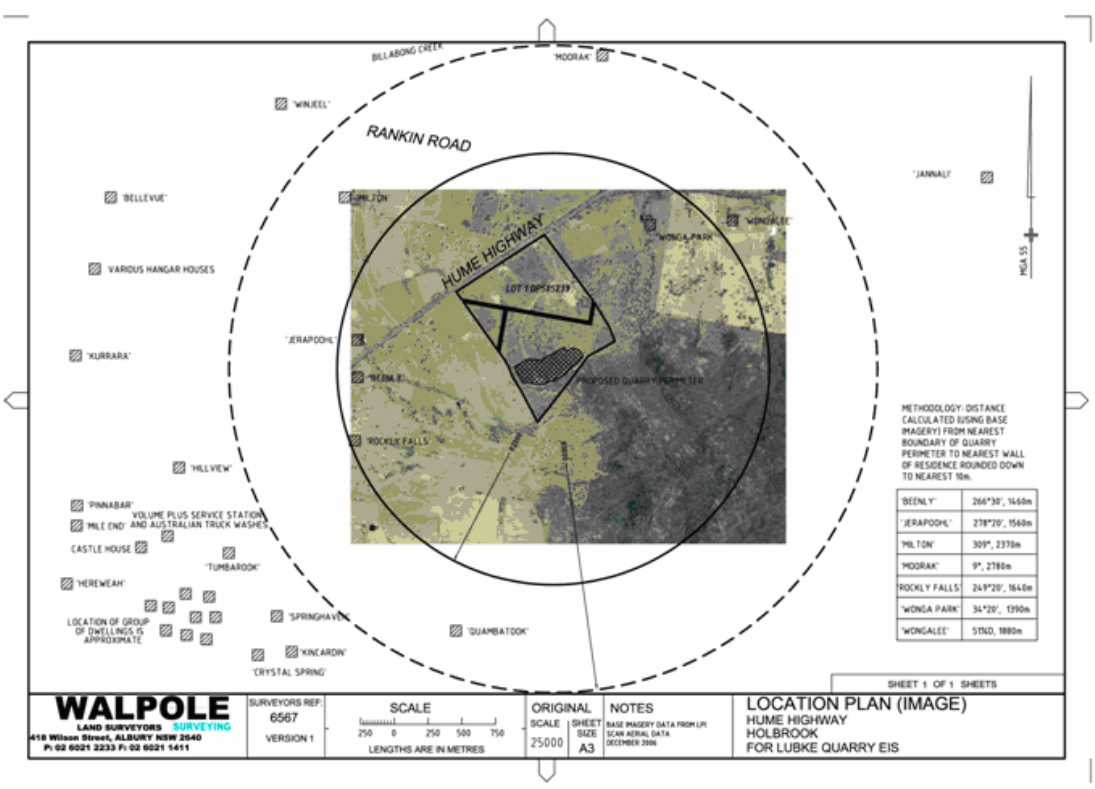
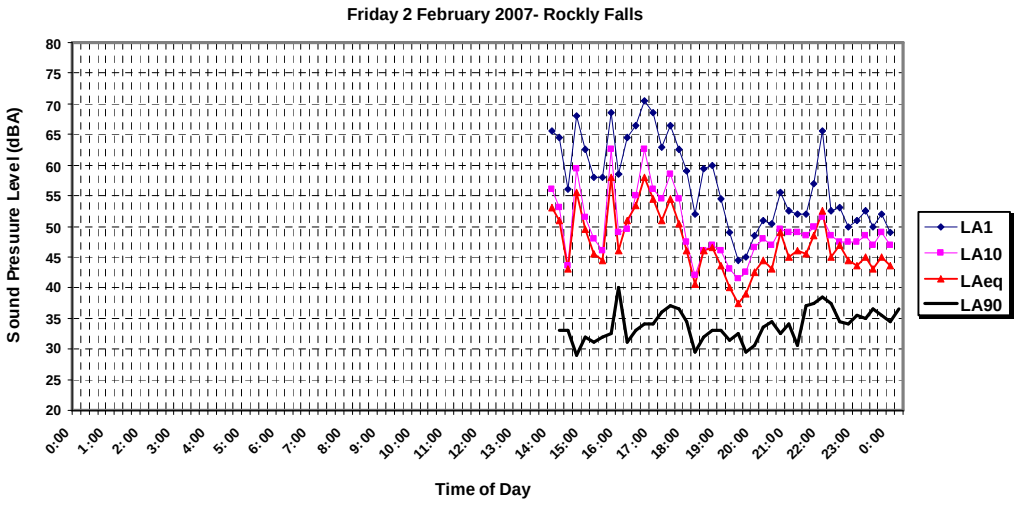


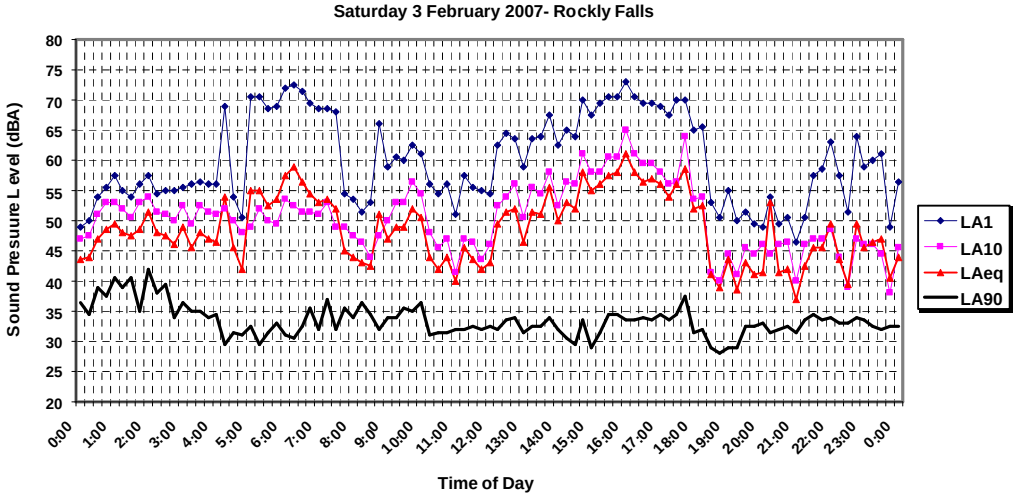
Figure A – Site Plan

APPENDIX B – MEASURED AMBIENT AND BACKGROUND NOISE LEVELS

Environmental noise levels can vary considerably with time; therefore it is not adequate to use a single number to fully describe the acoustic environment. The preferred, and now generally accepted, method of recording and presenting noise measurements is based upon a statistical approach. For example, the L_{A10} noise level is the level exceeded for 10% of the time, and is approximately the average maximum noise level. The L_{A90} level is the level that is exceeded for 90% of the time, and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the 'background' noise level. The L_{Aeq} level represents the average noise energy during the measurement period. This level is often referred to as the 'ambient' noise level.

