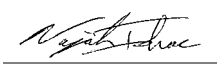
FINAL REPORT

Broken Hill Operations Pty Ltd

Rasp Mine
Noise and Vibration Assessment

November 2007

Environmental Resources Management Australia
Building C, 33 Saunders Street
Pyrmont, NSW 2009
Telephone +61 2 8584 8888
Facsimile +61 2 8584 8800
www.erm.com

Approved by:	*Najah Ishac*
Position:	Noise Technical Director
Signed:	
Date:	*November, 2007*

Environmental Resources Management Australia Pty Ltd Quality System

CONTENTS

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Broken Hill Operations Pty Limited (BHOP) is seeking approval for the resumption of full scale mining operations at the Rasp Mine Broken Hill. This study assesses the noise and vibration effects from all proposed operations at the Rasp Mine.

A thorough background and ambient noise monitoring survey was developed and implemented to quantify the existing climate at several representative residential locations in surrounding areas.

Detailed three-dimensional noise modelling was undertaken using the Environmental Noise Model (ENM) software. ENM takes into account distance, ground effect, atmospheric absorption and topographic detail. ENM is a DECC accepted noise prediction model as it gives consistently reliable predictions of environmental noise. Initial calculations were performed with no wind or temperature gradients, which are termed calm weather conditions.

The model incorporates three-dimensional digitised ground contours for the surrounding land and mine. Noise contours of the mine for each mining stage were superimposed on surrounding base topography. Equipment was placed at various locations and heights, representing potential operating conditions that could result in the greatest noise impacts for the life of the mine.

The Bureau of Meteorology (BoM) automatic weather station (AWS) at Broken Hill Airport provided years of representative meteorological data, which ERM analysed in accordance with the Industrial Noise Policy (INP).

The noise modelling incorporated measured equipment emission data used to produce an outer envelope noise affectation area based on worst case operations and INP weather conditions.

The predicted open cut noise levels are below DECC criteria at most assessment locations. The exceptions are at locations A2, A3 and A7 where noise levels are 5dB and 4dB and 2dB above criteria respectively. Given these results, are limited dayshift operations only and the duration of open cut and construction activities is limited to six months, impacts are considered to be marginal..

For underground operations, the noise modelling has shown that by adopting extensive noise mitigation, significant reduction of noise emission will be achieved.

The predicted daytime noise levels during underground operations are below or within 1dB of nominated DECC criteria for on-site operations. During intermittent (2 per day) locomotive movements on the rail spur, predicted noise levels are below or within 2dB of DECC criteria. This exposure equates to two 15 minute periods per day, and is therefore not considered significant.

The predicted evening and night time noise levels during underground operations indicate impact is not likely at most receptors. The only exception is at assessment location A6 during adverse weather, where noise is predicted to be marginally above recommended criteria. The development and implementation of a Noise Management Plan will address this issue.

BHOP's proposed environmental plans and procedures, which include ongoing noise monitoring, will be used to assess the performance of the mining operations against the predicted noise levels.

Blast design will incorporate control on the MIC (maximum instantaneous charge) as described in this study and implementation of BHOP's environmental plans and procedures will ensure that acceptable limits are maintained. This will include monitoring of all blasts.

1 INTRODUCTION

1.1 BACKGROUND

This report was prepared for Broken Hill Operations Pty Ltd (BHOP) to assess environmental noise and vibration associated with proposed operations at the Rasp Mine at Broken Hill, NSW.

BHOP proposes to resume full scale mining operations at RASP. This will be based on two stages of operations. The open cut operations will involve deepening the main pit (Kintore Pit). The underground operations will involve the mining of the western mineralisation, surface processing and transportation operations. The Proposal includes the following activities:

- Open cut (first six months) – Open cut mining of reserves in the southern areas of the existing Kintore Pit, deepening it by approximately 40m. The existing Kintore Pit depth in this southern area is approximately 80m. This will involve drill and blast techniques whereby ore and waste material will be fired together in paddock blasts. S.and filled material will be removed by an excavator Overburden and ore will be removed via an excavator and mine dump trucks. Overburden will be transported to an existing pit (formerly BHP Pit) or used for construction purposes. Ore will be stockpiled at the main ROM pad south of the Kintore Pit. This ROM pad will be formed over a period of six months in readiness for commissioning of the processing plant. During open cut operations, construction of the process plant and related infrastructure will occur between 7am and 7pm. The construction period will be approximately six months in duration. The mining operations will be conducted during the daytime only (7am to 7pm); and

- Underground (post six months onwards) – Underground mining of western mineralisation and surface processing and transportation. Underground mining of the ore will occur using long hole stoping. Mining will predominately occur from a depth downward of approximately 200 m below surface. The ore will be transported via underground mine trucks to the surface ROM pad where it will be loaded into the primary crusher with a front-end-loader. From here, the ore will undergo a three stage crushing, screening and milling process before being loaded into rail wagons for off-site transport. During underground operations, crushing, screening and on-site locomotive movements will occur during the daytime only. Other operations, including milling, flotation, thickening, filtration, loading of concentrate to rail wagons, truck haulage of ROM ore from underground and operation of the ventilation fans will occur 24 hours per day.

The above constitutes the Proposal and all major noise producing activities. This noise assessment conservatively assumed concurrent occurrence of all or most of such operations and includes two worst case mining stages in terms of noise generation which are representative of proposed operations.

This assessment has been prepared in accordance with the NSW Department of Environment and Conservation's (DECC) *Industrial Noise Policy* (*INP*), which was published in January 2000.

The location of the Rasp mine can be seen in *Figure 1.1*.

1.2 GLOSSARY

Table 1.1 provides a glossary of noise related terms used in this assessment.

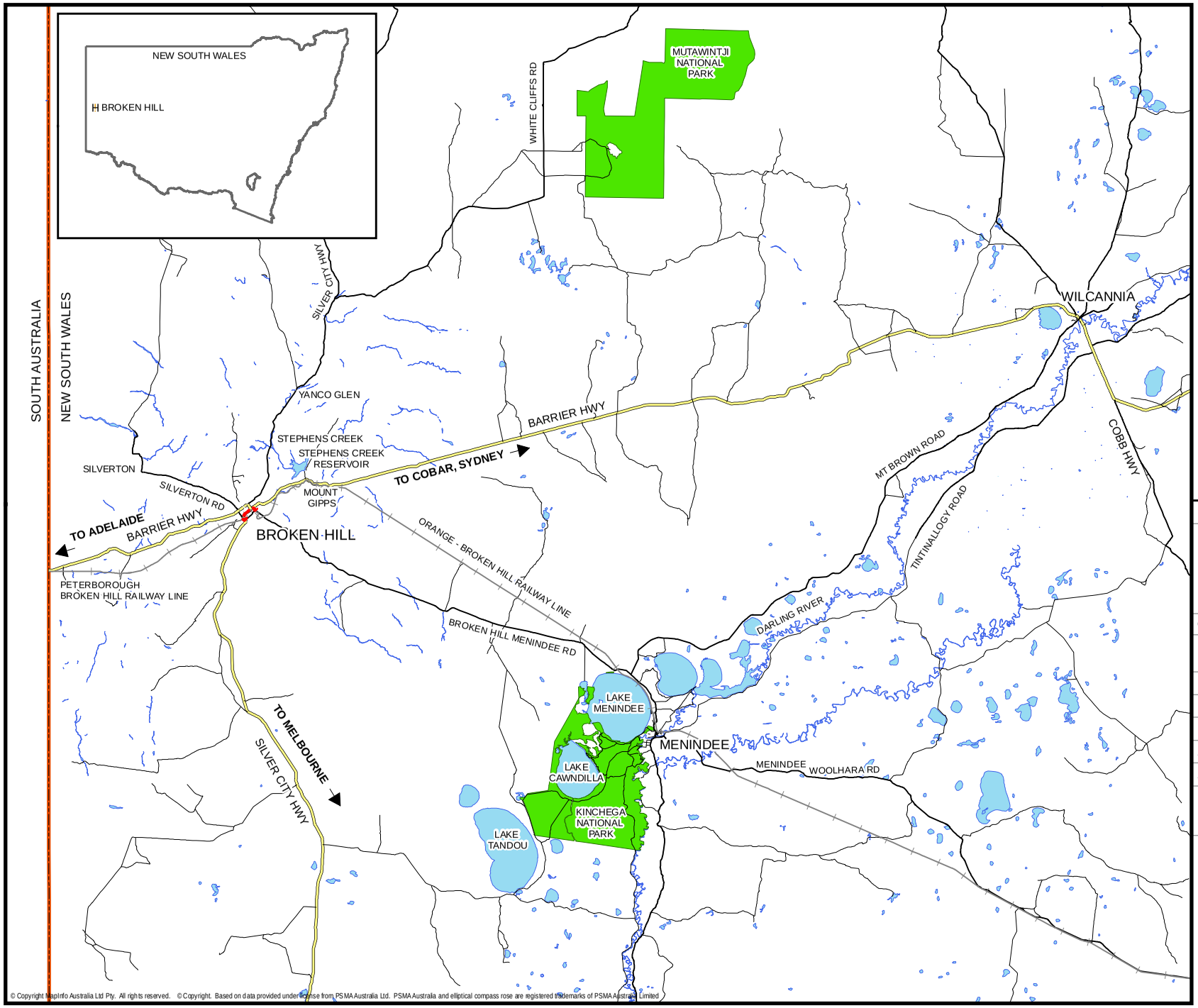
Table 1.1 Glossary of Terms

Term	Description
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{90} statistical noise levels.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(LinPeak)	The peak sound pressure level (not RMS) expressed as decibels with no frequency weighting.
dB + dB	Adding two noise levels in decibels is based on a log scale to the base 10, and can be done as follows: 10Log(10^L1/10 + 10^L2/10), where L1 and L2 are the two noise levels to be added. By way of example, 40dB(A) + 40dB(A) equates to 43dB(A).
INP	Industrial Noise Policy.
L_1	The noise level exceeded for 1% of a measurement period.
L_{10}	A noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L_{90}	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
L_{eq}	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
L_{max}	The maximum root mean squared (RMS) sound pressure level received at the microphone during a measuring interval.
MIC_{8MS}	Maximum Instantaneous Charge (with a minimum 8 milli-sec delay).
Peak Particle Velocity (ppv)	The maximum velocity of a particle of the transmission medium, used in assessment of vibration.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.

Term	Description
RMS	Root Mean Square which is a measure of the mean displacement (velocity or acceleration) of a vibrating particle.
SI	Still isothermal (SI) refers to calm weather conditions (defined as no wind and standard temperature gradients).
sigma-theta (σ_θ)	The standard deviation of horizontal wind fluctuation.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude to some height.

The following indicates what an average person perceives about noise levels in practice:

- noise differences of less than approximately 2 dB are generally imperceptible; and
- a difference of around 10 dB seems to be a doubling or halving of loudness.



Legend

Rasp Mine/CML 7 Boundary

Figure 1.1

Regional Location of Site

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS01_R1	Suffix No:	-
Date:	23/07/2007	Drawing size:	A4
Drawn by:	DH	Reviewed by:	JK
Source:	MapInfo Australia Pty Ltd		
Scale:	Refer to Scale Bar		

N

0 10 20 30km

ERM

2 EXISTING NOISE ENVIRONMENT

2.1 REPRESENTATIVE RECEPTORS

The site is surrounded by suburban residential, commercial and industrial properties to the south and north west and otherwise buffered from residential properties by vacant land, rail tracks and roadways. Ten representative locations are used for reference. These receptors are shown in *Table 2.1* and *Figure 2.1*.

Table 2.1 Surrounding Representative Receptors used for Modelling Purposes

Assessment Location	Name	MGA56 Coordinates		Location from Process Area
		Easting	Northing	
A1	Piper St North	544110	6462598	East
A2	Piper St Central	543763	6462312	East
A3	Eyre St North	543555	6462322	East
A4	Eyre St Central	543324	6462003	South
A5	Eyre St South	543140	6461859	South
[1]A6	Bonanza & Gypsum Sts	542833	6462000	West
A7	Carbon St	542604	6462718	North-West
A8	South Rd	542923	6462744	North
A9	Crystal St	542926	6463052	North
A10	Garnet & Blende Sts	543158	6463633	North-East

2.2 BACKGROUND AND AMBIENT NOISE

A key element in assessing environmental noise impact from industry is to quantify the ambient and background noise, including any existing industrial noise where relevant. From site observations, the surrounding residential areas are characterised by noise sources from road traffic, commercial, industrial, general urban hum and natural sounds.

To assess the existing noise environment, attended and unattended noise monitoring was used to determine existing noise levels. Unattended monitoring was conducted at five locations, and attended short term 15 minute measurements were also taken at several locations. Refer to *Figure 2.1* for monitoring locations.

The measurement data was analysed in accordance with the INP. All monitoring was conducted in accordance with Australian Standard AS 1055 *'Acoustics, Description and Measurement of Environmental Noise'*. Wind speed, direction and rainfall data were obtained from the NSW Bureau of Meteorology's nearest relevant weather station at Broken Hill Airport. This was used to identify times when rain occurred or when wind speeds exceeded 5m/s. During such adverse weather conditions the corresponding data from the noise logger was disregarded.

2.3 *UNATTENDED NOISE MONITORING RESULTS*

Long-term unattended noise monitoring at potentially affected receptors was conducted for the purpose of determining the level of ambient noise at the receptor locations. This data was used for the purpose of setting noise criteria.

The existing background noise data collected at five locations around the mine site was used to represent the noise climate at residences. The monitoring was undertaken during the period 1 to 21 February and 27 April to 18 May 2007. Extended monitoring is required in order to acquire seven days of monitoring data that is not affected by rain or excessive winds. Monitoring was conducted using noise data loggers, which were programmed to calculate and store statistical noise levels at 15-minute intervals. The equipment was calibrated by a NATA certified laboratory and field calibrated before and after the measurement. No significant drift in calibration was detected.

The monitoring locations were selected based on proximity to the site and potential exposure to noise from the proposed operations. The locations were not affected by any existing industrial noise. The three noise loggers were stationed at the locations nominated in *Table 2.2.* These locations, and their relationship to the site, are shown in *Figure 2.1.*

Table 2.2 Unattended Noise Monitoring Locations

	Logger Location	Monitoring Period
M1	Front veranda of 139 Eyre Street, Broken Hill (South of site)	1 Feb – 21st Feb 2007
M2	Back yard of 148 Piper Street, Broken Hill (South of site)	27 Apr – 18 May 2007
M3	Back yard of 237 Hebbard Street, Broken Hill (South of site)	1 Feb – 21st Feb 2007
M4	Back yard of 208 Carbon St Street, Broken Hill (North West of site)	1 Feb – 21st Feb 2007
M5	Back yard of 10 Argent Street, Broken Hill (North of site)	1 Feb – 21st Feb 2007

1. Data at 10 Argent St was completely contaminated by a generally constant noise source and therefore was discarded. This was supplemented by 2001 data at this same location (refer to *Annex A*).

Detailed daily results and charts for each logger are shown in *Appendix A.*

Some mechanical noise interference was evident in some of the data collected from each logger. For No. 10 Argent Street this contamination of data rendered the data completely unusable. However, data collected in 2001 by ERM was used for reference. This is likely to have been due to air conditioning units or similar sources in or near residences. In order to provide representative data, the affected data had to be removed from the analysis so that results would not be biased. Due to the removal of some data, wind speeds were required to be adjusted upwards of the DECC's preferred 5m/s threshold in order to retain a sufficient number of days for the logger data results. It should be noted that the Bureau of Meteorology's weather station at Broken Hill Airport was used for this purpose and that the wind speed at 10 m elevation at this location will be higher than that at the logger's microphone. Wind speed height corrections were applied as per AS1170.2 such that wind on the logger microphone would not affect the data used.

Table 2.3 shows the rating background levels (RBL) for the day time period during the monitoring period for the selected noise loggers.

Table 2.3 Summary of Amended Rating Background Levels

Monitoring Location		Rating Background Level (RBL) dB(A)			Ambient Leq Noise Level, dB(A)		
		Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
M1	139 Eyre St	39	36	34	58	57	49
M2	148 Piper St	33	32	30	49	40	49
M3	237 Hebbard St	33	33	32	48	53	46
M4	208 Carbon St	30	30	30	38	40	34
M5	10 Argent St (2001 Data)	37	36	30	54	54	39

1. Daytime is defined by DECC as 7am to 6pm; Evening is defined as 6pm to 10pm; Night is defined as 10pm to 7am

The higher day-time background noise at Eyre and Argent Streets is associated with road traffic and generally higher commercial activity in these areas as compared to other locations. Otherwise, background noise levels at surrounding residences are characteristic of rural or relatively quiet suburban residential localities. Hence, residences nearer to the town or commercial centres can be represented by Eyre Street and Argent Street for south and north of the site respectively.

2.4 ATTENDED NOISE MONITORING RESULTS

To better understand and quantify existing noise levels across a larger area, attended noise monitoring was undertaken to supplement long term unattended monitoring. Attended measurements were undertaken following installation of long term monitors and hence could be correlated with long term locations. This provides a direct comparison of noise levels at different locations when synchronised measurements are correlated. The results of attended measurements together with in-synch unattended measurements are summarised in *Table 2.4*.

The following findings are noted:

- South Road and Crystal Street residences are exposed to significantly higher noise levels during the day due to road traffic;
- residences south of Eyre Street are afforded relatively quieter ambient noise than Eyre Street;
- residences to the north west in and around Carbon Street are amongst the quietest areas of Broken Hill, comparable to rural residential climates;
- the main town centre and surrounding urban areas (north of the site) experience typical 'urban hum' climates during the day; and
- with the exception of Eyre Street, South Road and Crystal Street, night time conditions elsewhere are typical of rural residential climates.

Table 2.4 Attended and Unattended Noise Measurements

Attended Location	Unattended Location	Date	Logger End Time	Total measured Noise Levels, dB(A)				Notes and Comments
				Attended		Unattended		
				Leq,15min	L90,15min	Leq,15min	L90,15min	
				DAY				
Miners' Memorial	10 Argent St (M5)	1/02/2007	8:00	47	38	42	40	No site noise, windy, wind noise dominates >5m/s. Distant traffic noise ~45dB(A). Rail crossing horn 56dB(A).
RSL	10 Argent St (M5)	1/02/2007	8:30	64	49	44	40	Traffic noise (Crystal Rd) dominates. Vehicle drive by's 65 - 69dB(A). Bus 72dB(A). Vehicle on opposite side 63dB(A).
13 South Rd	10 Argent St & 208 Carbon St (M5) (M4)	1/02/2007	9:15	59	47	43 (Argent) 43 (Carbon)	39 (Argent) 38 (Carbon)	Traffic dominates (58-62dB(A), passby 66dB(A). No mining noise, RSPCA dogs barking ~52. No traffic no wind
1 South Rd	139 Eyre St & 208 Carbon St (M1) (M4)	1/02/2007	9:45	63	52	62 (Eyre) 43 (Carbon)	48 (Eyre) 39 (Carbon)	Traffic dominates 52-54dB(A), Vehicle drive by 63-65dB(A), motorbike 70dB(A). No mining noise. South road links Broken Hill to the city and has relatively heavy use.
201 Carbon St	208 Carbon St (M4)	1/02/2007	10:00	59	47	43	39	Workshop noise dominates, spraying noise 57-59 dB(A), mechanical plant 49dB(A) (no spraying), windy (gusts >3m/s).Up to 65dB(A) with spraying too.
139 Eyre St	139 Eyre St (M1)	1/02/2007	10:30	61	50	60	47	No mining noise. Plane flyby. Vehicle drive by 61-63dB(A). Cement mixer idling 50m away ~51dB(A).
95 Eyre St	139 Eyre St (M1)	1/02/2007	10:45	60	47	59	49	Traffic noise dominates, No industrial noise audible. Vehicle drive by 64- 66 dB(A). No vehicle's 49 - 51 dB(A).

Attended Location	Unattended Location	Date	Logger End Time	Total measured Noise Levels, dB(A)				Notes and Comments
148 Piper St (rear)	148 Piper St (M2)	27/04/2007	10:00	45	40	50	36	Wind gusting Min 0, Average 0.1, max 2.8m/s (9.50 - 10am).
233 South Rd (Front)	148 Piper St 10 Argent St & 208 Carbon St (Argent & Carbon 16/2/07) (M2) (M5) (M4)	27/04/2007	11:00	54	48	43 (Piper) 44 (Argent) 37 (Carbon)	38 (Piper) 40 (Argent) 35 (Carbon)	Dogs barking 50-55dB(A). Traffic noise 53-57dB(A)
233 South Rd (Front)	148 Piper St 10 Argent St & 208 Carbon St (Argent & Carbon 16/2/07) (M2) (M5) (M4)	27/04/2007	11:15	55	50	44 (Piper) 43 (Argent) 37 (Carbon)	39 (Piper) 40 (Argent) 34 (Carbon)	Truck noise 64dB(A)SPL. General traffic noise 55-56dB(A) (no barking dogs).
233 South Rd (Rear)	148 Piper St 10 Argent St & 208 Carbon St (Argent & Carbon 16/2/07) (M2) (M5) (M4)	27/04/2007	11:30	56	49	43 (Piper) 46 (Argent) 37 (Carbon)	37 (Piper) 40 (Argent) 34 (Carbon)	Shielded from RSPCA by dwelling (dogs still audible)
Crystal St Sth of Galena St	148 Piper St 10 Argent St (M2) (M5)	27/04/2007	12:00	62	49	46 (Piper) 42(Argent)	41 (Piper) 40(Argent)	Highway traffic noise (60kmh) 72dB(A) SPL;15 minute vehicle count, 73 to right, 73 to left. One heavy vehicle (semi)
10 Argent St (street median)	148 Piper St 10 Argent St (M2) (M5)	27/04/2007	12:30	48	44	40 (Piper) 42(Argent)	36 (Piper) 40(Argent)	Wind speeds: Min: 0, Max: 1.8m/s, Avg: 0m/s.

Attended Location	Unattended Location	Date	Logger End Time	Total measured Noise Levels, dB(A)				Notes and Comments
				EVENING				
Miners' Memorial	10 Argent St (M5)	31/01/2007	20:00	40	33	43	42	Wind noise dominates.(>2-3m/s) No other noise audible. Min 33-36dB(A) in absence of wind. Distant dog barking 35dB(A).
RSL	10 Argent St (M5)	31/01/2007	20:30	52	40	46	42	Traffic noise dominates, distant traffic and suburban noise. Wind gusting at 2- 3m/s.
139 Eyre St	139 Eyre St (M1)	31/01/2007	21:15	44	39	56	39	Occasional traffic pass by, distant traffic noise 40-42 dB(A). Constant hum (distant a/c unit). Slight breeze.
				NIGHT				
95 Eyre St	139 Eyre St (M1)	31/01/2007	22:00 (7 min)	61	42	54	39	Traffic noise dominates dog bark ~42dB(A). Suburban noise ~40dB(A).
201 Carbon St	208 Carbon St (M4)	31/01/2007	22:15 (3min)	45	42	36	33	Traffic noise dominates. Suburban sounds (distant a/c), no mining.
13 South Rd	10 Argent St & 208 Carbon St (M5) (M4)	31/01/2007	22:15 (3min)	54	37	52 (Argent) 36 (Carbon)	41 (Argent) 33(Carbon)	Traffic dominates, dog barking, suburban hum, traffic hum/ no mining noise.

1. The attended and unattended measurement duration is generally 15 minutes. Where time duration is quoted, this relates to attended measurements.
2. Daytime is defined as 7am to 6pm; Evening is defined as 6pm to 10pm; Night is defined as 10pm to 7am

Figure 2.1

Representative Receptors, Noise Monitoring Locations and Site

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS02_R2	Suffix No:	-
Date:	24/09/07	Drawing size:	A4
Drawn by:	DH	Reviewed by:	LS
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

0 200 400 600m

N

A RBL is a single figure that represents background noise levels at a particular location and has been derived from monitoring results undertaken over the whole monitoring period. As a result of correlating short term and long term monitoring data, RBLs have been developed for all monitored locations. These are provided for the nominated assessment locations A1 to A10 as summarised in *Table 2.5* along with comments to provide further explanation where required.

Table 2.5 Assessment Locations and Rating Background (Noise) Level, dB(A)

Assessment Location		Rating Background Level, dB(A)			Comments
		Day	Evening	Night	
A1	Piper St North	33	32	30	Based on Piper St logger. This also represents the southern urban area of Broken Hill.
A2	Piper St Central	33	32	30	Based on Piper St logger.
A3	Eyre St North	39	36	34	Based on Eyre St logger.
A4	Eyre St Central	39	36	34	Based on Eyre St logger.
A5	Eyre St South	39	36	34	Based on Eyre St logger.
A6	Bonanza & Gypsum Sts	43	36	34	Table 2.4 indicates 4dB noisier than Eyre St during the day; evening & night based on Eyre St logger. This is also demonstrated by traffic volumes reported in the Traffic Assessment.
A7	Carbon St	30	30	30	Based on Carbon St logger. This also represents the residential area to the north west of the site around Carbon St.
A8	South Rd	43	34	34	Table 2.4 indicates 10dB noisier than Piper St during day and 4dB noisier than Carbon St at night (used also for evening).
A9	Crystal St	41	34	34	Table 2.4 indicates 8dB noisier than Piper St during day and 4dB noisier than Carbon St at night (used also for evening).
A10	Garnet & Blende Sts	37	36	30	Based on Argent St logger. This also represents the northern urban area of Broken Hill.

1. Daytime is defined as 7am to 6pm; Evening is defined as 6pm to 10pm; Night is defined as 10pm to 7am.

2.5 *PREVAILING WEATHER CONDITIONS*

The efficiency of noise propagation over long distances can be significantly affected by the weather conditions. Of most interest, are source to receptor winds and the presence of temperature inversions as both these conditions can enhance received noise levels. To account for these phenomena, the DECC in their INP, specify weather analysis procedures to determine the prevalent weather conditions that enhance noise propagation. This is to determine whether they can be described as a feature of the area.

In this study a comprehensive set of hourly weather data was analysed, consisting of three years data recorded between 2004 to 2006 inclusive. This was obtained from the Bureau of Meteorology's (BoM) automatic weather station (AWS) at Broken Hill Airport. This was done in accordance with the procedures defined in the INP, and as otherwise advised by the DECC. For the purposes of this report, weather conditions modelled as a result of this analysis are referred to as INP weather conditions.

2.6 *TEMPERATURE INVERSIONS*

Records of the Pasquil Stability Class, a parameter representing the degree of mixing in the atmosphere, can gauge the prevalence and magnitude of temperature inversions. Stability classes are categorised as A to G. Stability Class A applies under sunny conditions with light winds when dispersion is most rapid. Stability Class D applies under windy and/or overcast conditions when dispersion is moderately rapid. Stability Classes F and G can occur at night when winds are light and the sky is clear. Stability Classes B, C and E are intermediate conditions between those described above. Temperature inversions may occur during stability classes E to G. Consistent with the INP, stability class F generally represents a range of temperature gradients from 1.5 ^{o}C/100 m to less than 4 ^{o}C/100 m, and stability class G is equal to or greater than 4 ^{o}C/100 m.

Records of wind speed and direction were available from BoM's Broken Hill Airport weather station, with cloud cover sourced from BoM's Cobar station. Almost three years of hourly data was used, including the periods 1 January 2004 to 21 December 2006.

The frequencies of stability classes are shown in *Table 2.6* based on the aforementioned hourly data. This was derived using the Turner Scheme documented in the INP. The analysis was undertaken by PDS Consultancy as summarised in *Annex D*. In addition, *Annex D* provides a justification for using cloud cover data from BOM's Cobar station.

The data indicates that temperature inversions having potential to enhance noise propagation are marginally above or approaching the DECC's 30% occurrence threshold for winter and autumn nights. This is based on the combined percentage occurrence of F and G stability classes shown in *Table 2.6*. Temperature inversions are therefore considered to be a feature of the area in winter according to the INP. Hence, a calculation for noise impact under a condition of 3°C/100m temperature inversion, corresponding to stability class F as defined in the INP, is provided in noise modelling results. As such, the 8°C/100m temperature inversion default position adopted by the DECC has not been applied for this assessment.

The combined occurrence of a temperature inversion and wind below 3m/s is below the INP's 30% threshold as shown in wind roses of *Appendix B*. Hence, a combined wind and inversion calculation is not considered assessable, nor is a drainage wind situation given the relatively flat terrain at Broken Hill.

Table 2.6 Stability Class Frequency of Occurrence for Nights in 2004 to 2006 inclusive

Stability Class	Summer		Autumn		Winter		Spring	
	Samples	**%**	**Samples**	**%**	**Samples**	**%**	**Samples**	**%**
A	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B	0	0.0%	0	0.0%	0	0.0%	1	0.0%
C	0	0.0%	0	0.0%	0	0.0%	20	0.6%
D	1984	61.7%	1112	31.0%	993	28.0%	1665	48.1%
E	867	27.0%	1454	40.5%	1410	39.7%	1232	35.4%
F	352	10.9%	905	25.2%	1015	**28.6%**	513	14.7%
G	13	0.4%	117	3.3%	131	**3.7%**	53	1.5%
Total	**3216**	**100%**	**3588**	**100%**	**3549**	**100%**	**3484**	**100%**

Source: BoM Broken Hill Airport wind and cloud cover data (using Turner Scheme approximation).
- Nights defined as per INP ie between 18:00 to 07:00.

In order to supplement the above data in future and provide an added mitigation measure, it is recommended that an on site weather station that captures sigma-theta values, to be used to estimate stability classes be installed and monitored. This will inform site operators as to the presence of temperature inversions and likely strengths of these. Should adverse conditions persist, operations could be modified accordingly.

2.7 PREVAILING WINDS

A thorough review of the vector components of the hourly wind data described above was undertaken. The hourly records of wind speed and wind direction indicate no prevalence of assessable winds. This is demonstrated in *Appendix B* where the windrose arm do not exceed the 30% threshold as indicated by the rose.

3 NOISE CRITERIA

3.1 OPERATIONAL NOISE

3.1.1 Industrial Noise Criteria

The NSW Government in its INP stipulates guidelines for assessment of noise from the operation of industrial facilities. The INP was specifically developed to provide a comprehensive assessment technique that complies with the *Protection of Environment (Operations) Act*. Assessment criteria depend on the existing environment of areas potentially affected by the proposed development and are outlined below.

Assessment criteria for residences potentially affected by noise from industries should achieve the following objectives:

1. protection of the community from excessive intrusive noise; and

2. preservation of the amenity for specific land uses.

Both criteria need to be met.

3.1.2 Residential Intrusiveness

The intrusiveness criterion requires that the $L_{Aeq,15min}$ noise levels from the newly-introduced source during each of the day, evening and night time periods do not exceed the existing RBL by more than 5dB at the most affected noise sensitive location. *Table 3.1* shows the derived project specific intrusiveness noise criteria.

Table 3.1 ***Project Specific Intrusiveness Noise Criteria***

Receiver No	Location	Criterion, $L_{eq,15minute}$ dB(A)			Comments
		Day	Evening	Night	
A1	Piper St North	38	37	35	This also applies to the southern urban area of Broken Hill.
A2	Piper St Central	38	37	35	
A3	Eyre St North	44	41	39	
A4	Eyre St Central	44	41	39	
A5	Eyre St South	44	41	39	
A6	Bonanza & Gypsum Sts	48	41	39	
A7	Carbon St	35	35	35	This also applies to the north west urban area of Broken Hill.
A8	South Rd	48	39	39	
A9	Crystal St	46	39	39	
A10	Garnet & Blende Sts	42	41	35	This also applies to the northern urban area of Broken Hill.

1. Criteria are based on the Existing Background Noise levels presented in *Table 2.5*.

3.1.3 Residential Amenity

The criterion for the preservation of amenity requires ambient noise levels from all industries to be within the acceptable levels for the particular locality and land uses. Where ambient noise levels are already high for the particular locality and land use, then they should not be deteriorated significantly.

Table 3.2 summarises the INP amenity criteria for various land use types. The fundamental difference between the intrusiveness and amenity criteria is that the former is based on a 15-minute period, whilst the latter is averaged over the entire assessment period (eg 11 hour daytime).

Table 3.2 ***INP Amenity Targets***

Category	Type	Noise Amenity Criteria, Leq,period dB(A)
Residence	Suburban	50 Day
		45 Evening
		40 Night
	Urban	60 Day
		50 Evening
		45 Night
Commercial		65
Industrial		70

Additionally, modifications to the base amenity criteria apply for areas that already approach the total cap.

The noise measurements and observations undertaken in February and April 2007 (refer to *Table 2.4*) demonstrate that existing industry noise at potentially affected residences are not at levels that require modification of targets or in the least result in amenity criteria being stricter than the intrusiveness criteria (refer to *Table 2.5*). Additionally, while this project involves new structures, it is essentially a resumption of previous operations of the site – that of an underground mine.

3.2 *PROJECT SPECIFIC NOISE CRITERIA*

Table 3.1 and *Table 3.2* present the intrusiveness and amenity noise criteria in accordance with the INP. Both sets of criteria must be satisfied and both are tested in the operational noise assessment.

The Project Specific Noise Criteria for the nominated assessment locations are presented in the *Table 3.3*. These are the stricter of the intrusiveness and amenity criteria, and in all cases here is equal to the intrusiveness criteria.

Table 3.3 Project Specific Noise Criteria

Receiver No	Location	Criterion, $L_{eq,15minute}$ dB(A)			Comments
		Day	Evening	Night	
A1	Piper St North	38	37	35	This also applies to the southern urban area of Broken Hill.
A2	Piper St Central	38	37	35	
A3	Eyre St North	44	41	39	
A4	Eyre St Central	44	41	39	
A5	Eyre St South	44	41	39	
A6	Bonanza & Gypsum Sts	48	41	39	
A7	Carbon St	35	35	35	This also applies to the north west urban area of Broken Hill.
A8	South Rd	48	39	39	
A9	Crystal St	46	39	39	
A10	Garnet & Blende Sts	42	41	35	This also applies to the northern urban area of Broken Hill.

3.2.1 Sleep Disturbance

The INP criteria are appropriate for assessing noise from continuous and intermittent sources, such as engine noise from mobile plant and general processing plant and equipment. However, transient noise sources such as reversing alarms, truck tailgates and intermittent high revving also require assessment. Given the transient nature of these events, the L_{eq} noise level from such sources would not be representative since the noise in question may not be present for much of the time. Hence the INP criterion is not relevant for this type of noise.

The most important effect of these transient noises would be the possibility of disturbing the sleep of nearby residents. The DECC's Environmental Noise Control Manual indicates that to prevent sleep disturbance, the $L_{1\ 1min}$ noise level from an intrusive source should not exceed the background noise level by more than 15dB.

On this basis, the maximum noise level from any operational event should not exceed the levels shown in *Table 3.4*.

Table 3.4 Project Specific Sleep Disturbance Noise Criteria

Receiver No	Location	Criterion, $L_{1,1minute}$ dB(A)
A1	Piper St North	45
A2	Piper St Central	45
A3	Eyre St North	49
A4	Eyre St Central	49
A5	Eyre St South	49
A6	Bonanza & Gypsum Sts	49
A7	Carbon St	45
A8	South Rd	49
A9	Crystal St	49
A10	Garnet & Blende Sts	45

1. Criteria are based on the Existing Background Noise levels presented in *Table 2.5*.
2. Sleep disturbance criteria apply during the night assessment period only.
3. Criteria are assessable at the façade of the most affected sleeping area.

However, this criterion does not take account of more recent research on the effects on sleep of road traffic noise. The DECC's Environmental Criteria for Road Traffic Noise policy indicates that maximum noise levels below 50 – 55 dB(A) within residences are unlikely to cause awakening reactions. If bedroom windows are open, this corresponds to an external maximum noise level of approximately 60 - 65 dB(A) at a residence.

In our experience, adopting the former more stringent criterion would be desirable in the first instance, and if exceedances are predicted, consideration of more recent research can be used.

3.2.2 *Noise from Trains on the Main Rail Line*

The noise from locomotive operations on the spur to the site is included as part of industrial site operations and therefore assessed under the INP. However, train movements on the main line will be assessed separately. The current criteria applicable is promulgated in the Australian Rail Track Corporation (ARTC) Environment Protection Licence 3142 section L6.2. This is summarised as follows:

- Stationary and idle at 15 metres -70dB(A) Lmax;
- Stationary and self load at 15 metres -87dB(A) Lmax, and 95dB(L) Lmax; and
- Service Condition as per AS2377-2002 - 87dB(A) Lmax, and 95dB(L) Lmax.

3.3 *CONSTRUCTION NOISE CRITERIA*

It should be noted that the NSW DECC acknowledges that noise from construction sites is unavoidable and mitigation is often limited. The DECC's current view is that noise limits will not be set for most construction sites, but expect that all reasonable and feasible noise mitigation is applied. The DECC's criteria for construction noise is currently under review and in the absence of such, the former EPA guidelines are discussed below.

3.3.1 *Level Restriction*

Construction noise is explicitly excluded from the INP, and assessment criteria for construction noise is set out in the Environmental Noise Control Manual ENCM (EPA, 1994) will be used. These are expressed in terms of the L_{10} level of noise from the construction site. The criteria depend on the existing background noise level (L_{90}) at the assessment location and applies to residential premises only. The criteria states:

- for construction periods of four weeks and under, the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 20 dB;
- for construction periods of between four and 26 weeks, the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 10 dB; and
- for construction periods greater than 26 weeks, the criteria for a continuously operating noise source would apply, which would generally mean that the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 5 dB.

The criteria for construction noise apply only to sites for which the total construction period is less than 26 weeks. For this project the total construction period will be approximately 6 months. For construction periods longer than 26 weeks, the criteria for a continuously-operating source should apply, which generally means that the L_{10} noise level due to construction should not exceed the existing L_{90} background noise level by more than 5 dB. Furthermore, the DECC's view for extractive type sites is that construction noise criteria adopt that for operations given the likely similarities between construction and operations for such sites.

Table 3.5 ***Daytime Construction Noise Criteria***

Receiver No	Location	Construction noise criteria, $L_{10,15minute}$ dB(A)
A1	Piper St North	43
A2	Piper St Central	43
A3	Eyre St North	49
A4	Eyre St Central	49
A5	Eyre St South	49
A6	Bonanza & Gypsum Sts	53
A7	Carbon St	40
A8	South Rd	53
A9	Crystal St	51
A10	Garnet & Blende Sts	47

1. Criteria are based on the Existing Background Noise levels presented in *Table 2.5*.

3.3.2 Time Restriction

ENCM also specifies time limits for construction activities where construction noise is audible at residential premises. These are:

- Monday to Friday, 7:00 am to 6:00 pm;
- Saturday, 8:00 am to 1:00 pm, otherwise 7:00 am to 1:00 pm if inaudible at residential premises; and
- no construction on Sundays or public holidays..

Proposed construction activities will generally only occur during daytime hours. As the proposed open cut operations are intended to occur during the typical 12 hour shift of 7am to 7pm, construction is also proposed from 7am to 7pm.

3.4 *ROAD TRAFFIC NOISE*

The potential impacts of traffic noise resulting from both the construction and operational related traffic on public roads are assessed against the same noise criteria, that is those defined in the NSW Government's *Environmental Criteria for Road Traffic Noise* (ECRTN).

In the case of this project, vehicular access to the site will be through use of Eyre Street.

The DECC in its ECRTN provides external traffic noise goals which can be applied to the proposed development.

For the purpose of this traffic noise assessment, Eyre Street has been used to assess impacts due to the proposed development.

Eyre Street is classified as a collector road, taking traffic from one area to another. A collector road is defined in the ECRTN as:

'…a road situated in a built up area that collects local traffic leaving a locality and connects to a sub-arterial road.'

Thus the following criteria for 'Land use developments with potential to create additional traffic on collector roads' was selected as most suitable for assessment of traffic noise impacts:

- DAYTIME: $L_{Aeq,1hr}$60dB(A); and
- NIGHT TIME: $L_{Aeq,1hr}$55dB(A).

Furthermore, the ECRTN states that where criteria are already exceeded, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB. Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria.

For traffic noise assessment purposes, daytime is 7am to 10pm, and night the compliment.

3.5 *CUMULATIVE NOISE*

The cumulative impact of more than one development can be compared against the DECC's amenity criteria which has a holistic approach to industrial noise. The noise criteria applicable is that quoted earlier for preservation of amenity (*Table 3.2*).

3.6 *BLASTING*

Blasting limits are applicable to two main effects of blasting:

- airblast noise overpressure; and
- ground vibration.

The limits for blasting are described below based on the Australian and New Zealand Environment Council (ANZEC) guidelines, which are generally consistent with DECC's superseded Environmental Noise Control Manual (ENCM 1994).

3.6.1 *Airblast Overpressure*

The airblast overpressure should not exceed 115 dB(Lpeak) for more than 5% of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 120 dB(Lpeak) at any time. The dB(Lpeak) unit of sound measurement considers the low frequency sounds which are not audible to the human ear but can be 'felt'. Such limits will also ensure damage from blast noise overpressure is avoided. Where blasts occur outside specified times below, airblast overpressure should be limited to 105dB(Lpeak) between 5pm to 8pm and 6am to 9am, and to 95dB(Lpeak) between 8pm to 6am. Current licence conditions stipulate that air blast overpressure should be limited to 115dB(Lpeak) between 7am and 7pm and 95dB(Lpeak) between 7pm to 7am.

3.6.2 *Ground Vibration*

The peak particle velocity (ppv) from ground vibration should not exceed 5 mm/s for more than 5% of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 10 mm/s at any time. These criteria apply to minimise human annoyance and discomfort and were not developed to control possible structural damage. However, if ground vibration peak particle velocities comply with criteria for minimising human annoyance and discomfort, they would also be below levels that may cause structural damage to buildings.

3.6.3 Time and Frequency of Blasting

The blasting should generally be limited to the hours from 9.00 am to 5.00 pm Monday to Saturday and should not take place on Sundays or public holidays without the written approval of DECC. Blasts should be limited to once a day. According to the ANZEC guidelines, these time and frequency restrictions do not apply to those premises where the effects of blasting are not perceived at noise sensitive sites or at major underground metalliferous mining operations. The latter infers underground metalliferous mining and therefore implies underground blasts for this project need not be limited by time or frequency.

4 NOISE MODELLING

4.1 CALCULATION PROCEDURE

The ENM noise prediction software was used for modelling purposes. ENM takes into account distance, ground effect, atmospheric absorption and topographic detail. ENM is a DECC accepted noise prediction model as it gives consistently reliable predictions of environmental noise. Initial calculations were performed with no wind or temperature gradients, which are termed calm weather conditions. Assumed night air temperature and relative humidity were 10°C and 80% respectively. Noise levels during other conditions are discussed in *Section* 2.

The model incorporates three-dimensional digitised ground contours for the surrounding land and mine site. Contours of the mine for each mining stage were superimposed on surrounding base topography. Equipment was placed at various locations and heights, representing potential operating conditions that could result in the greatest noise impacts for the life of the mine.

The noise model predicts LAeq noise levels, based on equipment sound power levels determined from measurements conducted at the existing and similar operations elsewhere. The results assume that all plant and equipment operate simultaneously. In practice, such an operating scenario would occur infrequently. The results are therefore considered conservative and worst case.

4.2 MODELLING SCENARIOS

As discussed previously, two stages of operations have been considered representative of on going activities. These are open cut and underground operations as follows:

- Open cut (first five months) – Open cut mining in Kintore Pit. This will also include construction activities at the processing area which will be undertaken between 7am and 6pm. Open cut mining operations will be conducted during 7am to 7pm.

- Underground (post five months onwards) – Underground mining of western mineralisation and surface processing and transportation. During underground operations, crushing, screening and locomotive movements will occur during the daytime only. Other operations, including milling, flotation, thickening, filtration, loading of concentrate to rail wagons, truck haulage of ROM ore from underground and operation of the ventilation fans will occur 24 hours per day.

Worst case scenarios were selected in terms of potential impacts to surrounding receptors. This environmental noise 'envelope' approach was adopted to provide maximum flexibility for mining operations within acceptable noise parameters.

4.3 *PLANT NOISE LEVELS*

Typical equipment used during the two stages of operations are listed in *Table 4.1*. Sound power levels shown in *Table 4.1* are indicative and are based on measurements at the existing and similar operations.

Table 4.1 Equipment Sound Power Levels

Plant	Representative $L_{eq,15minute}$ Sound Power Level, dB(A)	Quantity	Operation
Open cut - Open cut mining in Kintore Pit			
Ore/Overburden Truck – CAT773	114	6	Surface haul road 7am – 7pm
		2	ROM Pad and BHP pit.
D9 Dozer	110		7am – 7pm
Drill	119	1	Kintore Pit 7am – 7pm
Excavator	110	1	Kintore Pit 7am – 7pm
Grader	105	1	At surface 7am – 7pm
Water Cart	103	1	At surface 7am – 7pm
Underground - Underground mining and surface processing and transportation			
24 Hour Operations			
Ore Bin	94	1	Process area
Transfer station	104	1	Process area
Conveyor	95	1	Process area
Milling	96	1	Process area
Flotation Area	99	1	Process area
Reagent Handling	99	1	Process area
Loading rail wagons	93	1	Rail load out area
Underground Mine Truck (eg Toro 40)	103	5	Surface haul road
Ventilation Fan	111	2	Little Kintore Pit.
Daytime Only Operations			
Front-End-Loader (mitigated)	108	1	ROM Pad feeding crusher
Primary Crusher (mitigated)	106	1	Process area
Secondary Crusher (mitigated)	106	1	Process area
Tertiary Crusher (mitigated)	106	1	Process area
Conveyor 1	93	1	Process area
Tramp Metal station	104	1	Process area
Conveyor 2	97	1	Process area
Conveyor 3	95	1	Process area
Screen (mitigated)	106	1	Process area
Conveyor 4	97	1	Process area

Plant	Representative $L_{eq,15minute}$ Sound Power Level, dB(A)	Quantity	Operation
Locomotive idling continuously	100	1	Rail load out area
Locomotive pass-by (low notch setting)	90	1	Rail Spur
Fork-lift – all terrain	99	1	Process area
Road Truck	103	1	Process area

1. L_{eq} levels are for each individual source.

Noise for train movement along the rail spur was represented by a 15 minute Sound Power Level of LAeq 90dB(A). This is based on actual measured data contained in the aforementioned ARTC database for 48class locomotives using low notch (or throttle) setting. The 48class loco is a relatively small unit. The highest measured noise level in the ARTC data was 82dB(A) SEL at 30m. The noise modelling included nineteen point sources along the 570m length of the spur.

The proponent has advised that on the approach to site, with empty wagons, rail operators would use no higher than notch 4 setting (from a possible maximum of 8 notch). This level is needed initially to get the wagons moving, and once in motion will be set at a lower notch. Leaving the site, with full wagons, the locomotive will be under brakes (and therefore engines idling and quieter) as the track is downhill all of the way to the main line.

4.4 ADOPTED NOISE MITIGATION

It was clear from initial investigations that mitigation of noise was required to minimise noise impacts at surrounding residential areas. Therefore, strong consideration was given to designing key project components to minimise acoustic impacts. These design elements are presented following and in *Figure 4.1*:

- noise suppression kit on the front-end-loader that operates at the ROM pad, which is exposed;
- processing area located within a depression, being 10m below site surface to the north west;
- cladding on the primary, secondary, tertiary crushers and screen;
- enclosed conveyors;
- re-design mine truck haulage on site from southern to northern alignment, leading to greater separation distances to residences;

- re-locating surface ventilation fans from the preferred location near to Crystal Street north of the main railway tracks to an existing pit (Little Kintore Pit) at the southern area of the site. In addition, provision for manufacturer supplied noise suppression on the two ventilation fan arrangements;
- four metre high earth bunding along the northern haul road alignment;
- four metre high earth bunding along the southern haul road alignment, including the area south of Little Kintore Pit, further shielding the ventilation fans; and
- four metre high solid wall running east-west along the southern edge of the proposed Reagent Handling structure.

The proponent has committed to a substantial capital outlay for the implementation of noise mitigation measures.

Legend

- Rasp Mine/CML 7 Boundary
- Project Area
- Process Area 10m Depression
- Bunding
- 4m Wall
- Fan

Figure 4.1
Adopted Noise Mitigation (Indicative)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS03	Suffix No:	R2
Date:	27/08/2007	Drawing size:	A4
Drawn by:	DH	Reviewed by:	JK
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

N

0 100 200 300m

ERM

5 PREDICTED NOISE LEVELS

The following section provides results of noise modelling for the Proposal.