The following graphs show the noise logger results at three locations 'Rockly Falls'; 'Wongalee' and 'Rankin Park'/'Milton' which represents the acoustic climate in all of surrounding areas of the subject site.

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Time of Day
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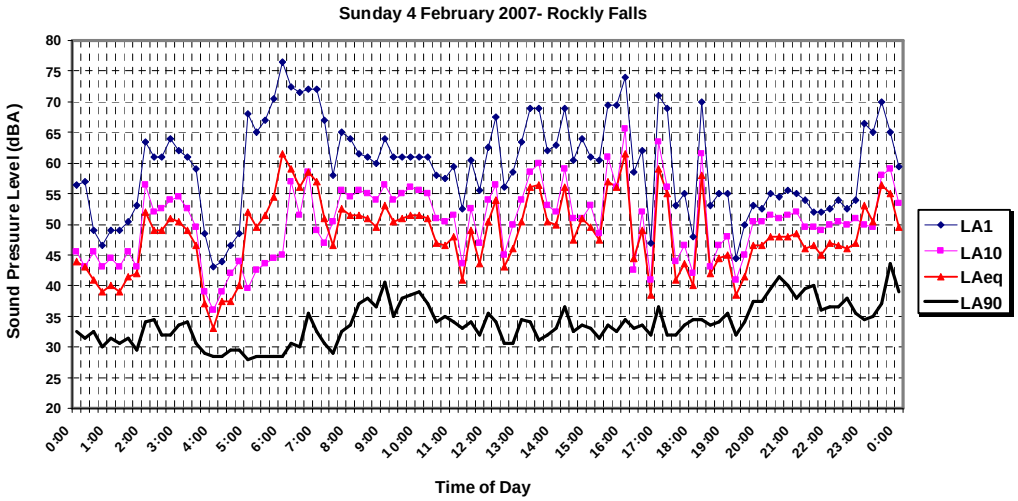
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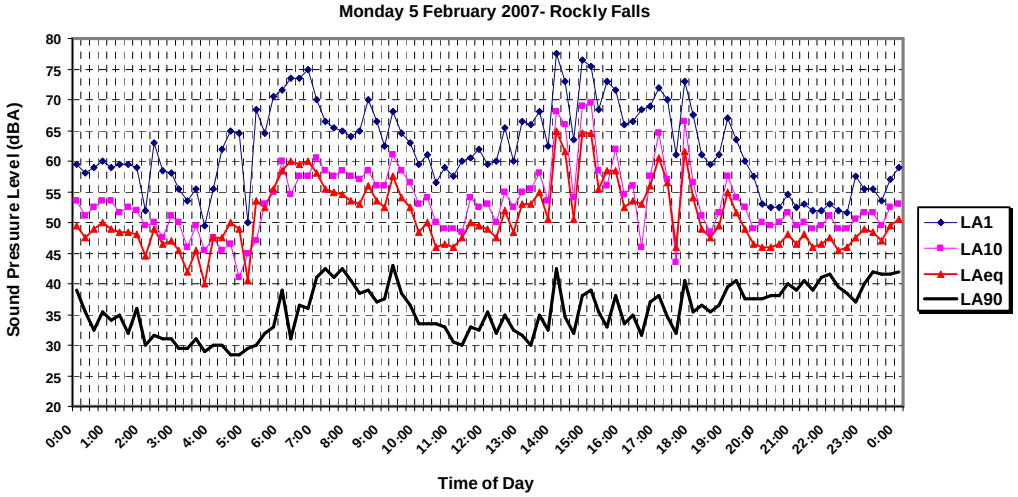
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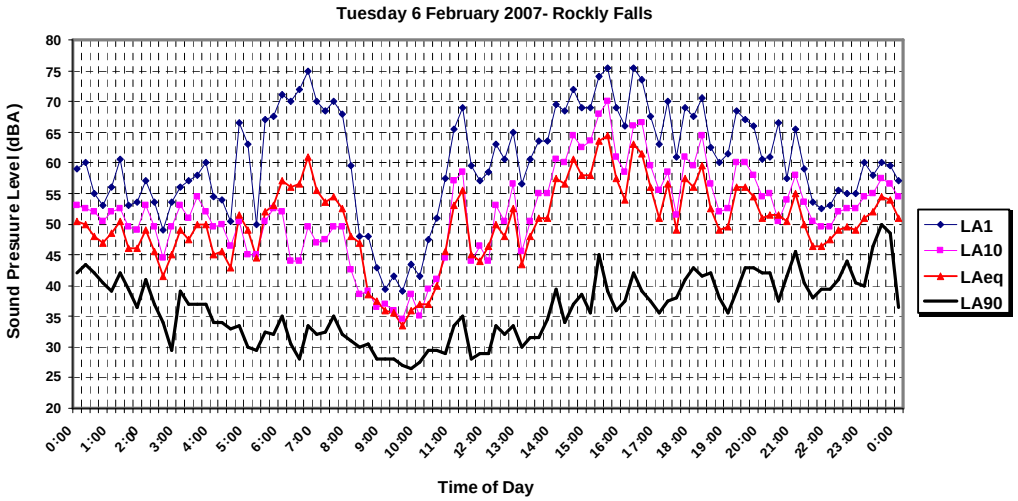