5.1 DAYTIME NOISE LEVELS

Table 5.1 summarises noise modelling results for calm weather conditions and daytime operations. Predicted noise levels more than 2 dB (threshold of perception) above criteria are highlighted in bold text. Calm weather daytime noise contours are presented graphically in *Figure 5.1* and *Figure 5.2* for open cut and underground respectively. These levels typify expected external noise levels at the receptors surrounding the mine during the day.

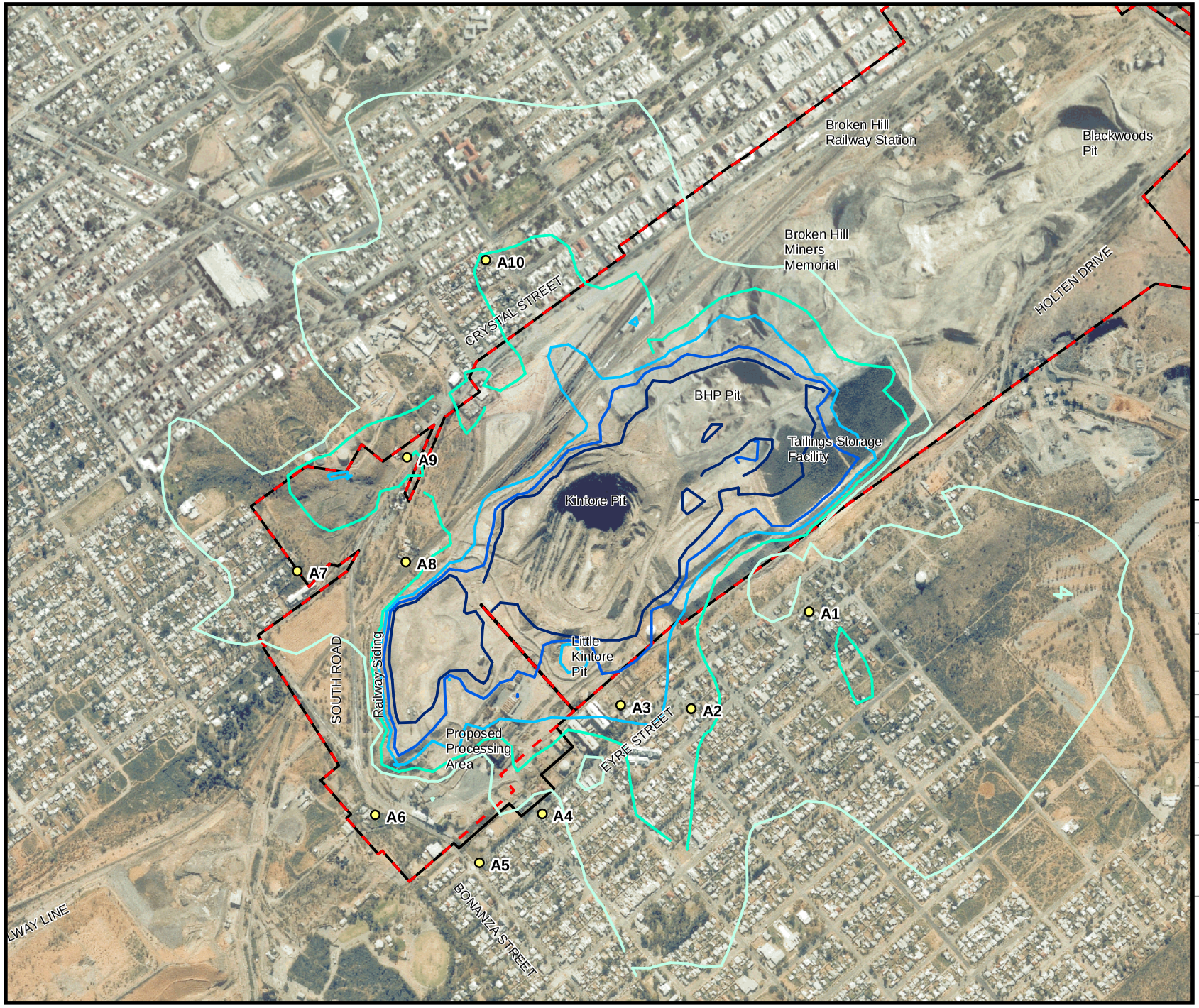
The results indicate that daytime noise impact is not likely at most receptors. During open cut, predicted operational noise levels are above nominated criteria at assessment locations A2 and A3 and A7. These are 5 dB and 4 dB and 2dB above the DECC criteria respectively, and are considered marginal in respect of level, and given the expected six month operation.

The predicted daytime noise levels during underground operations are below or within 1dB of nominated DECC criteria for on-site activities. During intermittent (2 per day) locomotive movements on the rail spur, predicted noise levels are below or within 2 dB of DECC criteria. This exposure equates to two 15 minute periods per day, and is therefore not considered significant.

Table 5.1 Predicted Daytime Noise Levels (7am to 7pm)

Assessment Location	Predicted $L_{eq,15minute}$ Noise level, dB(A)			Criteria, dB(A)	
	Open cut	Underground		Day	Day/ evening Shoulder (6pm-7pm)
		Without Rail Spur	With Rail Spur		
A1	37	34	34	38	37
A2	**42**	39	39	38	37
A3	**47**	40	40	44	43
A4	34	41	42	44	43
A5	33	41	42	44	43
A6	31	43	46	48	45
A7	37	34	37	35	35
A8	39	34	37	48	44
A9	40	36	37	46	43
A10	40	33	33	42	41

1. The day/evening shoulder criteria are derived according to the INP.



Legend

- Receiver Location
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- Rasp Mine/CML 7 Boundary
- Project Area

Figure 5.1

Stage 1 $L_{eq,\ 15\ minute}$ Daytime Operational Noise Levels, dB(A)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS04_R1	Suffix No:	-
Date:	27/07/07	Drawing size:	A4
Drawn by:	DH	Reviewed by:	LS
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

0 150 300 450m

N

ERM

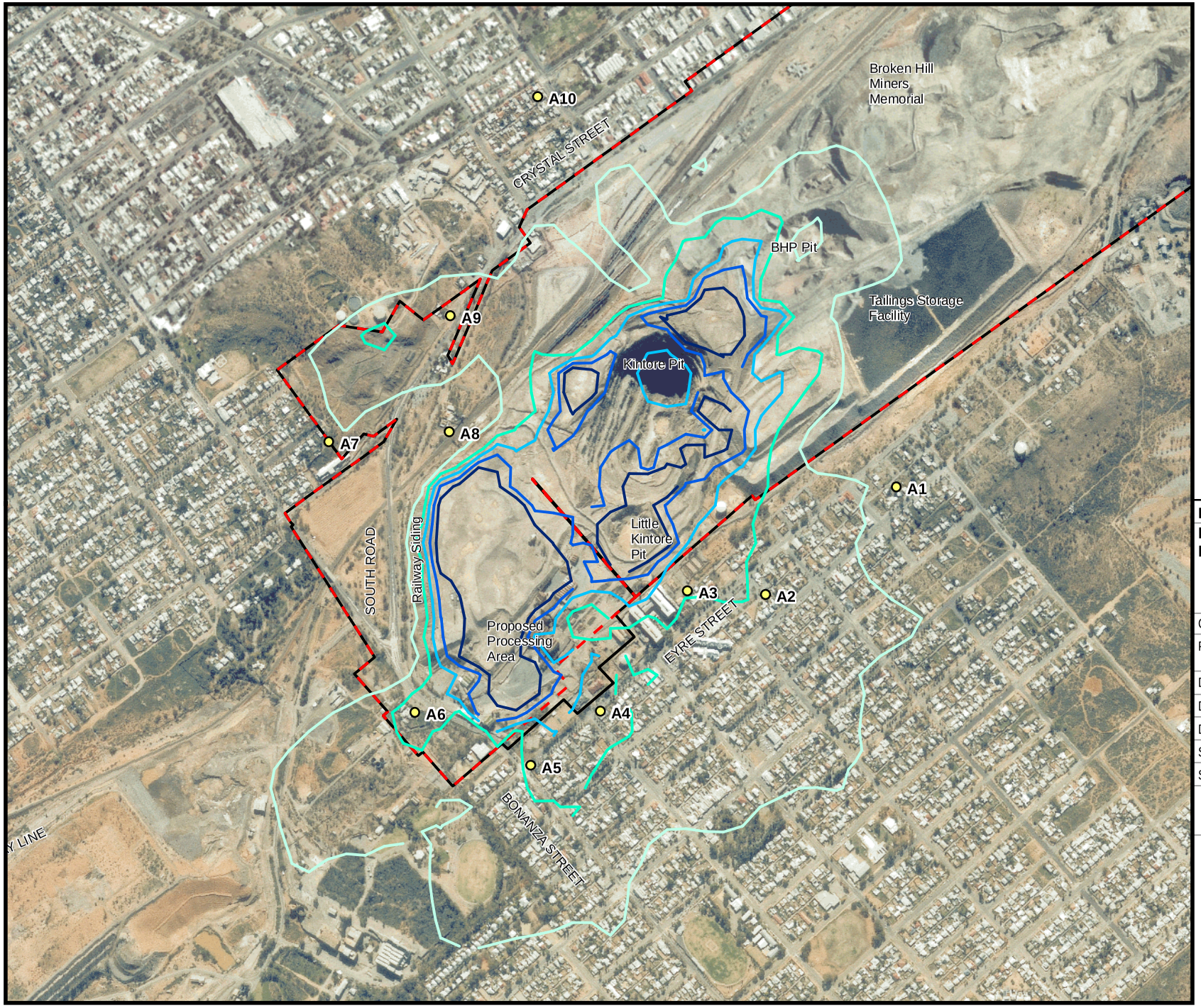


Figure 5.2

$L_{eq,\ 15\ minute}$ Daytime Operational Noise Levels Underground, dB(A)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS05_R2	Suffix No:	-
Date:	24/09/07	Drawing size:	A4
Drawn by:	DH	Reviewed by:	LS
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

0 150 300 450m

N

ERM

5.2 *EVENING AND NIGHT TIME NOISE LEVELS – UNDERGROUND OPERATIONS*

The proposal includes night time operations for underground mining and processing as described earlier.

Table 5.2 summarises noise modelling results for evening and night time operations. Predicted noise levels more than 2dB (threshold of perception) above criteria are highlighted in bold text. The noise contours are presented graphically in *Figure 5.3* and *Figure 5.4* for calm and adverse weather respectively. These levels typify expected external noise levels at receptors surrounding the mine during the evening and nigh time period.

The results indicate that evening and night time noise impact is not likely at most receptors. The only exception is at assessment location A6 during adverse weather. This is 3 dB above the DECC night time criteria, and are not considered significant in respect of level. In our experience, the DECC considers industrial noise to result in significant impact if this is more than 10dB above the background noise at residences (ie more than 5dB above criteria).

Table 5.2 Underground Predicted Evening and Night time Noise Levels (7pm to 7am)

Assessment Location	Predicted $L_{eq,15minute}$ Noise level, dB(A)		Criteria, dB(A)	
	Calm Weather	3°C/100 m Temperature Inversion	Evening	Night
A1	27	30	37	35
A2	34	37	37	35
A3	39	40	41	39
A4	38	40	41	39
A5	34	37	41	39
A6	40	**42**	41	39
A7	31	33	35	35
A8	32	33	39	39
A9	34	36	39	39
A10	30	36	41	35

Legend

- Receiver Location
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)
- 55 dB(A)
- Rasp Mine/CML 7 Boundary
- Project Area

Figure 5.3

$L_{eq,\ 15\ minute}$ Night Time Operational Noise Levels (Calm Weather), dB(A)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS06_R2	Suffix No:	-
Date:	24/09/07	Drawing size:	A4
Drawn by:	DH	Reviewed by:	LS
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

0 100 200 300m

N

ERM

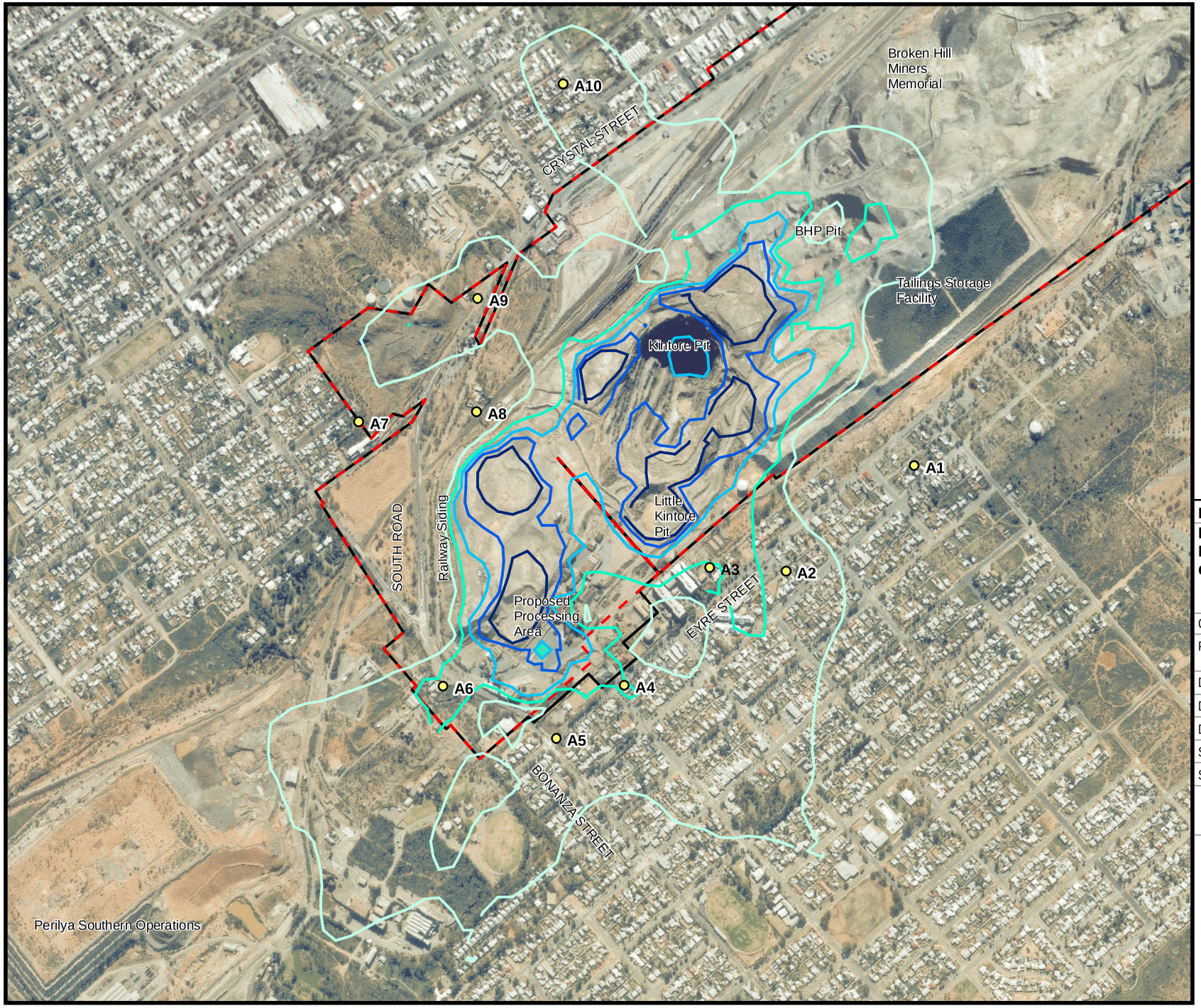


Figure 5.4

$L_{eq,\ 15\ minute}$ Night Time Operational Noise Levels (3°C/100m Inversion), dB(A)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS07_R2	Suffix No:	-
Date:	24/09/07	Drawing size:	A4
Drawn by:	DH	Reviewed by:	LS
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

0 150 300 450m

N

ERM

5.3 SLEEP DISTURBANCE – UNDERGROUND OPERATIONS ONLY

There is a potential for sleep of residents to be disturbed by transient noise such as shovel gates banging, bulldozer track plates, truck engine at fast revving and vehicle reversing alarms. *Table 5.3* presents noise levels for the noisiest of these sources measured by ERM for previous projects.

Table 5.3 Maximum Transient Noise

Noise Source	Measured L_{max} Noise Level, dB(A)	Distance from Source (metres)
Shovel gate banging	60	400
Bulldozer with reversing alarm	69	80

Typically, haul trucks are the most common source of maximum noise levels. A typical maximum sound power level from trucks is 120dB(A). This has been used in modelling sleep disturbance impacts. Maximum noise levels were calculated under calm and INP weather conditions for each receptor location.

Table 5.4 shows calculated maximum noise levels from the highest ranked source for a given receptor. This is based on the typical equipment locations used for mining operations and corresponds to the maximum sound power level for the particular item of plant (generally that for a truck or 120 dB(A)). The equipment judged to create a transient noise event was either a waste truck, ore truck or a dozer. Calculations were for a single event, rather than the simultaneous operation of a number of plant items because the values given are instantaneous maxima and such events are not simultaneous. The criteria used to assess sleep disturbance are based on the DECC's background plus 15 dB for the $L_{1,1min}$ noise level (which in this case is conservatively approximated by the maximum noise level (Lmax)).

Table 5.4 Sleep Disturbance Impact – INP Weather

Receptor	External L_{max} Noise Level From On-Site Plant, dB(A)		$L_{1,1min}$ Criteria, dB(A)
	Calm	Temperature Inversion	
A1	40	42	45
A2	45	**51**	45
A3	50	**52**	49
A4	39	45	49
A5	40	46	49
A6	36	39	49
A7	47	**49**	45
A8	45	46	49
A9	47	50	49
A10	46	**53**	45

Table 5.4 demonstrates that calculated noise levels under calm weather conditions are within the stipulated criteria at all receptors. During adverse weather, predicted maximum noise levels are above criteria at assessment locations A2, A3, A7 and A10. These weather conditions are limited to approximately 30% of winter nights. On any given night there could be approximately 47 truck movements between the Kintore Pit and the ROM pad. However not all truck movements will result in the worst case Lmax noise levels presented in *Table 2.1*, as this depends on truck driver techniques. Current night time Lmax noise levels from ambient (non-site related) sources vary from location to location. For example, night time Lmax noise levels at Piper Street are 53dB(A) on average, peaking at 87dB(A), with typical levels ranging between 50dB(A) to 60dB(A) each night (refer to *Annex A* charts). Hence, the predicted site related Lmax noise level is equal to the typical average ambient Lmax at receivers.

5.4 OTHER NOISE EMISSIONS

5.4.1 Construction Activities

Construction activities for the proposal will include:

- earth works associated with establishing of the ROM pad area;
- installation of the crushers, screen, conveyors, reagent handling, flotation structures and rail load-out facility; and
- on-site roads.

As discussed previously, the works above will be undertaken concurrently with the open cut operations and are therefore not expected to contribute to predicted open cut noise levels at residences.

Construction works will be limited to normal daytime hours as defined earlier. This time restriction together with a construction management plan will minimise impacts.

5.4.2 Road Traffic Noise

A total of 143 workers are proposed to be employed at the Rasp Mine during full production. Additional workers will be required during the construction phase to upgrade the infrastructure.

The traffic assessment provides the following information with respect to existing volumes on Eyre Street:

- Eyre St east of Bonanza St 170vph peak, with 4% heavy vehicles (ERM 26 May 2007, 07:45-08:45am))
- Eyre St east of Comstock St 153 vph peak, with 14% heavy vehicles (ERM 26 May 2007, 08:45-09:45am)

From this limited information it would appear that a large proportion of heavy vehicles avoid the T-intersection round-a-bout at Eyre Street and Bonanza Street, and use Comstock Street.

Based on the site's expected traffic volumes and distribution, the location of residences potentially most affected by road traffic noise from the site are those at or just east of Comstock Street.

By combining existing and future traffic from the proposal we are able to calculate expected traffic noise levels at a representative residence of Eyre Street (ie façade 20m from the road). This is summarised in *Table 5.5* and is based on the United States Federal Highway (FHWA) road traffic noise algorithms. The results indicate that during the busiest hour of the day or night, the ECRTN criteria will be met at the potentially most affected residence.

Table 5.5 Predicted Traffic Noise –Eyre Street (20m from road)

	Peak 1hr Traffic Volumes			Leq,1hr dB(A)	Criteria, dB(A)
	Light	Heavy	Total		
Existing (day)	132	21	153	65	NA
RASP Operation Only (day)	57	12	69	62	NA
Cumulative (Existing & RASP Operation) – day	189	33	222	67	67 (65+2 Allowance)
RASP 6.30am – 7.30am i.e. for 7am shift change (Peak 1-hour for night)	57	0	57	51	55

1. Modelled speed is 50km/hr as per street sign post.
2. Criteria are ERCTN criteria for land use developments with potential to create additional traffic on collector roads.
3. The night time shift change 55dB(A) criteria assumes existing traffic noise levels are relatively low at below 45dB(A).

5.4.3 *Main Rail Line Noise*

The existing main rail line operations through Broken Hill are approximately 3 to 7 freight trains and one passenger train per day.

The Proposal will include generally one train load (typically 11 wagons) per day This will occur only during daytime hours. However, it is anticipated that site wagons will be driven by existing services on the main line. That is, no extra locomotive operations will be needed on the main rail line as a result of the proposal. Where this cannot be accommodated, at most one additional locomotive operation may be needed each week. Hence, in noise terms no net change in noise impact or exposure is generally anticipated from the operations of the main line. Nonetheless, typical rail operational noise levels are provided below.

The closest existing residential property to the main rail line is assessment location A8, immediately north of the track and site. This residence is approximately 30 m north of the nearest track.

Measured noise levels for various train sets are published by the former Rail Access Corporation (RAC) and these are used here for demonstrating likely noise levels at assessment location A8, which is 30 m away. *Table 5.6* indicates that freight type trains (including locomotives, coal, ore and other freight) generally produce a noise level of 80dB(A) as a median value (with a 6dB(A) standard deviation) at 30 m. This is below the ARTC's current licence limit of 87dB(A) stipulated in their Environment Protection Licence described earlier.

Table 5.6 Train Noise Levels

Location	Existing				RASP Freight		Criteria
	Passenger		Freight				
	Lmax, dB(A)	Frequency	Lmax, dB(A)	Frequency	Lmax, dB(A)	Frequency	
A8 (30m)	71-80	1/day	63-93 80 median 6 Stdev	3-7/day	63-93 80 median 6 Stdev	2/day	87dB(A)

Source: Rail Access Corporation (RAC) Database; Based on 144 freight and 5 passenger measurements at 30m.

6 BLASTING NOISE AND VIBRATION

The Proposal includes blasting stopes in the base of the Kintore Pit (open cut) and underground blasts in the western mineralisation area (underground).

The minimum separation distance between the proposed blast locations and assessment locations are summarised in *Table 6.1*. For blast noise overpressure purposes, the appropriate distance is taken from the stope location for open cut and portal (or decline entrance) for underground. For blast ground vibration, the distance to the ore body blast location is used for underground (inclusive of depth). An additional assessment location was added for this assessment due to the position of the western mineralisation ore body and therefore blasting areas. This location is representative of the closest receivers on Crystal Street. This ensures that potential worst case impacts to residences have been assessed.

Table 6.1 Receptor Locations

Assessment Location	Minimum Blast Separation Distance, m		
	Open Cut	Underground	
		From Portal	Ore Body
A1	749	758	997
A2	574	680	1158
A3	483	607	1119
A4	746	898	1436
A5	922	1070	1607
A6	954	1091	1578
A7	866	919	1165
A8	582	627	924
A9	669	658	739
A10	977	910	517
Other (Crystal St)	-	-	289

6.1 OPEN CUT BLASTS

The blast design is actively managed by the operation, and hence corresponding airblast overpressure and ground vibration can be controlled. The site's existing blast management procedures will be used to ensure appropriate charge masses are used for blasting. Such charge masses (or maximum instantaneous charge, MIC) are presented in *Table 6.2* for distances covering the range in *Table 6.1* for open cut. These were derived from 95% formulae in Blastronics Pty Limited publication for monitoring data collected at similar open cut coal mines.

For air blast overpressure, the 95% confidence formulae is:

$$dBL = 172.8 - 23.7\text{Log}(D/W^{1/3})$$

where dBL is the noise overpressure (linear frequency weighting) at distance D (in metres) from the blast, with a charge mass (MIC) of W.

For ground vibration, the 95% confidence formulae is:

$$PPV = 1667(D/\sqrt{W})^{-1.45}$$

Where PPV is the peak particle velocity is mm/s.

The MIC suggested in *Table 6.2* assume daytime blasts only and hence the 115dBL target for blast overpressure was adopted.

As would normally be expected, the results indicate that blasts will be limited by overpressure noise and will require strict controls to ensure targets are achieved at residences.

Table 6.2 Recommended Blast Charge Mass

Blast to Receptor Distance, m	MIC_{8ms} to Satisfy ANZECC 95% Overpressure Limit of 115 dB(Lin), kg	MIC_{8ms} to Satisfy ANZECC 95% Ground Vibration Limit of 5 mm/s (ppv), kg
450	12	67
500	14	83
550	19	100
600	25	119
650	32	140
700	40	162
750	49	186
800	59	212
850	71	239
900	84	268
950	99	299
1,000	116	331

1. These results are derived from equations contained in the Drill and Blast Study, prepared by Blastronics Pty Limited in September 1994

2. A marginal 3dB correction has been applied to overpressure formulae to account for directional effects afforded by the Kintore Pit.

All blasts will be monitored for overpressure noise and ground vibration at several locations.

It is recommended that when a temperature inversion is known to exist, blasting should be avoided if practical. This does not apply where the effects of blasting are not perceived at noise sensitive locations. In addition to the above criteria, general best practice procedures can be used to effectively minimise noise impacts (see *Section 7*).

6.2 UNDERGROUND BLASTS

Underground blasts have been monitored at the site for both noise overpressure and ground vibration. The measured overpressure data was provided to ERM by the proponent and is used here to predict potential impacts.

6.2.1 Blast Noise Overpressure

Blast noise overpressure data collected at three locations between the period 11 May to 17 August 2007 was analysed. A total of 263 records were used with 85 to 89 records from each location. The monitors are 209m, 433m and 491 metres from the decline portal in the Kintore Pit (ie source of noise overpressure). The estimated MIC used during this period ranged between 15kg to 120kg, with 89% of records being for 60kg MIC. Hence, the analysis is generally suitable for MIC values close to 60kg. It should also be noted that this data is specific to the current decline depth and orientation, which will change in future to include (for example) a change in direction or bend. This will reduce overpressure noise escaping through the portal to residential areas.

The resulting 95 percentile noise overpressure equation is

$$dBL = 198.11 - 42.494 \text{Log}(D/W^{1/3})$$

as shown in *Figure 6.1*.

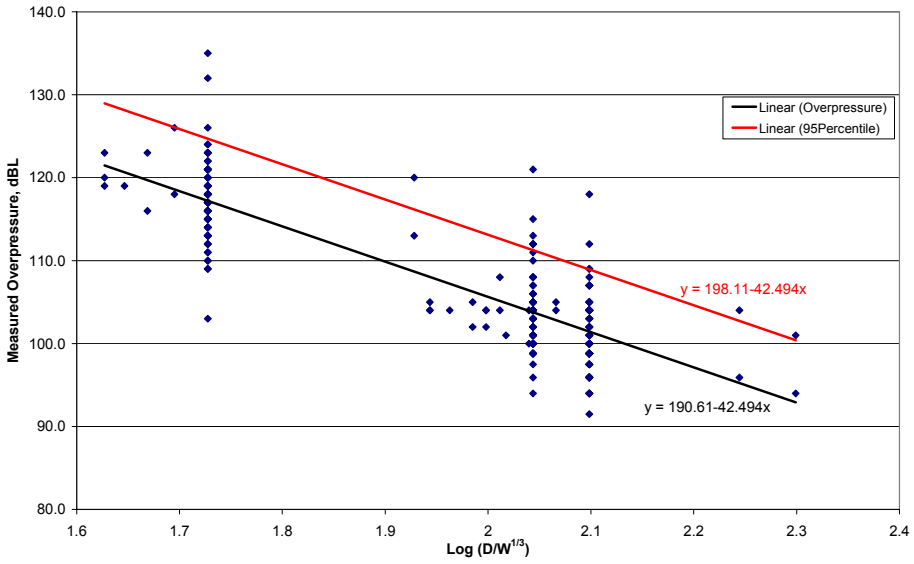


Figure 6.1 Site Specific Noise Overpressure Measurements

From the site specific 95% blast noise overpressure formulae, a range of distances for representative receivers surrounding the mine were assessed. The results of which are summarised in *Table 6.3*. The results demonstrate that strict control of MIC values is needed to achieve the 95dBL night time noise overpressure criteria at receivers. These MIC values should be used as a guide for proposed blasts.

Table 6.3 ***Recommended Blast Charge Mass***

Blast to Receptor Distance, m	MIC_{8ms} to Satisfy ANZECC 95% Overpressure	MIC_{8ms} to Satisfy ANZECC 95% Overpressure
	Day Limit of 115 dB(Lin), kg	Night Limit of 95 dB(Lin), kg
600	293	11
650	373	14
700	465	18
750	572	22
800	695	27
850	833	32
900	989	38
950	1,163	45
1,000	1,357	53
1,050	1,571	61
1,100	1,806	70

6.2.2 Underground Blast Vibration

In the absence of site specific ground blast vibration data, the assessment shown earlier in *Table 6.2* can be used as a guide. As described later, all blast noise overpressure and ground vibration will be monitored as part of the site's management plan.

7 *NOISE MANAGEMENT*

In addition to the identified noise mitigation described in *Section 4.4*, which will be adopted from the outset, the following measures will be implemented.

Detailed noise management procedures will be developed to govern the management of noise across the site. This will form part of the BHOP's Environmental Management Plan (EMP) and include procedures for blasting, noise monitoring and compliance assessment.

These procedures will be implemented and will be upgraded regularly to reflect the operations.

The management procedures will include requirements for:

- training in noise control procedures;
- maintenance and testing for plant and equipment;
- equipment operation;
- timing of activities and equipment operations;
- equipment purchase requirements;
- management of community complaints.
- blast overpressure and vibration limits;
- timing of blasts;
- blast design including MIC; and
- restrictions due to weather conditions.

Monitoring will include attended as well as unattended noise monitoring in specified locations and operating conditions. Similarly, all blasts within the subject areas will be monitored.

The procedure for monitoring will include a noise and blasting component which includes requirements for:

- monitoring of noise quarterly in the first twelve months and annually thereafter, or at other times when circumstances require additional monitoring at locations where there is a sensitivity to noise and vibration arising from mining operations;

- overpressure and vibration monitoring at sites approved by the DECC and adjacent to the mine site for each blast;

- data capture for blast monitoring calculated annually and assessed against DECC's criteria;

- noise monitoring and blast monitoring to comply with the relevant Australian Standards;

- an on-site weather station, including capability for capturing sigma-theta. The weather station will be installed as per relevant Australian Standards and be used to approximate temperature inversion strengths through Pasquil Stability classes derived from recorded sigma-theta values;

- management of the operation so as to minimise noise and ensure that statutory requirements are met; and

- keeping the local community and regulators informed and responding quickly and effectively to issues and complaints.

The Environmental Management Plan will outline noise, blasting and vibration control criteria and guidelines and requirements for community liaison and monitoring and reporting. In addition, it will provide management measures to be implemented to mitigate potential impacts resulting from noise generated during construction and operation including blasting and vibration impacts.

8 CONCLUSIONS

This study considers the potential noise impacts of the Proposal, as described in *Section 1.1*. The acoustic assessment includes modelling of all major mining equipment at representative operational locations. The study had the following features:

- an extensive background and ambient noise survey at several residential areas in Broken Hill;
- years of site-specific hourly meteorological data analysed to describe prevailing winds in accordance with the DECC's INP;
- source sound power levels for all equipment measured under operational conditions at mines;
- the noise modelling addressed the DECC's INP with regard to adverse weather conditions; and
- predicted mine noise is based on worst case operating scenarios and hence results in an 'outer-envelope' impact area.

The predicted open cut noise levels are below DECC criteria at most assessment locations. The exceptions are at locations A2, A3 and A7 where noise levels are 5dB, 4dB 2dB above criteria respectively. Given these results, limiting operations to daytime only, and duration of activities being limited to six months, impacts are considered marginal. In our experience, the DECC considers industrial noise to result in significant impact if this is 10dB above the background noise at residences. Further, the development and implementation of a Environmental Management Plan will address this issue.

For underground operations, the noise modelling has shown that by adopting extensive noise mitigation, significant reduction of noise emission will be achieved.

The predicted daytime noise levels during underground operations are below or within 1dB of nominated DECC criteria for on-site operations. During intermittent (2 per day) locomotive movements on the rail spur, predicted noise levels are below or within 2dB of DECC criteria. This exposure equates to two 15 minute periods per day, and is therefore not considered significant.

The predicted evening and night time noise levels during underground operations indicate impact is not likely at most receptors. The only exception is at assessment location A6 during adverse weather. This is 3 dB above the DECC night time criteria, and are not considered significant in respect of level. Further, location A6 is in the most a commercial property, notwithstanding one tenanted residence.

BHOP's proposed environmental plans and procedures, which include ongoing noise monitoring, will be used to assess the performance of the mining operations against the predicted noise levels.

Blast design will incorporate control on the MIC (maximum instantaneous charge) as described in this study and implementation of BHOP's environmental plans and procedures will ensure that acceptable limits are maintained. This will include monitoring of all blasts.

REFERENCES

Blastronics (1994) Drill & Blast Study, Mount Pleasant.

DECC (1994) *Environmental Noise Control Manual (ENCM).*

DECC (1999) *Environmental Criteria for Road Traffic Noise.*

DECC (2000) *Industrial Noise Policy.*

RTA Technology *Environmental Noise Model (ENM), Windows Version 3.06.*

Annex A

Noise Monitoring Data

Table A.1 139 Eyre St Broken Hill

Date	[2]ABL Day	ABL Evening	ABL Night	[2]Leq 11hr Day	Leq 4hr Evening	Leq 9hr Night
Wednesday, 31-01-07	0	39.5	0	0	56.4	0
Thursday, 01-02-07	0	37.5	0	0	54.5	0
Friday, 02-02-07	0	36	30	0	54.3	49.4
Saturday, 03-02-07	34	34	31.5	55	55.6	48.5
Sunday, 04-02-07	34	34.5	30	56.3	53.8	48.9
Monday, 05-02-07	39	38.5	0	56.7	63.5	0
Tuesday, 06-02-07	0	0	0	0	0	0
Wednesday, 07-02-07	0	0	0	0	0	0
Thursday, 08-02-07	0	36.5	34	0	55.4	48.9
Friday, 09-02-07	38	35	0	59.3	56.1	0
Saturday, 10-02-07	0	0	0	0	0	0
Sunday, 11-02-07	0	0	0	0	0	0
Monday, 12-02-07	0	35.5	34.5	0	54	47.1
Tuesday, 13-02-07	39.5	36	33.5	58.5	55.6	48.7
Wednesday, 14-02-07	0	0	0	0	0	0
Thursday, 15-02-07	0	37.5	0	0	56.1	0
Friday, 16-02-07	0	0	0	0	0	0
Saturday, 17-02-07	0	0	35	0	0	49.7
Sunday, 18-02-07	0	0	0	0	0	0
Monday, 19-02-07	40.5	0	36.5	58.1	0	48.8
Tuesday, 20-02-07	0	0	34	0	0	47.2
Wednesday, 21-02-07	40	37	0	57.9	57	0
Summary Values						
RBL	**39**	**36**	**34**			
Average				**58**	**57**	**49**

1. 0 indicates periods with too few valid samples due to weather or logger operation.

2. Daytime levels derived on the basis of 7m/s wind speed threshold at 10m above ground at Broken Hill Airport. This is considered to represent less than 5m/s at the microphone according to AS1170.2.

Table A.2 148 Piper Street Broken Hill

Date	ABL Day	ABL Evening	ABL Night	Leq 11hr Day	Leq 4hr Evening	Leq 9hr Night
Friday, 27-04-07	0	37	0	0	42.7	0
Saturday, 28-04-07	0	0	0	0	0	0
Sunday, 29-04-07	0	0	0	0	0	0
Monday, 30-04-07	34.5	31.5	27	43.5	40.3	40.6
Tuesday, 01-05-07	0	0	0	0	0	0
Wednesday, 02-05-07	0	35.5	0	0	40.9	0
Thursday, 03-05-07	0	0	34	0	0	41
Friday, 04-05-07	0	33.5	30.5	0	41.3	39.3
Saturday, 05-05-07	33	32.5	29.5	42.6	39.4	37.1
Sunday, 06-05-07	30.5	30	25.5	41.4	38.3	35.5
Monday, 07-05-07	32.5	30.5	29	43.1	39.2	36
Tuesday, 08-05-07	0	0	0	0	0	0
Wednesday, 09-05-07	0	30	0	0	39.4	0
Thursday, 10-05-07	0	0	27.5	0	0	36.8
Friday, 11-05-07	33	0	0	49.6	0	0
Saturday, 12-05-07	32	29	0	55.2	36.2	0
Sunday, 13-05-07	31.5	31	0	44.3	41.2	0
Monday, 14-05-07	0	33	0	0	37.7	0
Tuesday, 15-05-07	0	32	0	0	38.8	0
Wednesday, 16-05-07	0	0	0	0	0	0
Thursday, 17-05-07	0	0	34	0	0	57.6
Friday, 18-05-07	0	0	0	0	0	0
Summary Values						
RBL	**33**	**32**	**29 (Adopt 30)**			
Average				**49**	**40**	**49**

1. 0 indicates periods with too few valid samples due to weather or logger operation.

2. Daytime levels derived on the basis of 6m/s wind speed threshold at 10m above ground at Broken Hill Airport. This is considered to represent less than 5m/s at the microphone according to AS1170.2.

Table A.3 237 Hebbard St Broken Hill

Date	[2]ABL Day	ABL Evening	ABL Night	[2]Leq 11hr Day	Leq 4hr Evening	Leq 9hr Night
Wednesday, 31-01-07	0	0	0	0	0	0
Thursday, 01-02-07	0	36	0	0	54.5	0
Friday, 02-02-07	0	41.5	30.5	0	53.7	47.9
Saturday, 03-02-07	32	41.5	30.5	45.3	52.6	49.2
Sunday, 04-02-07	32	42	32.5	45	49.6	45.6
Monday, 05-02-07	33	42	0	49.6	58.6	0
Tuesday, 06-02-07	0	0	0	0	0	0
Wednesday, 07-02-07	0	0	0	0	0	0
Thursday, 08-02-07	0	35	29.5	0	48.9	50.2
Friday, 09-02-07	33.5	36.5	0	50.1	56.5	0
Saturday, 10-02-07	0	0	0	0	0	0
Sunday, 11-02-07	0	0	0	0	0	0
Monday, 12-02-07	0	35	31.5	0	45.3	37.4
Tuesday, 13-02-07	33.5	35	32	47.6	47.5	38.1
Wednesday, 14-02-07	0	0	0	0	0	0
Thursday, 15-02-07	0	35.5	0	0	47.9	0
Friday, 16-02-07	0	0	0	0	0	0
Saturday, 17-02-07	0	0	33.5	0	0	37.4
Sunday, 18-02-07	0	0	0	0	0	0
Monday, 19-02-07	33.5	0	32.5	48.4	0	38.1
Tuesday, 20-02-07	0	0	32.5	0	0	40.3
Wednesday, 21-02-07	33	0	0	48.5	0	0
Summary Values						
RBL	**33**	**36 (~Day 33)**	**32**			
Average				**48**	**53**	**46**

1. 0 indicates periods with too few valid samples due to weather or logger operation.

2. Daytime levels derived on the basis of 7m/s wind speed threshold at 10m above ground at Broken Hill Airport. This is considered to represent less than 5m/s at the microphone according to AS1170.2.

Table A.4 208 Carbon Street Broken Hill

Date	[2]ABL Day	ABL Evening	ABL Night	[2]Leq 11hr Day	Leq 4hr Evening	Leq 9hr Night
Wednesday, 31-01-07	0	0	0	0	0	0
Thursday, 01-02-07	0	32	0	0	36.9	0
Friday, 02-02-07	0	31	27	0	36.4	32.4
Saturday, 03-02-07	29	30.5	29	37.4	35.3	34.2
Sunday, 04-02-07	29	30	27.5	37.7	35.6	33.9
Monday, 05-02-07	29.5	30.5	0	36.9	36.4	0
Tuesday, 06-02-07	0	0	0	0	0	0
Wednesday, 07-02-07	0	0	0	0	0	0
Thursday, 08-02-07	0	31.5	29.5	0	36.1	34.8
Friday, 09-02-07	30.5	33	0	37.9	46.5	0
Saturday, 10-02-07	0	0	0	0	0	0
Sunday, 11-02-07	0	0	0	0	0	0
Monday, 12-02-07	0	31	27.5	0	37.8	33.4
Tuesday, 13-02-07	30.5	30.5	26	36.7	35.8	31.8
Wednesday, 14-02-07	0	0	0	0	0	0
Thursday, 15-02-07	0	31	0	0	40.8	0
Friday, 16-02-07	0	0	0	0	0	0
Saturday, 17-02-07	0	0	29	0	0	34.8
Sunday, 18-02-07	0	0	0	0	0	0
Monday, 19-02-07	29.5	0	27	38.8	0	36.9
Tuesday, 20-02-07	0	0	29.5	0	0	34.3
Wednesday, 21-02-07	30.5	0	0	39.5	0	0
Summary Values						
RBL Average	**30**	**31 (~Day=30)**	**28 (Adopt 30)**	**38**	**40**	**34**

1. 0 indicates periods with too few valid samples due to weather or logger operation.

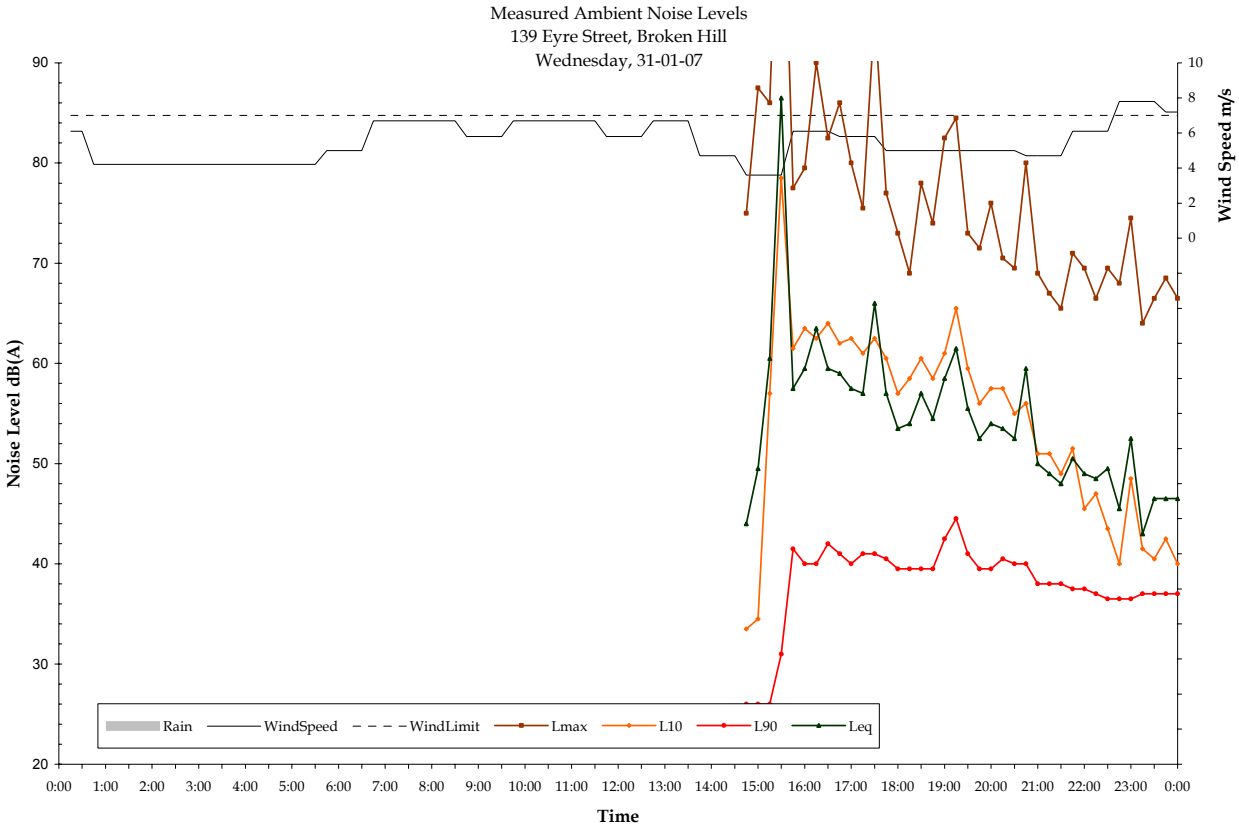
2. Daytime levels derived on the basis of 7m/s wind speed threshold at 10m above ground at Broken Hill Airport. This is considered to represent less than 5m/s at the microphone according to AS1170.2.

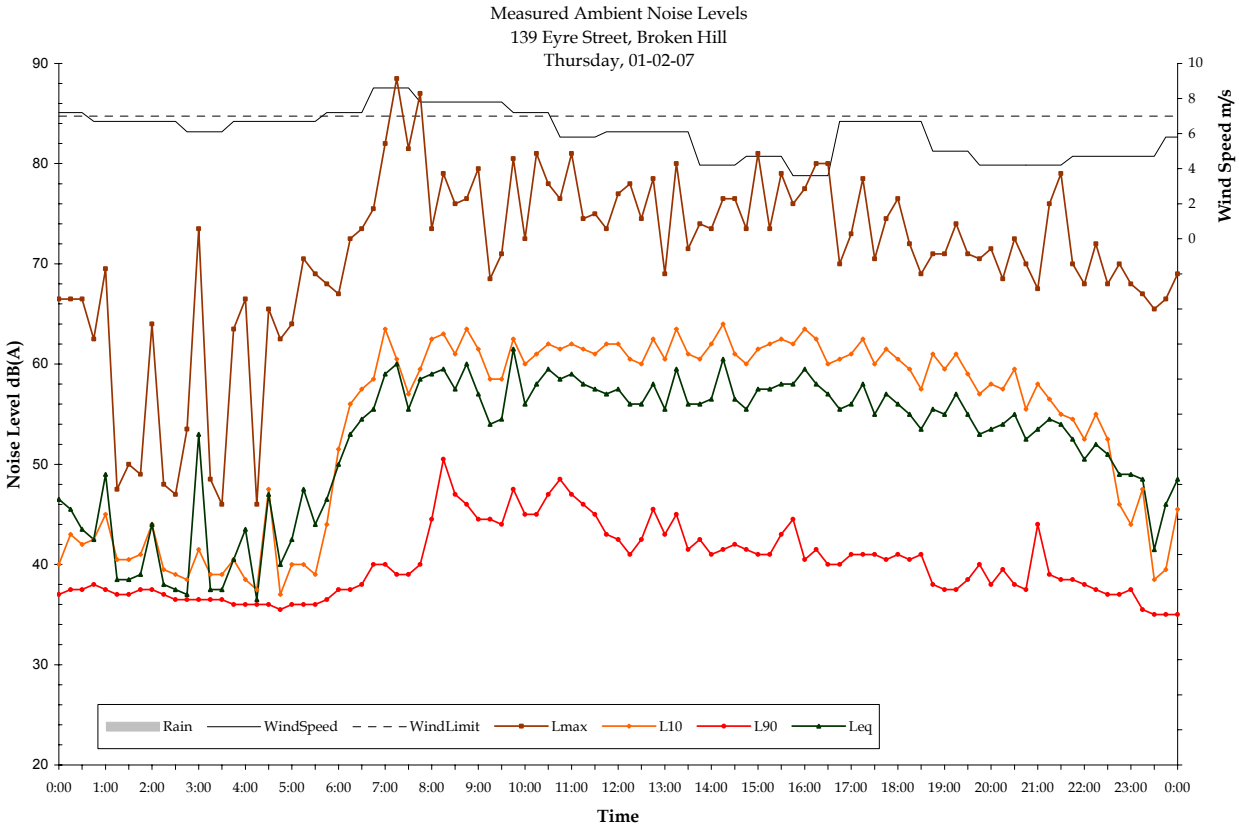
Logger placed at 10 Argent St Broken Hill during the same period above was contaminated by cooling/ventilation plant used at this residence, and therefore could not be used. However, 2001 SEE data at 10 Argent Street shows lowest ABL of 37dB(A), 36dB(A) and 30dB(A) for day, evening and night respectively.