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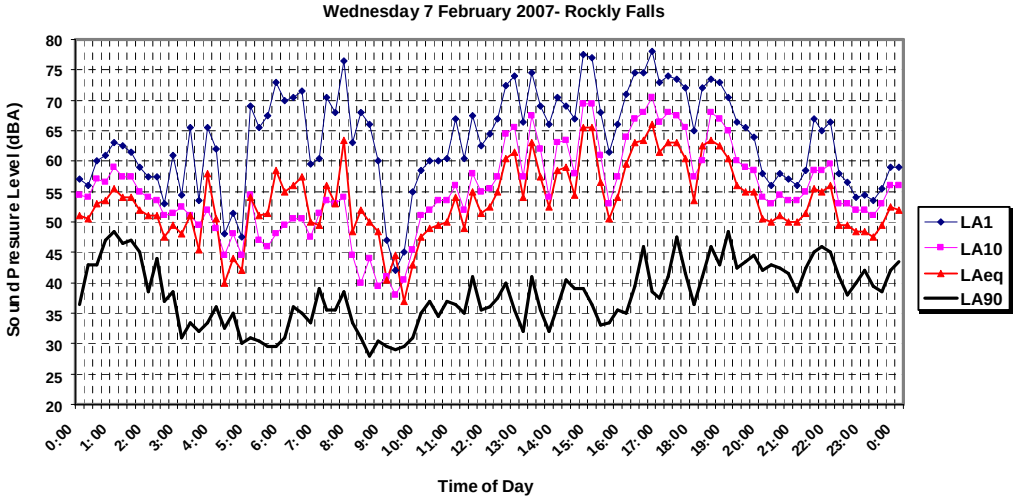
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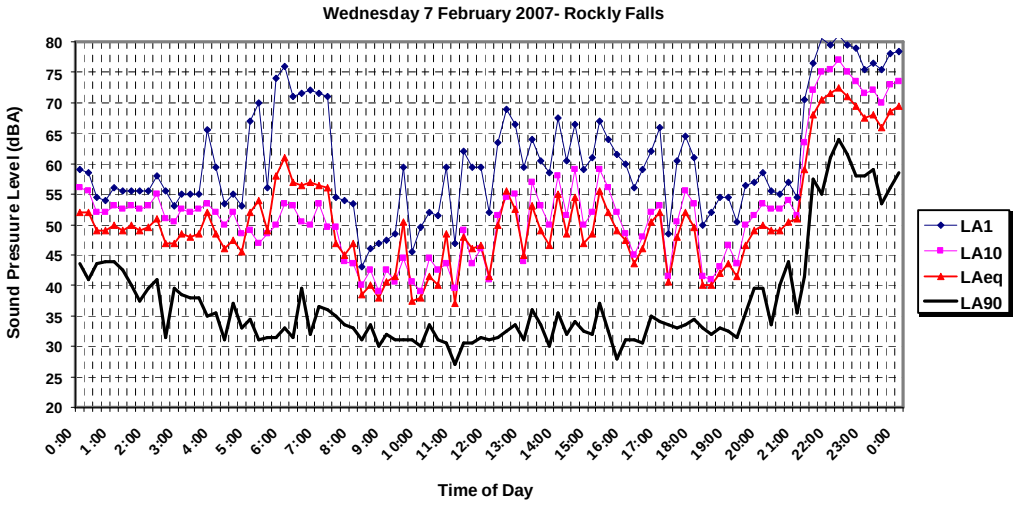
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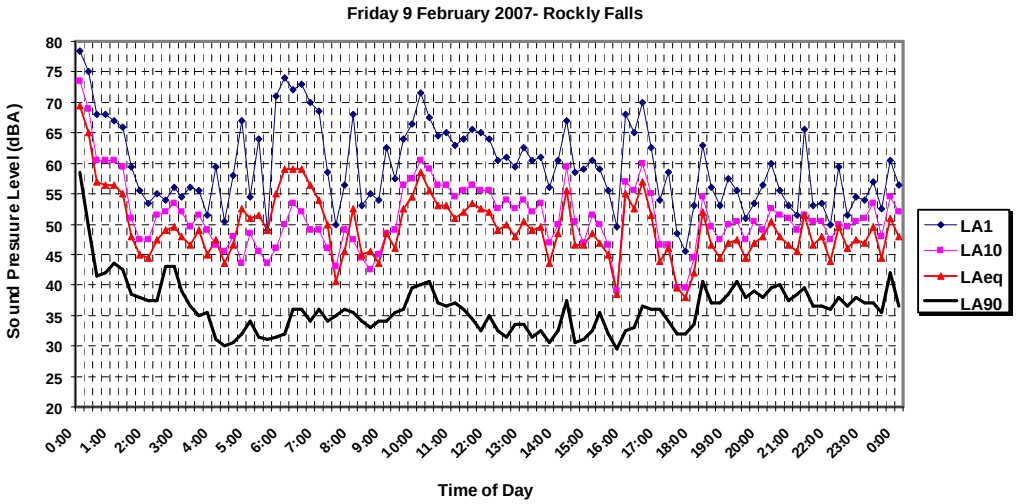
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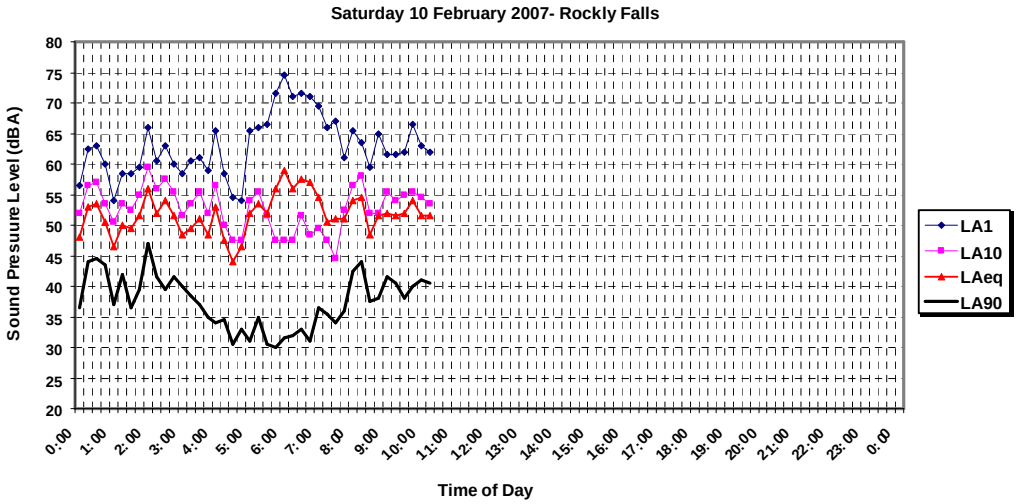
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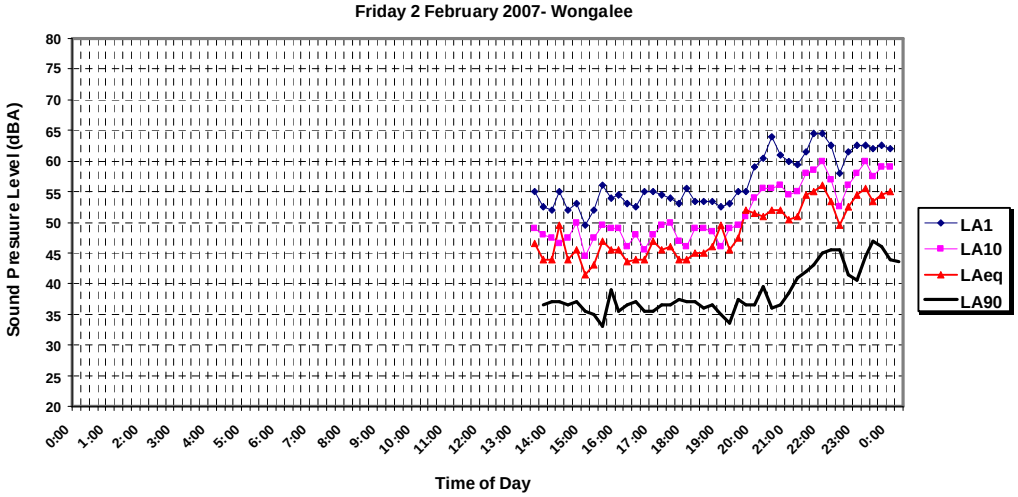
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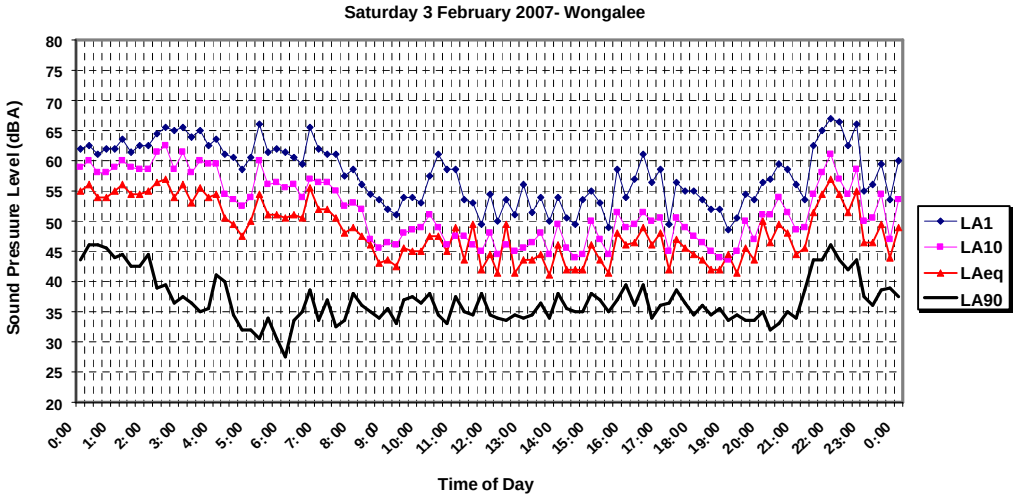