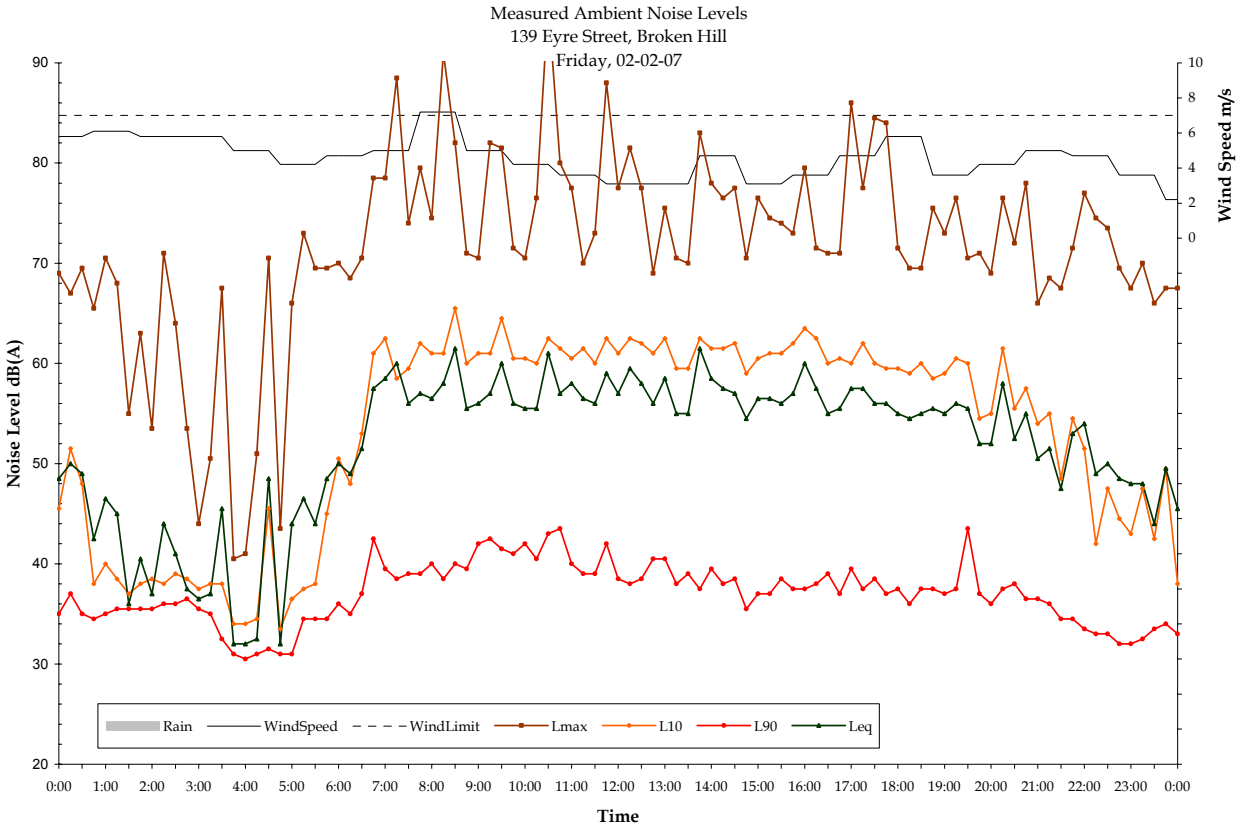
Table A.5 10 Argent St Broken Hill – 2001 Data

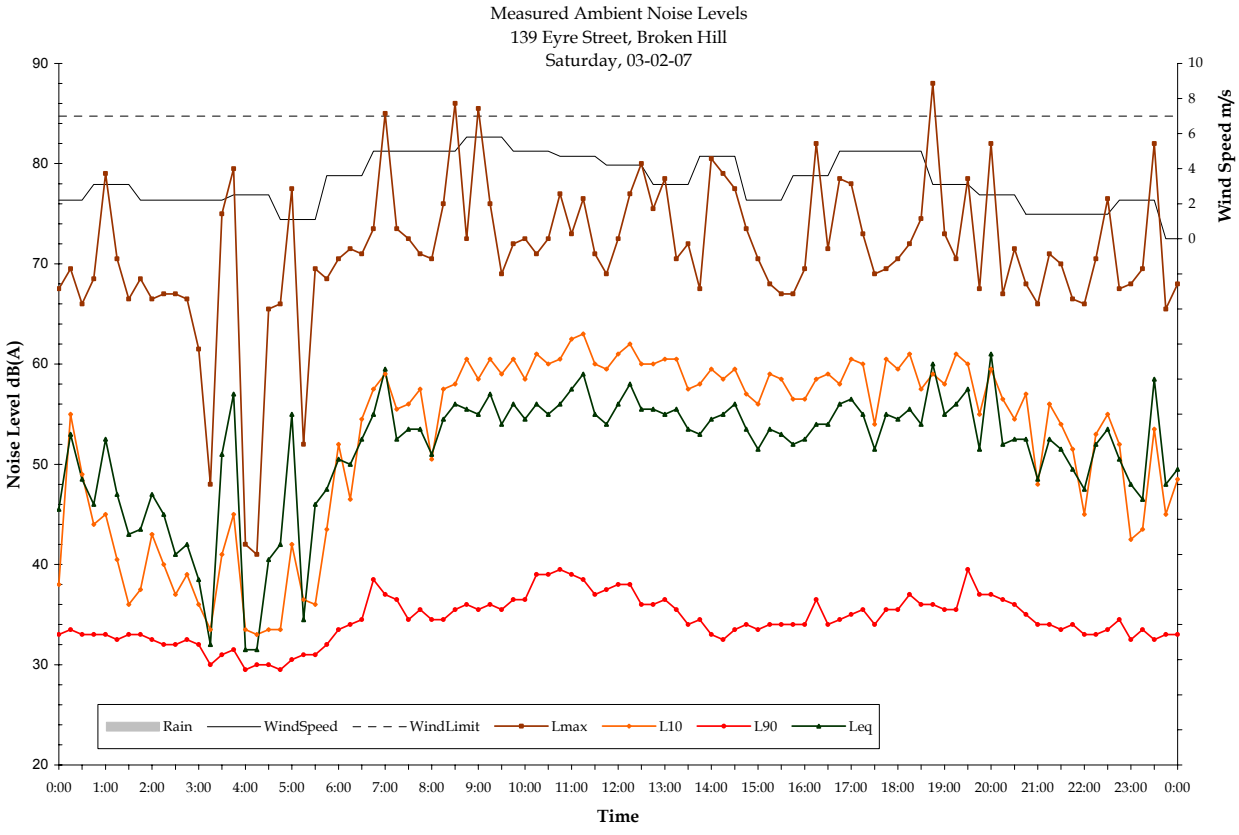
Date	Assessment Background Level, dB(A)					
	Only Rain Excluded			Wind and Rain Excluded		
	Day	Evening	Night	Day	Evening	Night
14-May-01	0	0	33.0	0	0	0
15-May-01	40.5	37.5	34.0	0	0	0
16-May-01	41.5	38.5	34.0	0	0	0
17-May-01	40.5	0	0	0	0	0
18-May-01	0	39.5	35.0	0	39.5	0
19-May-01	38.5	39.5	33.0	0	39.5	33.0
20-May-01	37.5	36.0	29.5	37.5	36.0	29.5
21-May-01	36.5	36.5	29.0	36.5	36.5	29.0
22-May-01	36.5	36.0	27.5	36.5	36.0	27.5
23-May-01	0	0	0	0	0	0
Rating Background Level	**38.5**	**37.5**	**33.0**	**36.5**	**36.5**	**29.3**
Average Leq	**-**	**-**	**-**	**54**	**54**	**39**

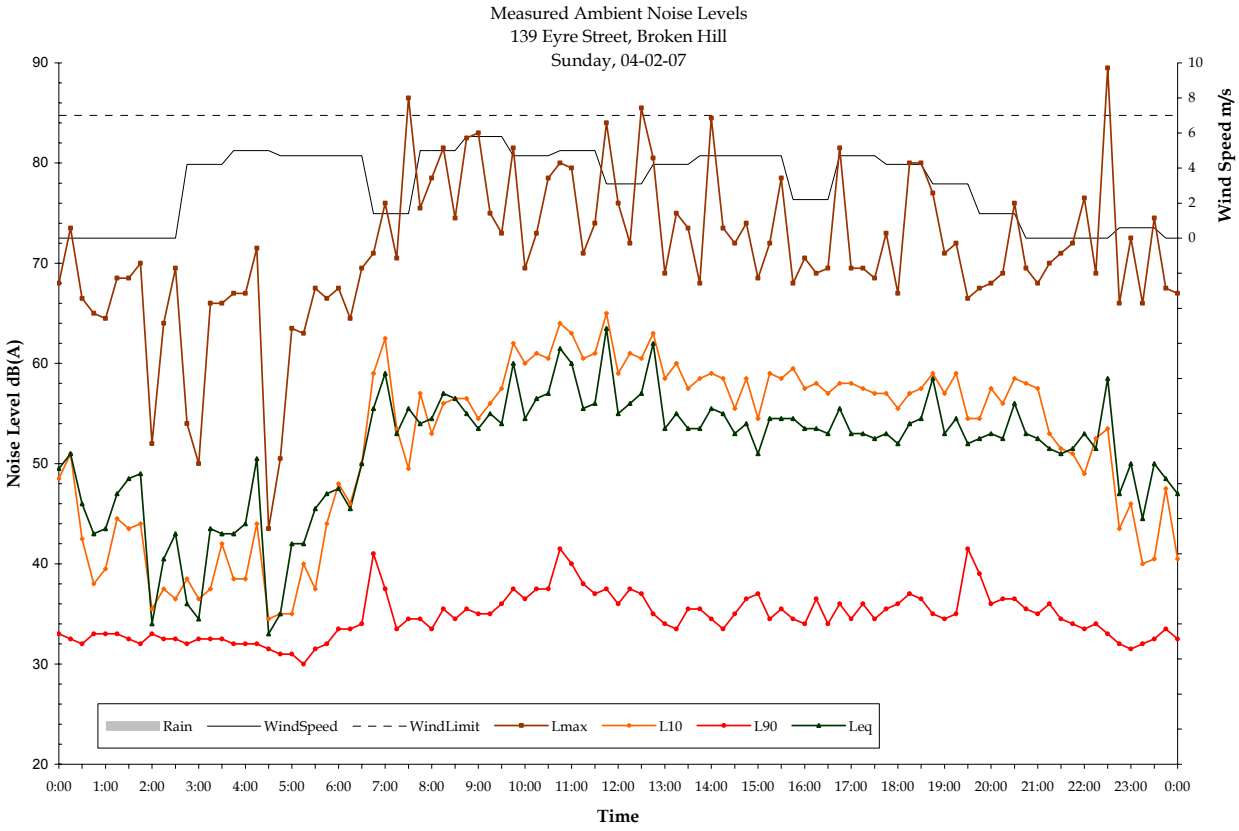
1. 0 indicates periods with too few valid samples due to weather or logger operation.

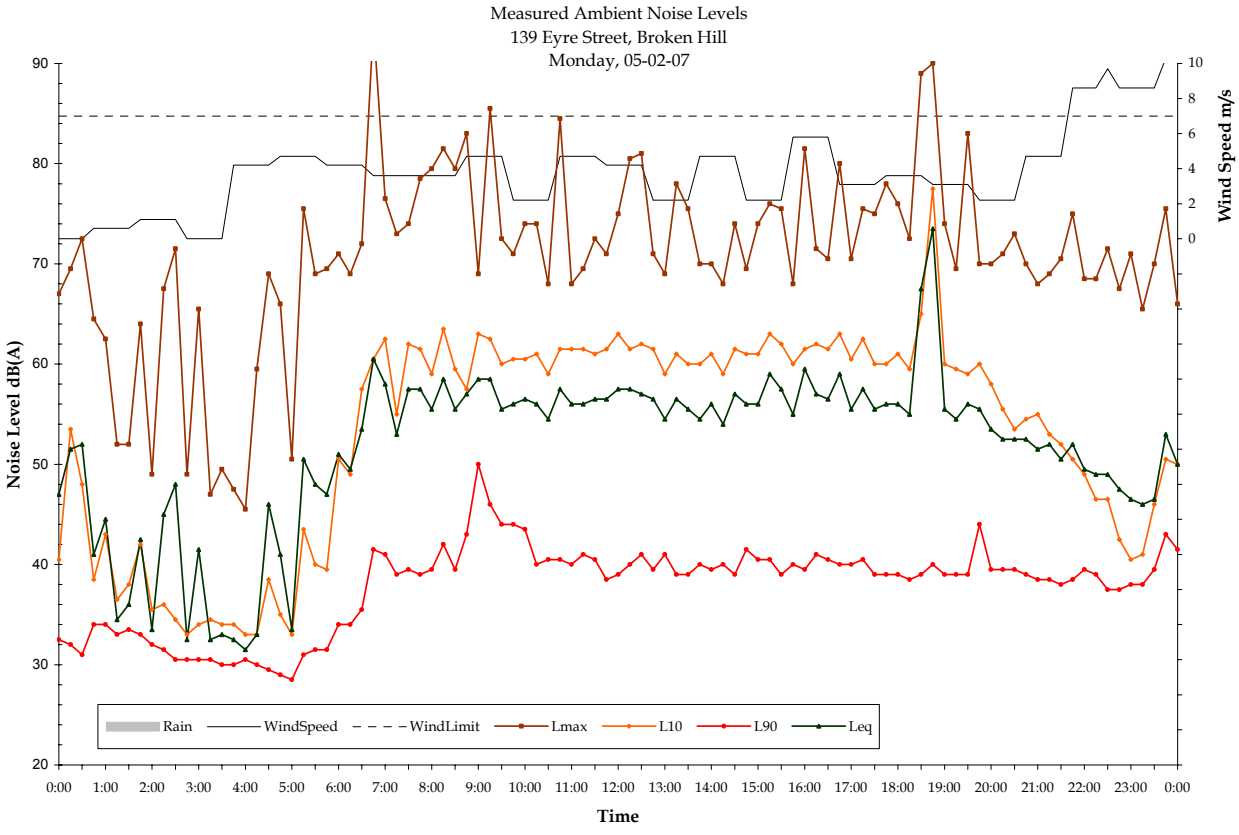

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Wednesday, 31-01-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

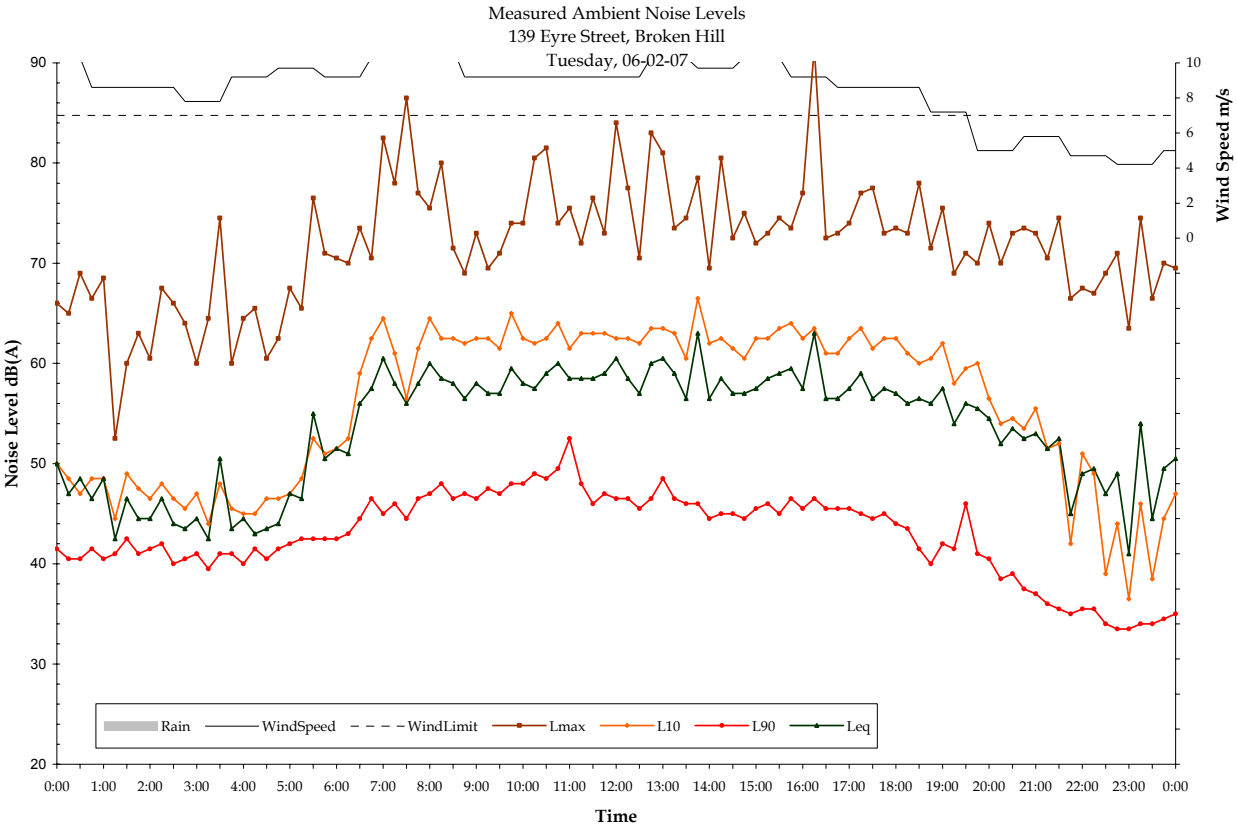

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Thursday, 01-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

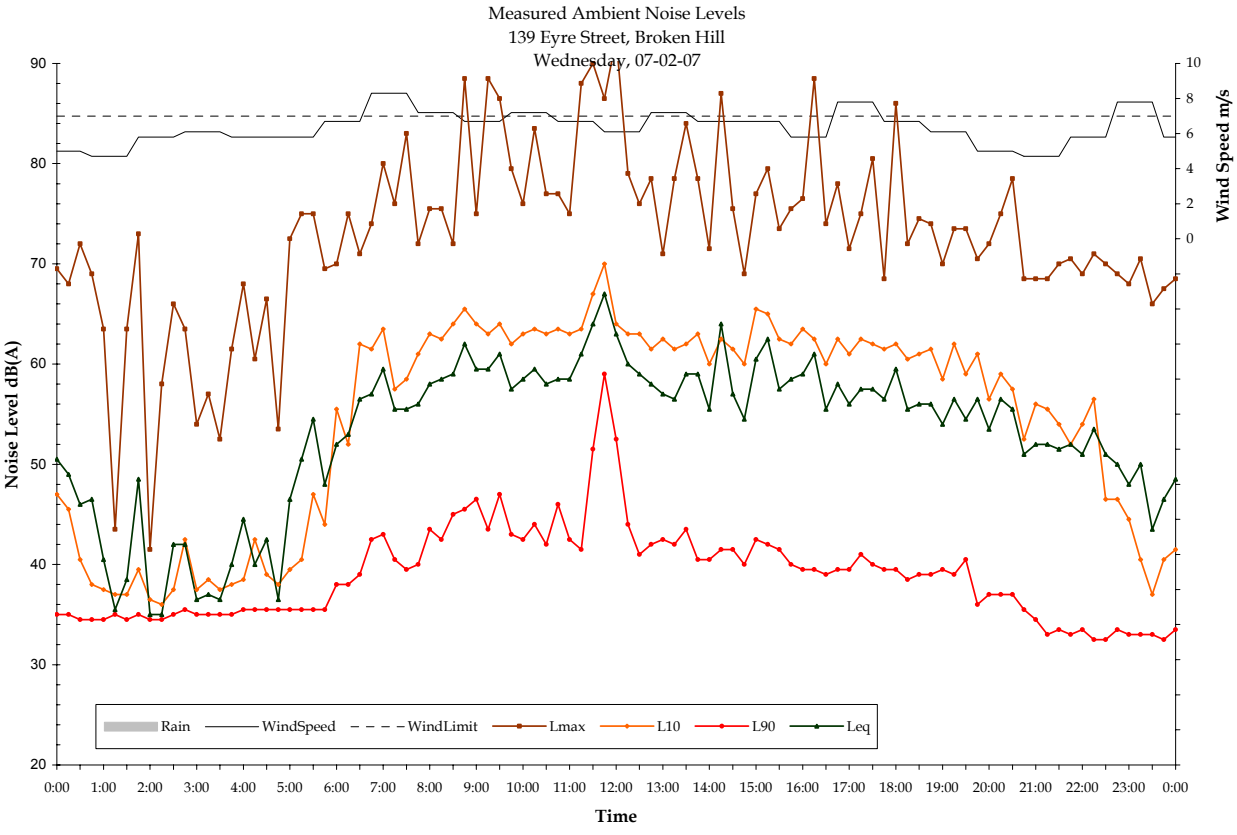

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Friday, 02-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

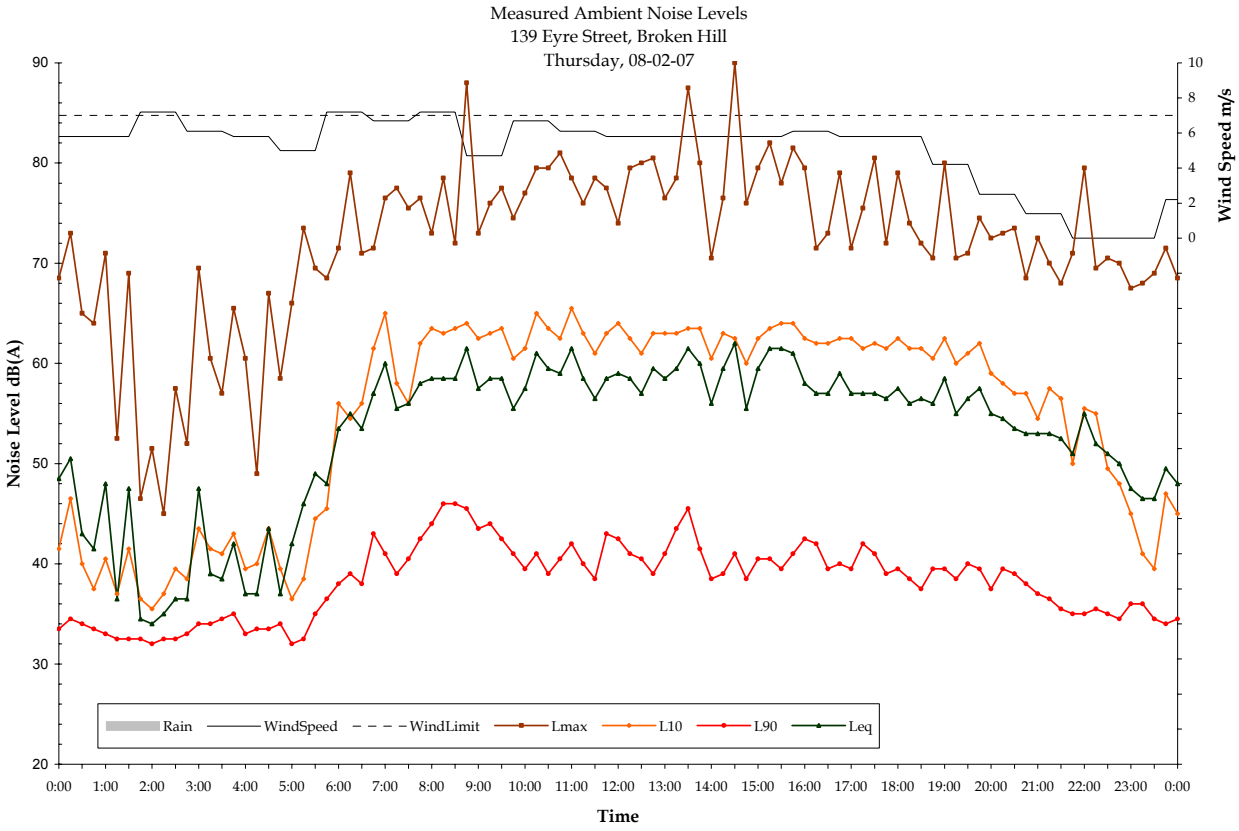

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Saturday, 03-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

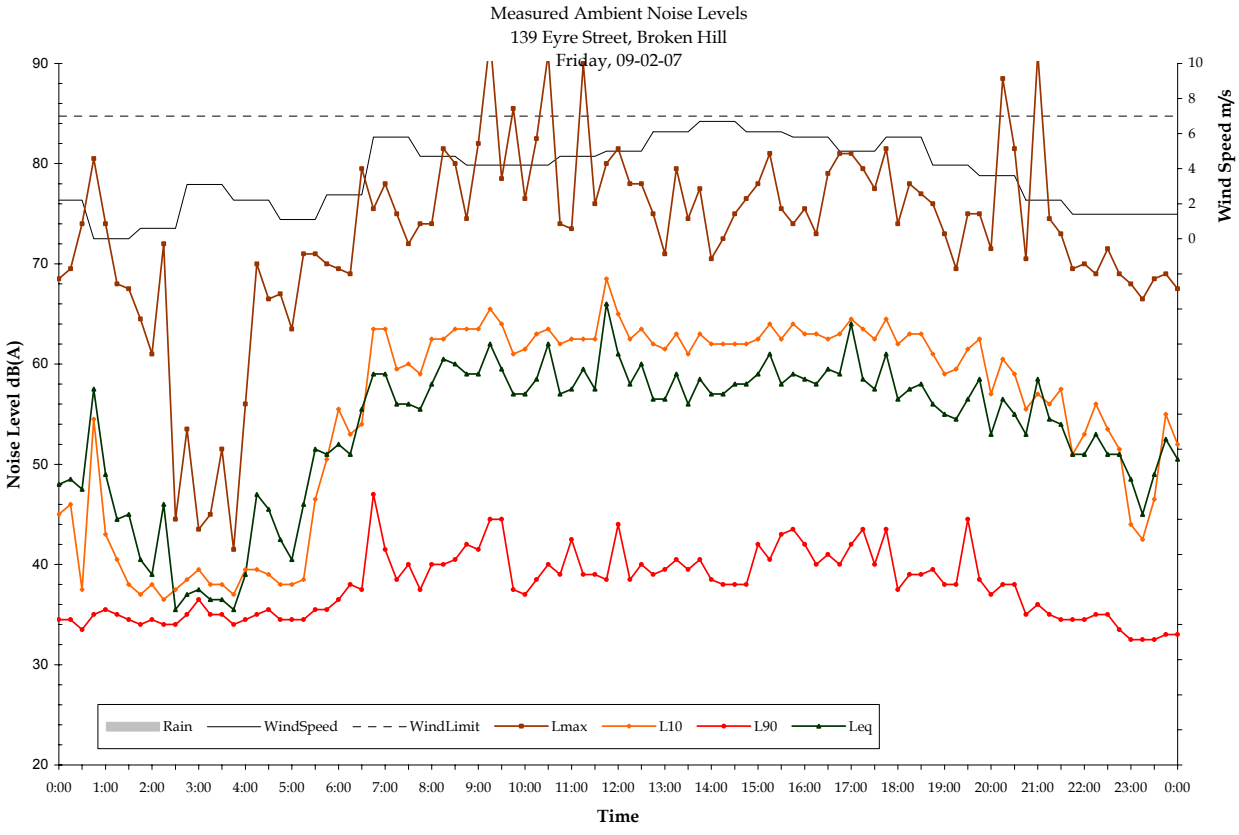

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Sunday, 04-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

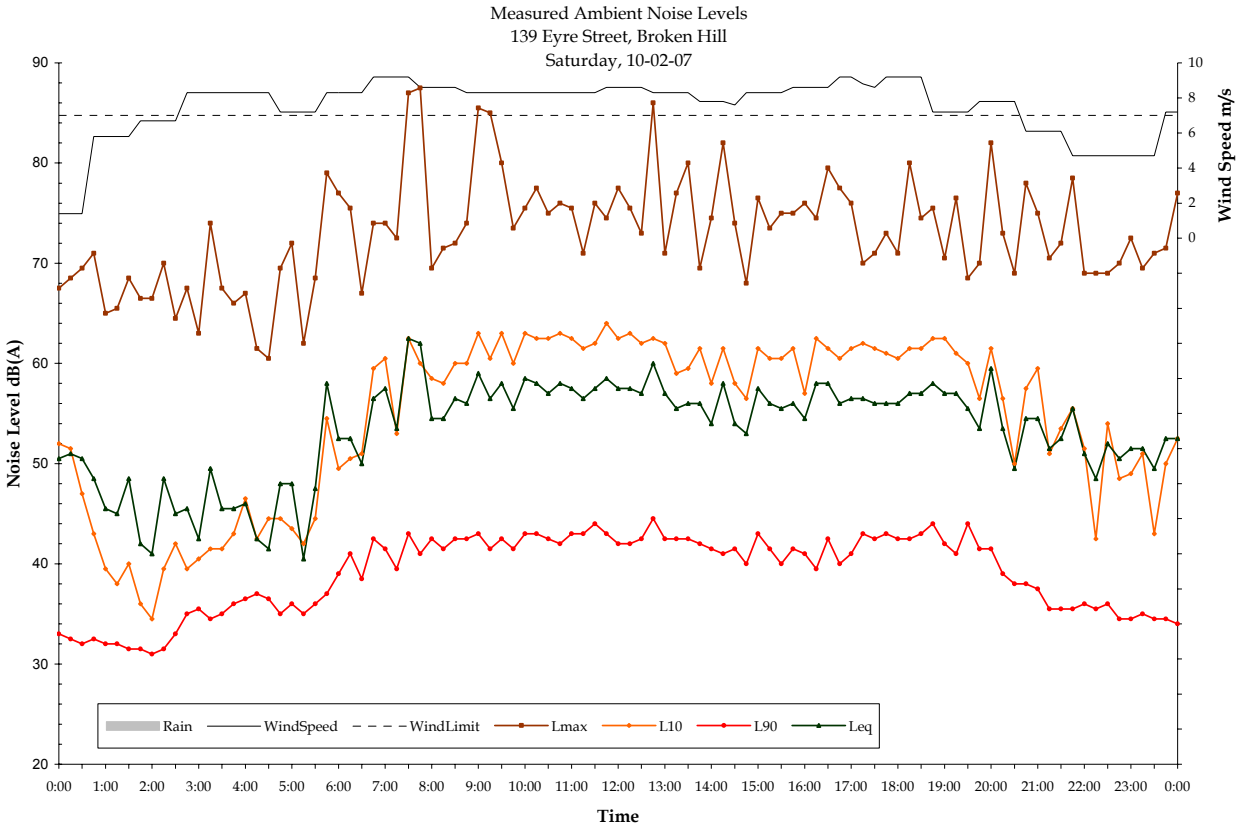

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Monday, 05-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

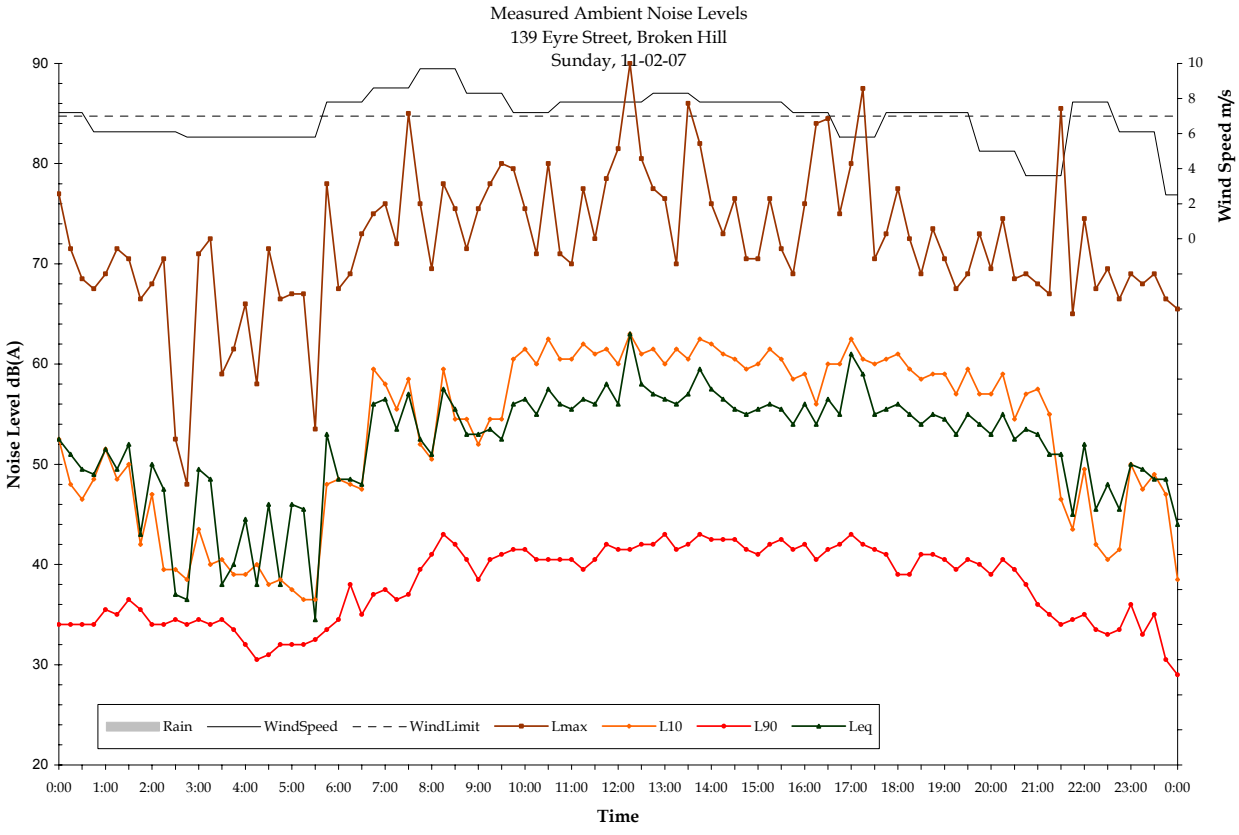

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Tuesday, 06-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

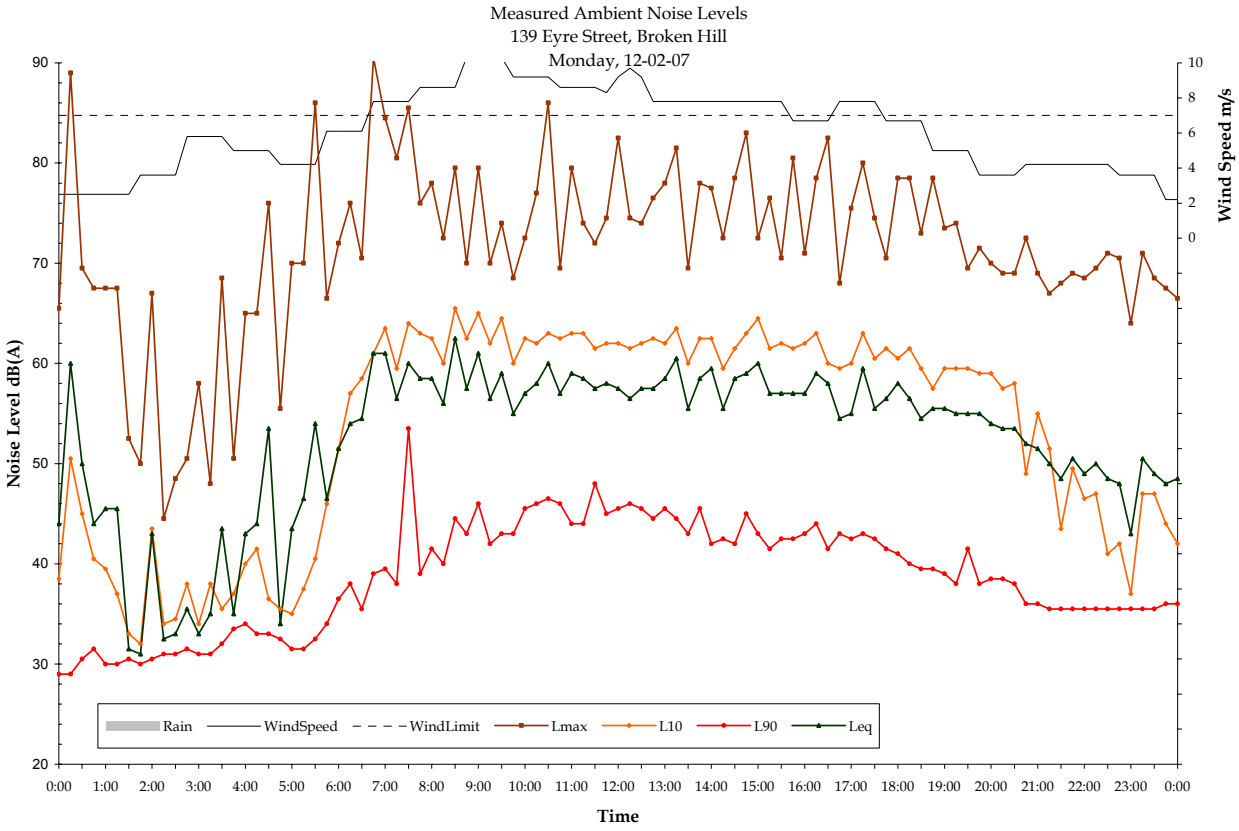

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Wednesday, 07-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

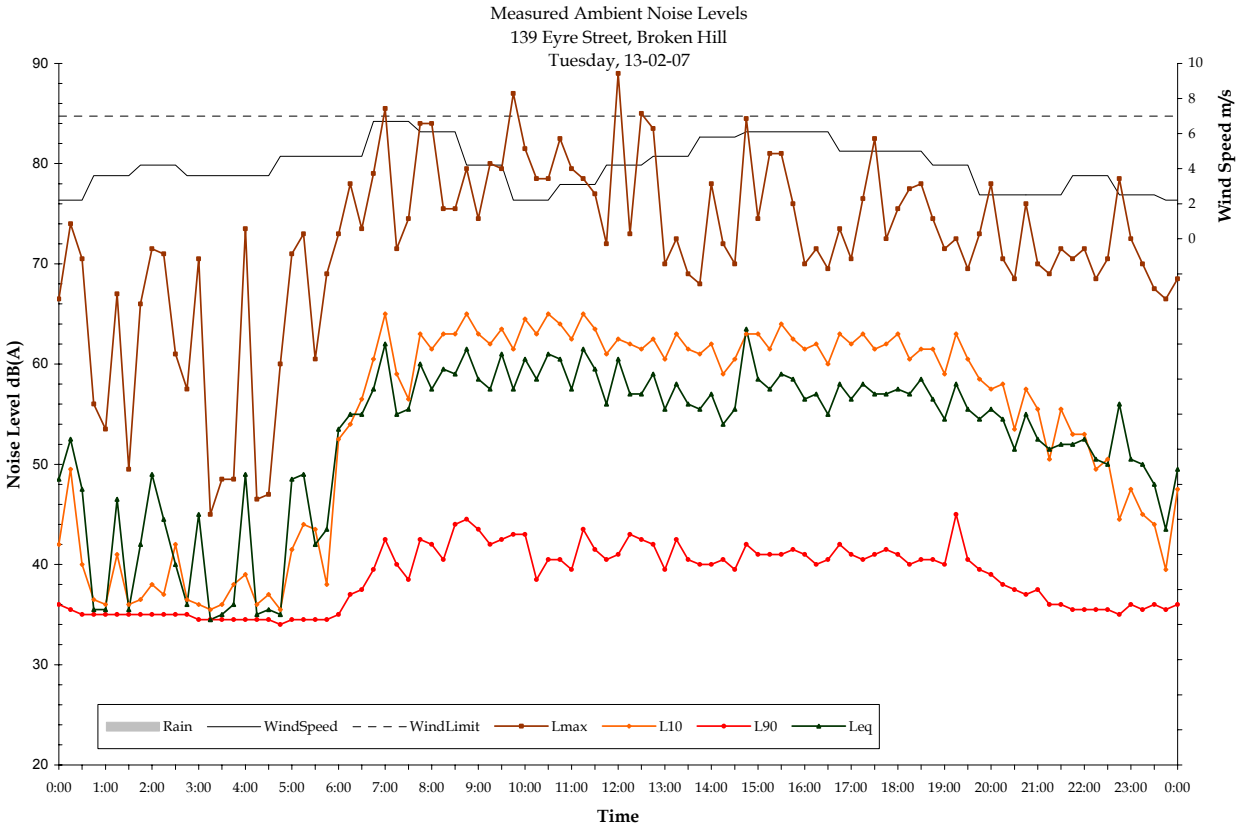

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Thursday, 08-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

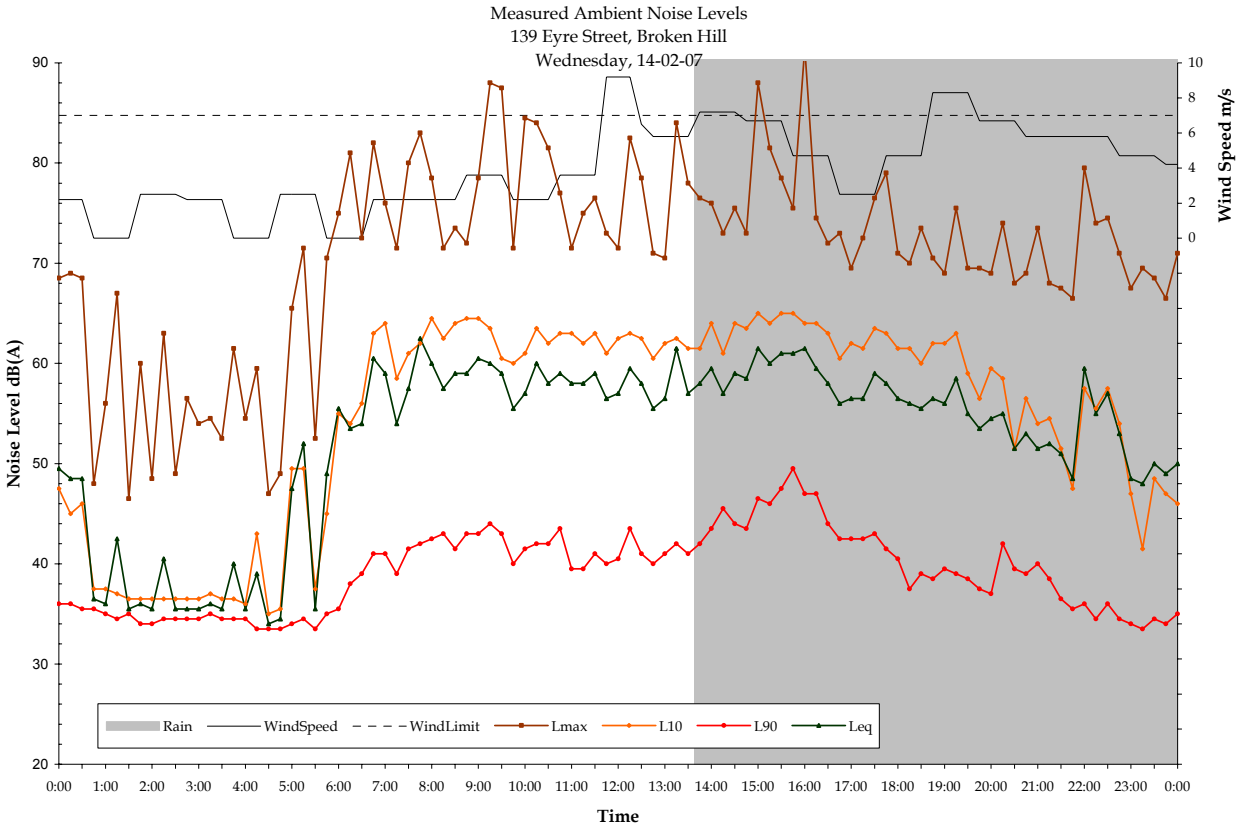

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Friday, 09-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

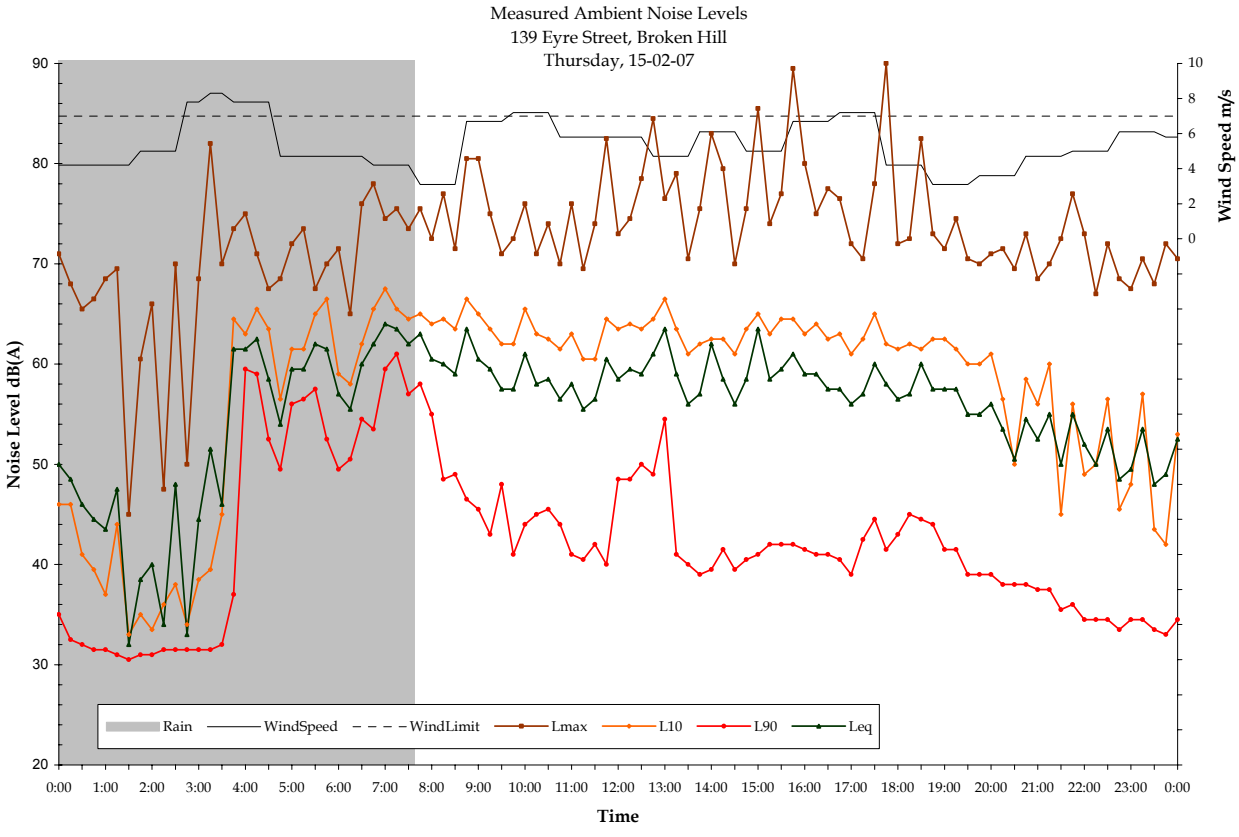

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Saturday, 10-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