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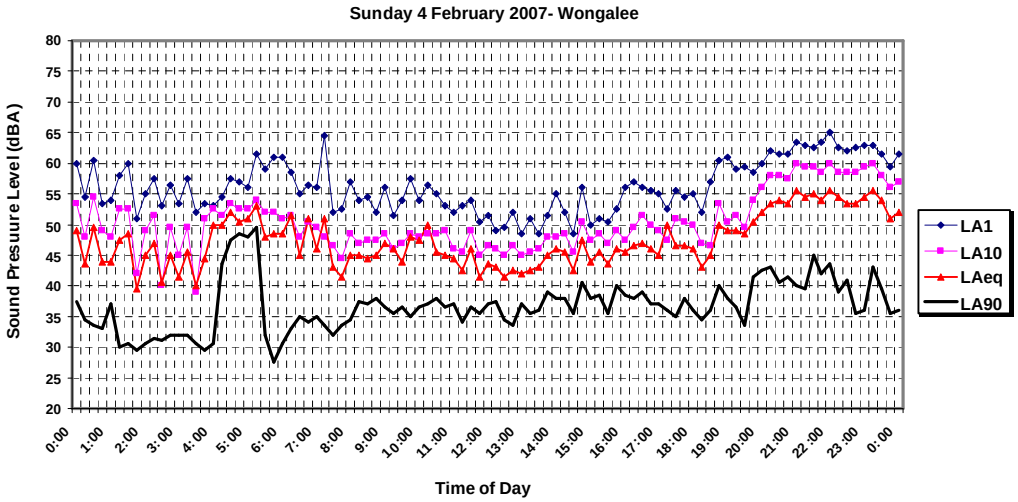
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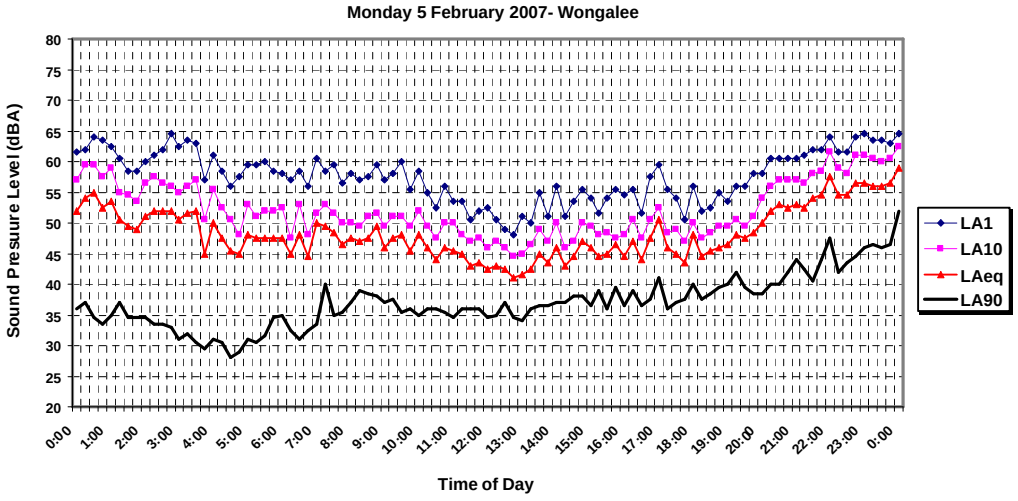
Monday 5 February 2007- Wongalee
Sound Presuure Level (dBA)
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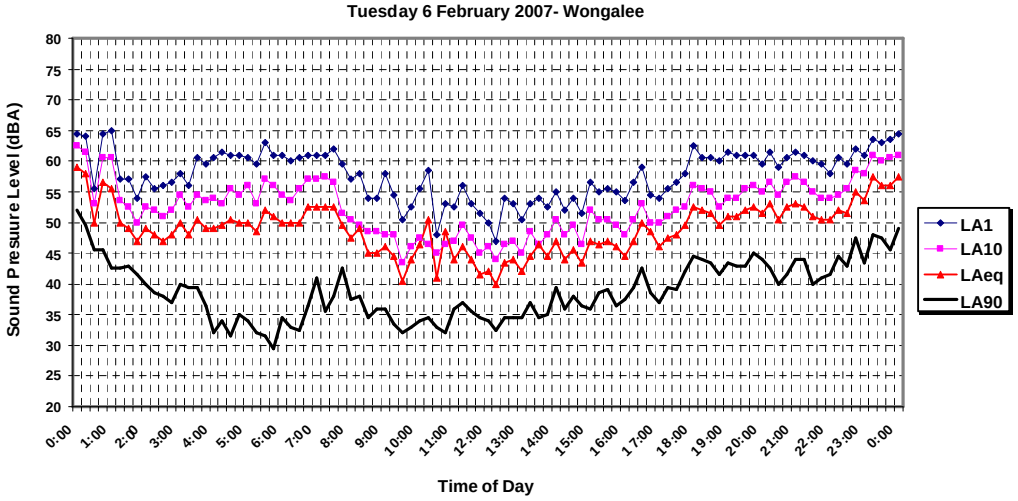
Tuesday 6 February 2007- Wongalee
Sound Presuure Level (dBA)
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Time of Day
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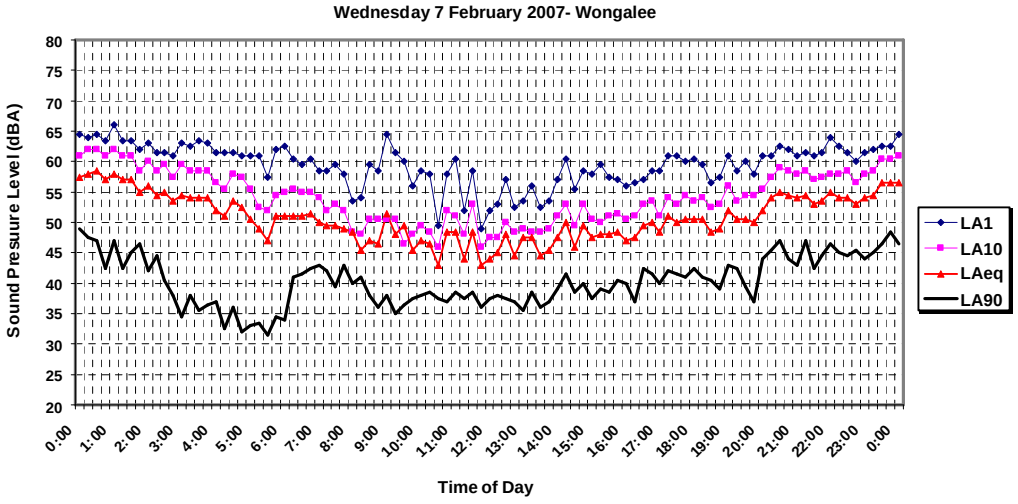
Wednesday 7 February 2007- Wongalee
Sound Presuure Level (dBA)
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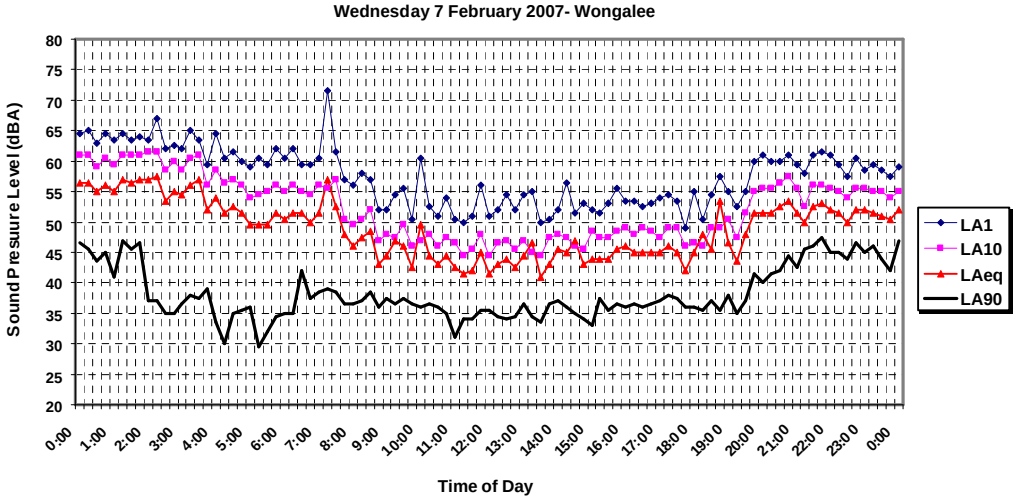
Wednesday 7 February 2007- Wongalee
Sound Presuure Level (dBA)
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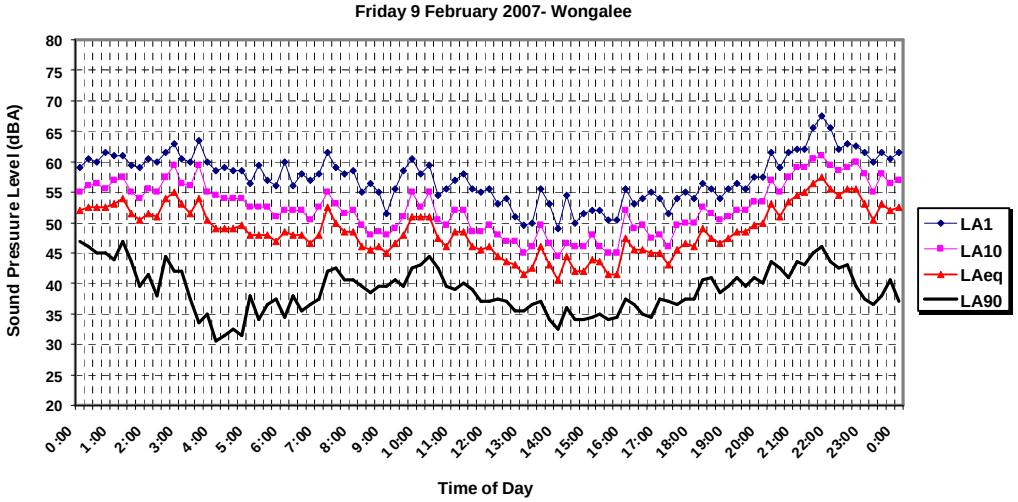
Friday 9 February 2007- Wongalee
Sound Presuure Level (dBA)
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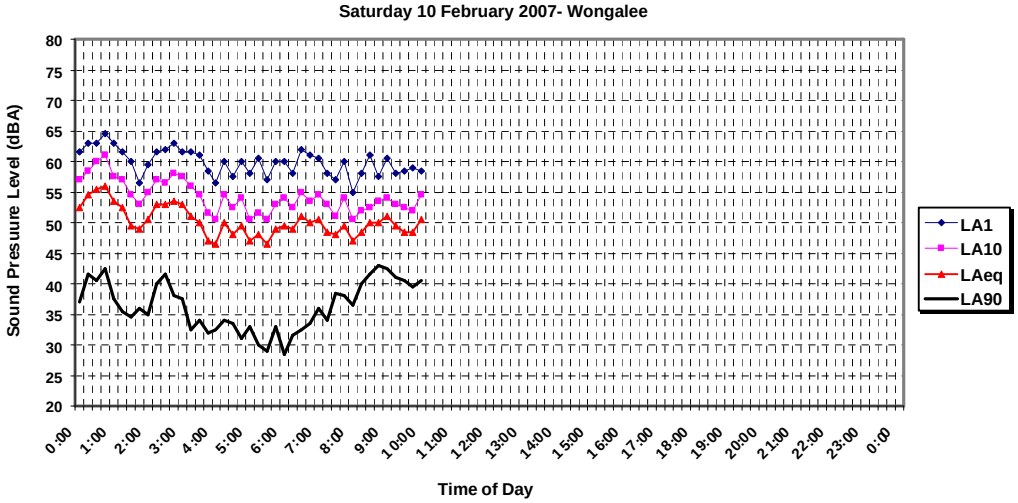
Saturday 10 February 2007- Wongalee
Sound Presuure Level (dBA)