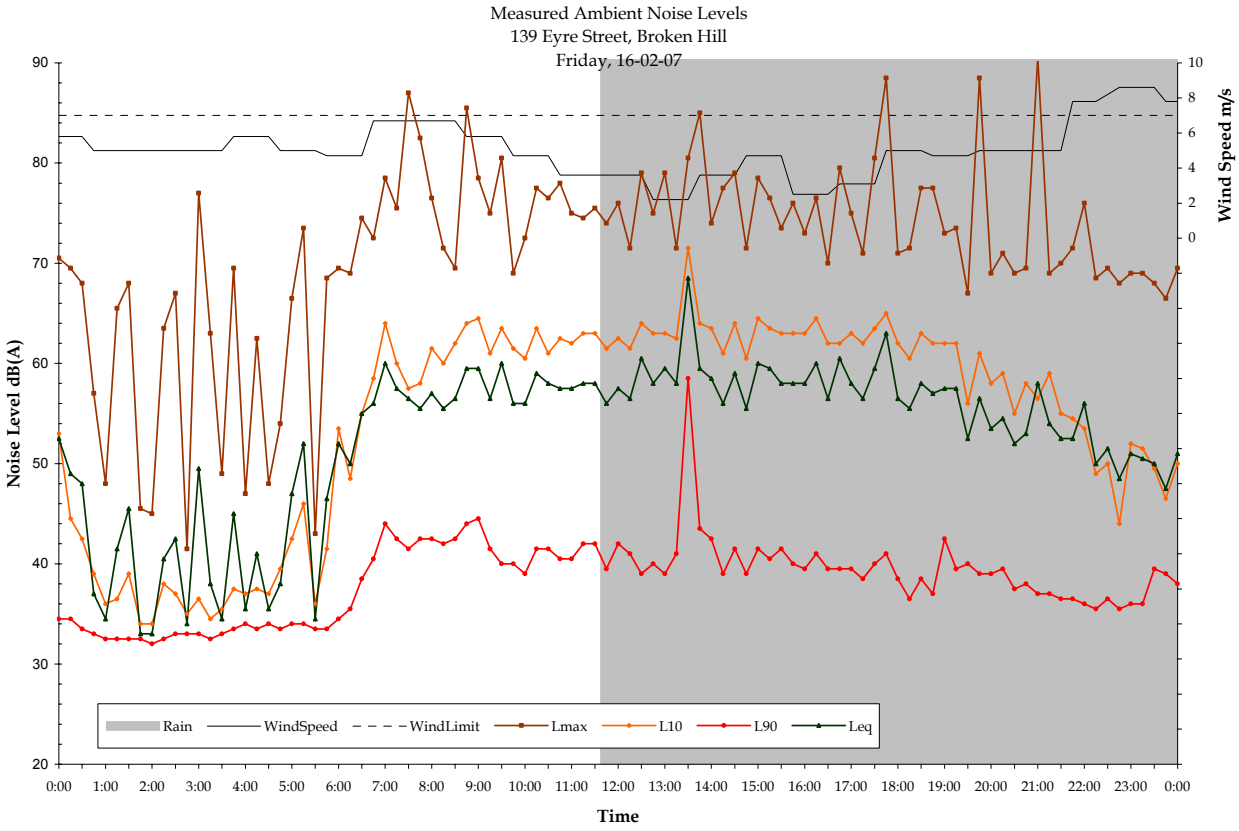

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Sunday, 11-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

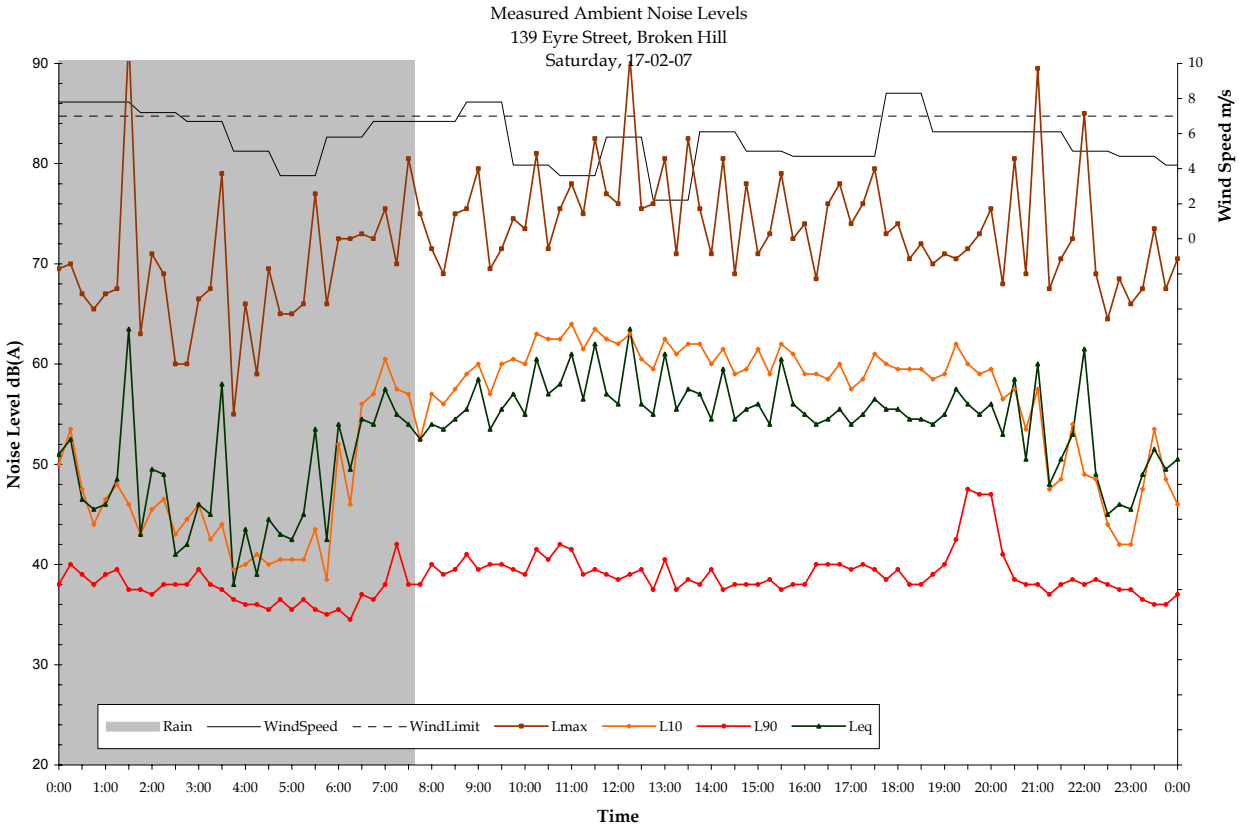

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Monday, 12-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

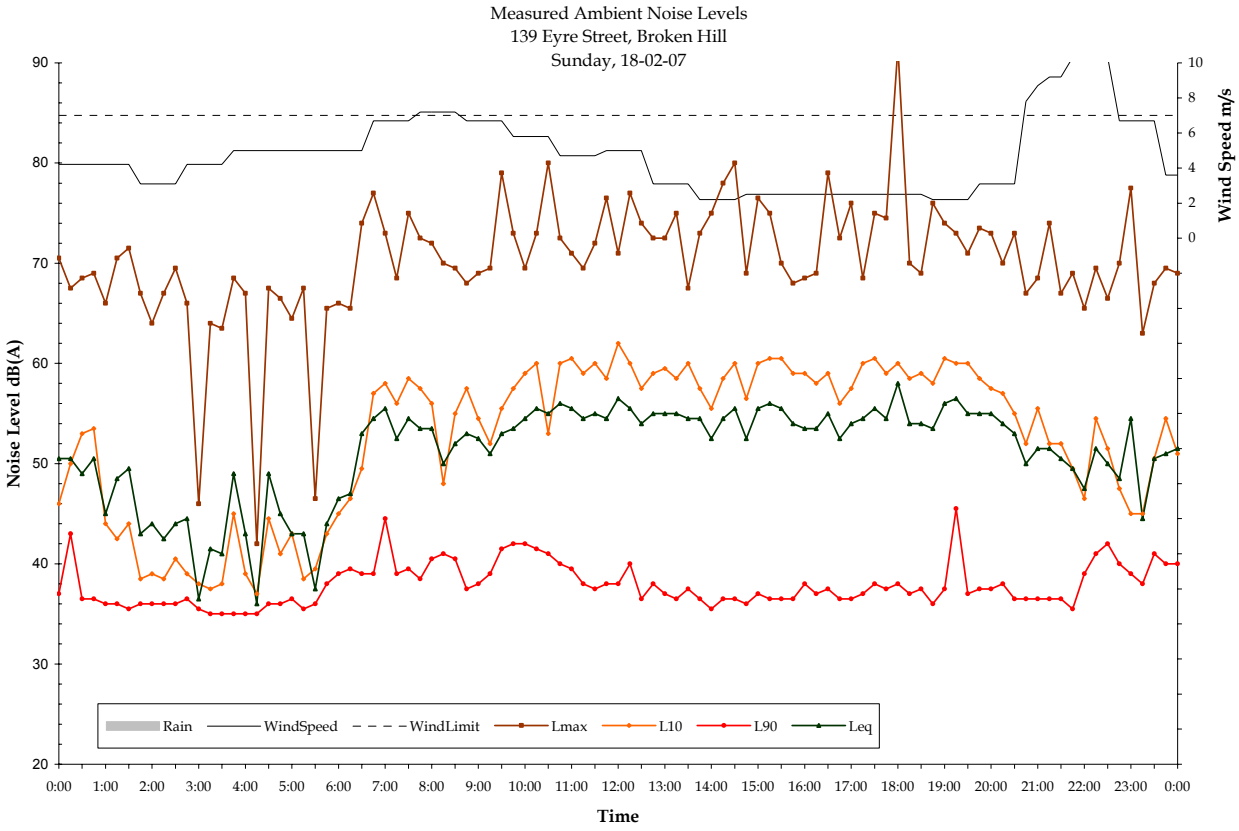

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Tuesday, 13-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

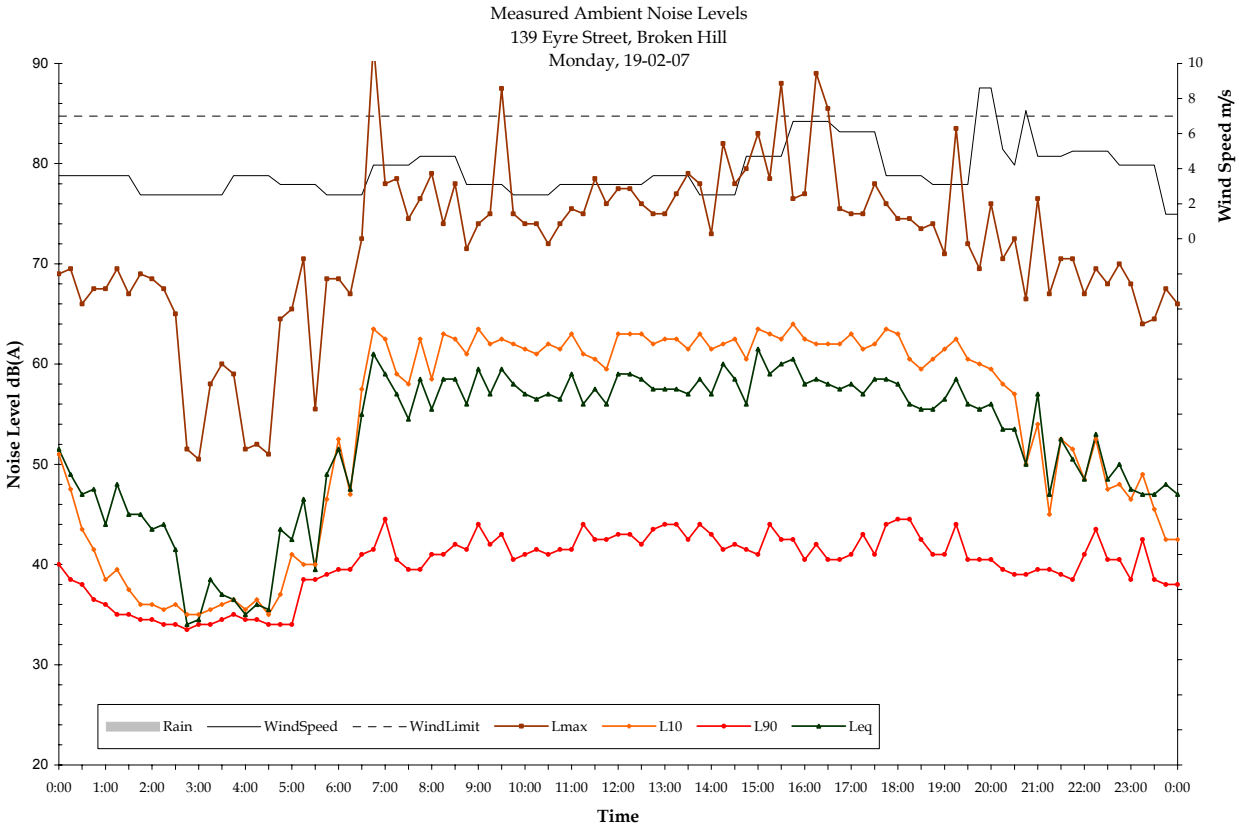

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Wednesday, 14-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

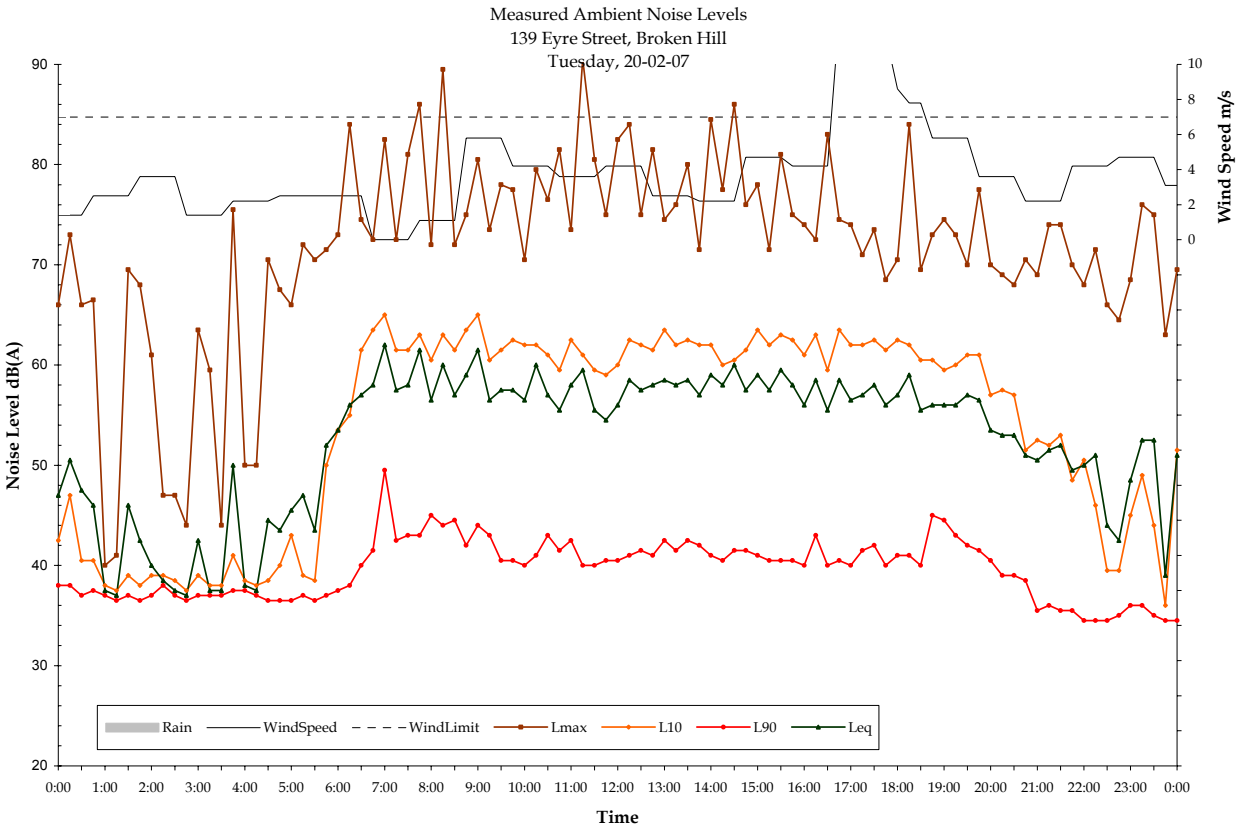

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Thursday, 15-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

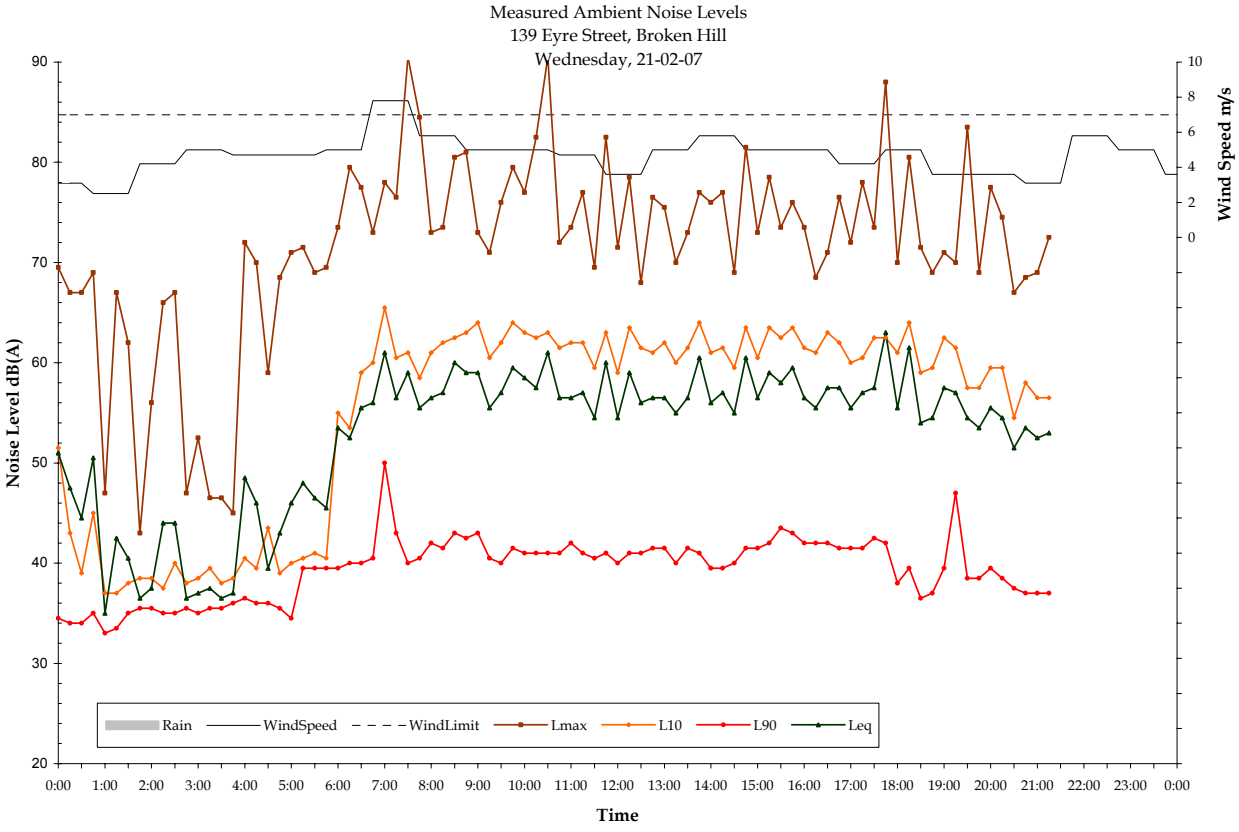

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Friday, 16-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

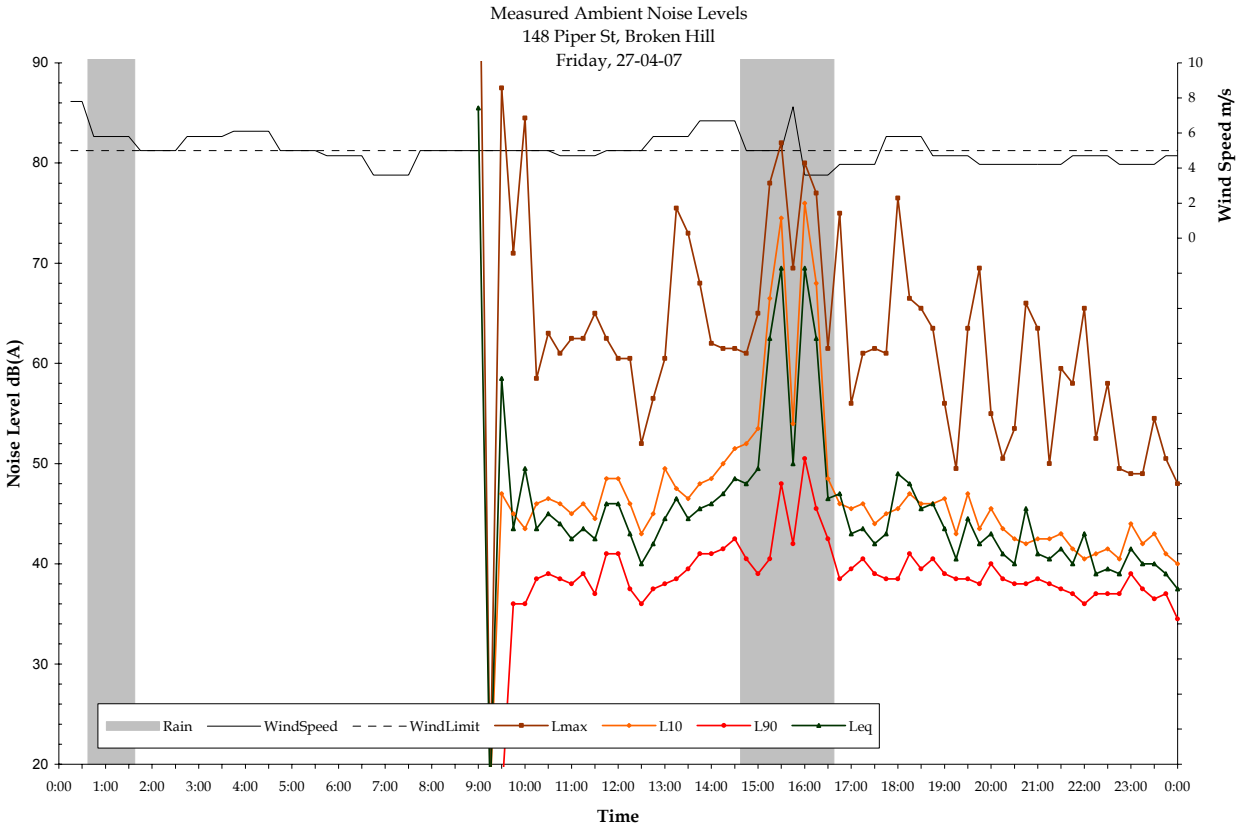

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Saturday, 17-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

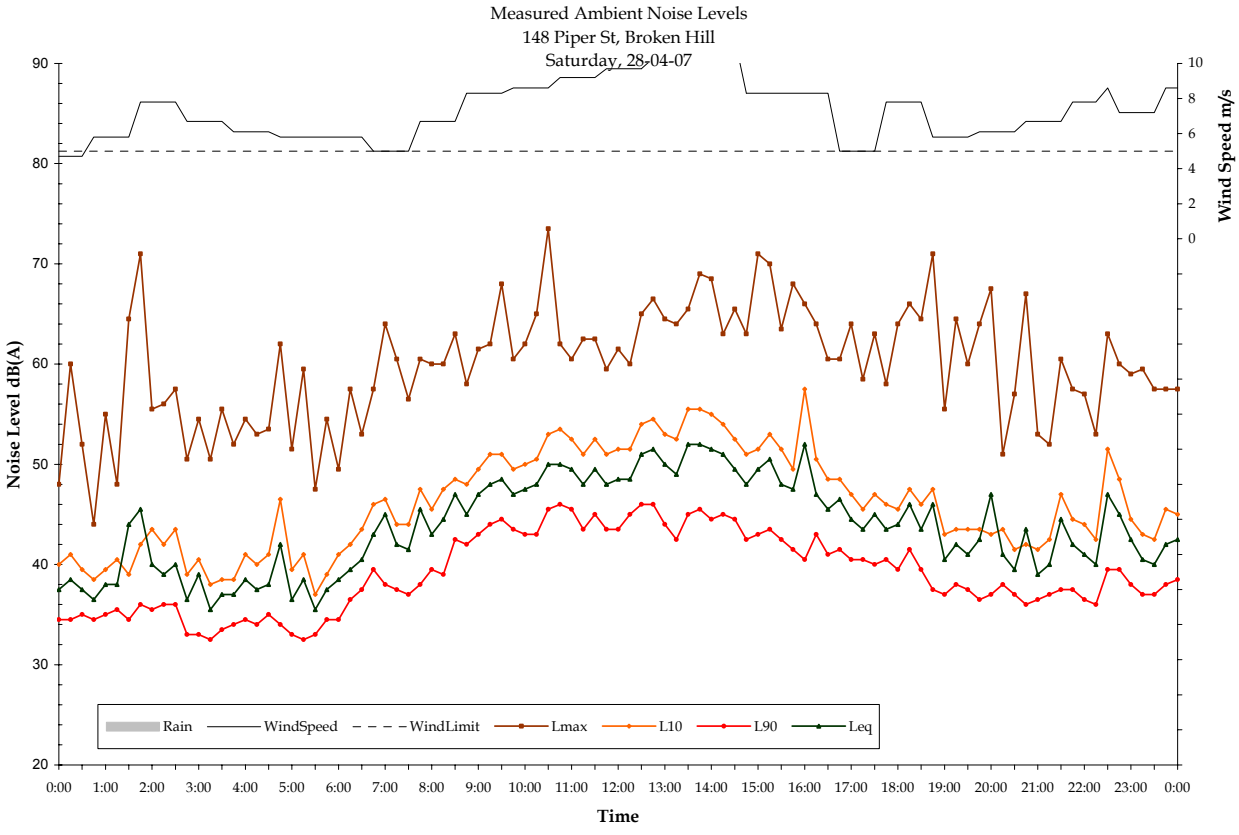

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Sunday, 18-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

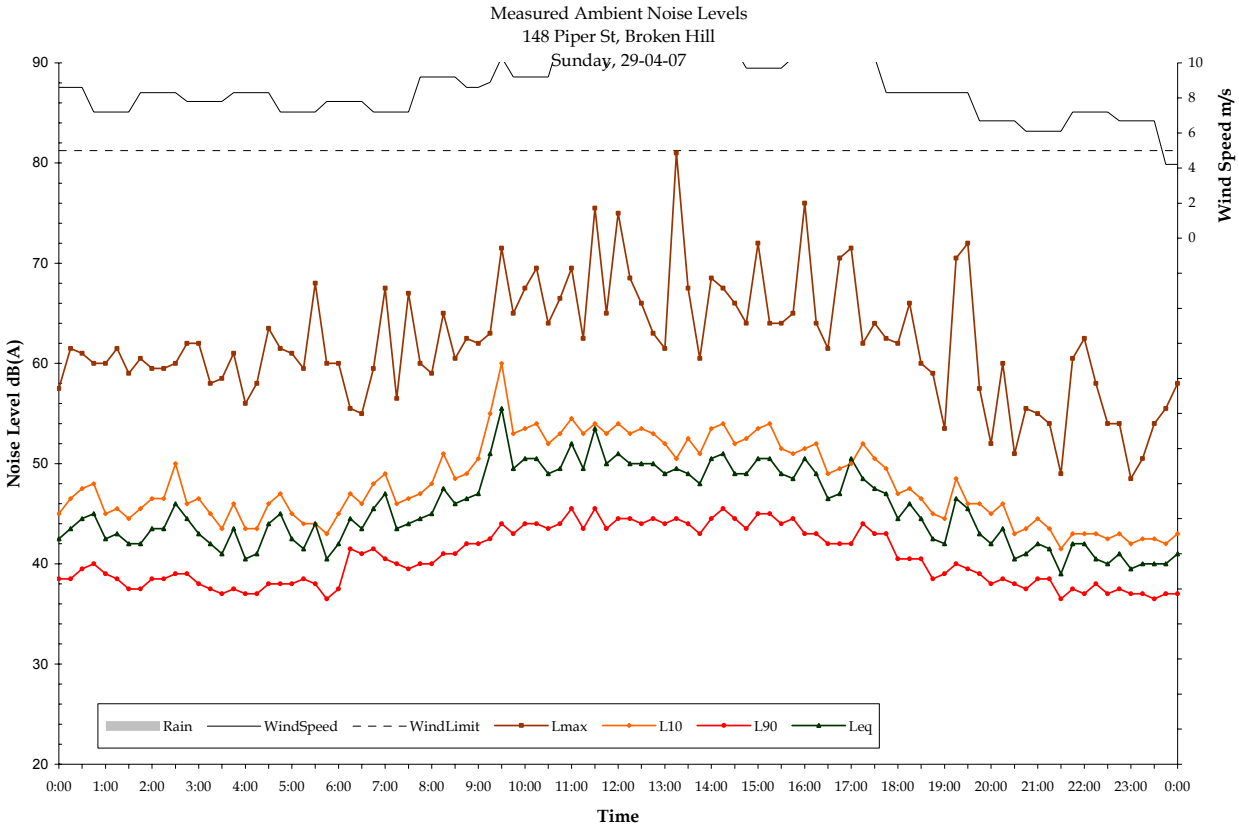

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Monday, 19-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

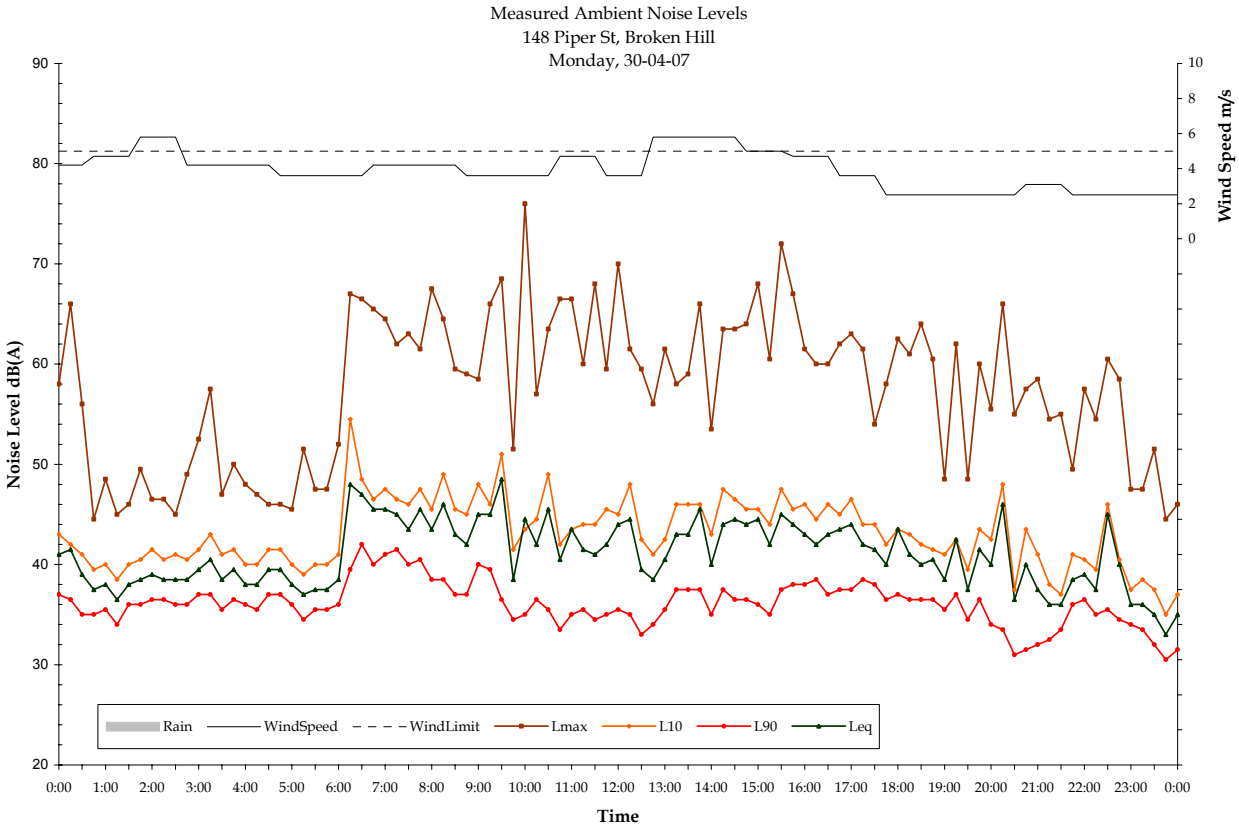

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Tuesday, 20-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

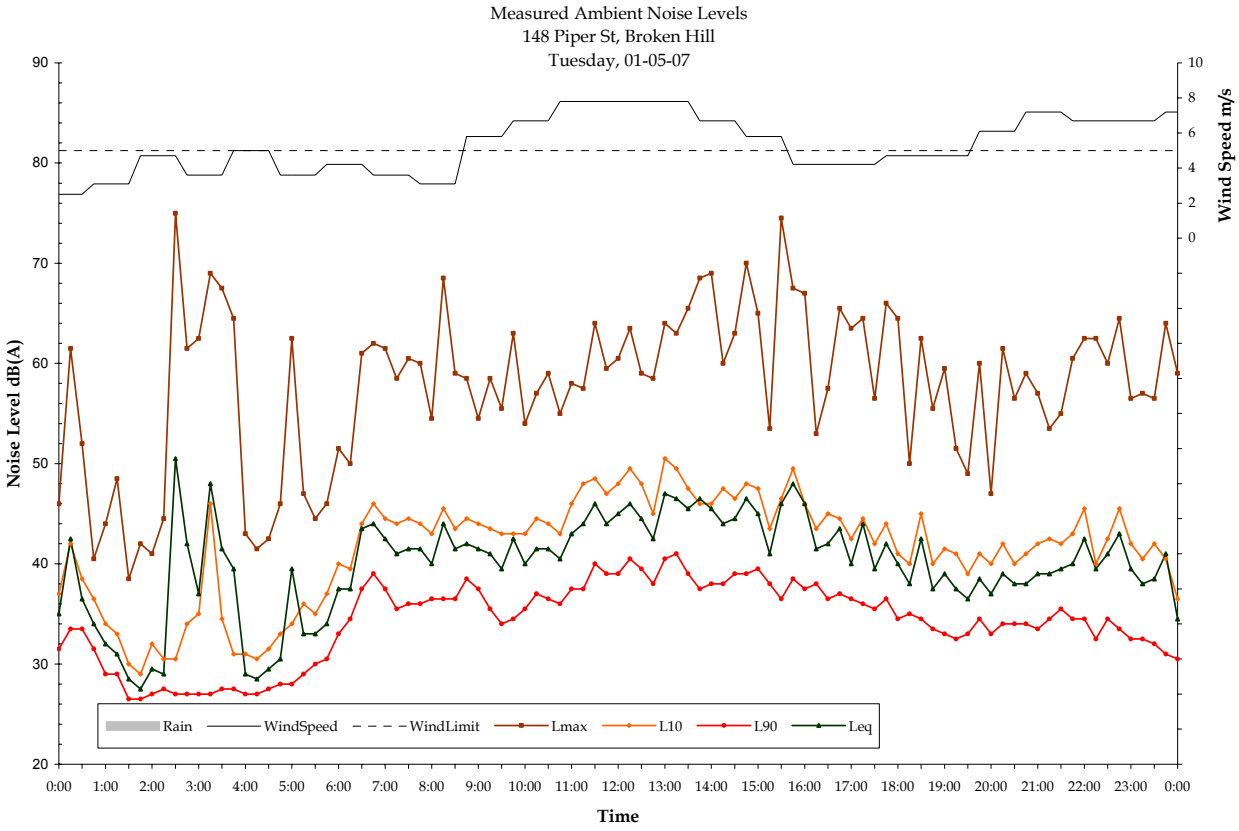

Measured Ambient Noise Levels
139 Eyre Street, Broken Hill
Wednesday, 21-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

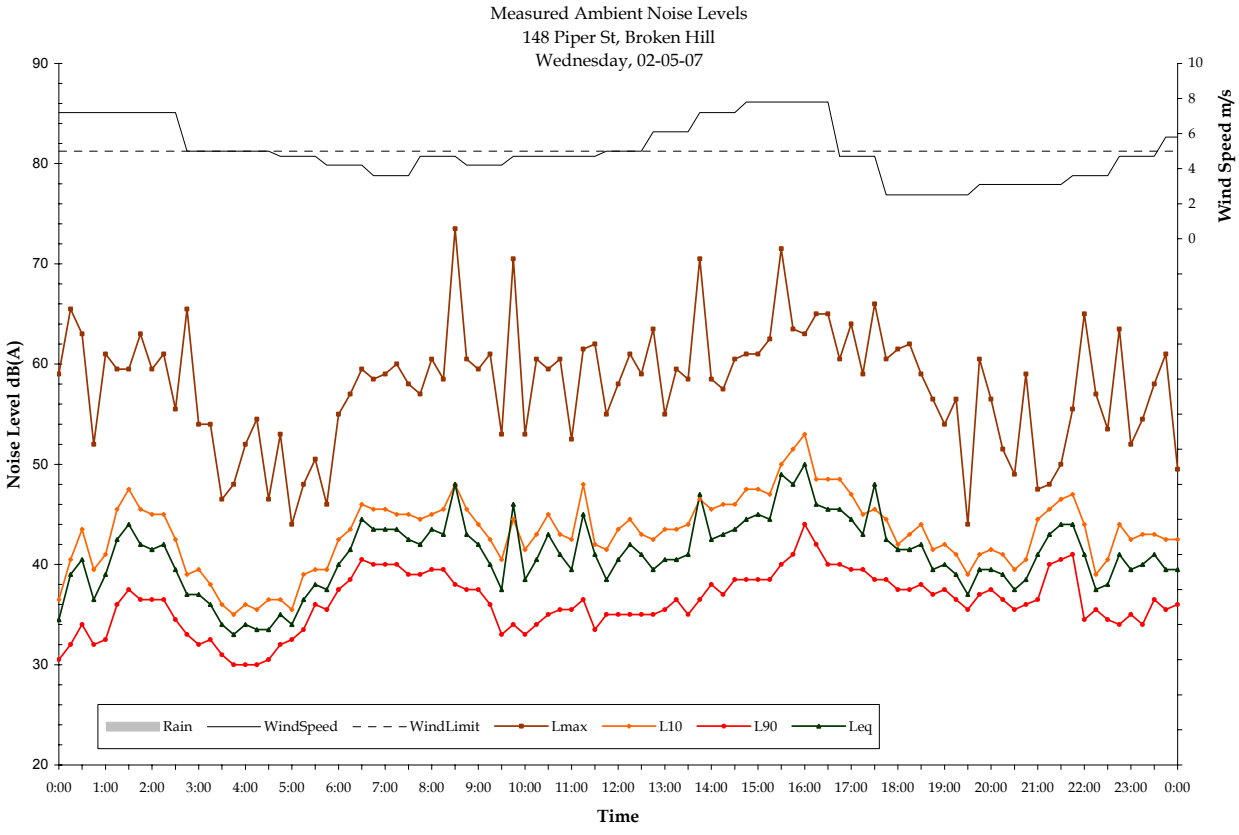

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Friday, 27-04-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

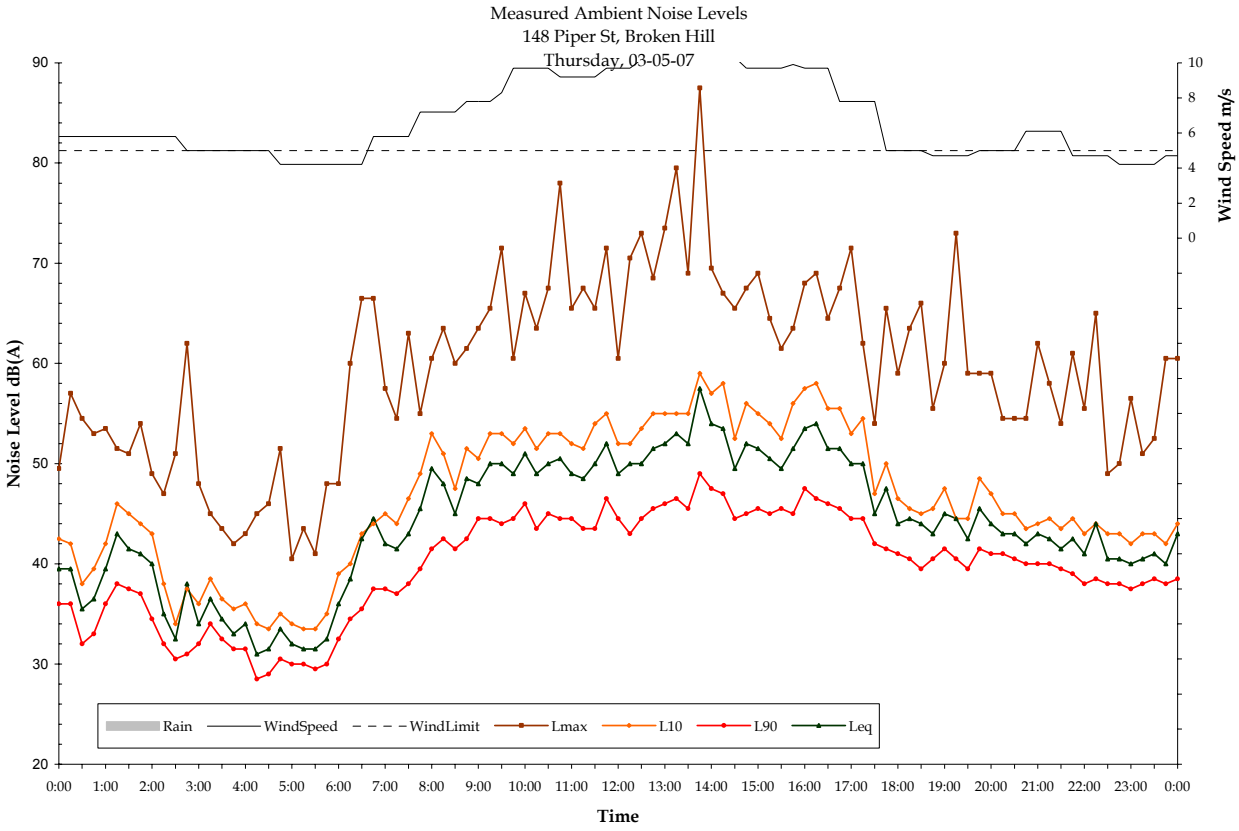

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Saturday, 28-04-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

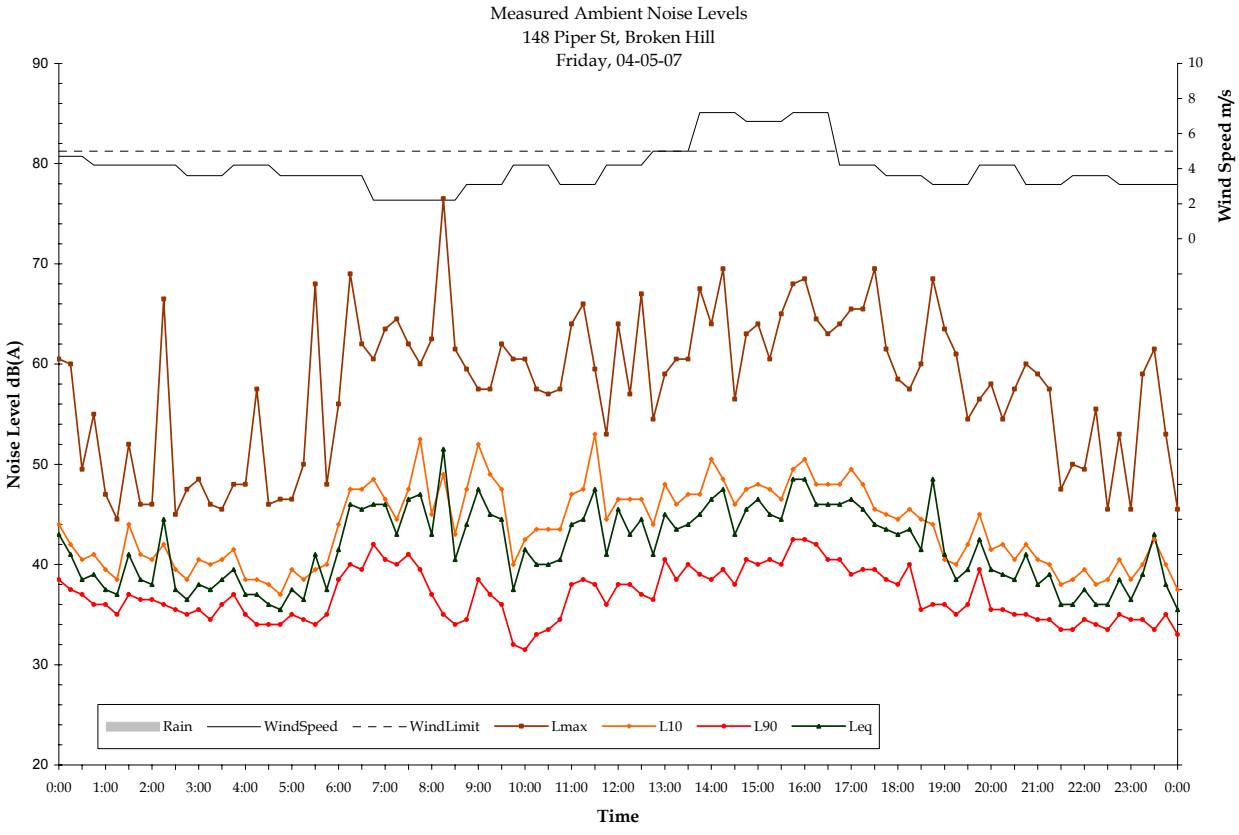

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Sunday, 29-04-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

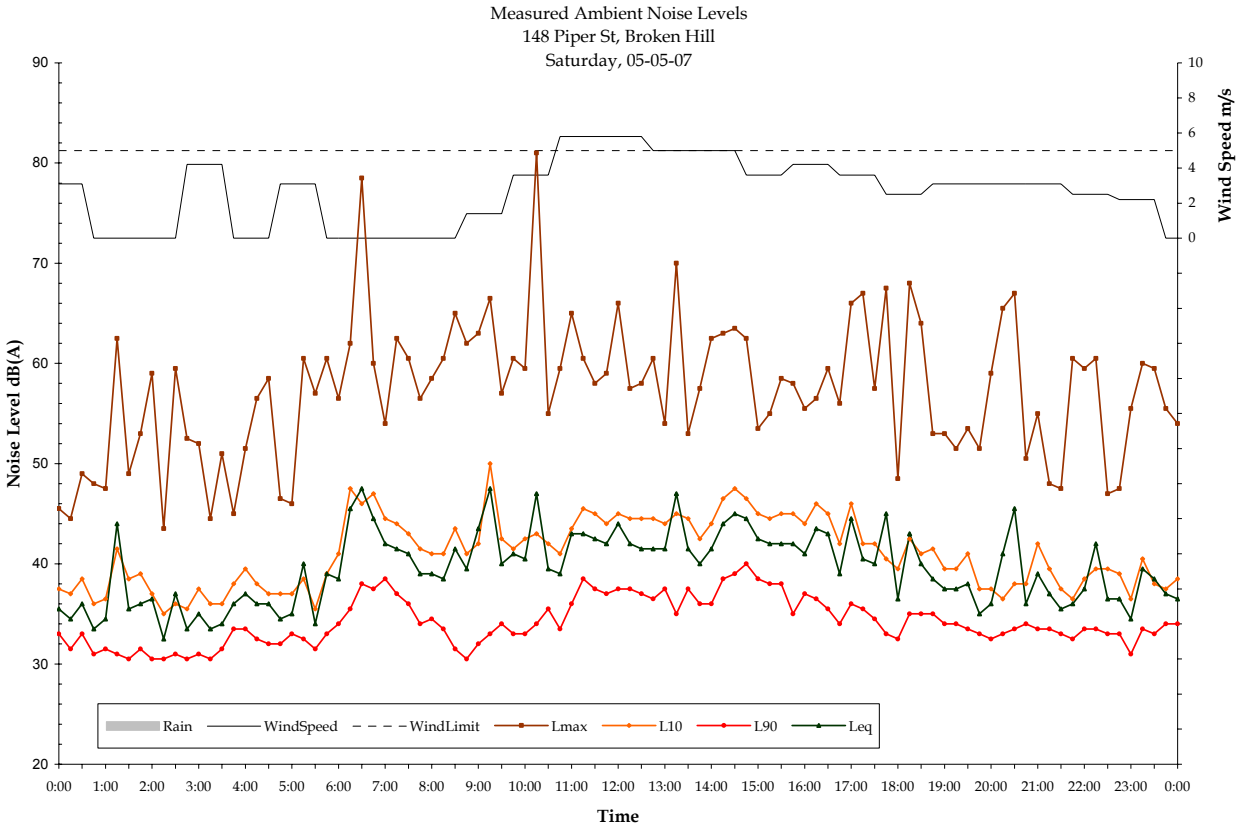

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Monday, 30-04-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