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Time of Day
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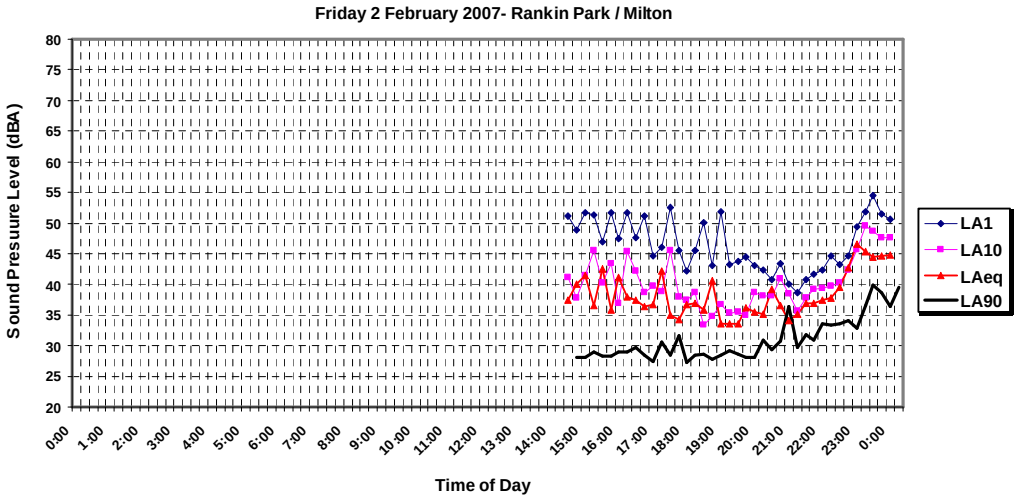
Friday 2 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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Time of Day
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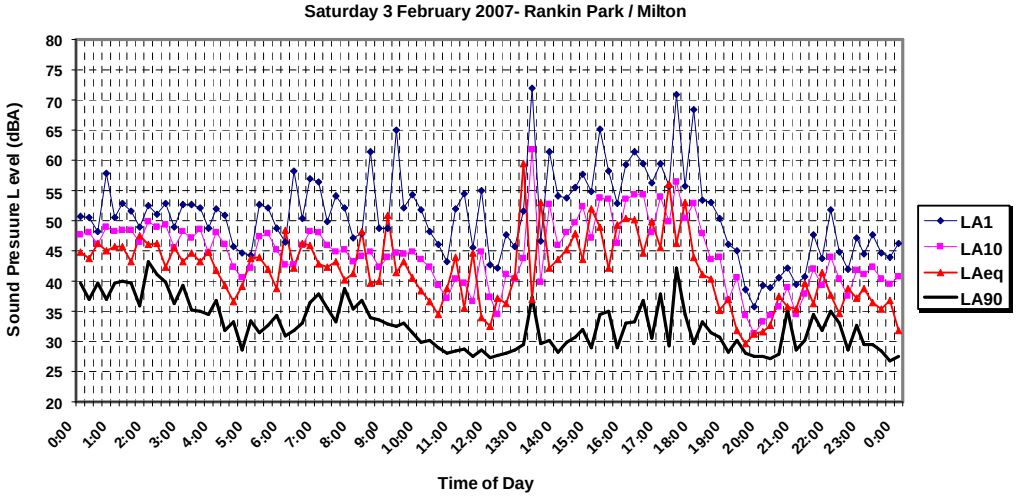
Saturday 3 February 2007- Rankin Park / Milton
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Time of Day