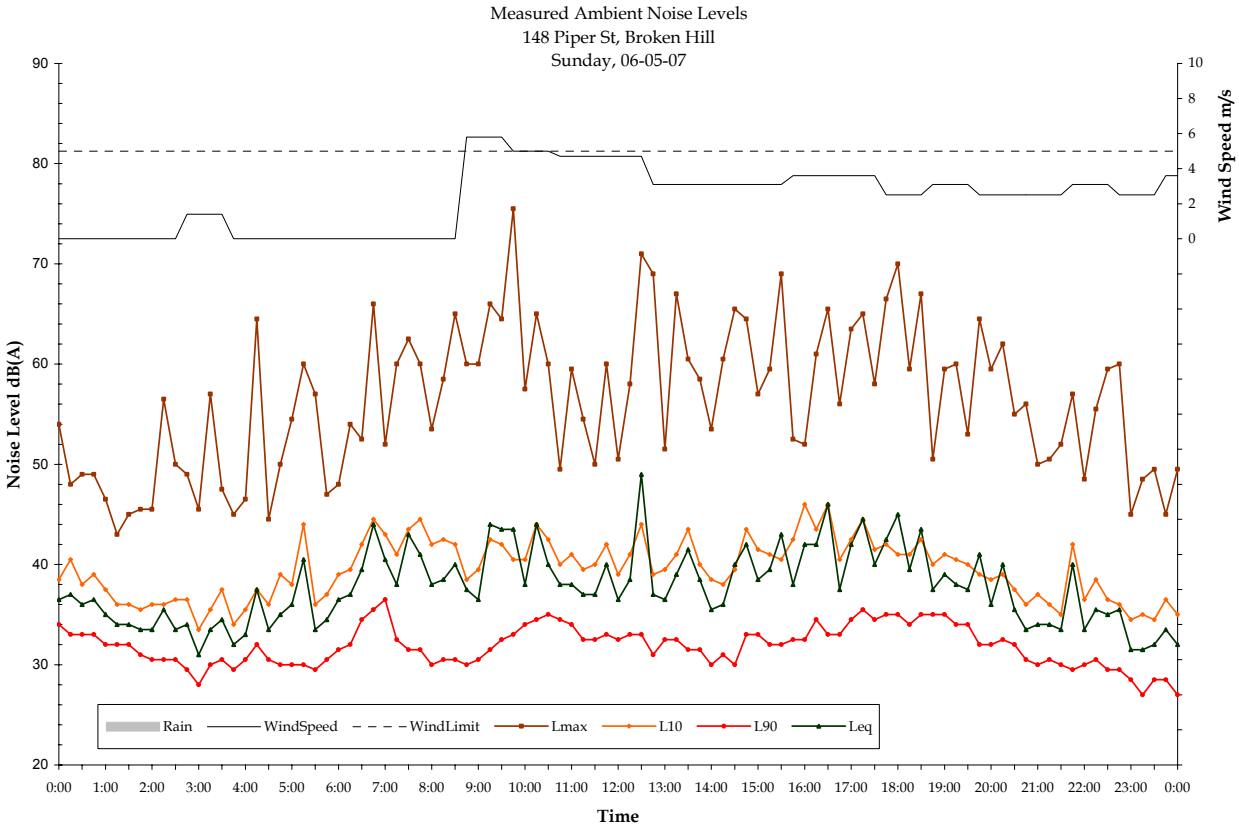

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Tuesday, 01-05-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

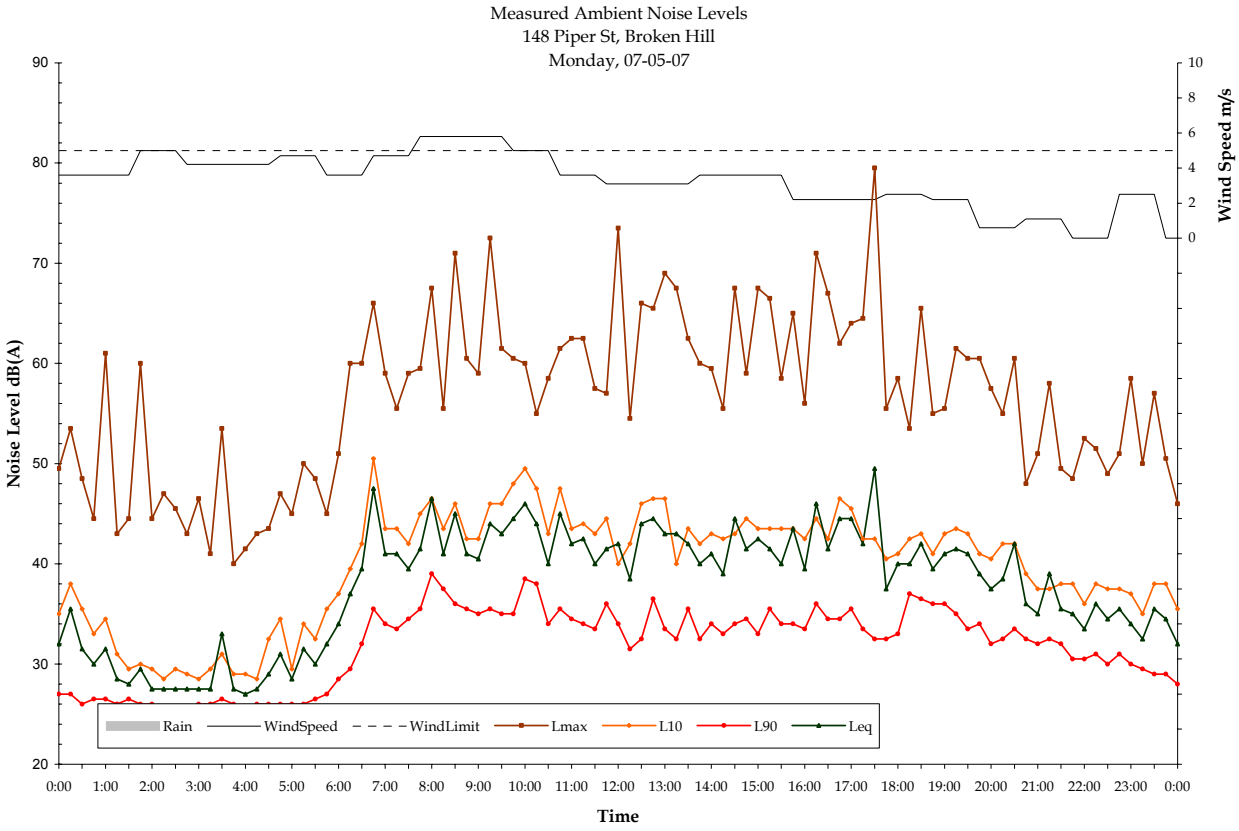

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Wednesday, 02-05-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

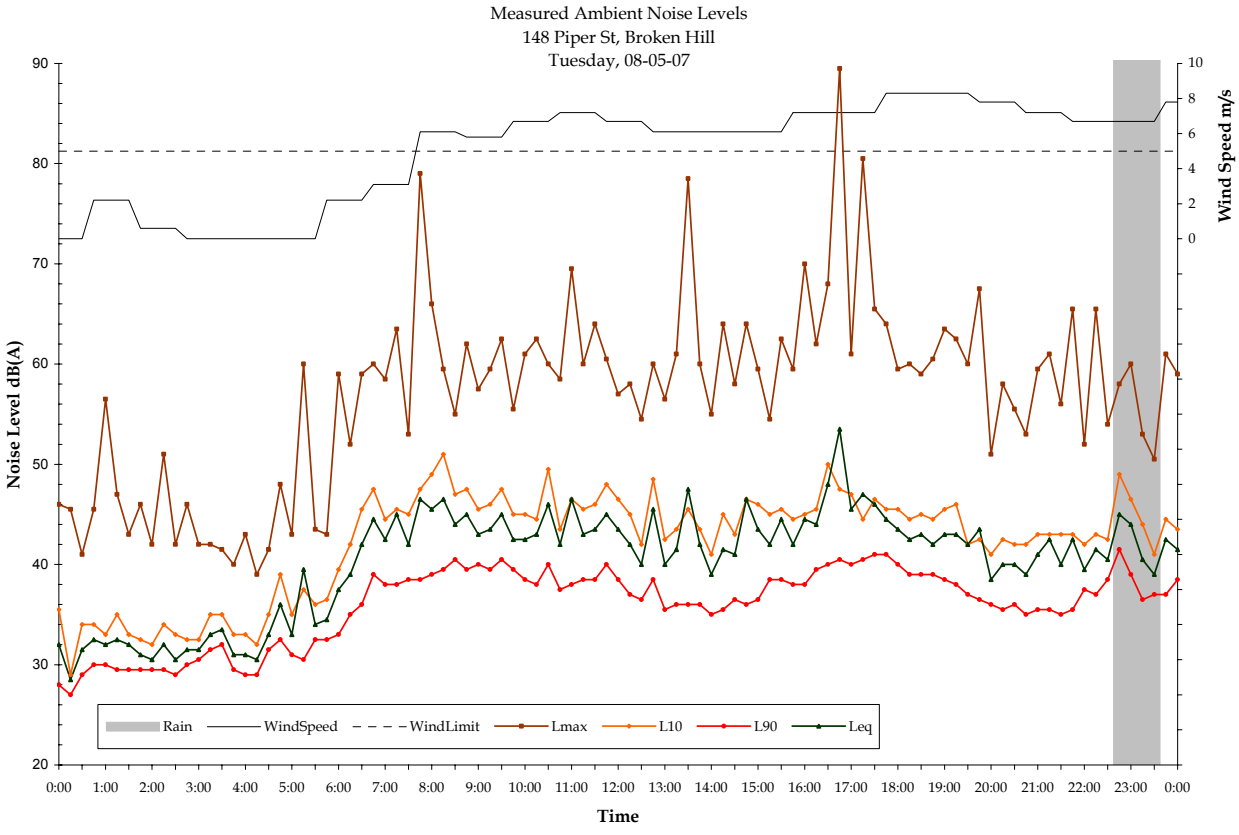

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Thursday, 03-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

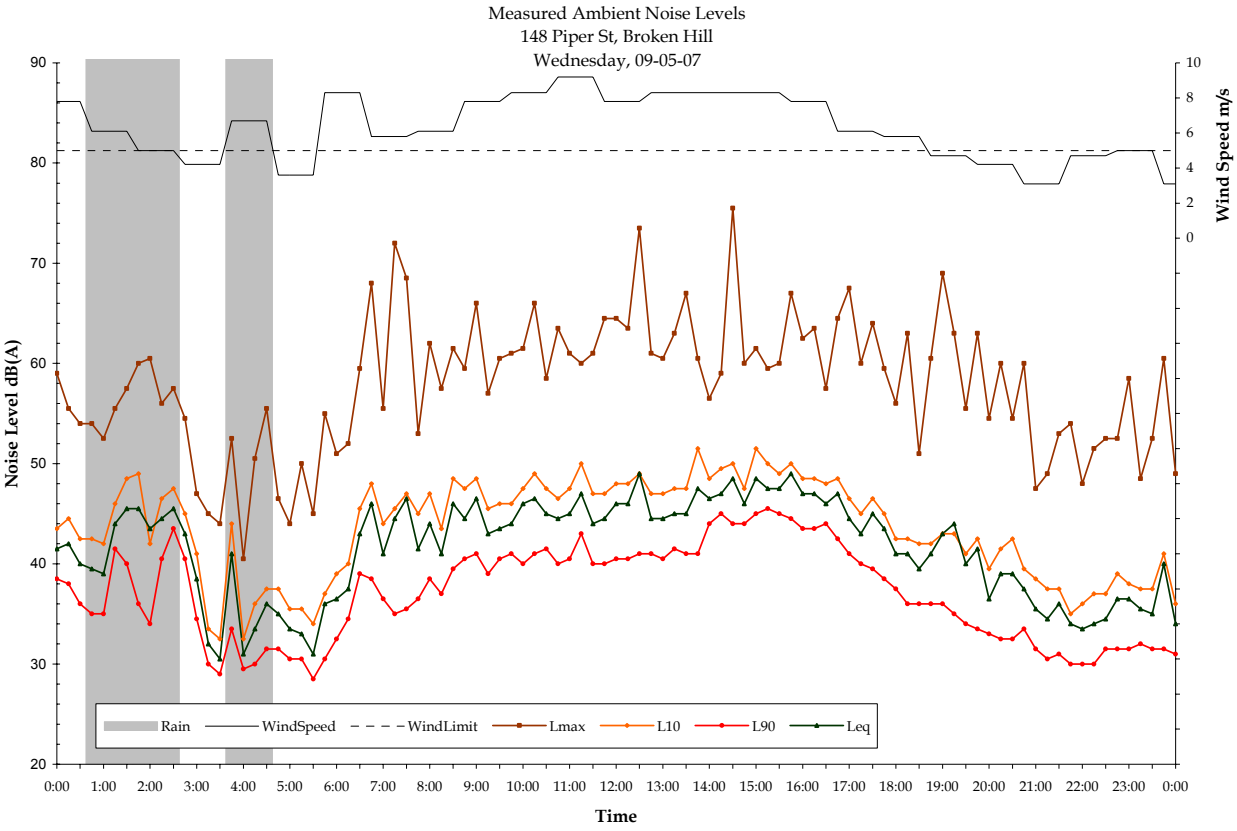

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Friday, 04-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

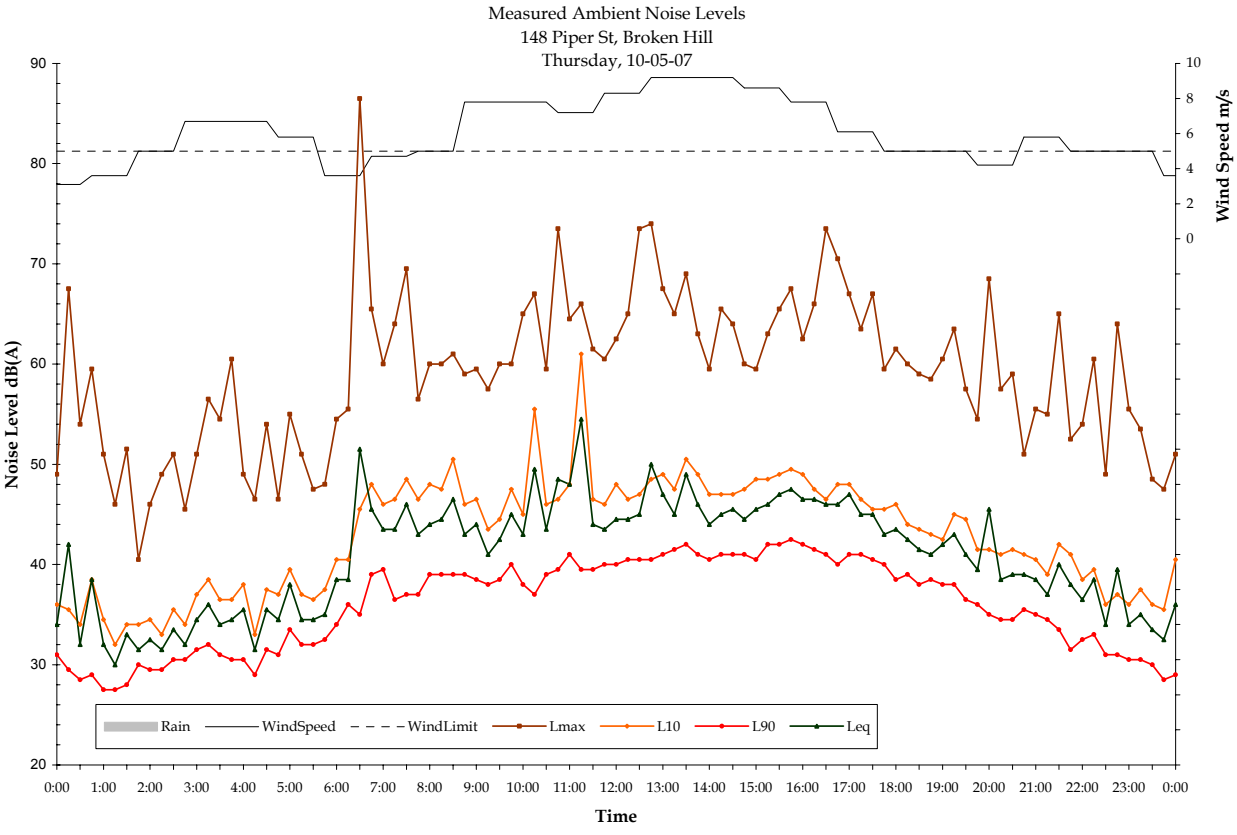

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Saturday, 05-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

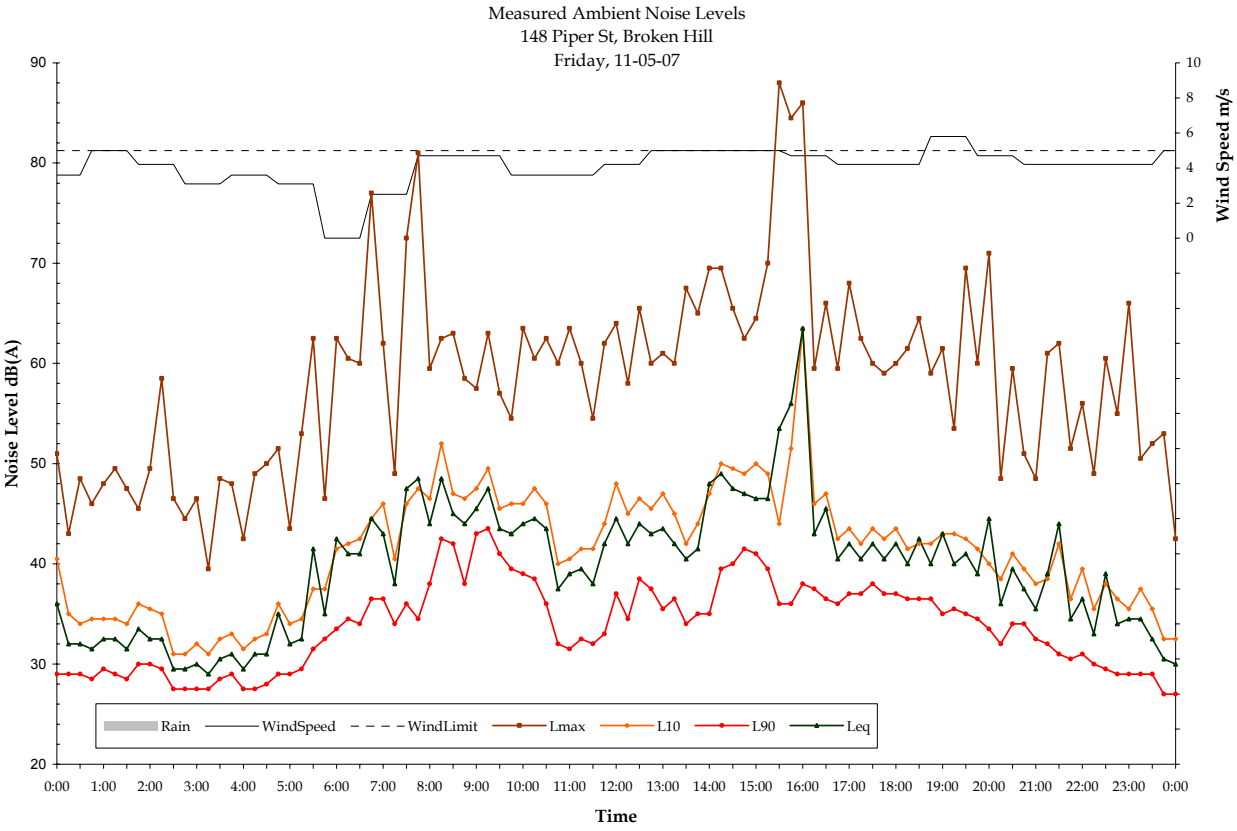

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Sunday, 06-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

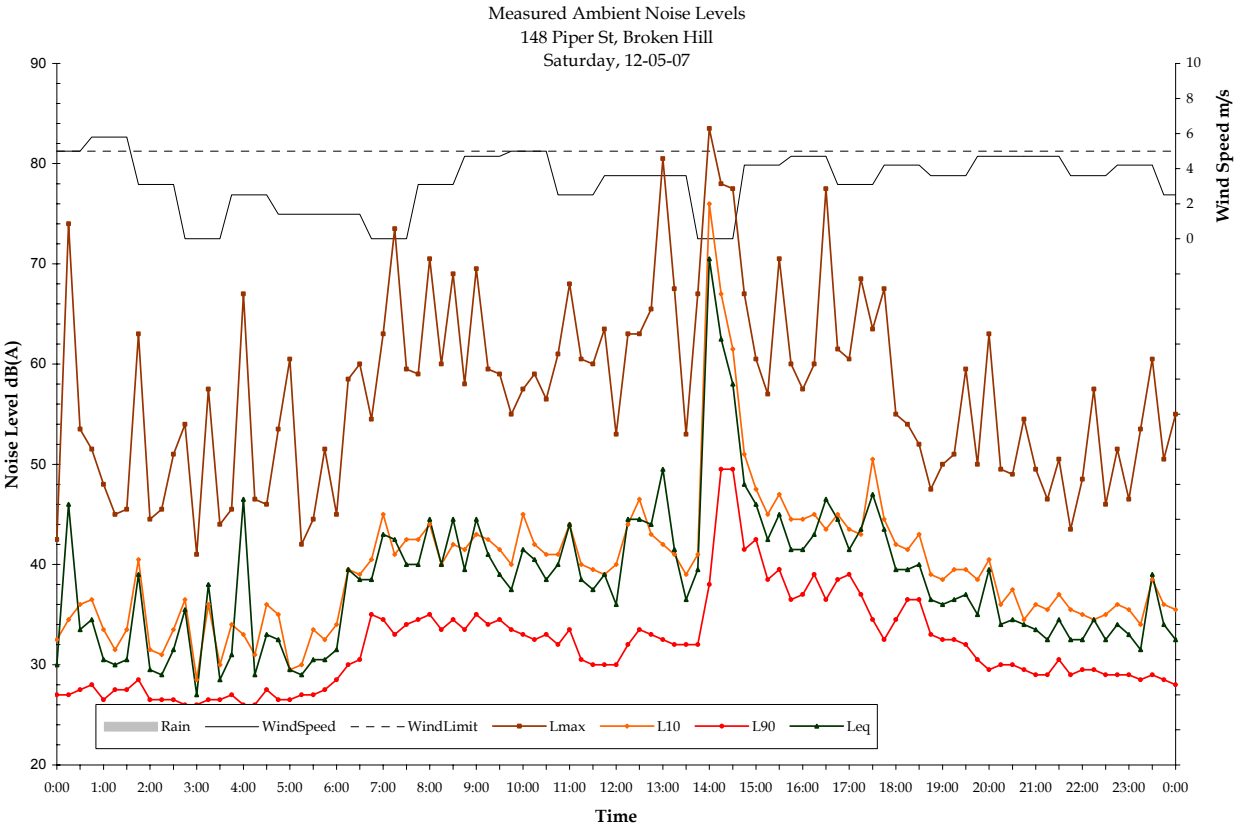

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Monday, 07-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

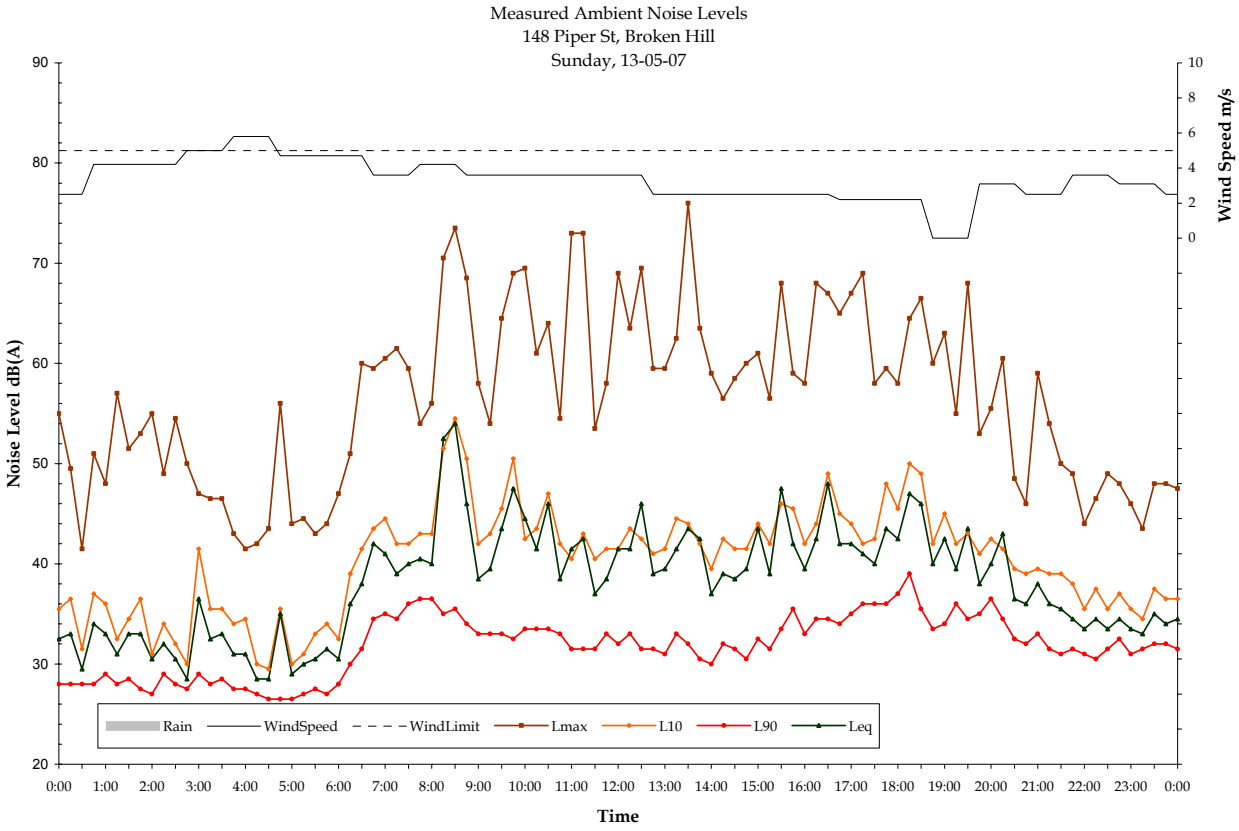

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Tuesday, 08-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

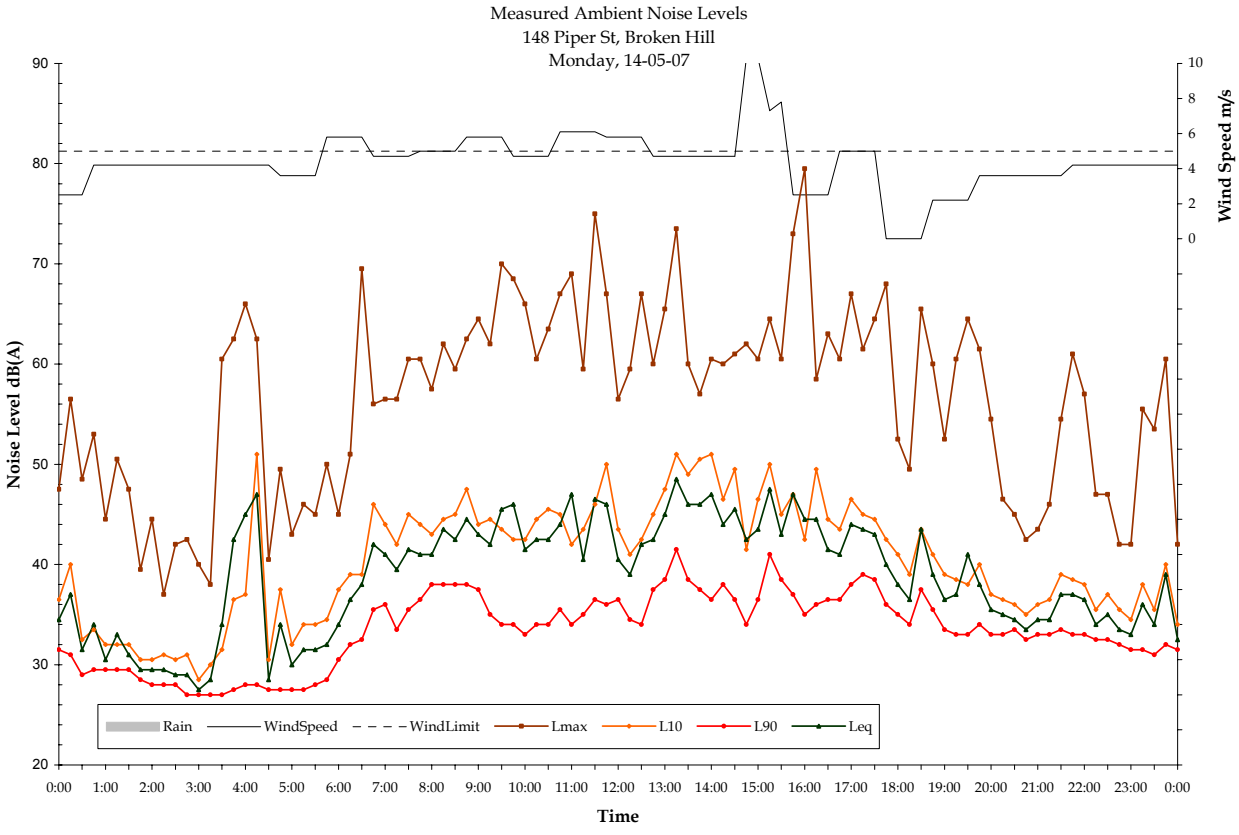

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Wednesday, 09-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

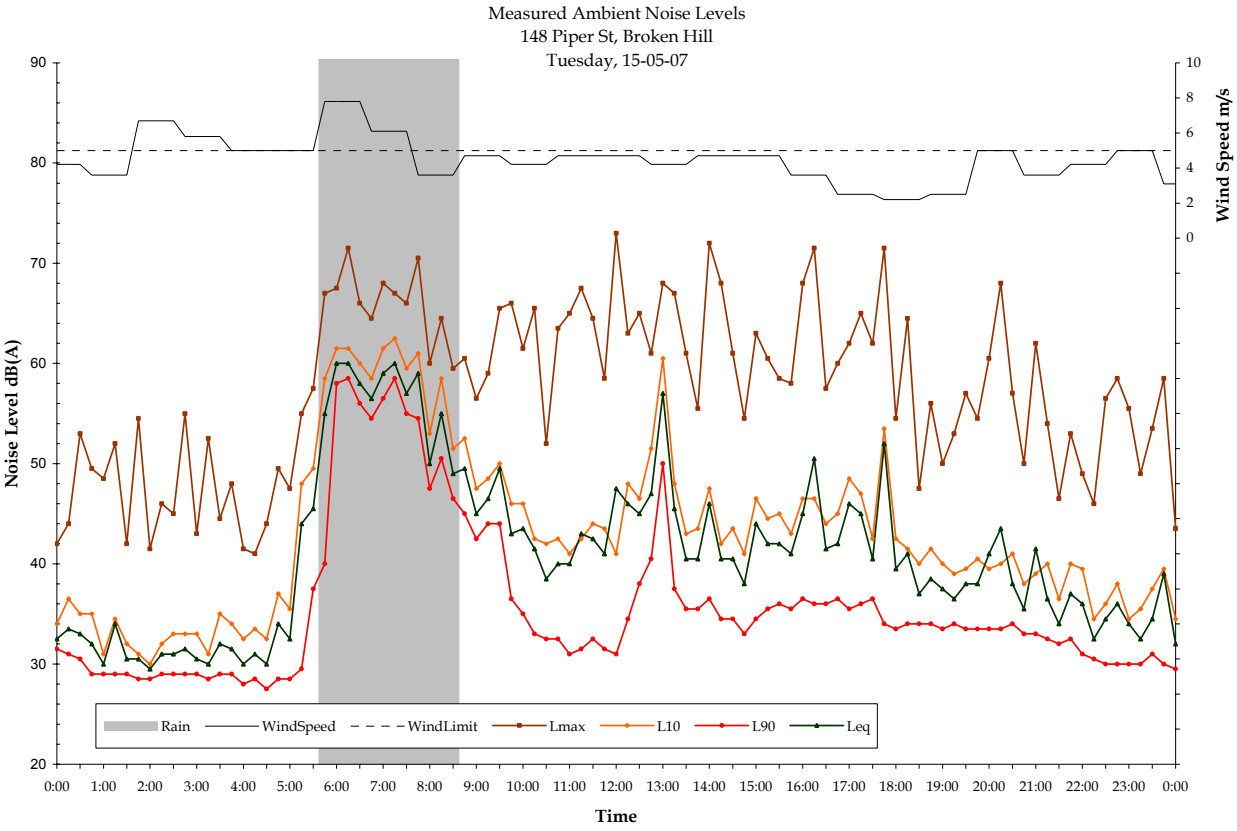

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Thursday, 10-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

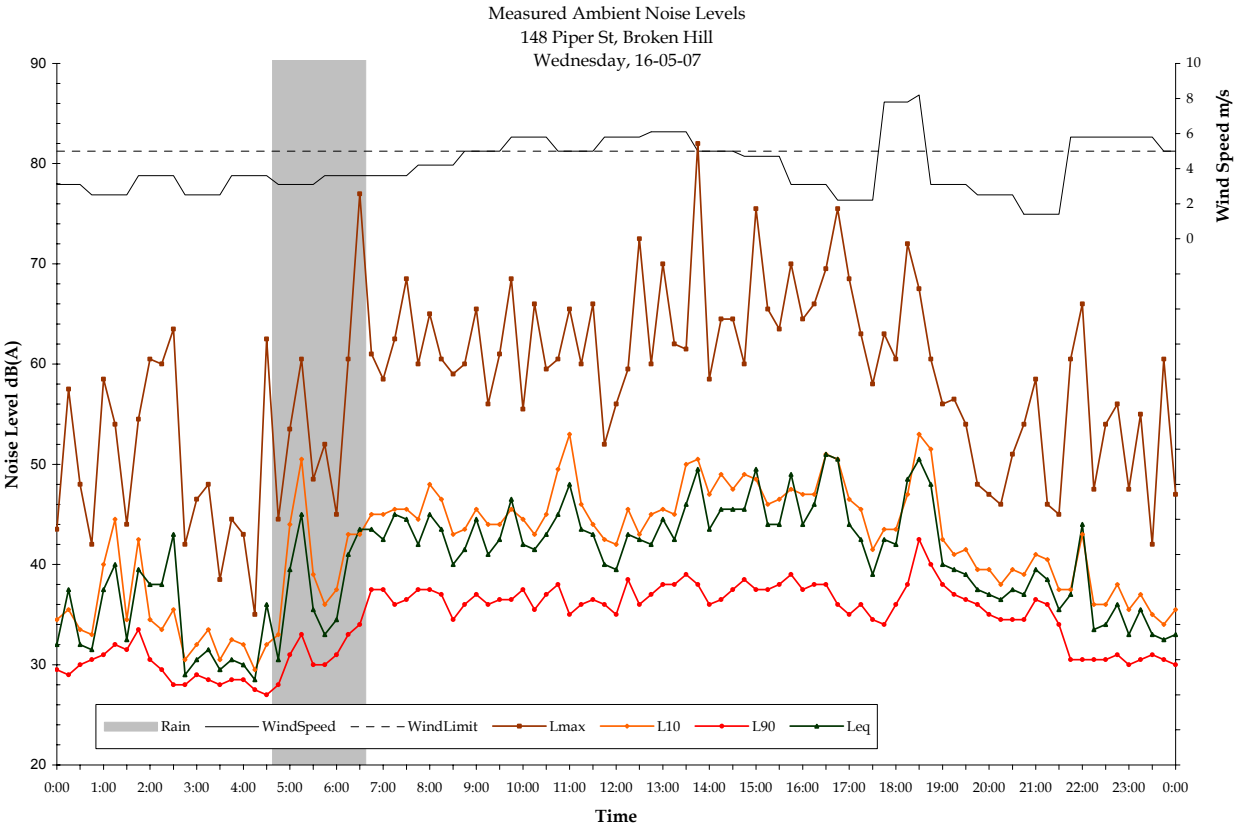

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Friday, 11-05-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

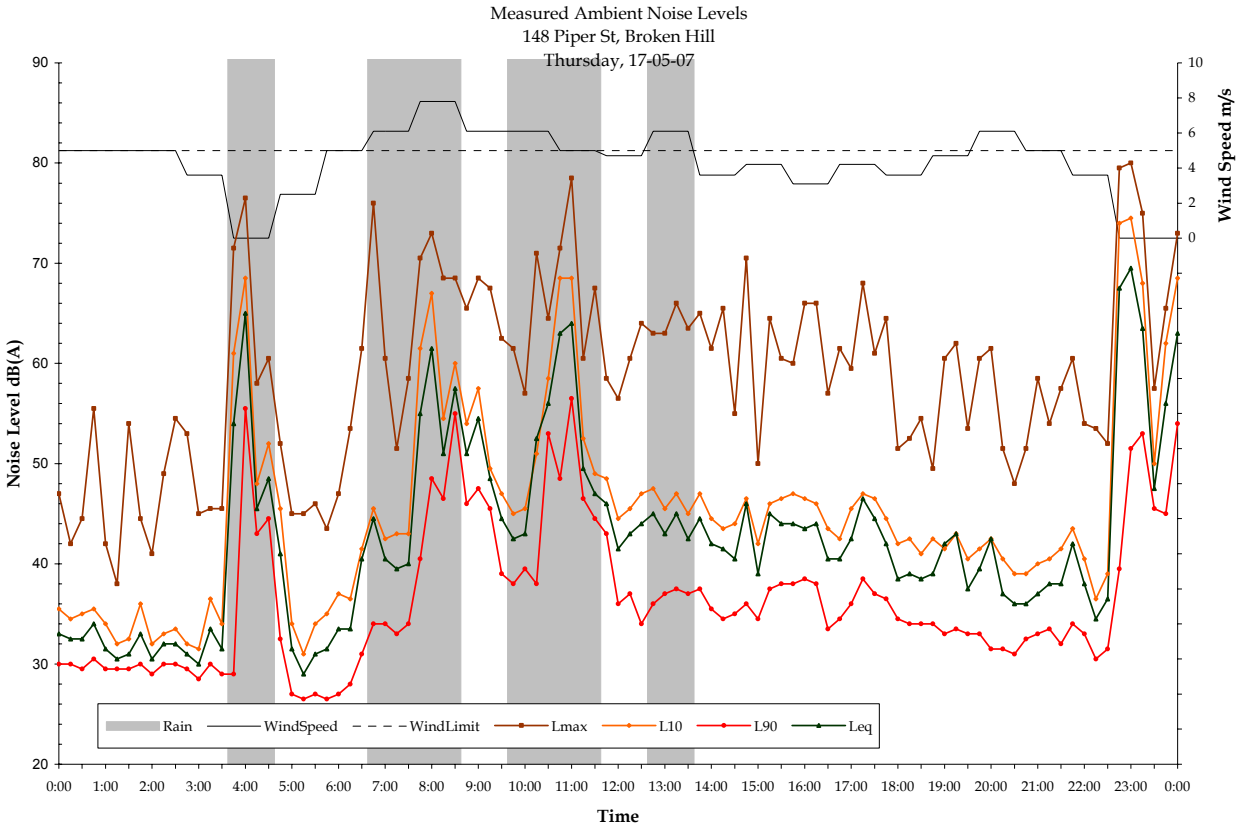

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Saturday, 12-05-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

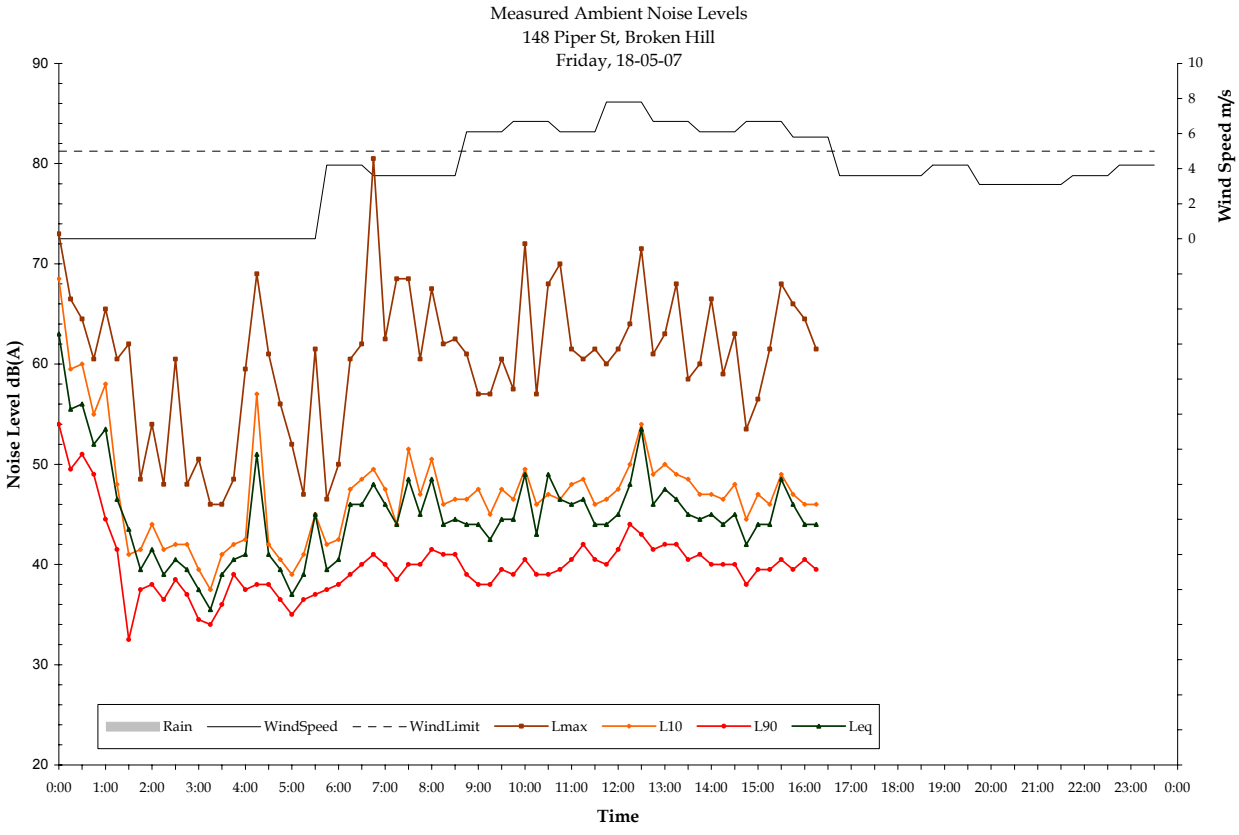

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Sunday, 13-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

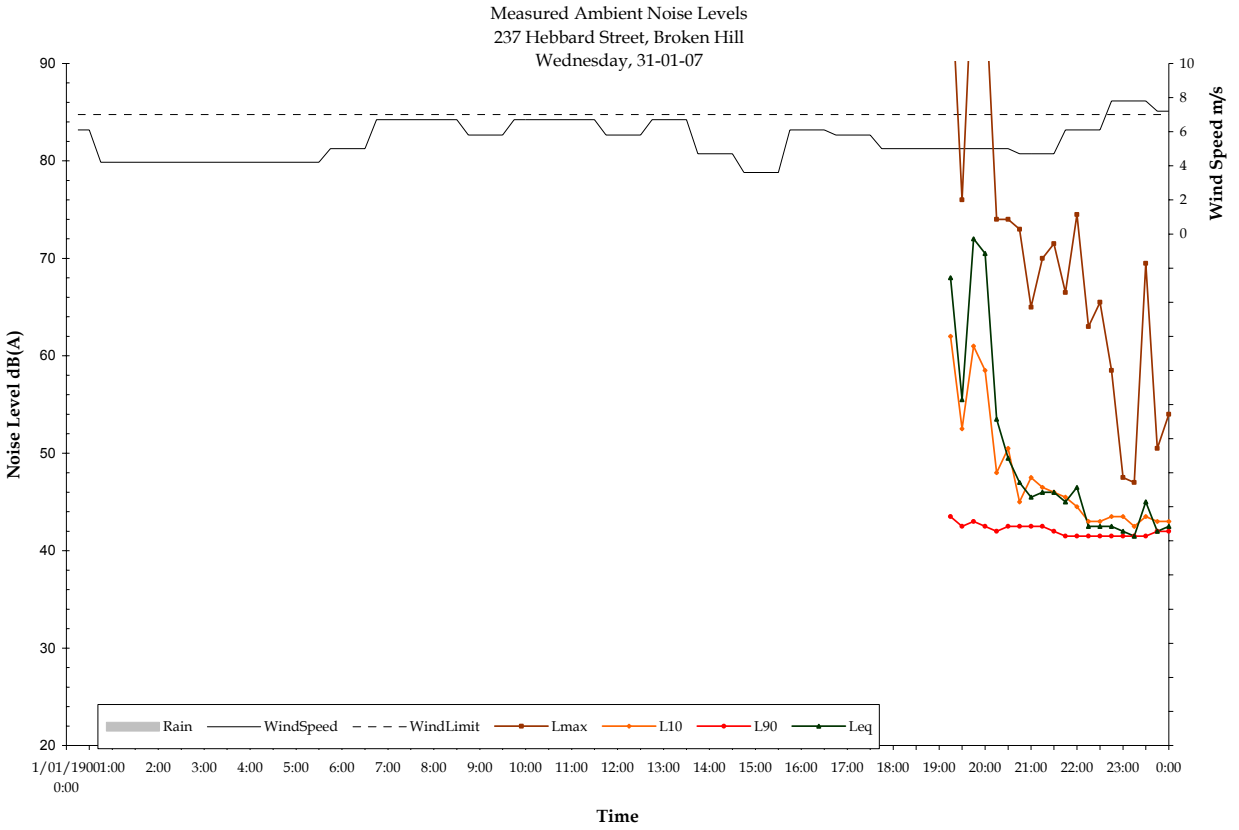

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Monday, 14-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

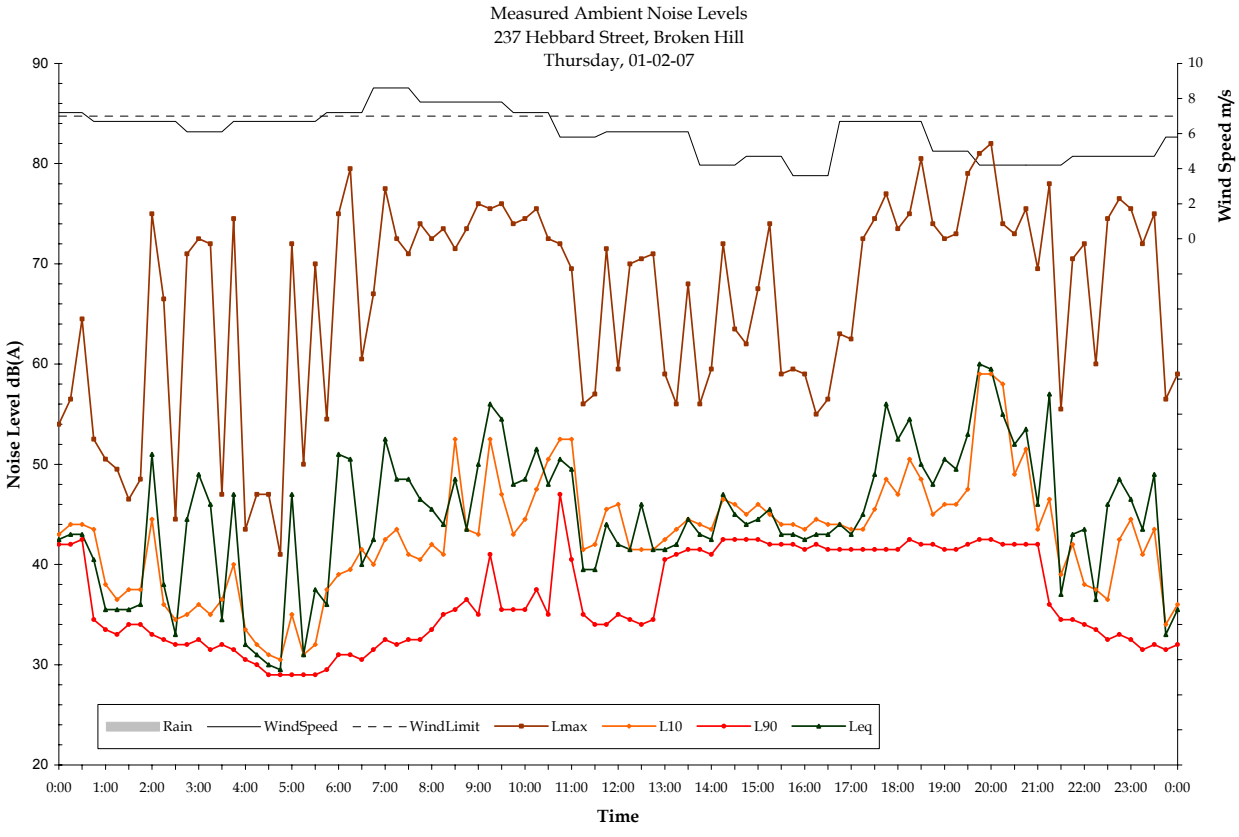

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Tuesday, 15-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

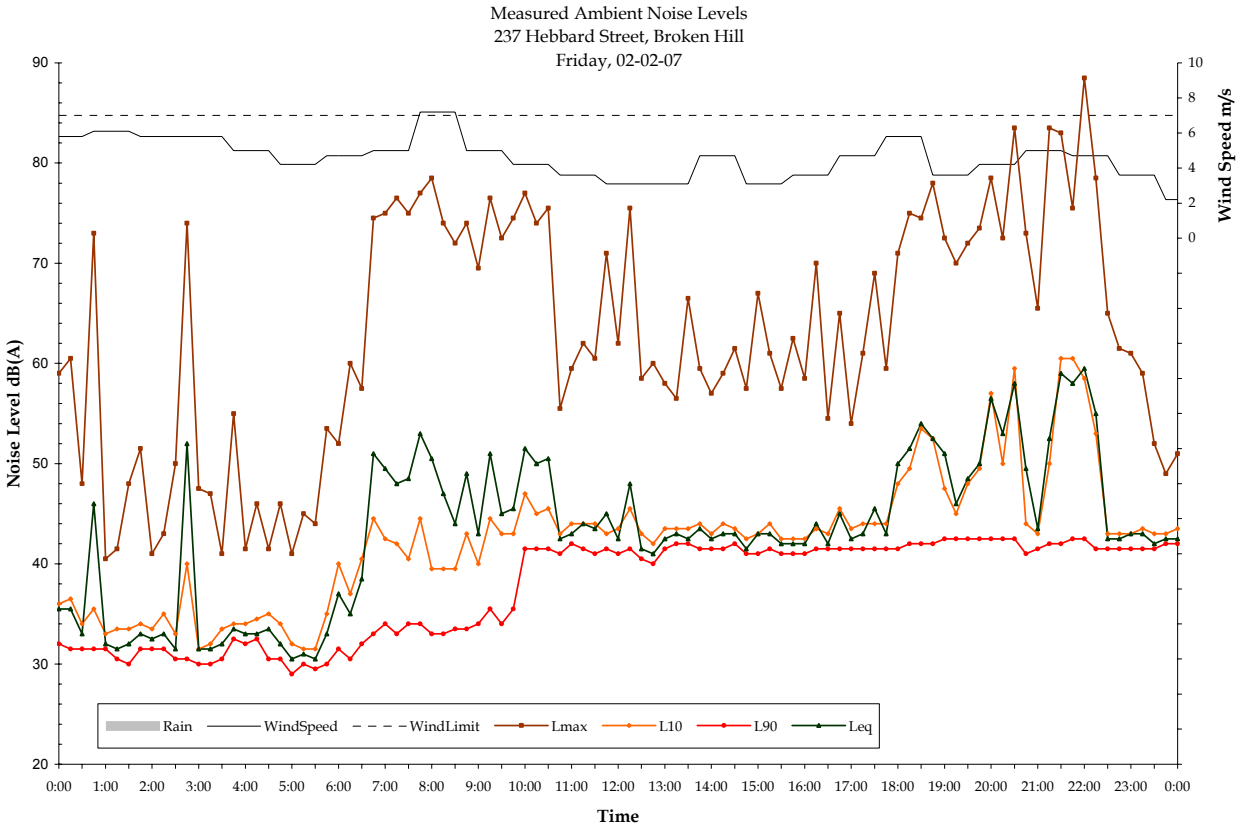

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Wednesday, 16-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

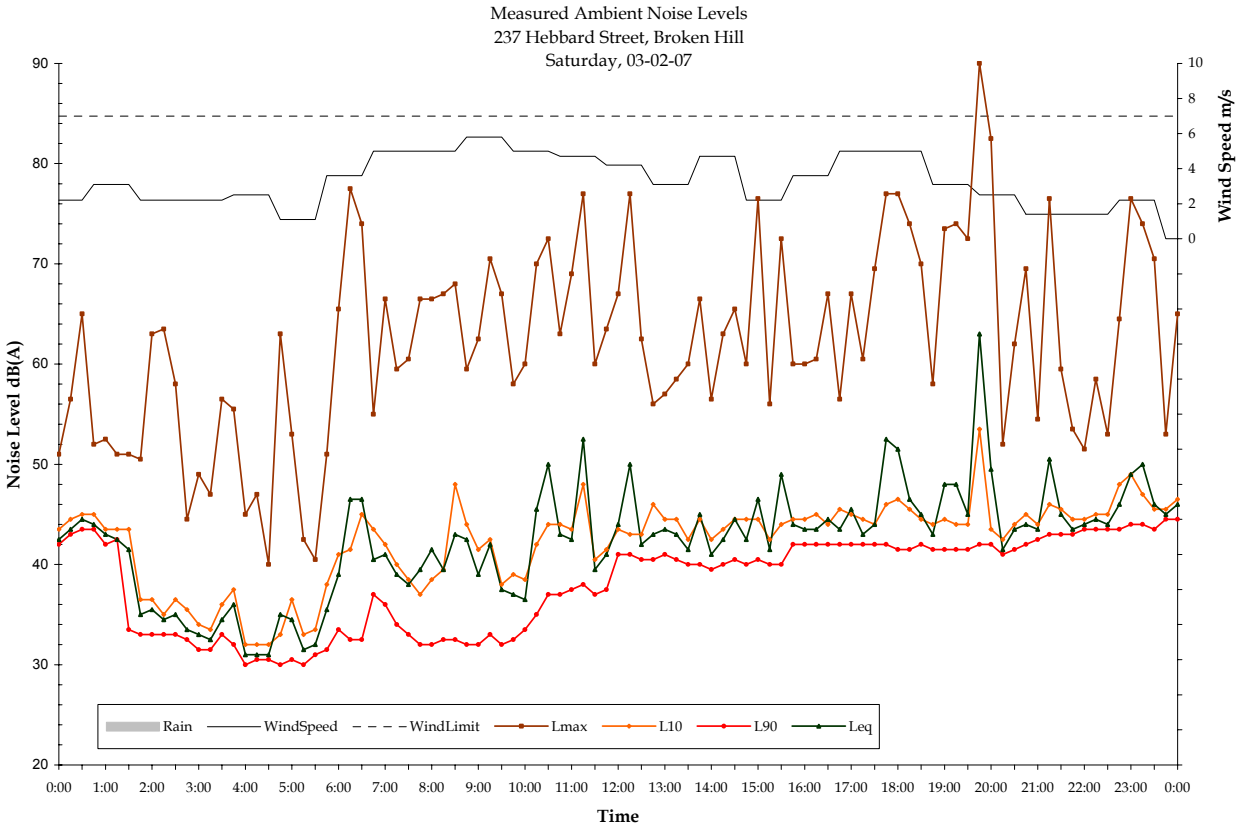

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Thursday, 17-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

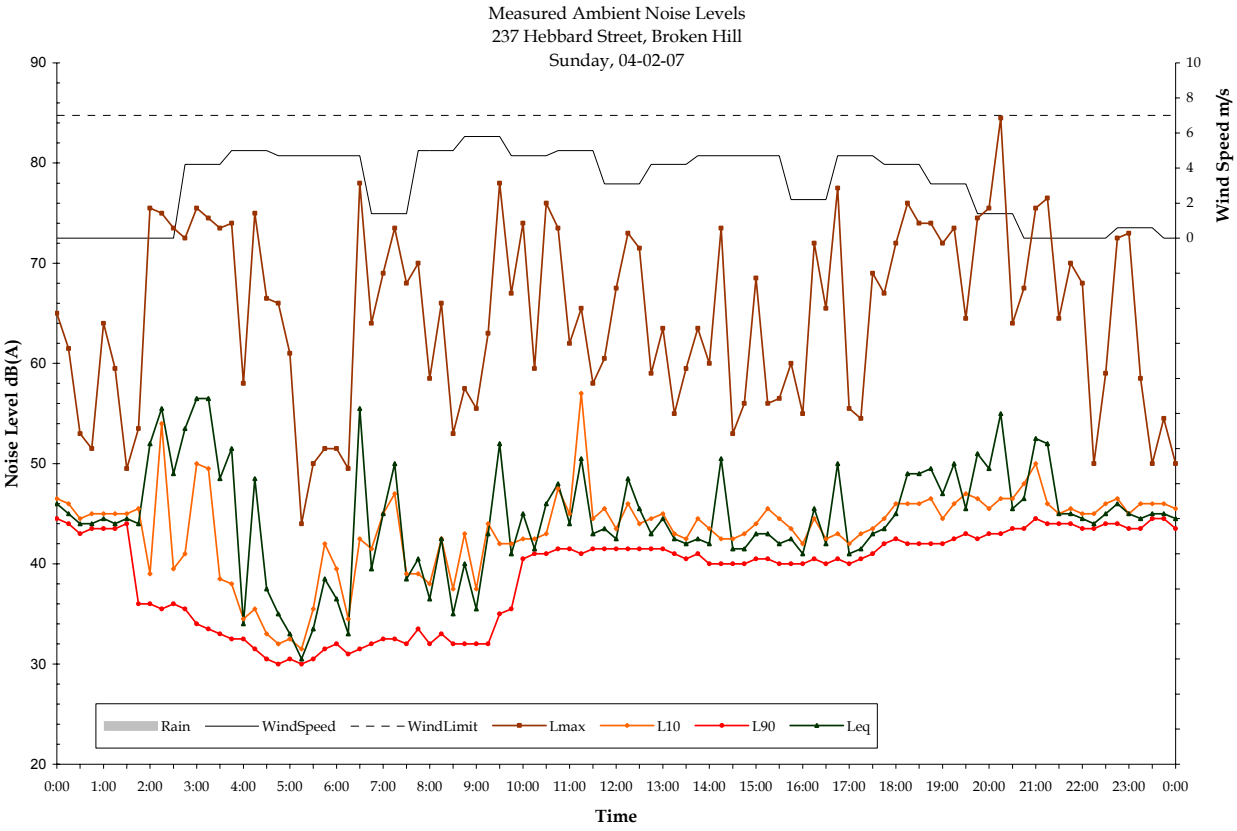

Measured Ambient Noise Levels
148 Piper St, Broken Hill
Friday, 18-05-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

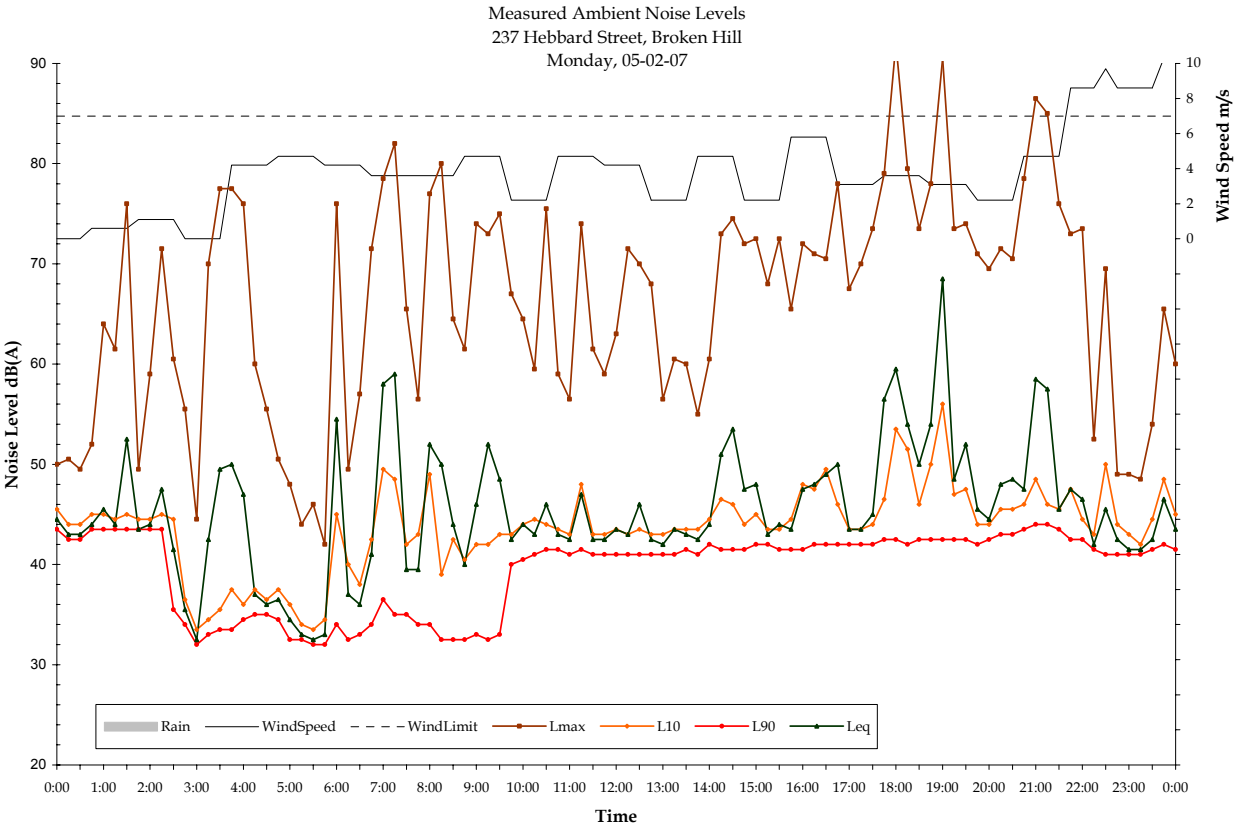

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Wednesday, 31-01-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

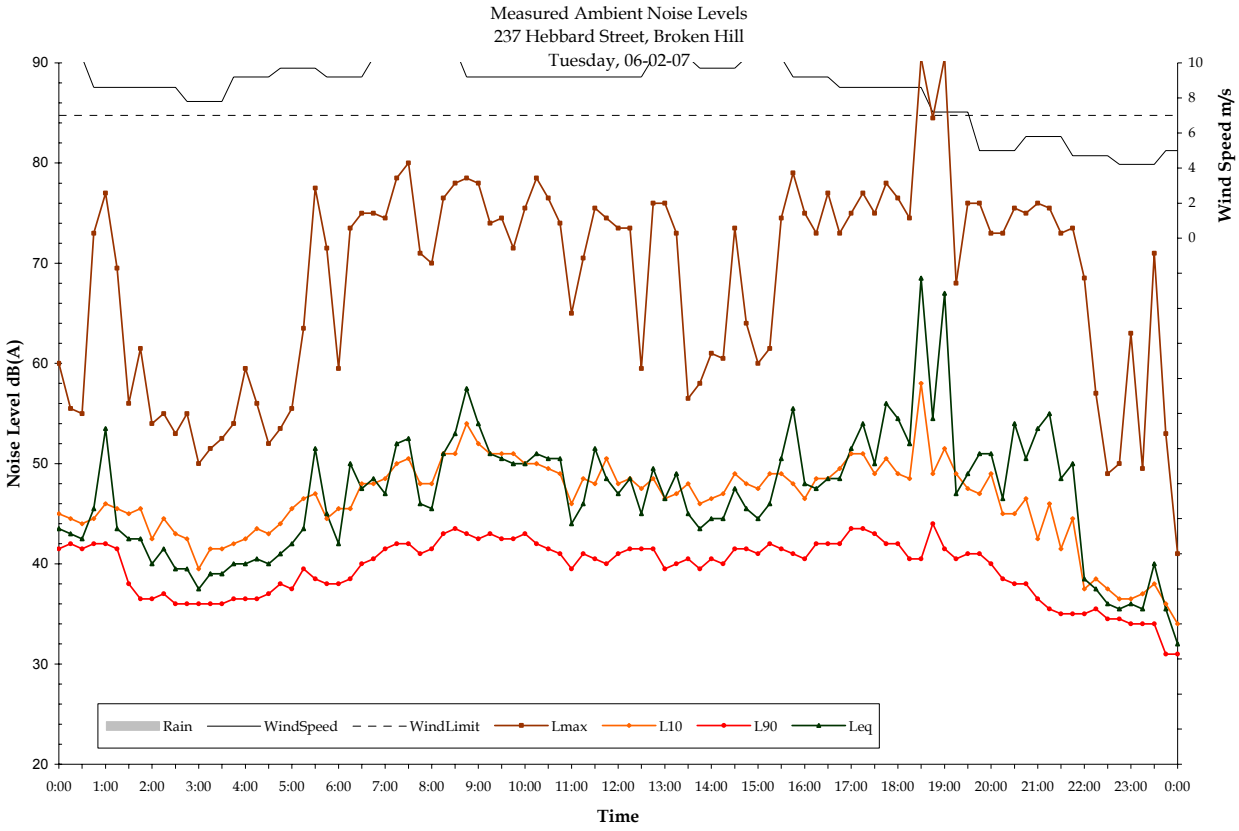

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Thursday, 01-02-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

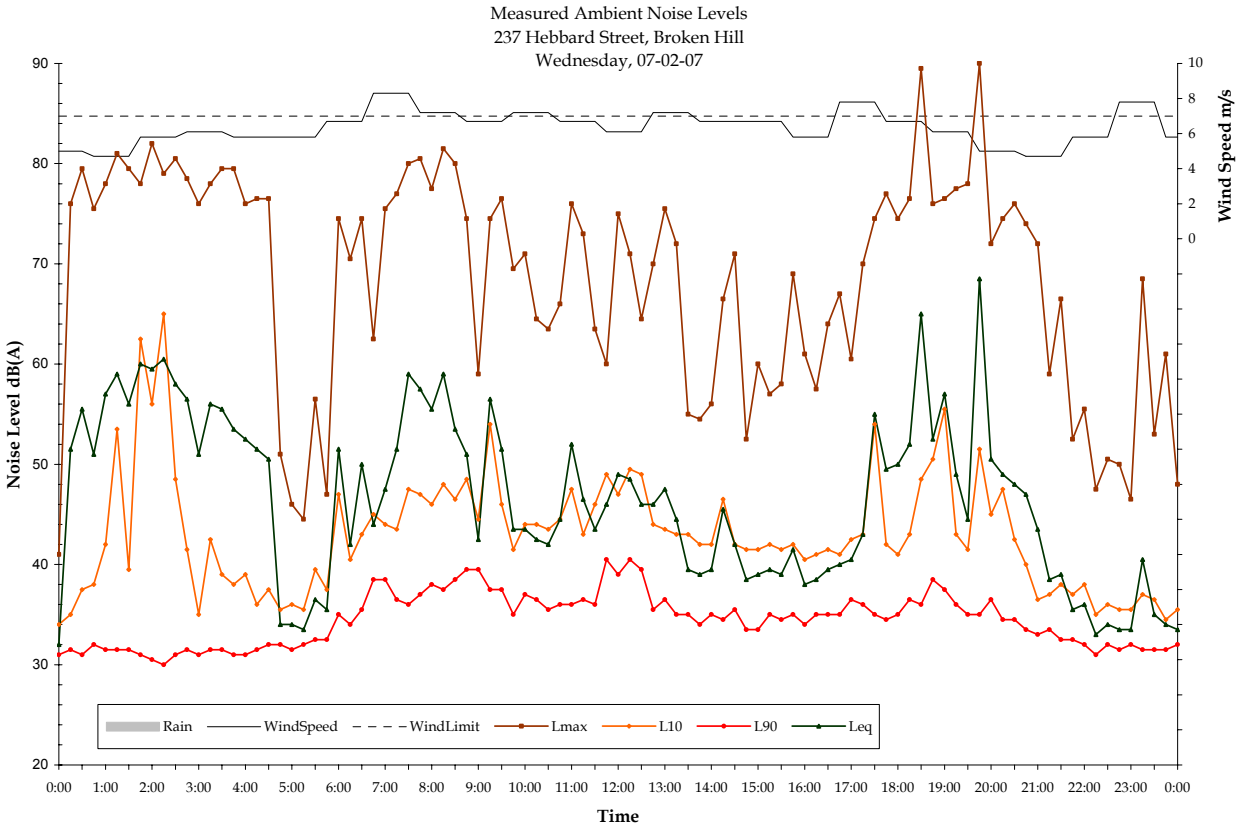

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Friday, 02-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

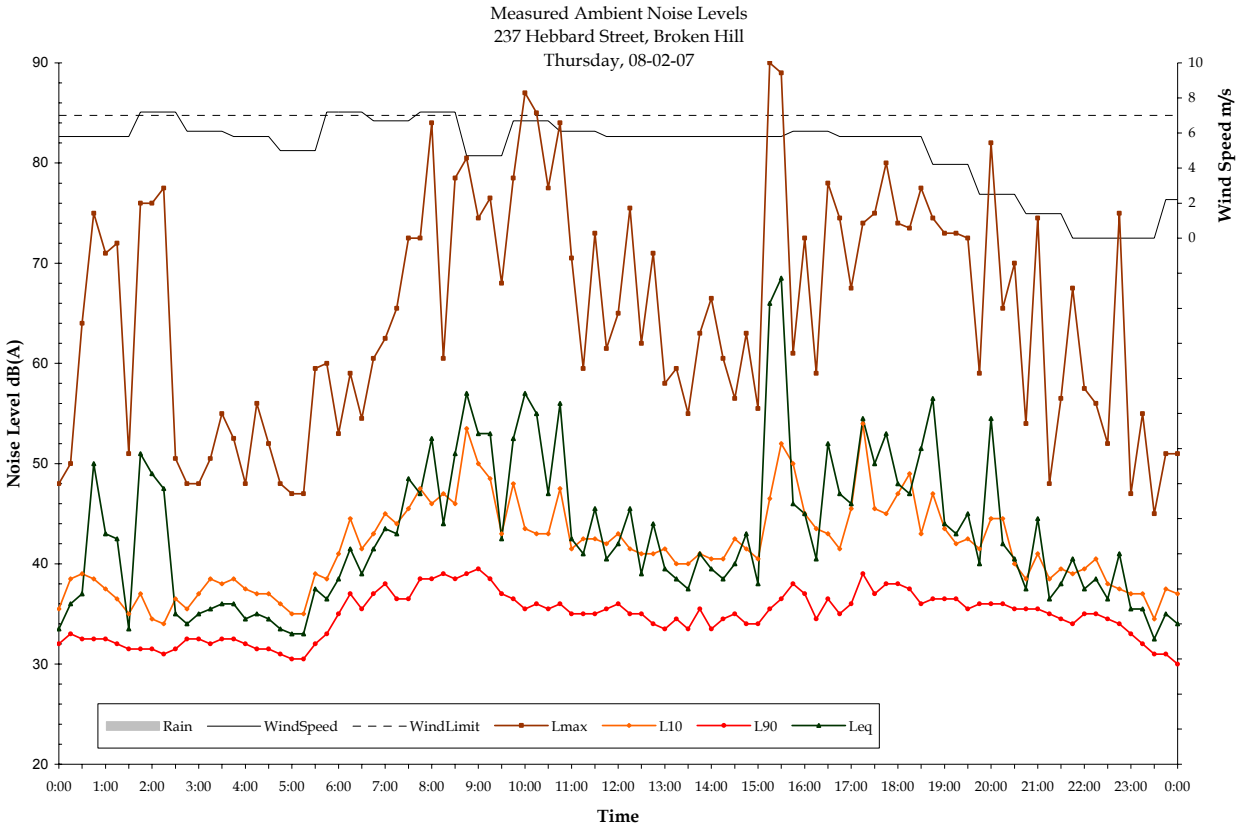

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Saturday, 03-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

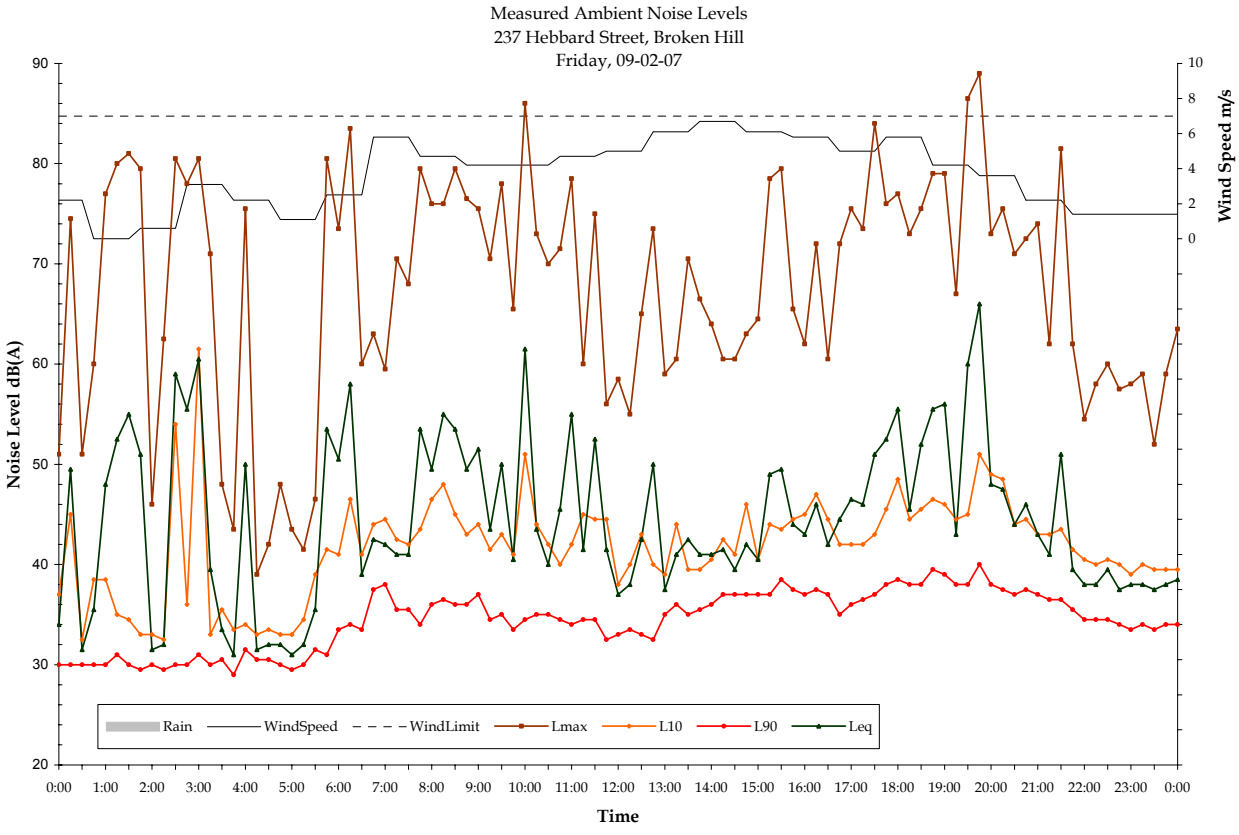

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Sunday, 04-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

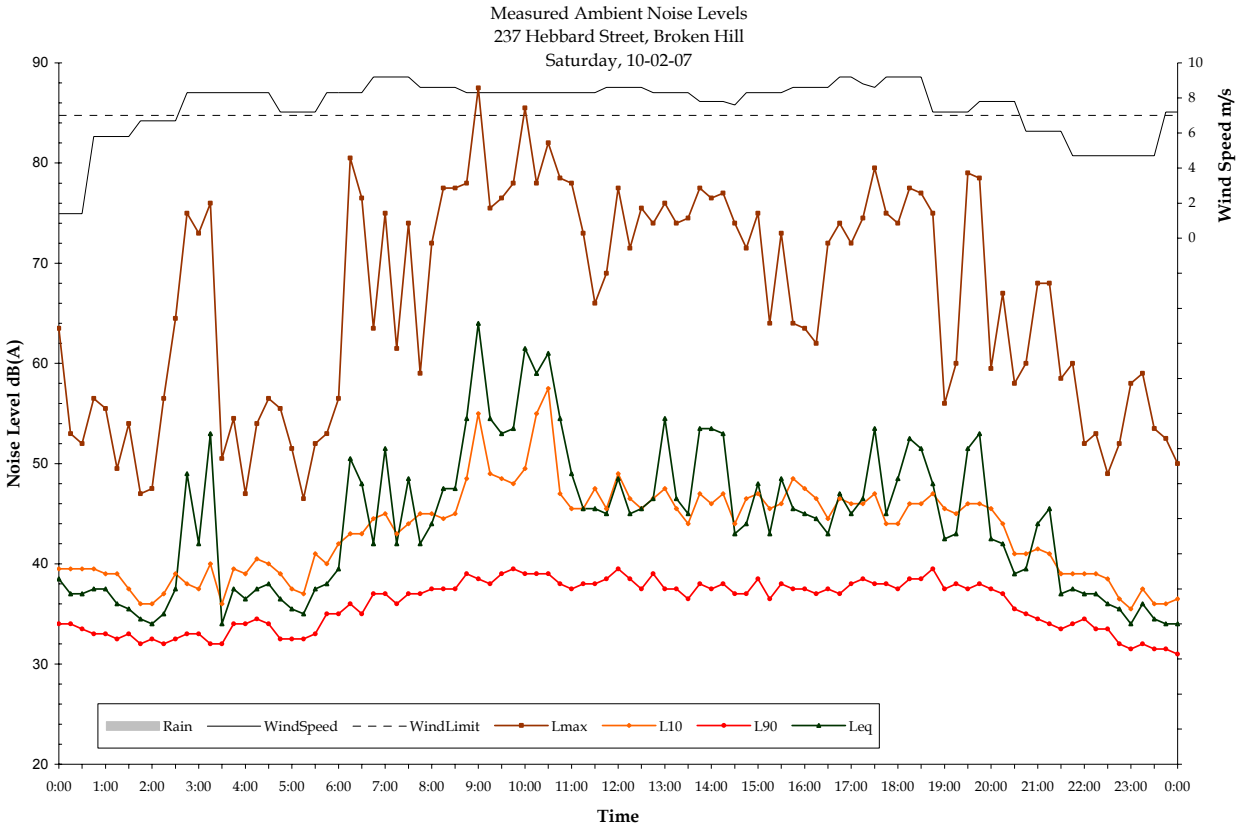

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Monday, 05-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

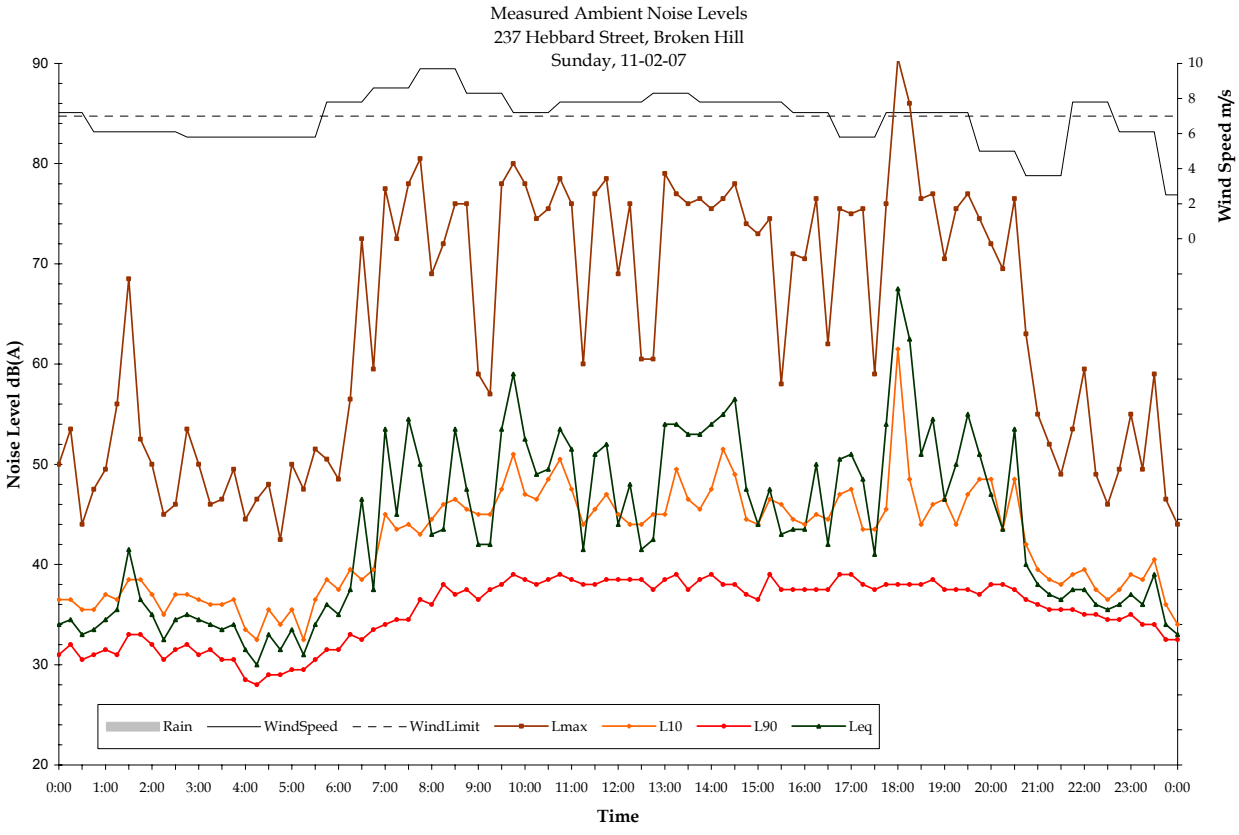

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Tuesday, 06-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

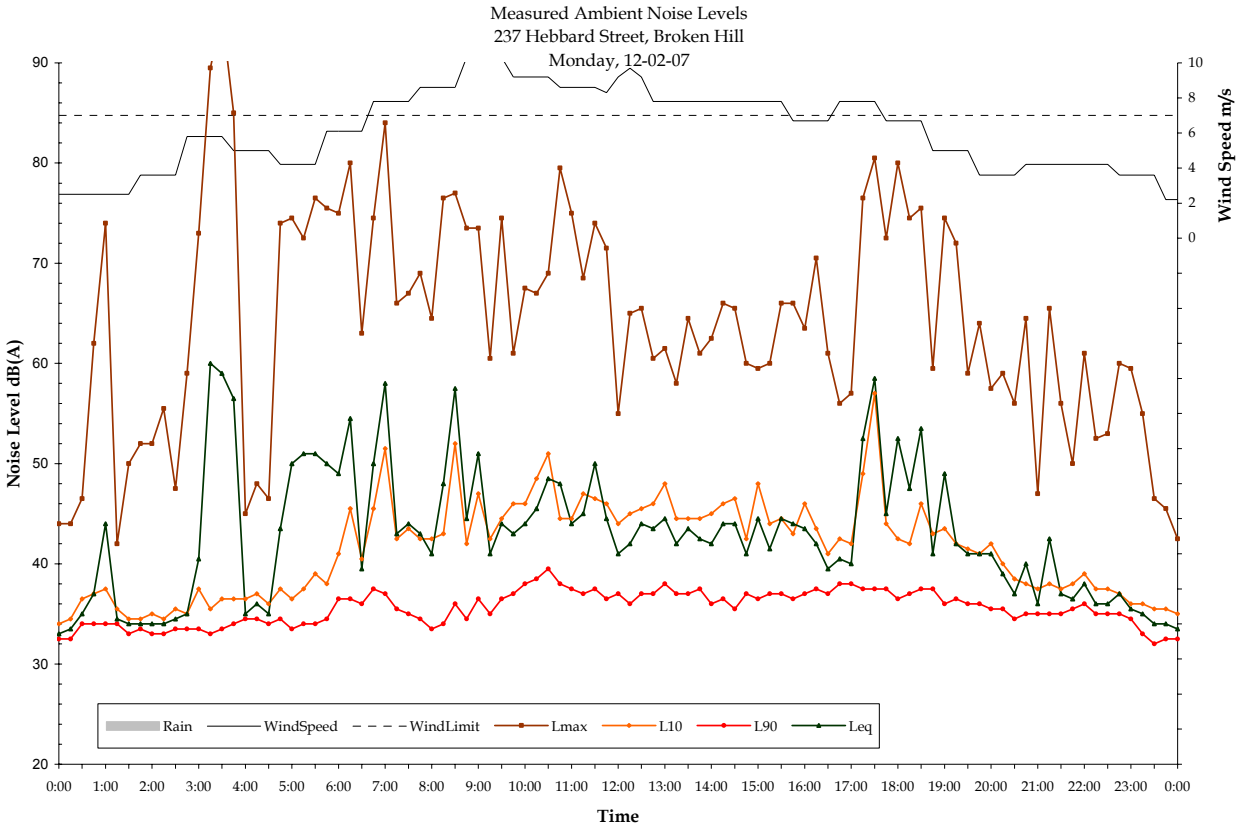

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Wednesday, 07-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

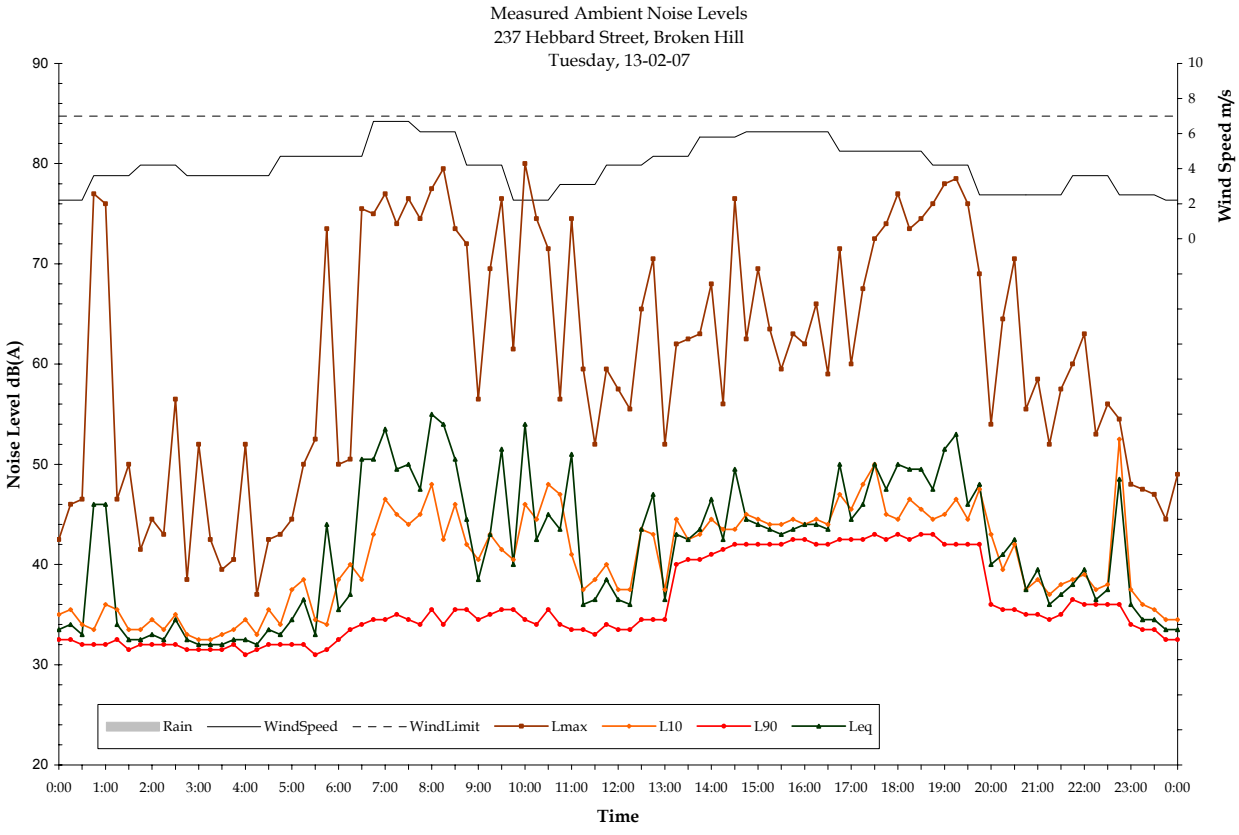

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Thursday, 08-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

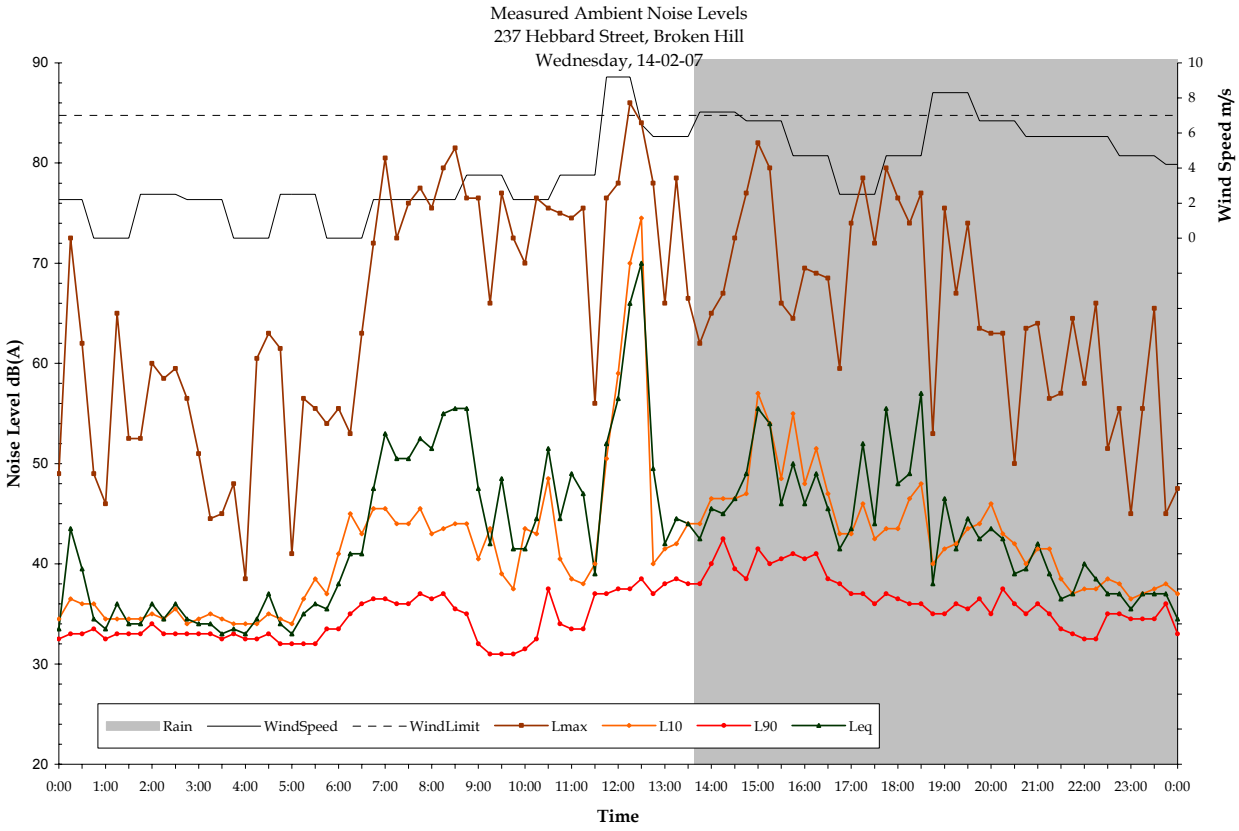

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Friday, 09-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

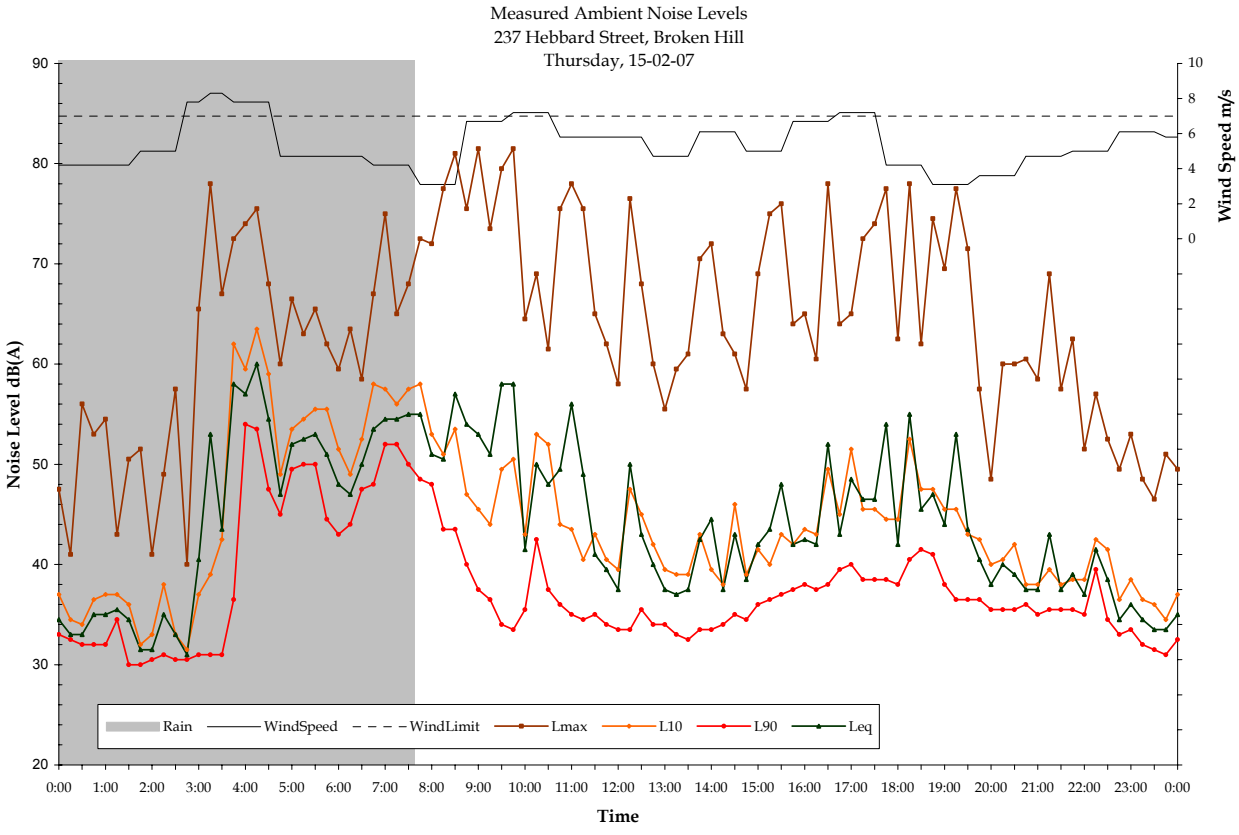

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Saturday, 10-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

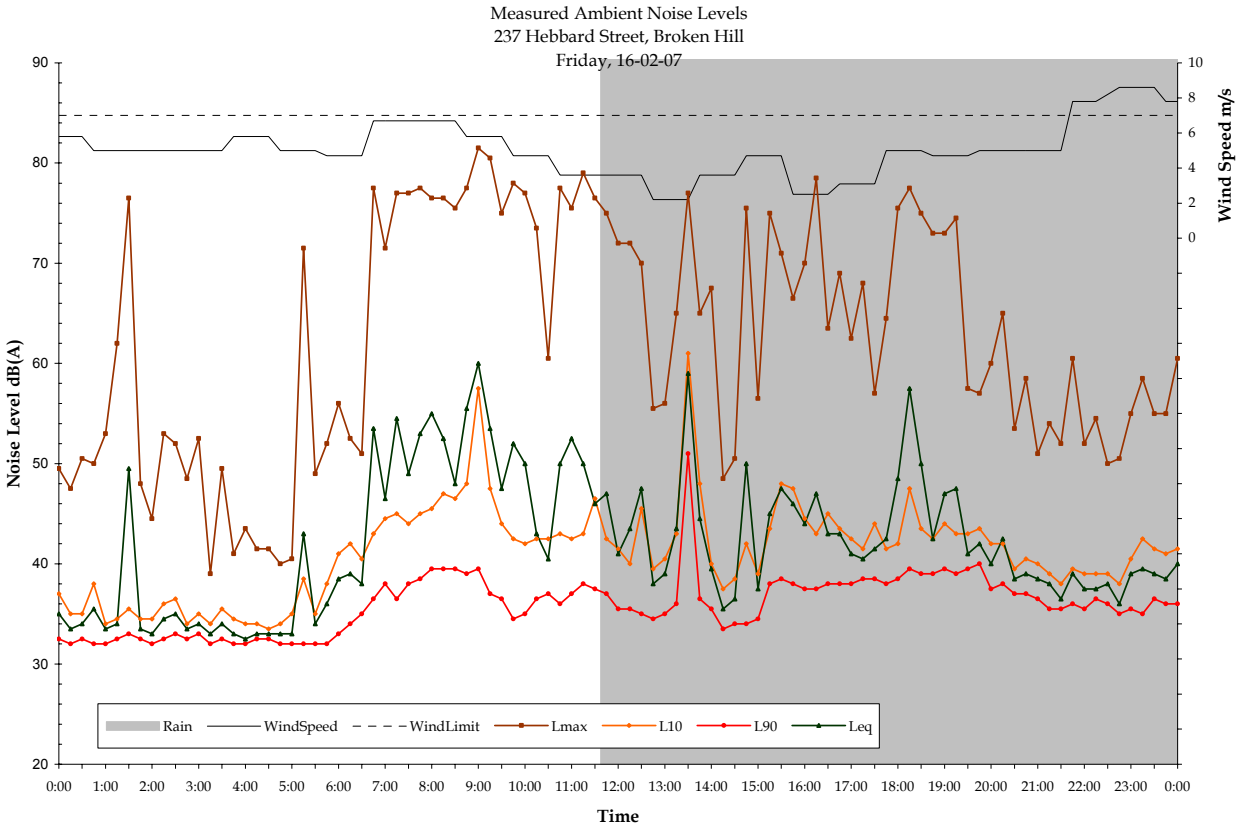

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Sunday, 11-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