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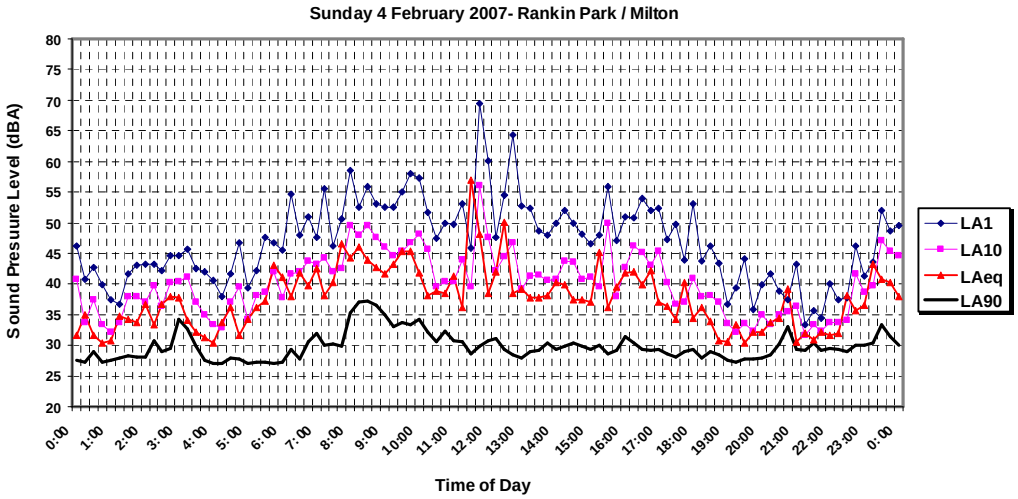
Sunday 4 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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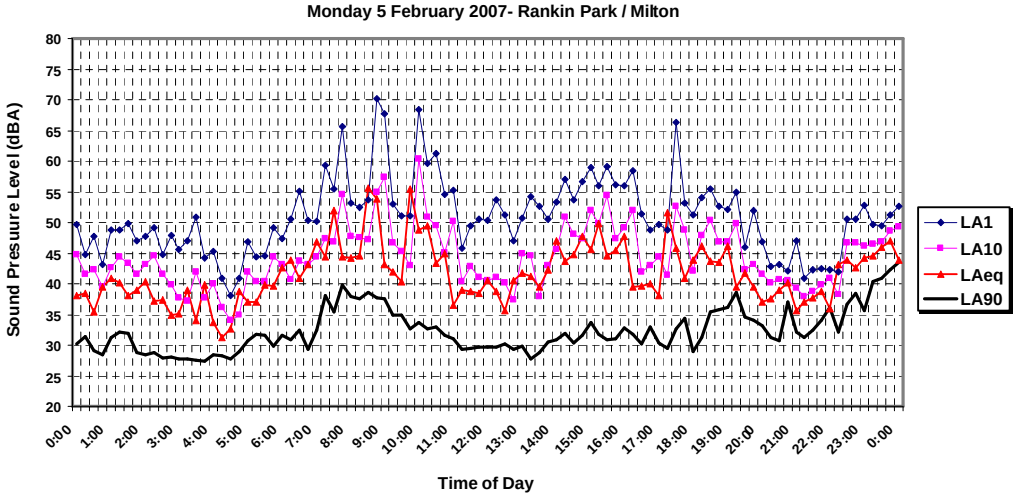
Monday 5 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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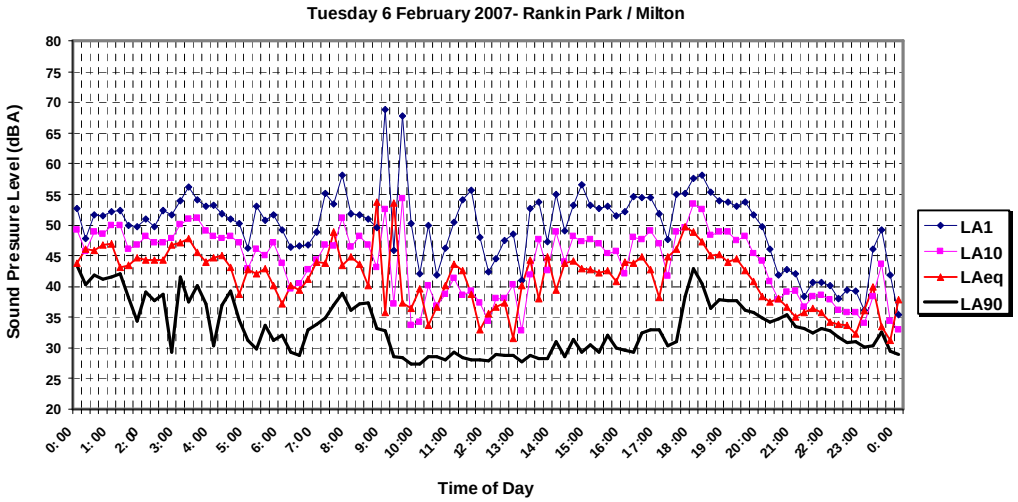
Tuesday 6 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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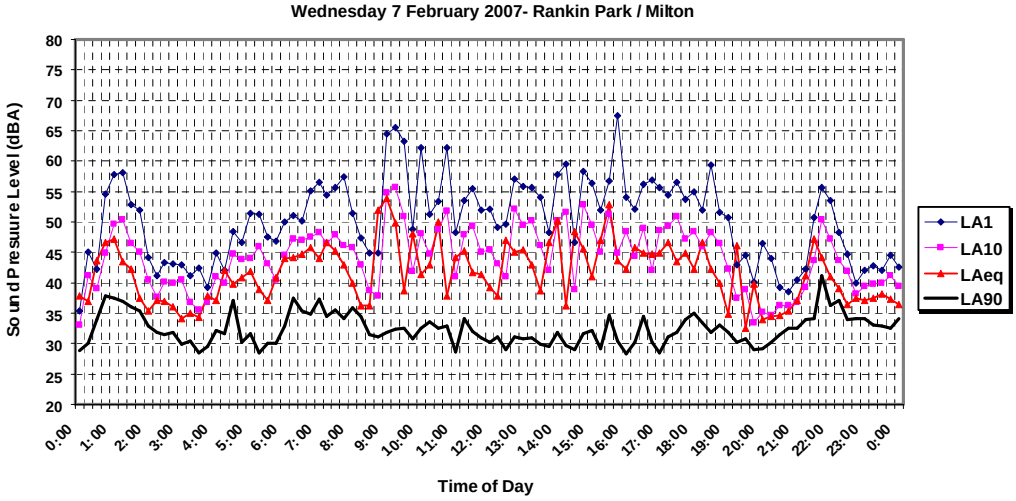