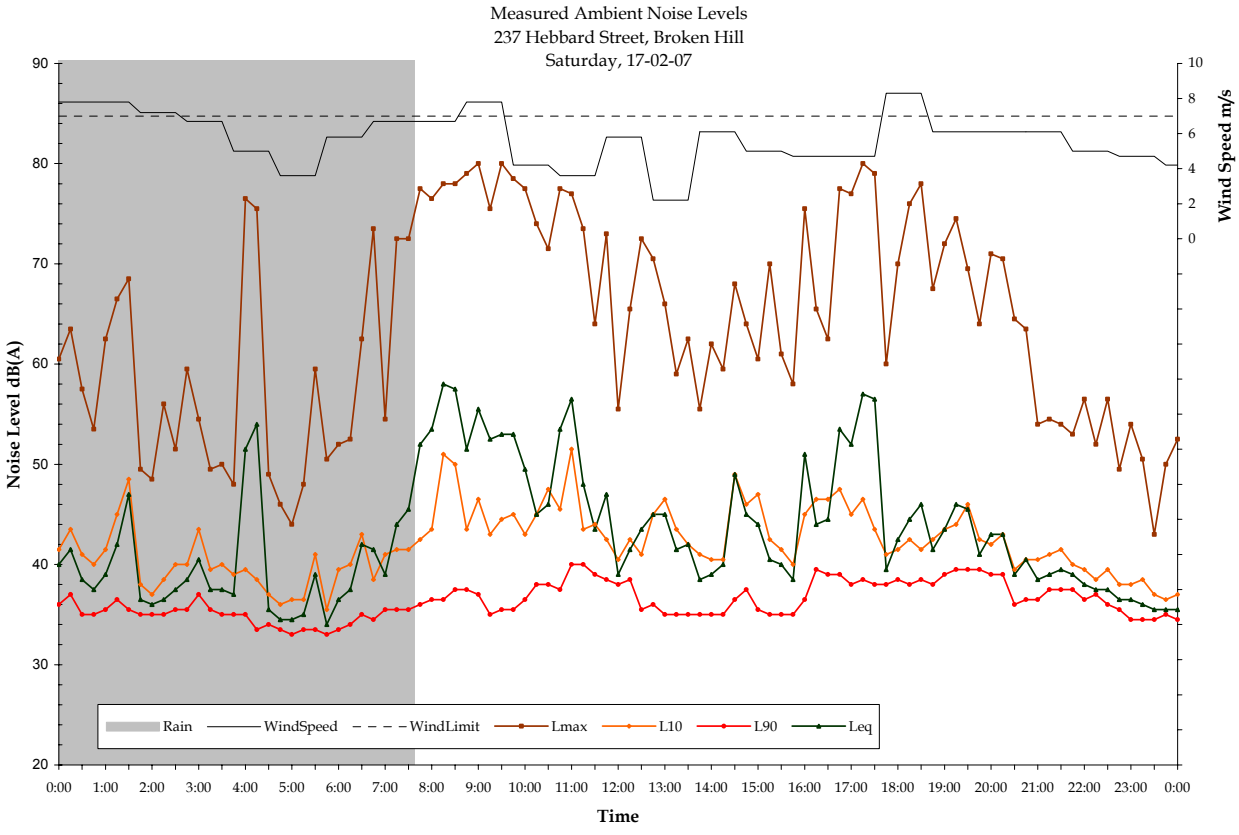

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Monday, 12-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

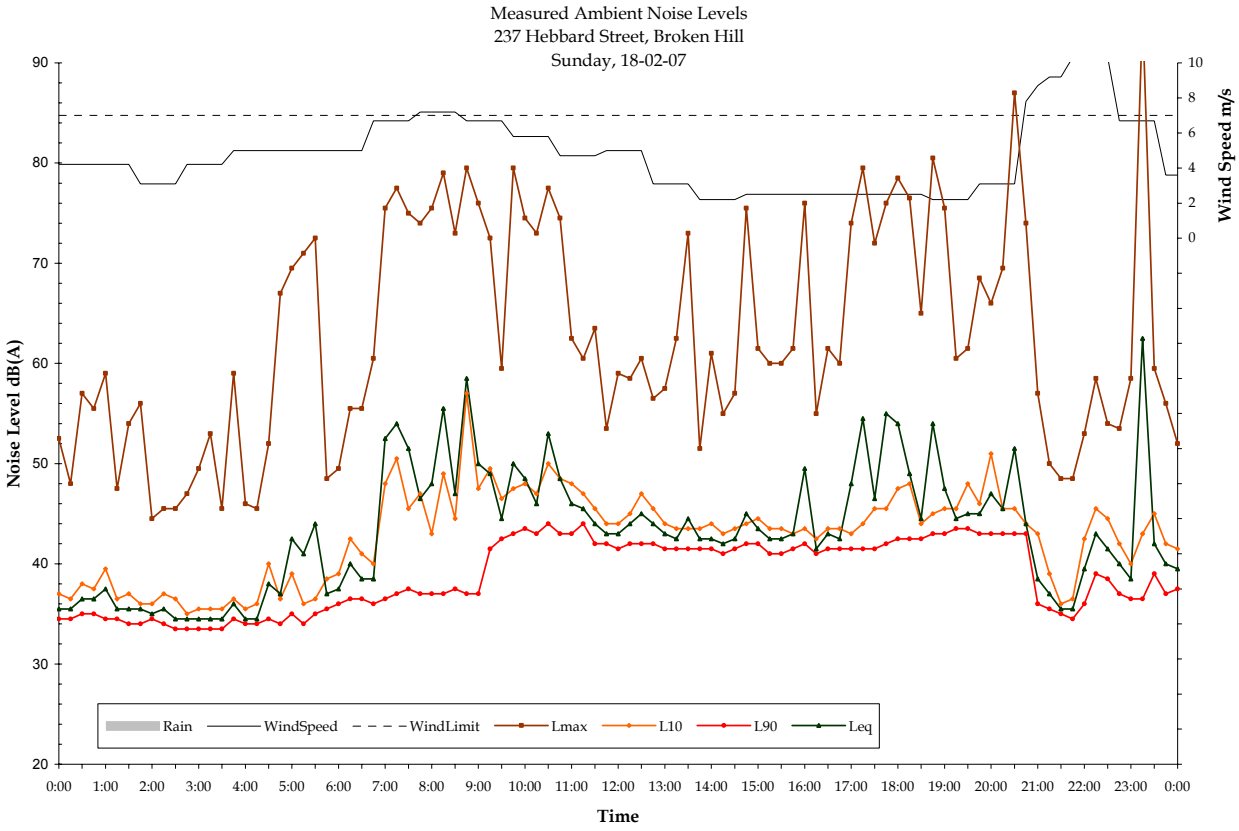

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Tuesday, 13-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

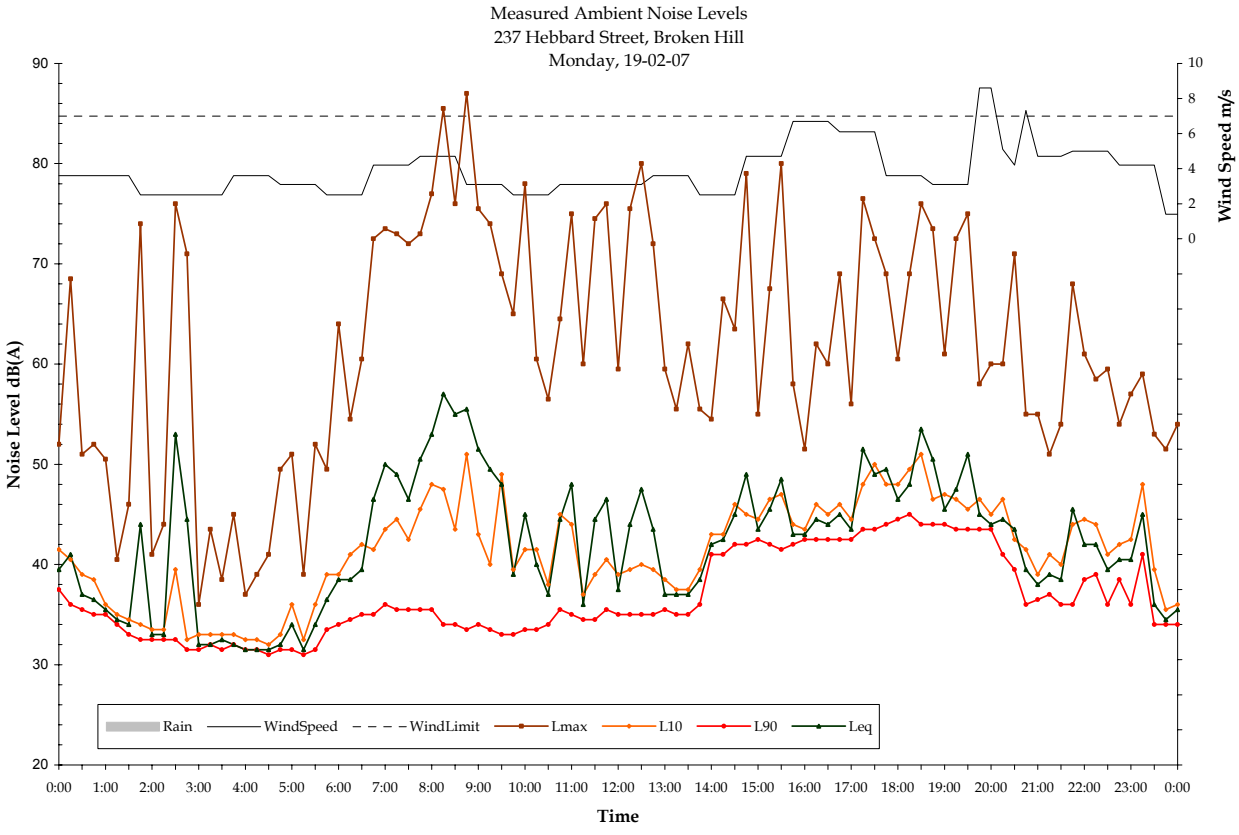

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Wednesday, 14-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

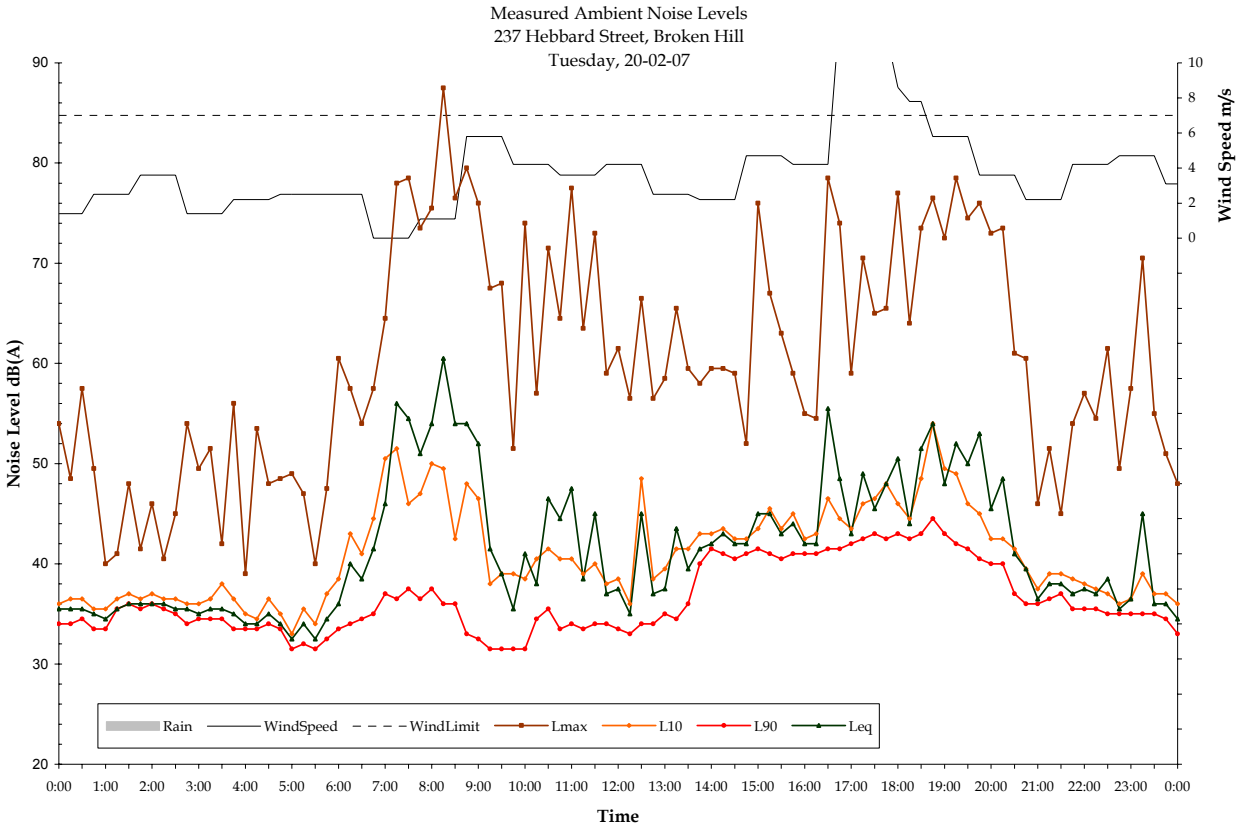

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Thursday, 15-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

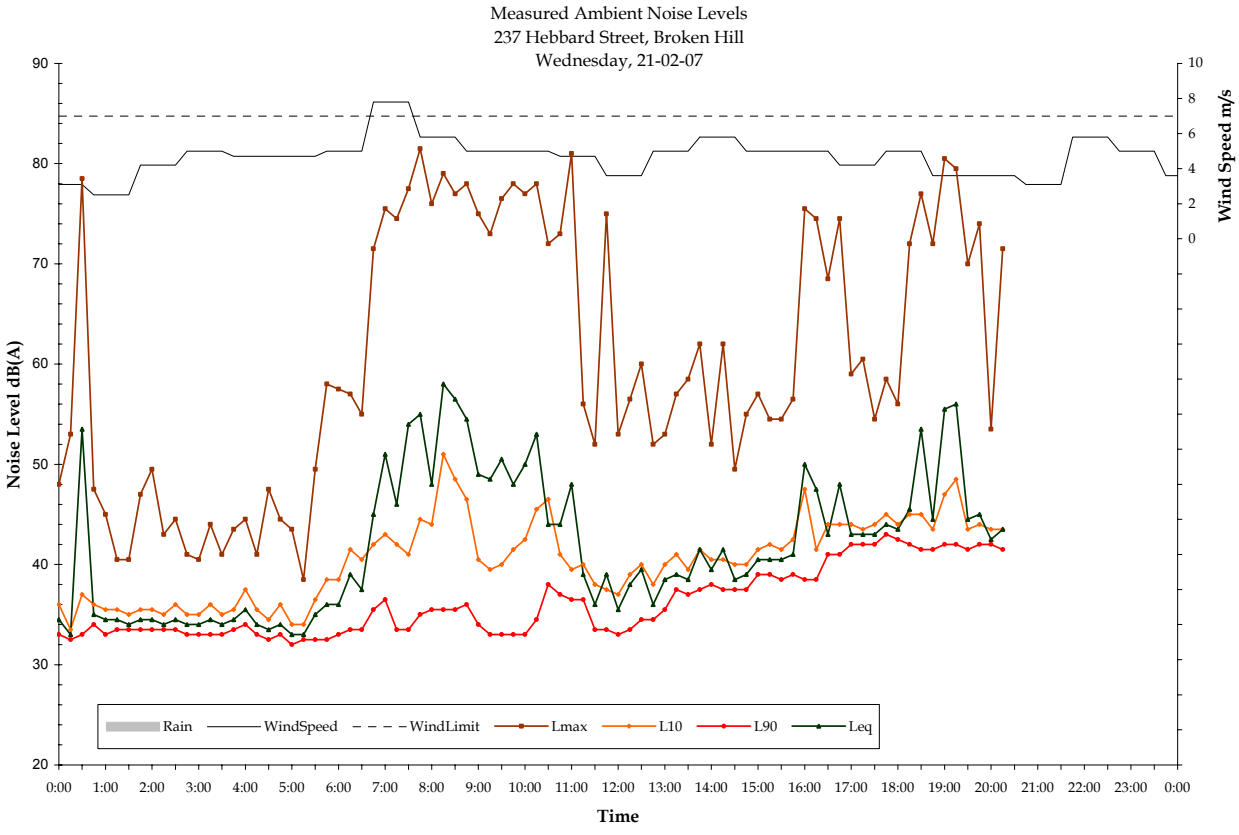

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Friday, 16-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

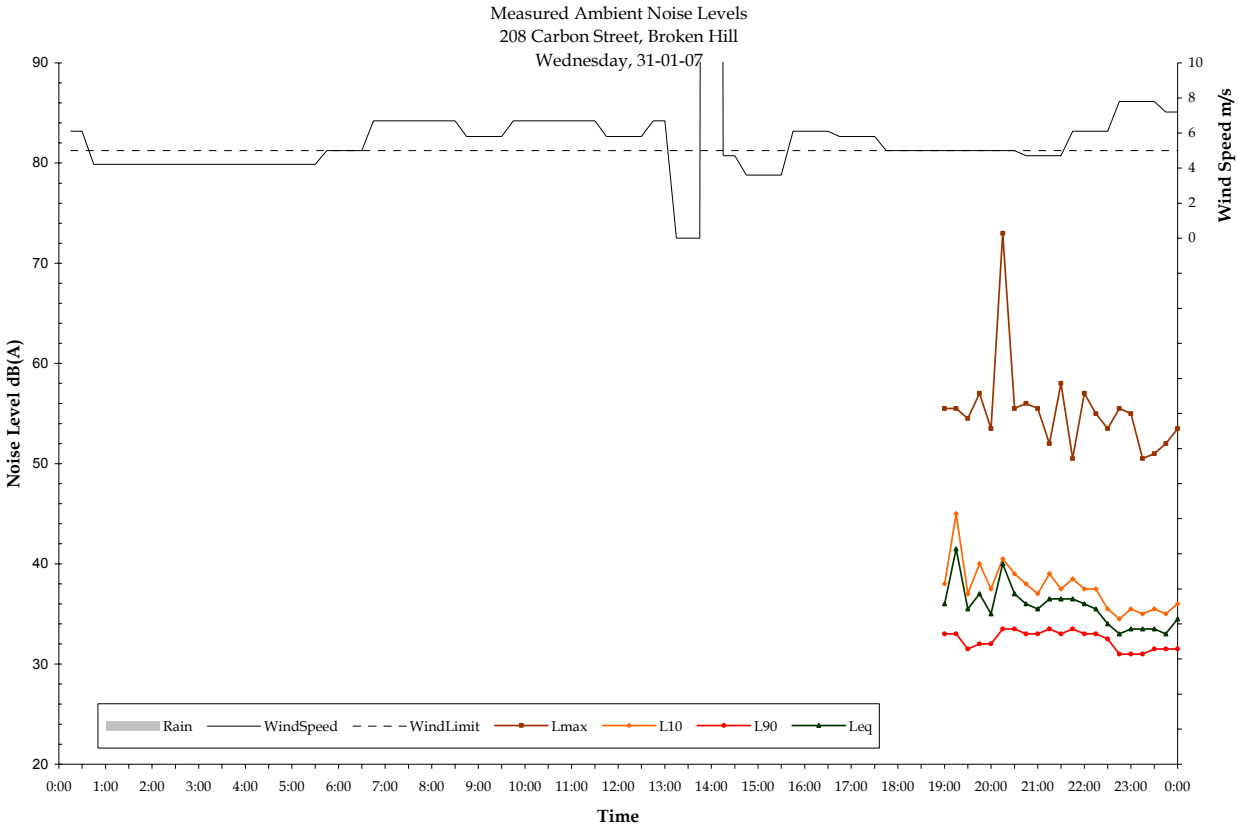

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Saturday, 17-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

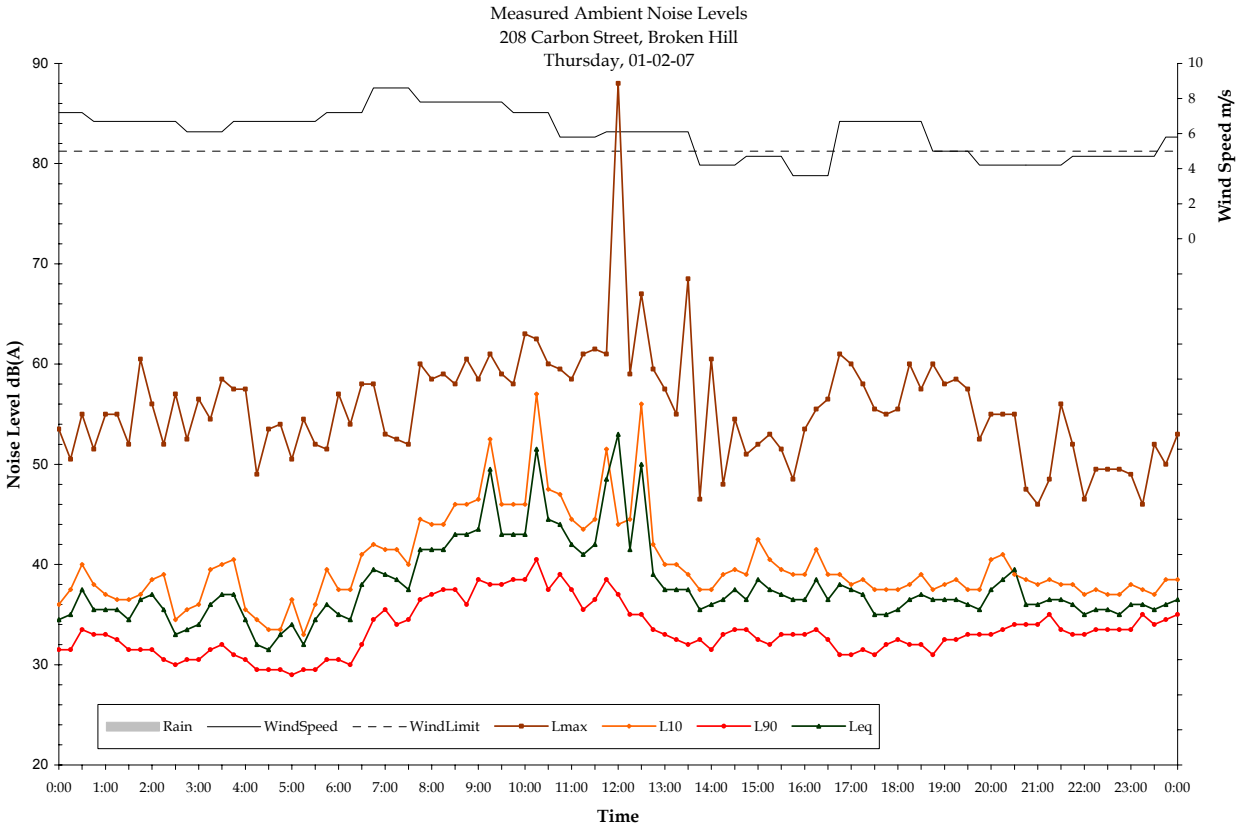

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Sunday, 18-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

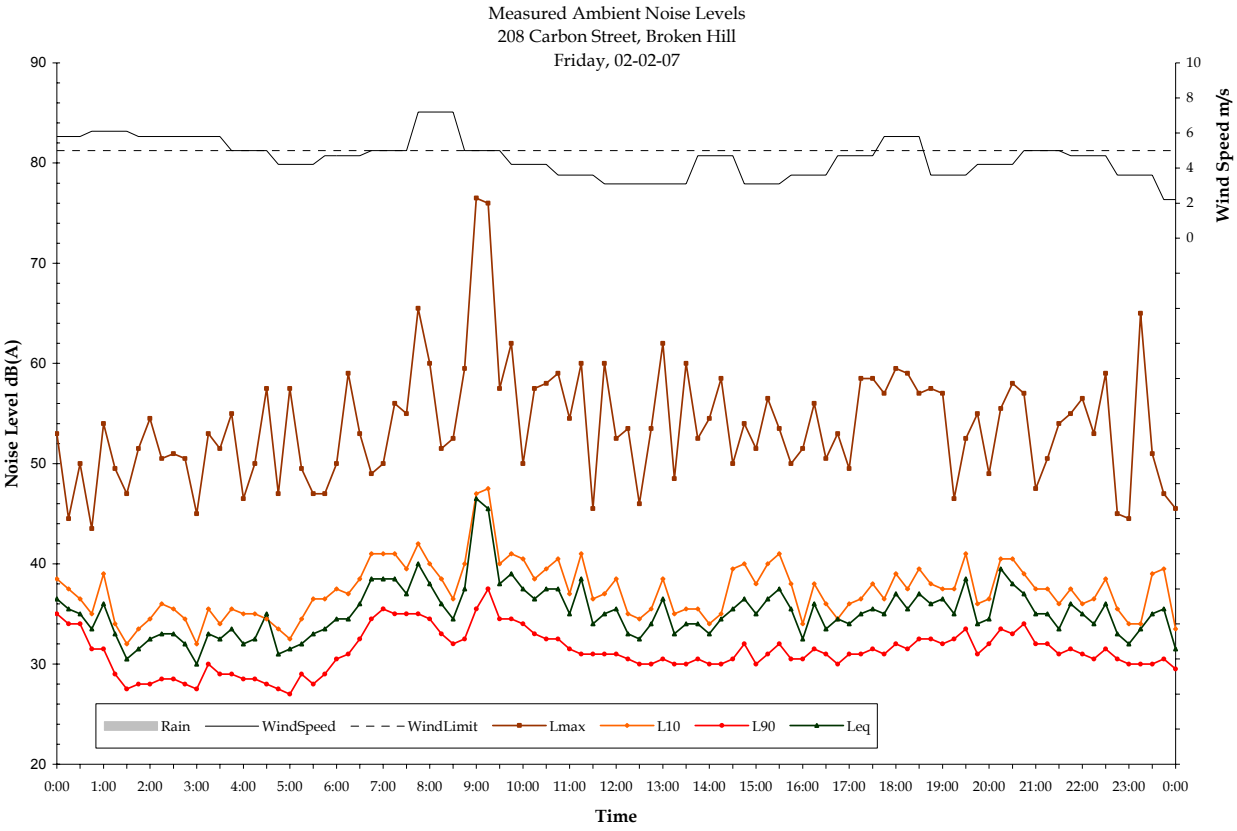

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Monday, 19-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

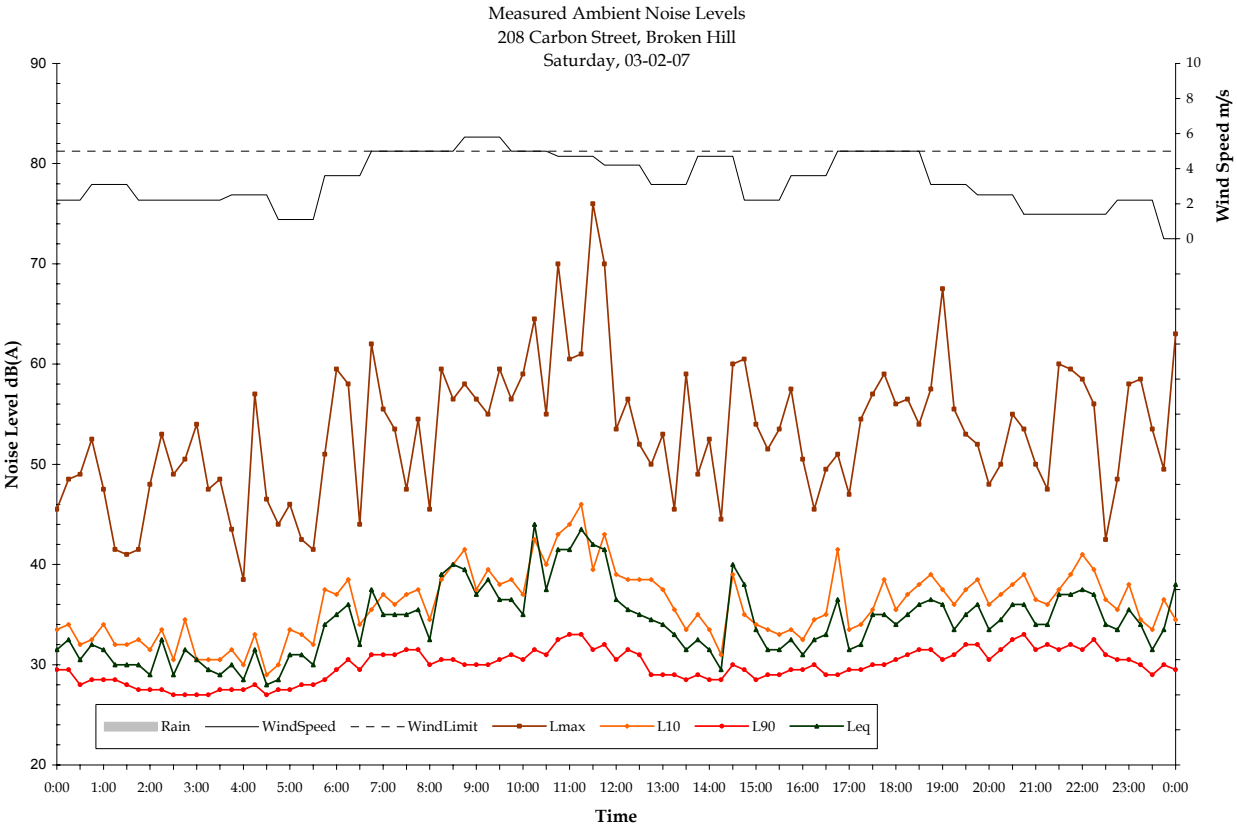

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Tuesday, 20-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

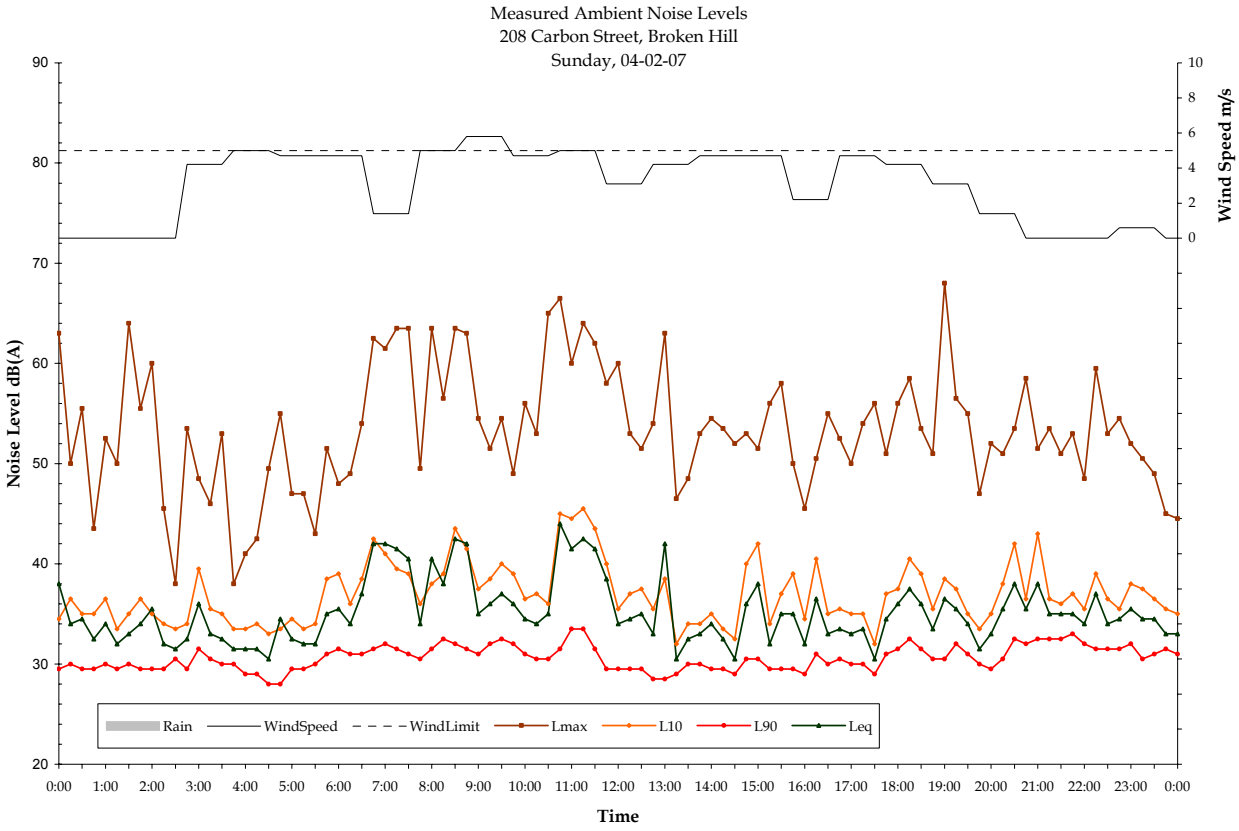

Measured Ambient Noise Levels
237 Hebbard Street, Broken Hill
Wednesday, 21-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

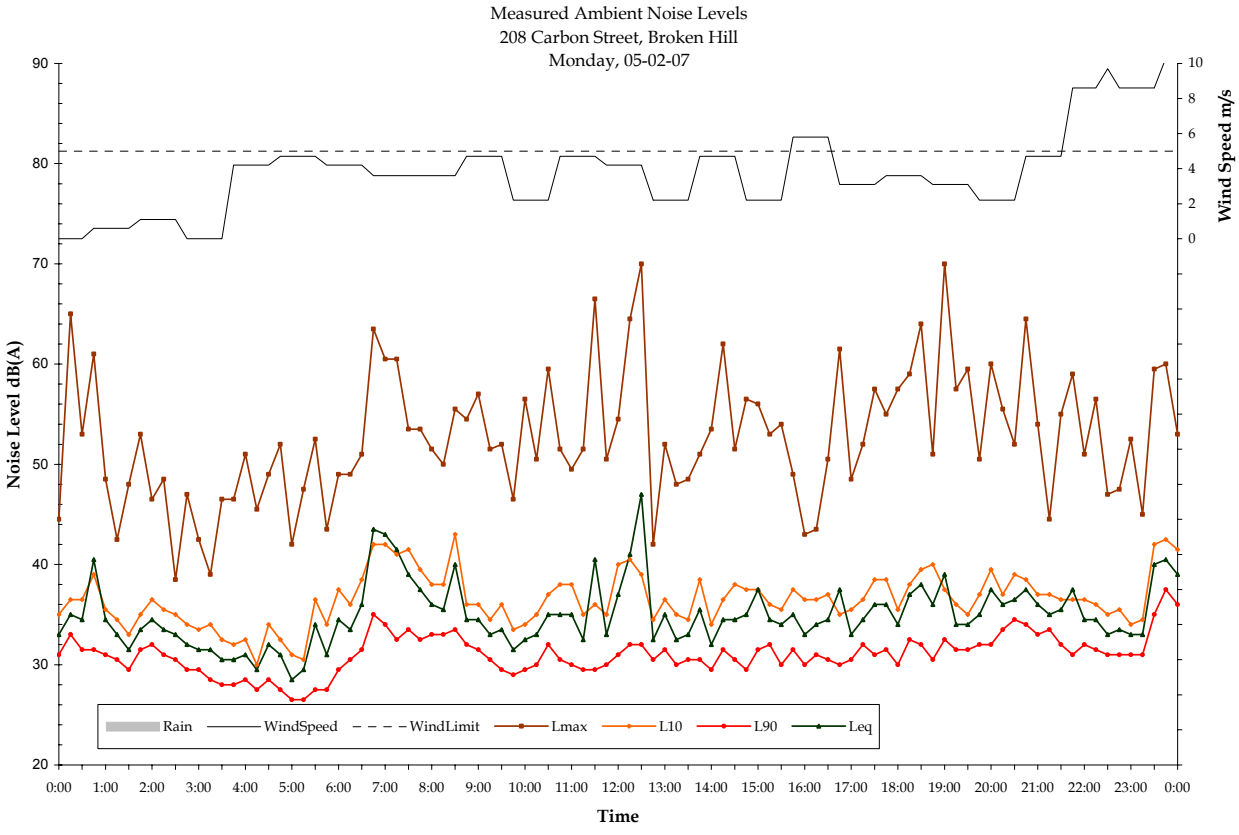

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Wednesday, 31-01-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

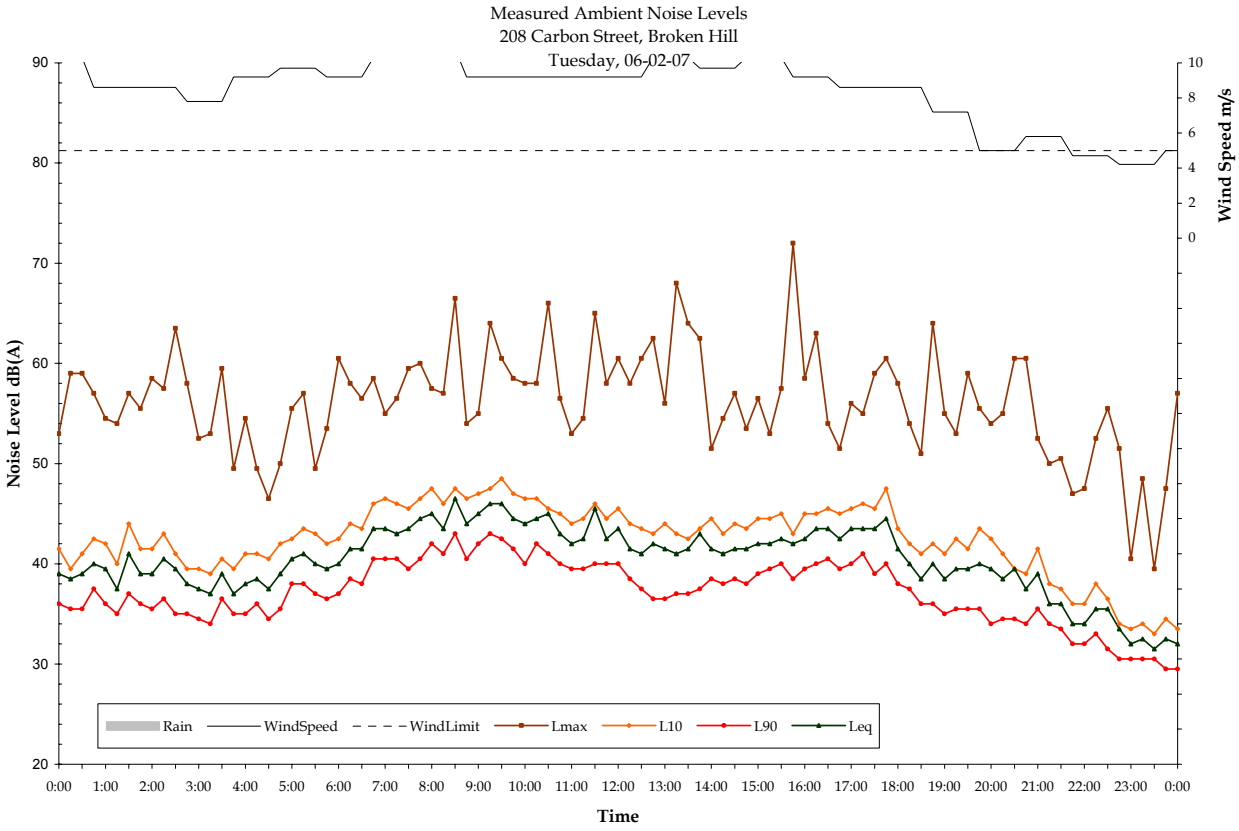

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Thursday, 01-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

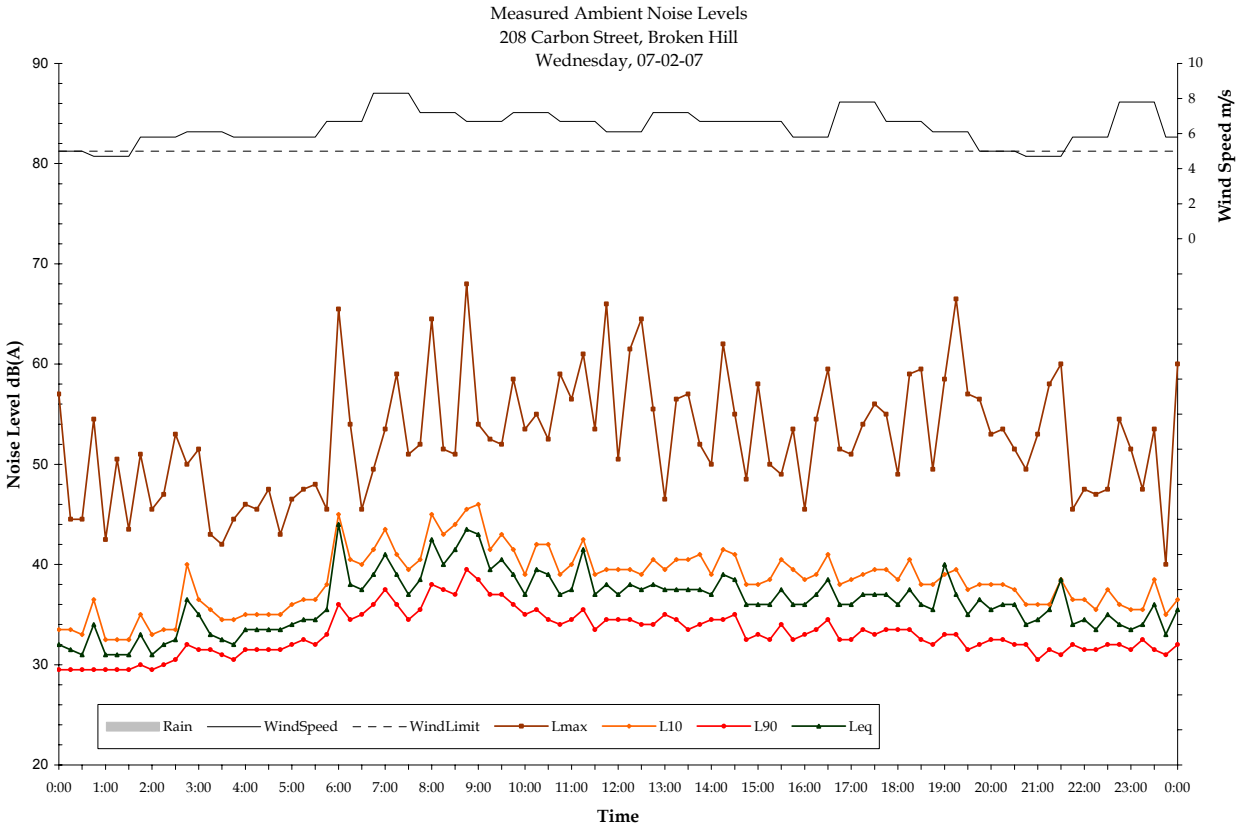

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Friday, 02-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

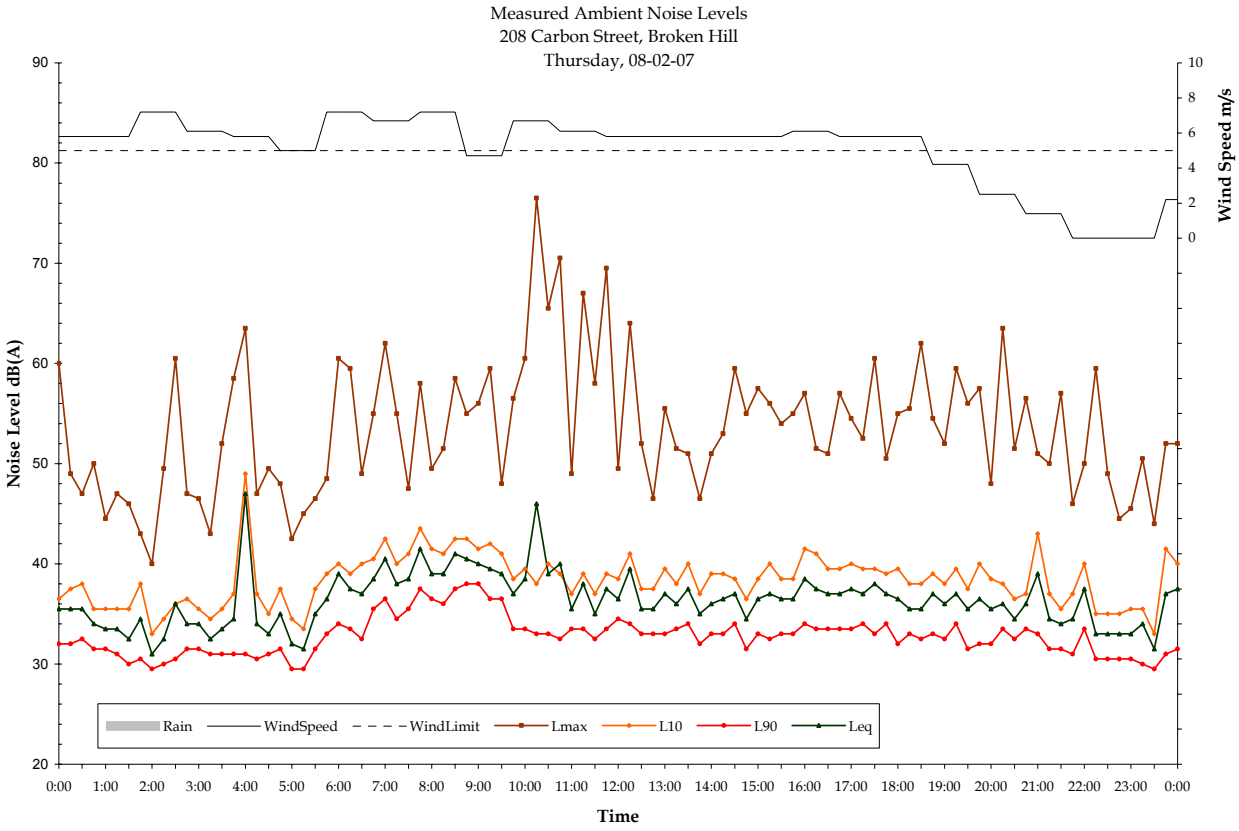

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Saturday, 03-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