Wednesday 7 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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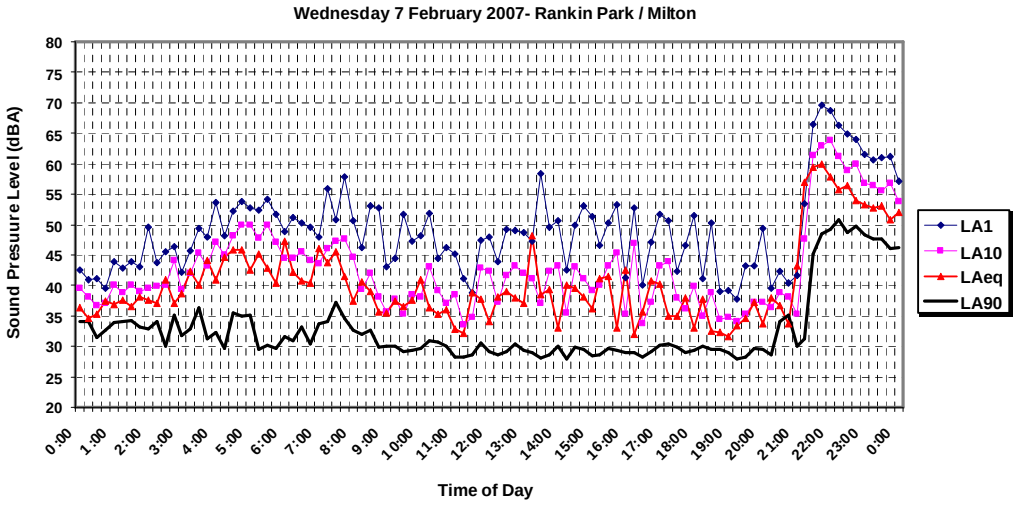
Wednesday 7 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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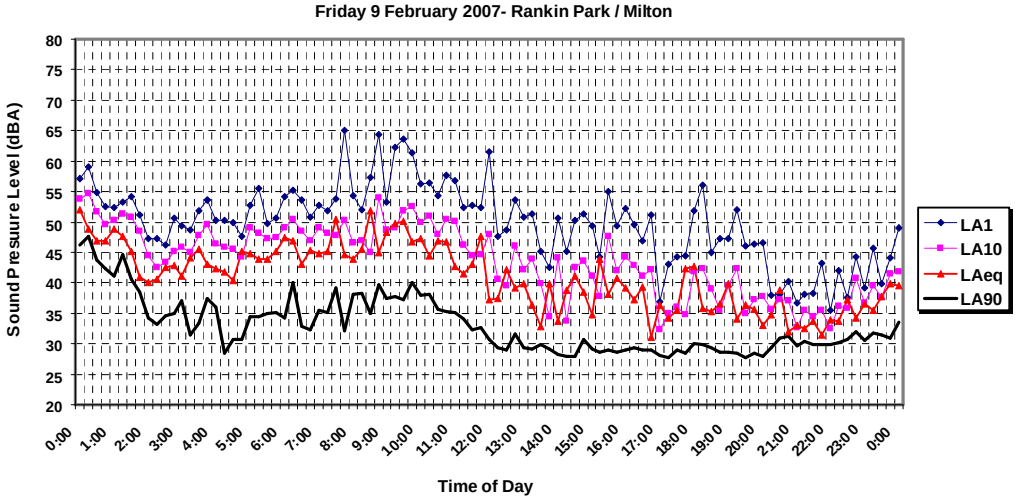
Friday 9 February 2007- Rankin Park / Milton
Sound Presuure Level (dBA)
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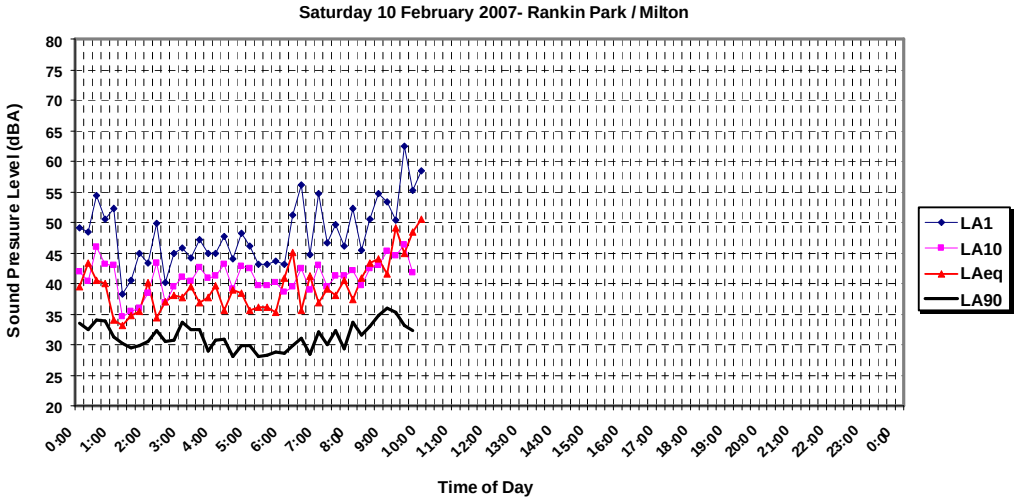
Saturday 10 February 2007- Rankin Park / Milton
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