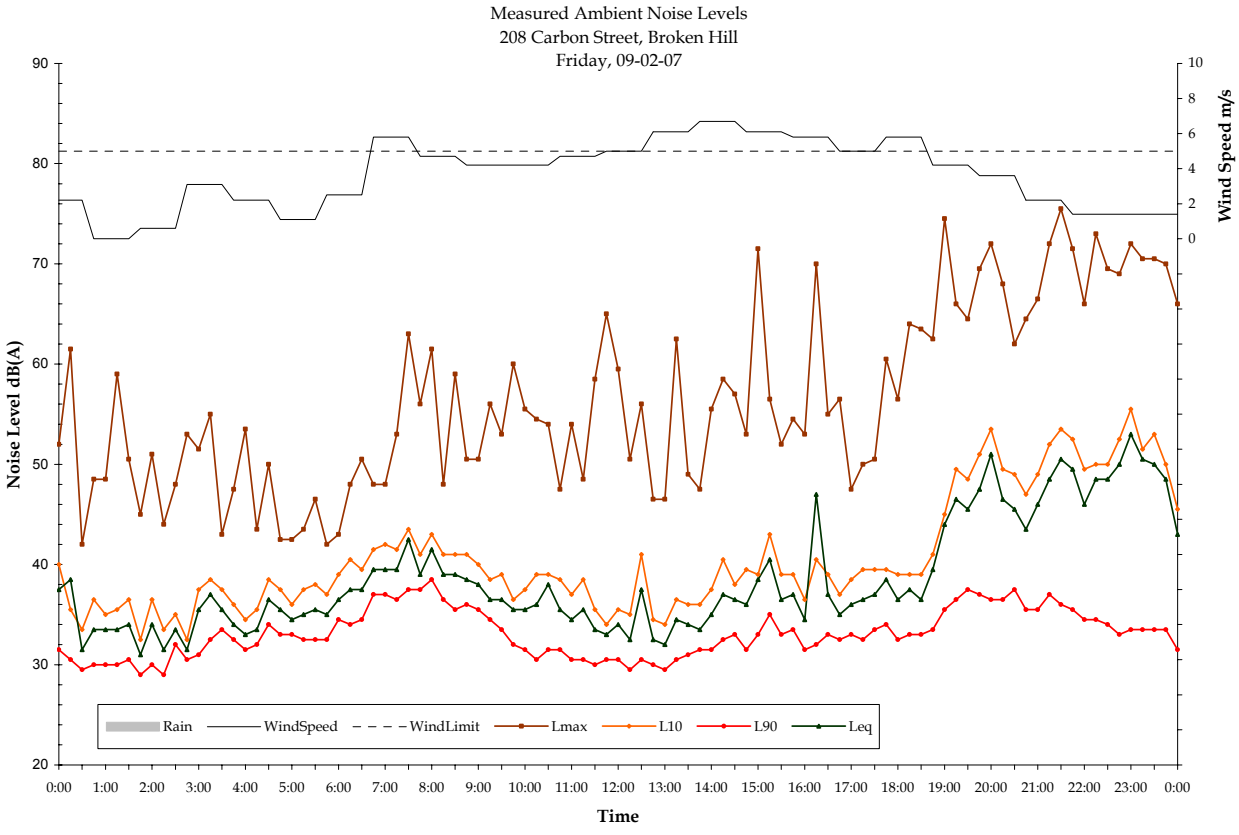

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Sunday, 04-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

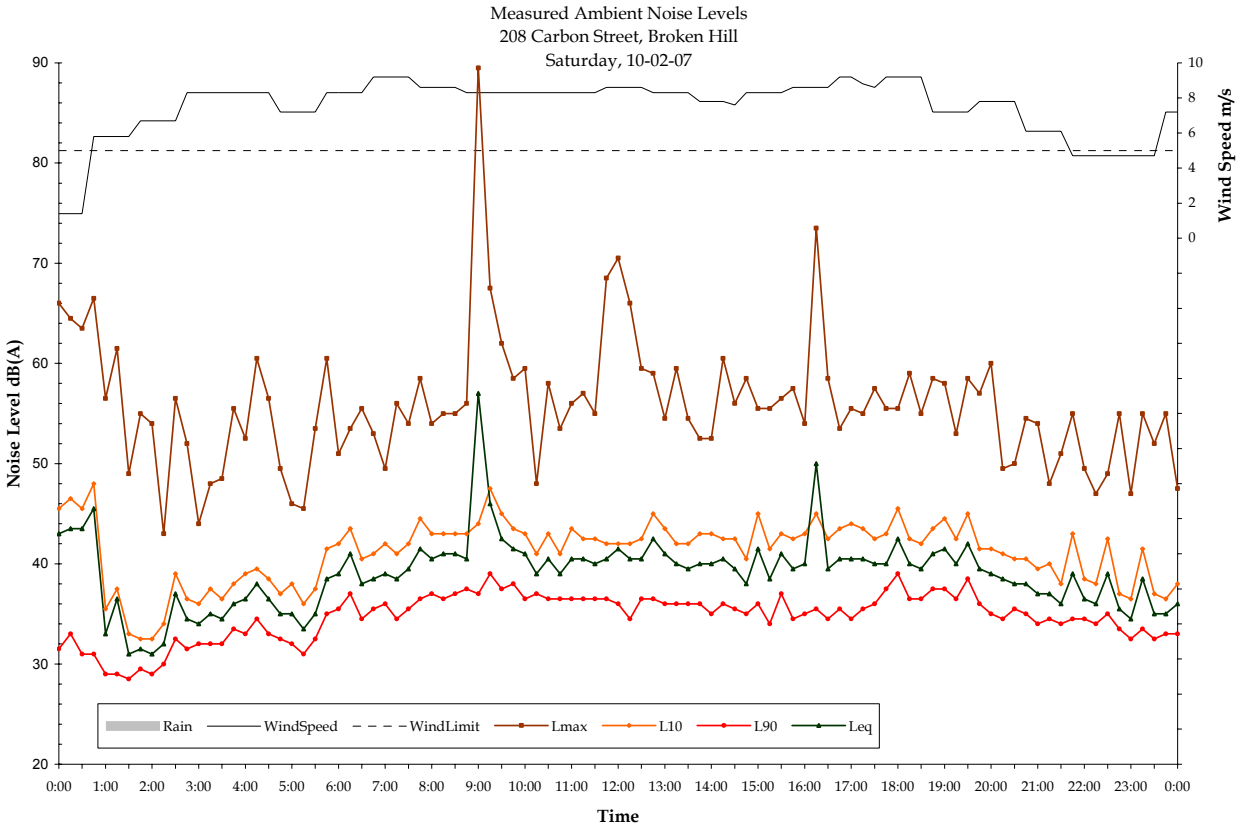

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Monday, 05-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

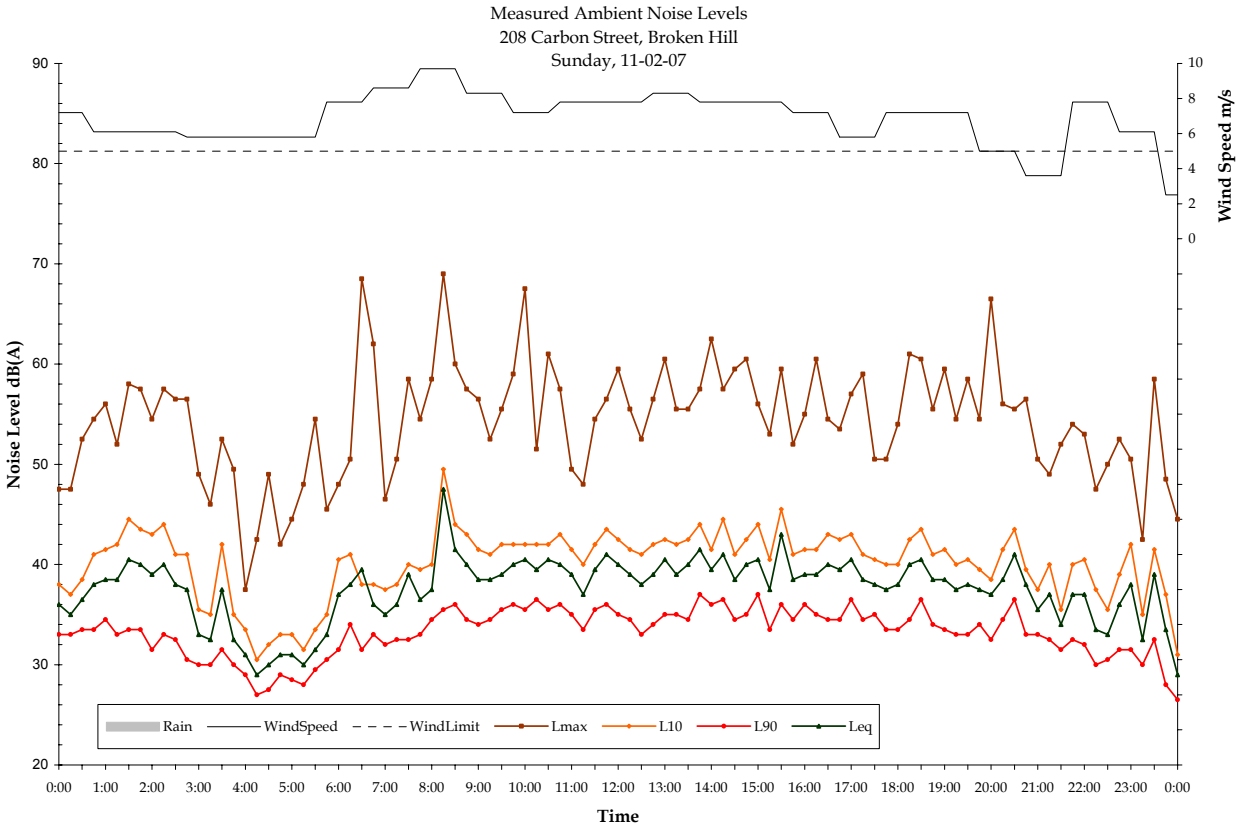

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Tuesday, 06-02-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

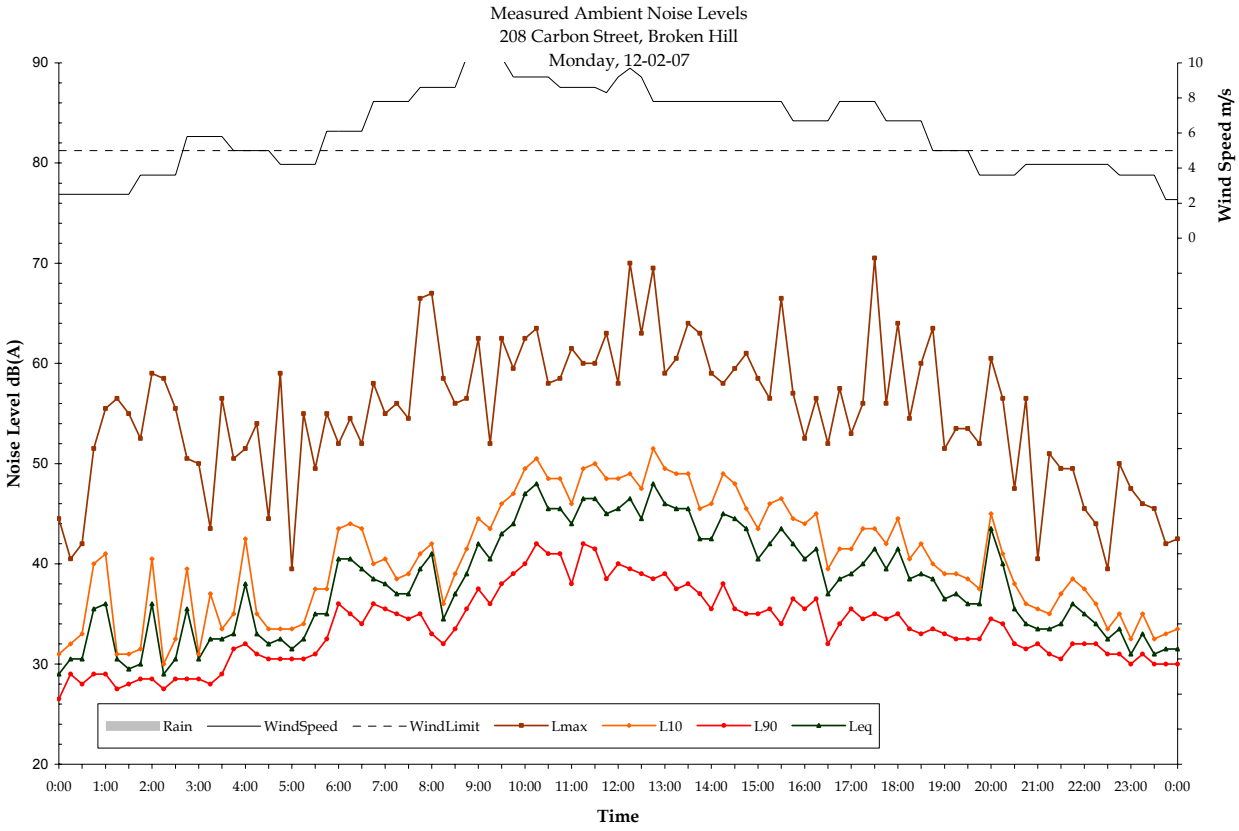

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Wednesday, 07-02-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

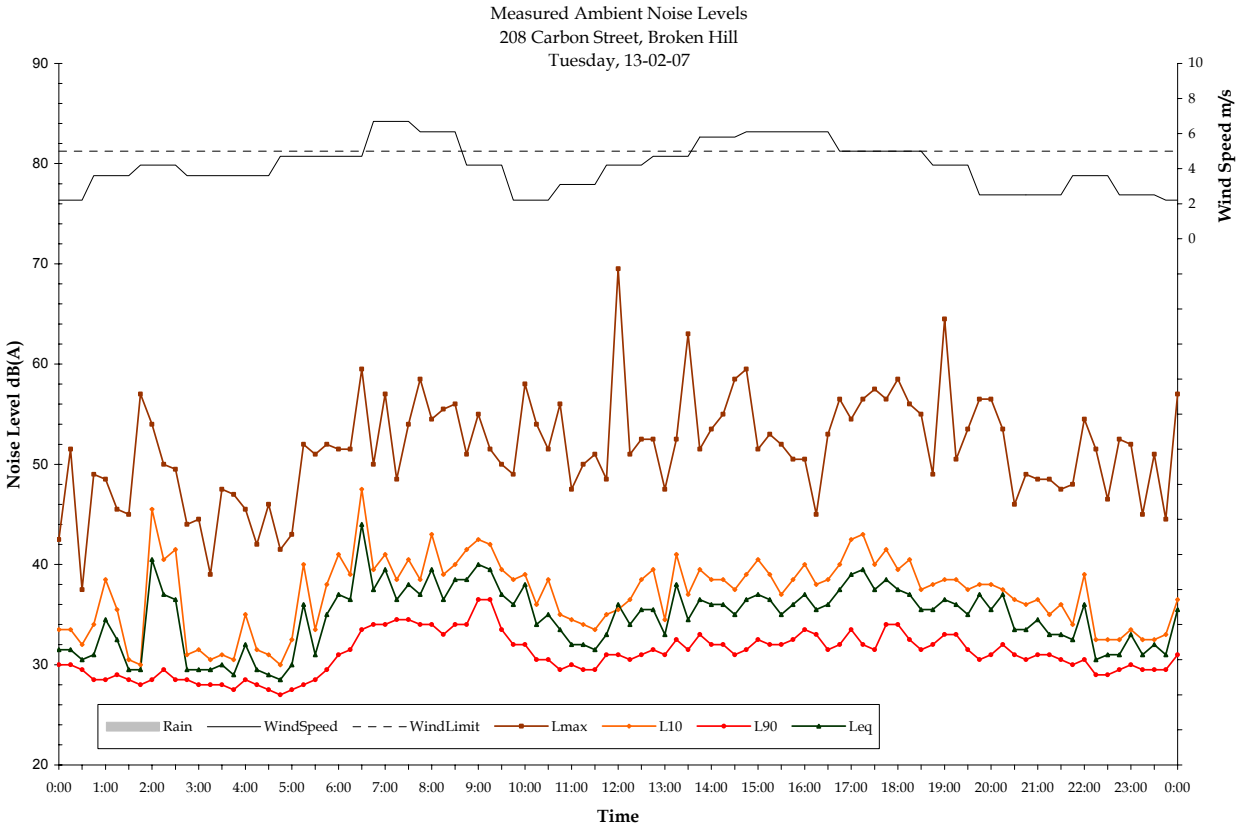

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Thursday, 08-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

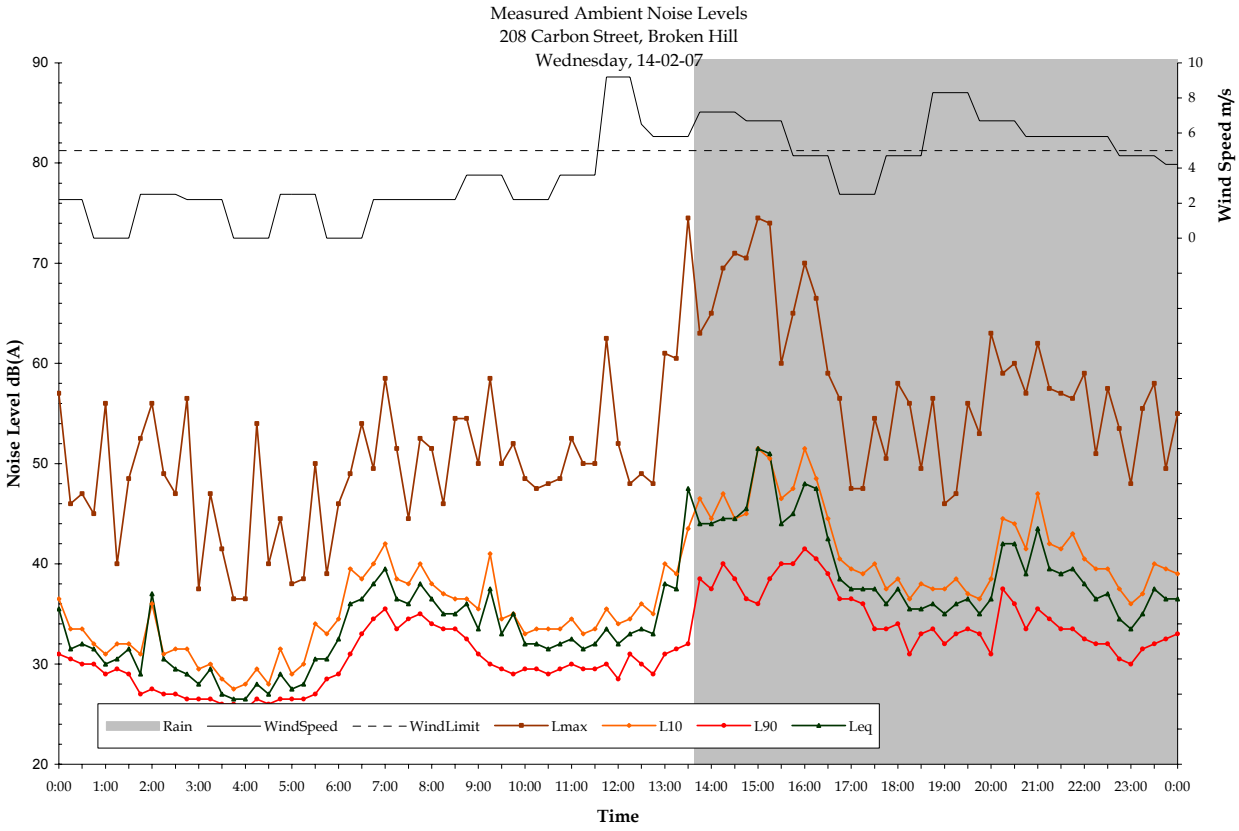

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Friday, 09-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

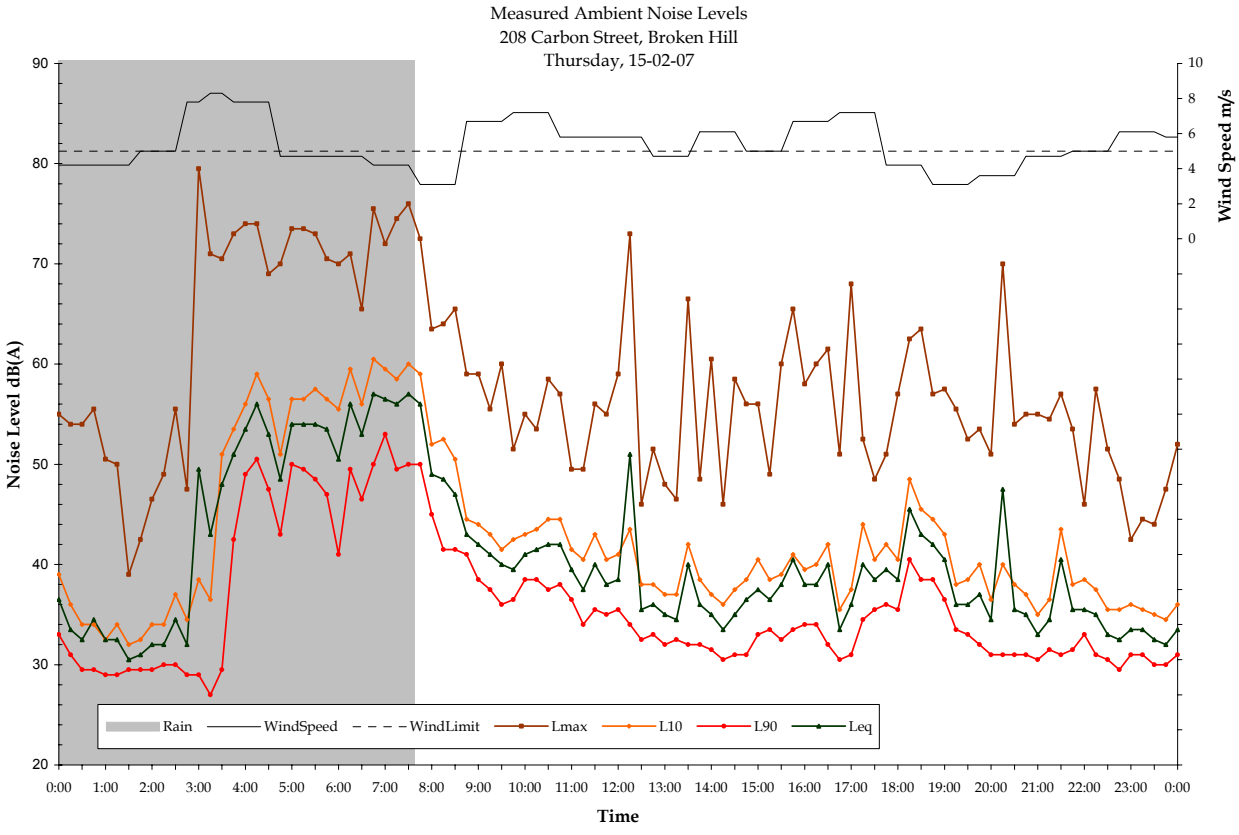

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Saturday, 10-02-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

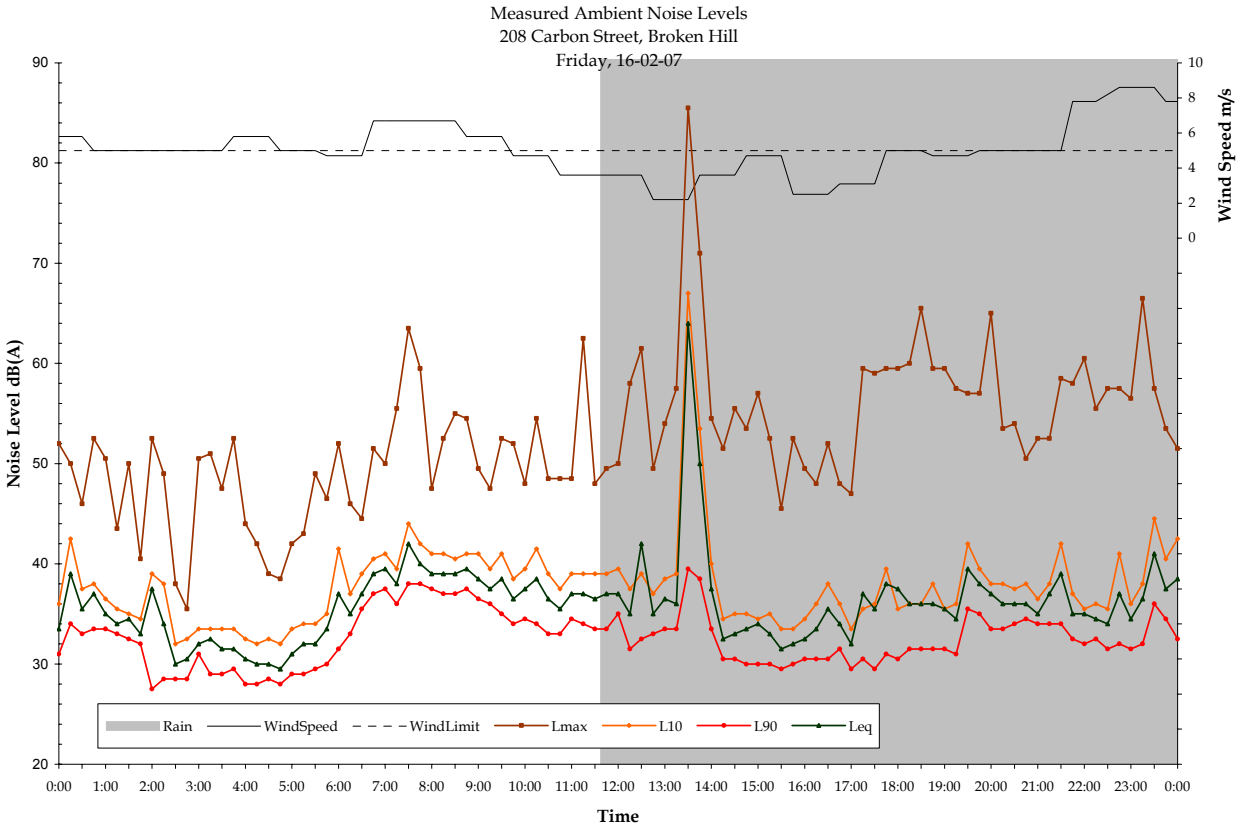

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Sunday, 11-02-07
Noise Level dB(A)
Wind Speed m/s
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq
Time

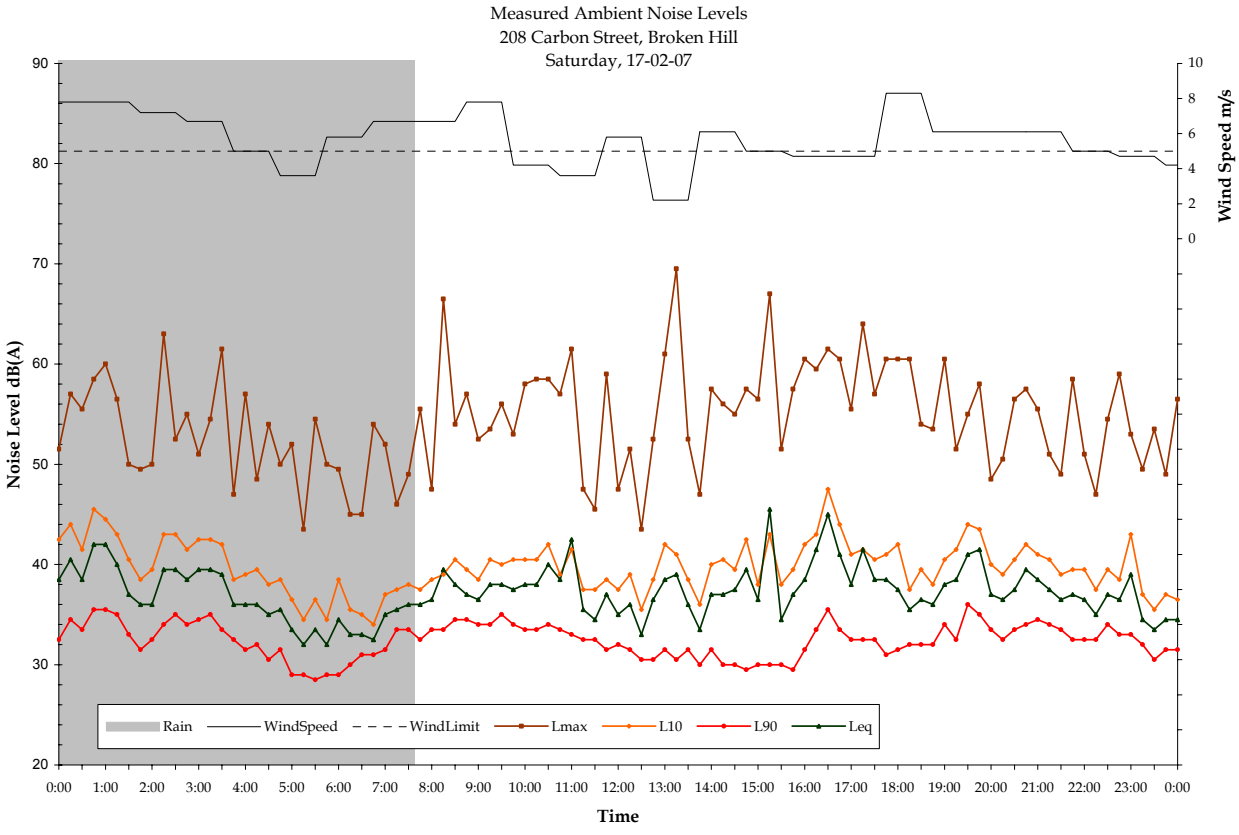

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Monday, 12-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

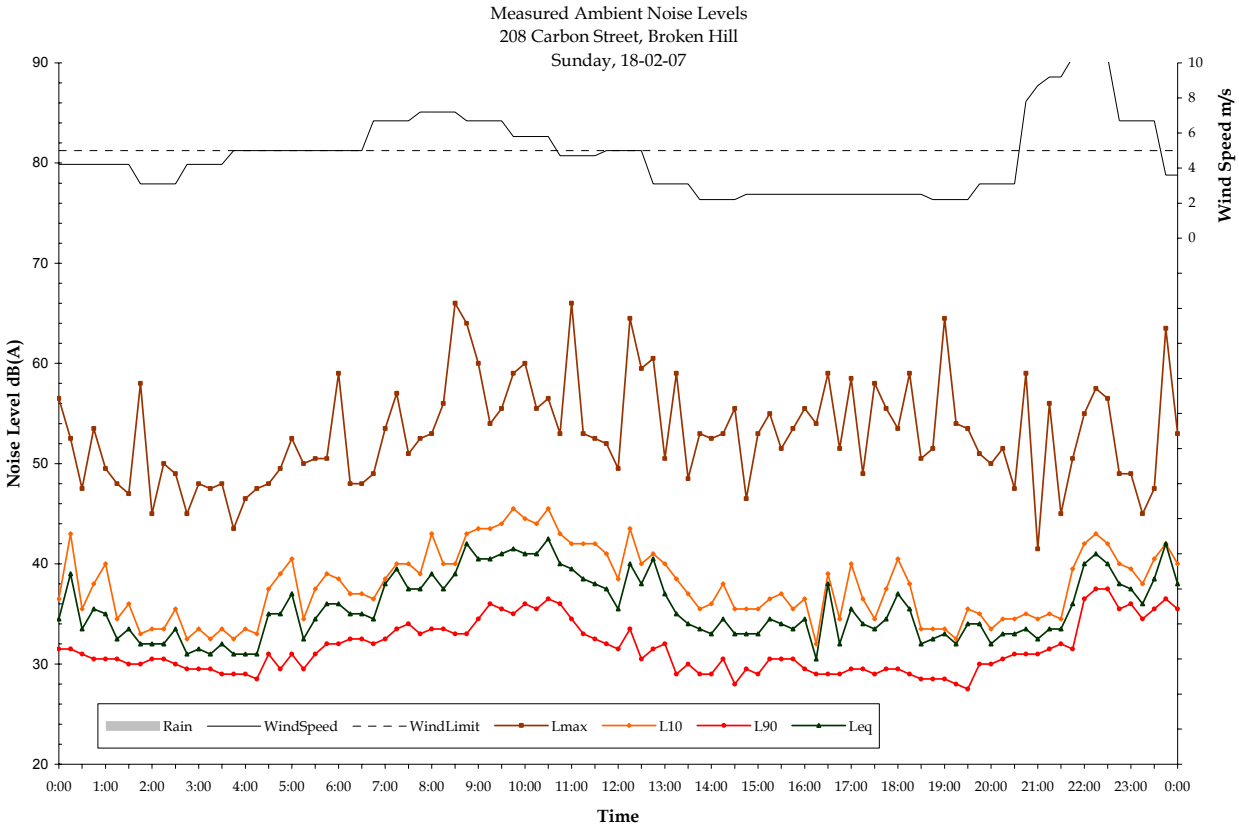

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Tuesday, 13-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

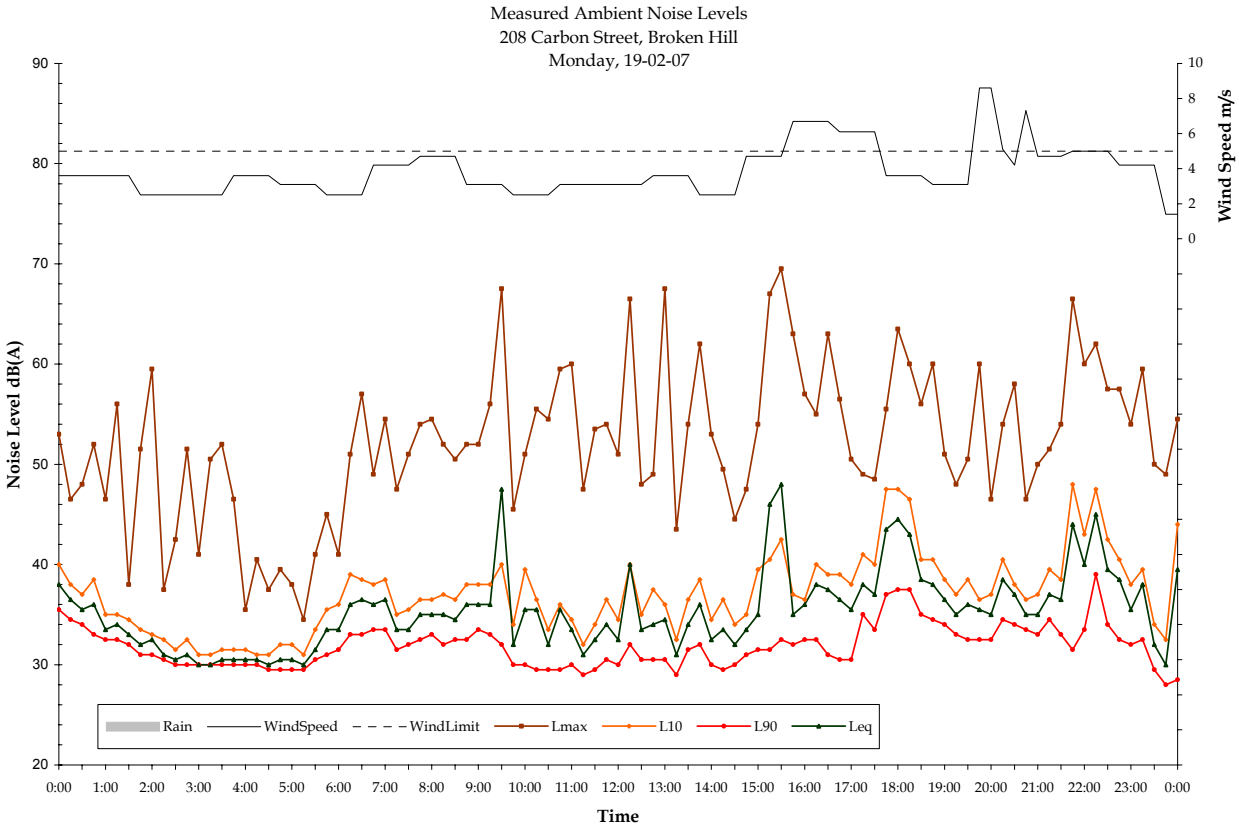

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Wednesday, 14-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

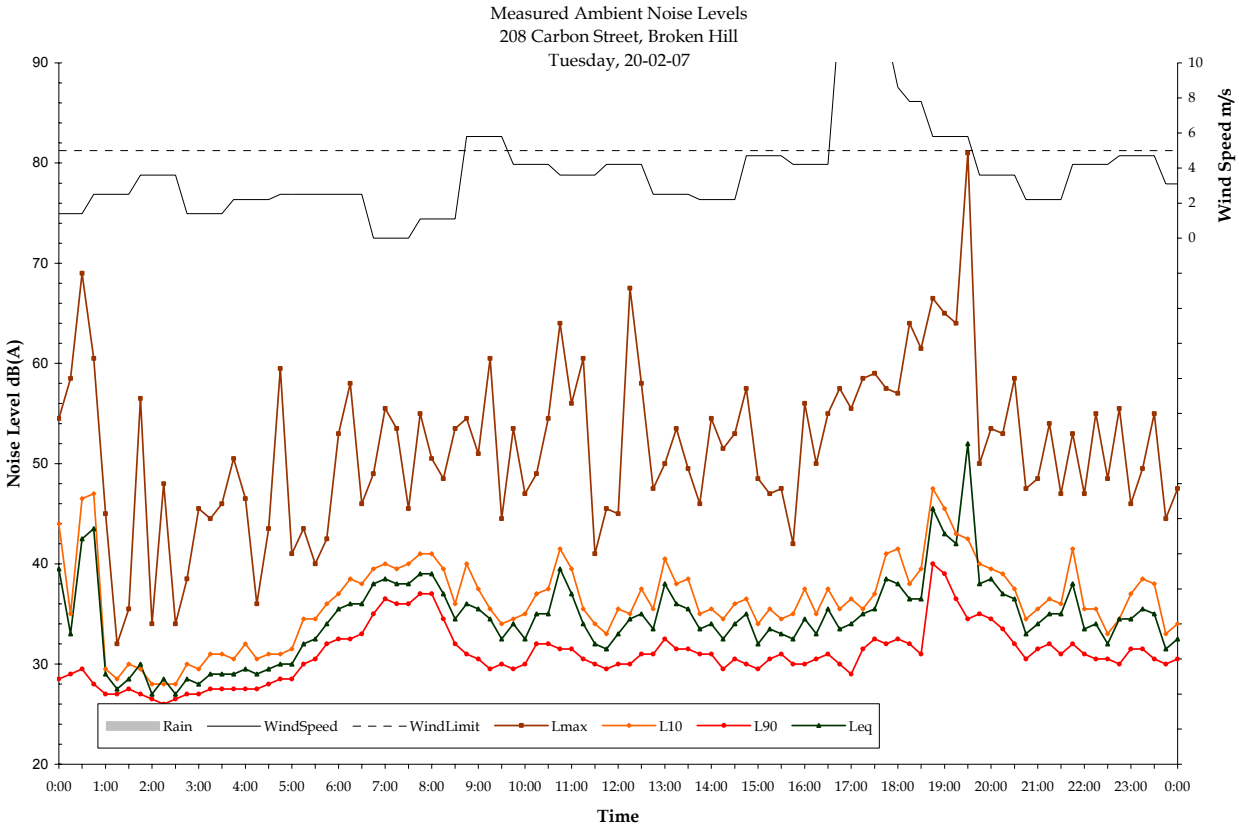

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Thursday, 15-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

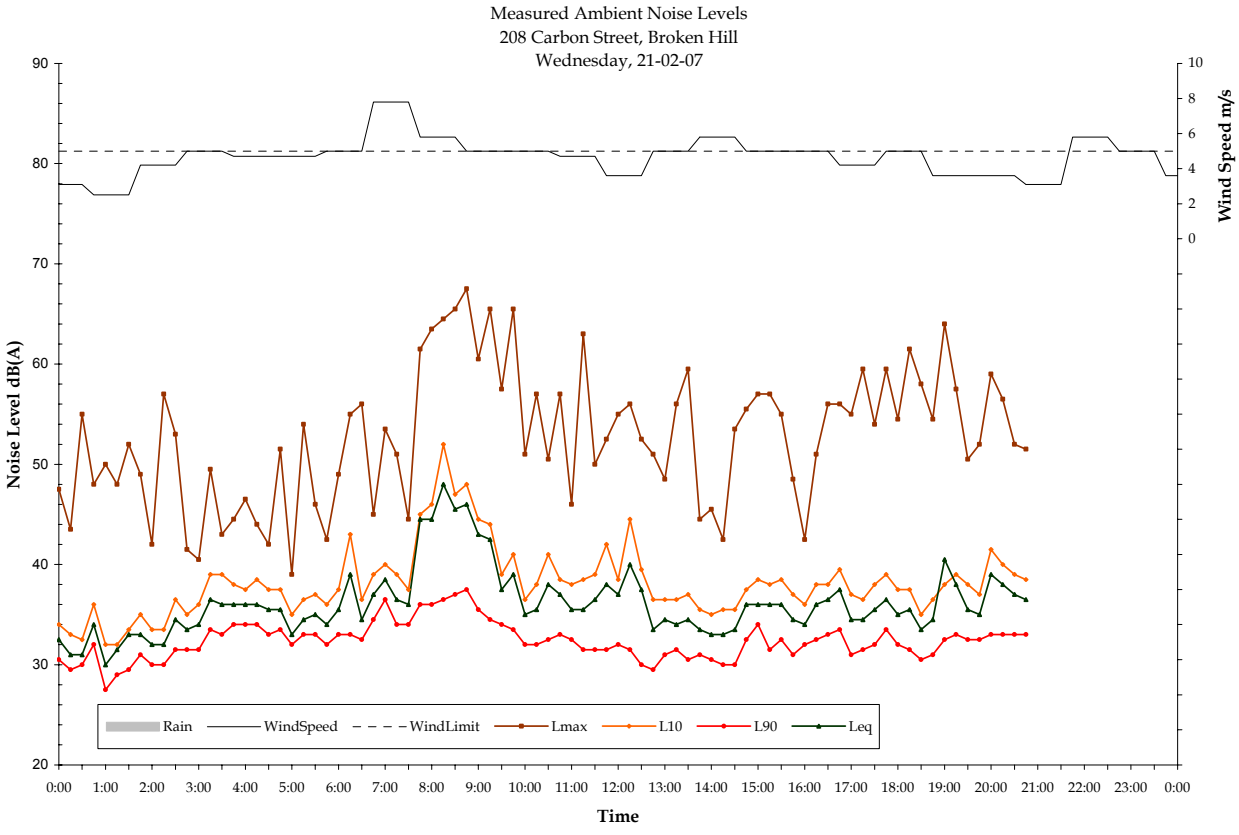

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Friday, 16-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

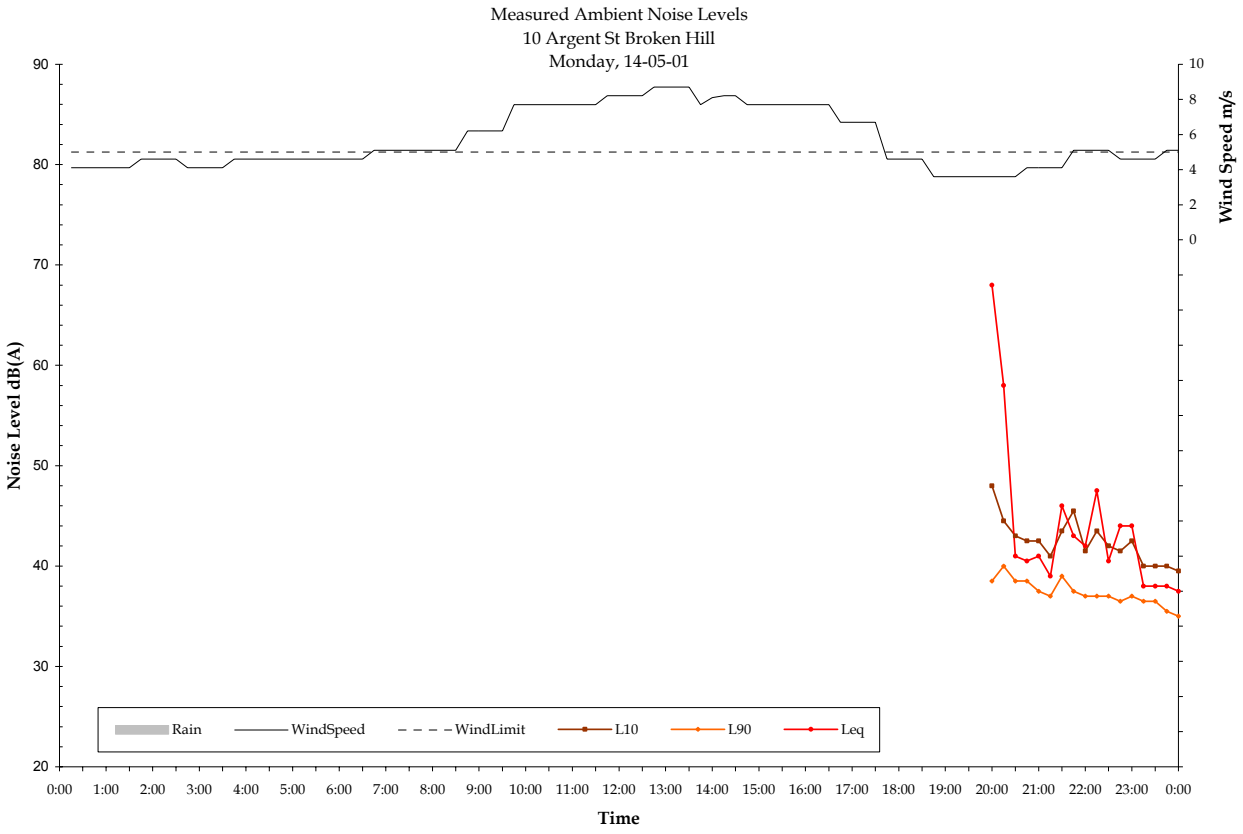

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Saturday, 17-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

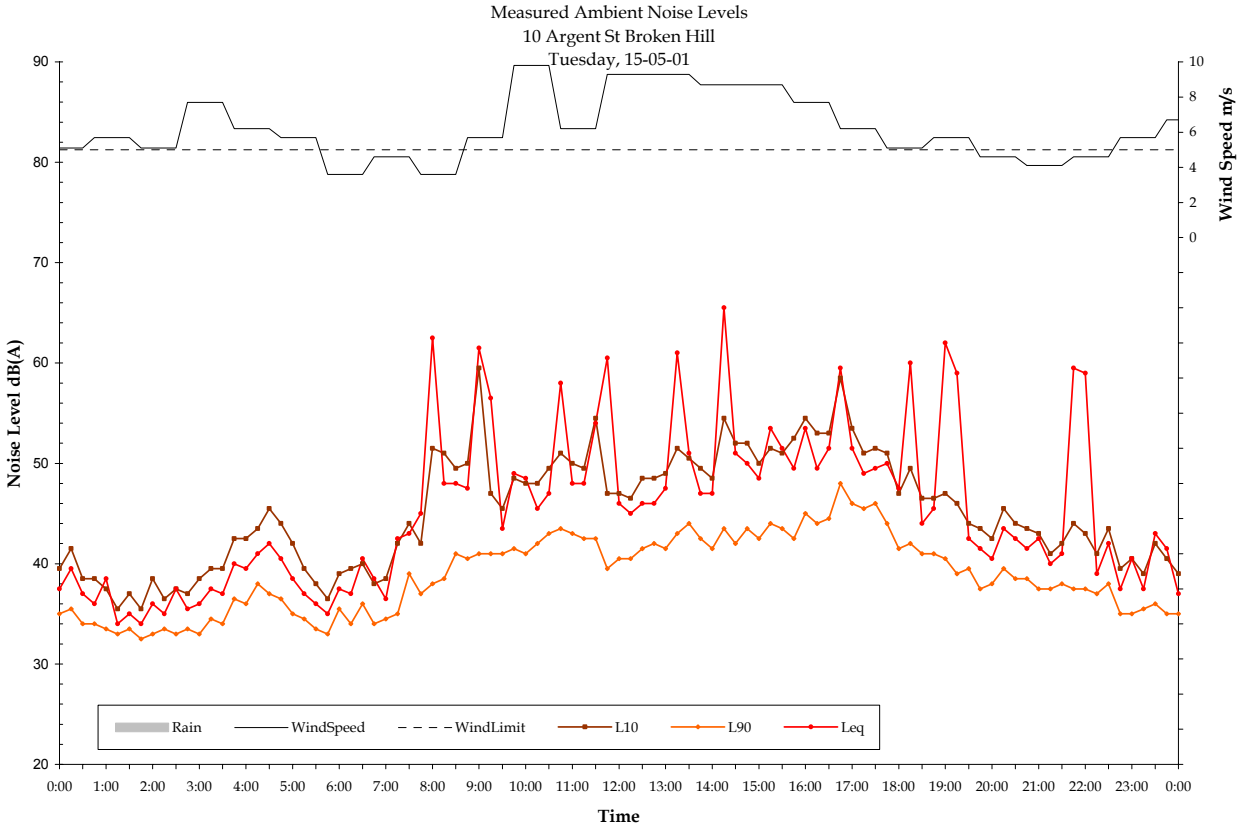

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Sunday, 18-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

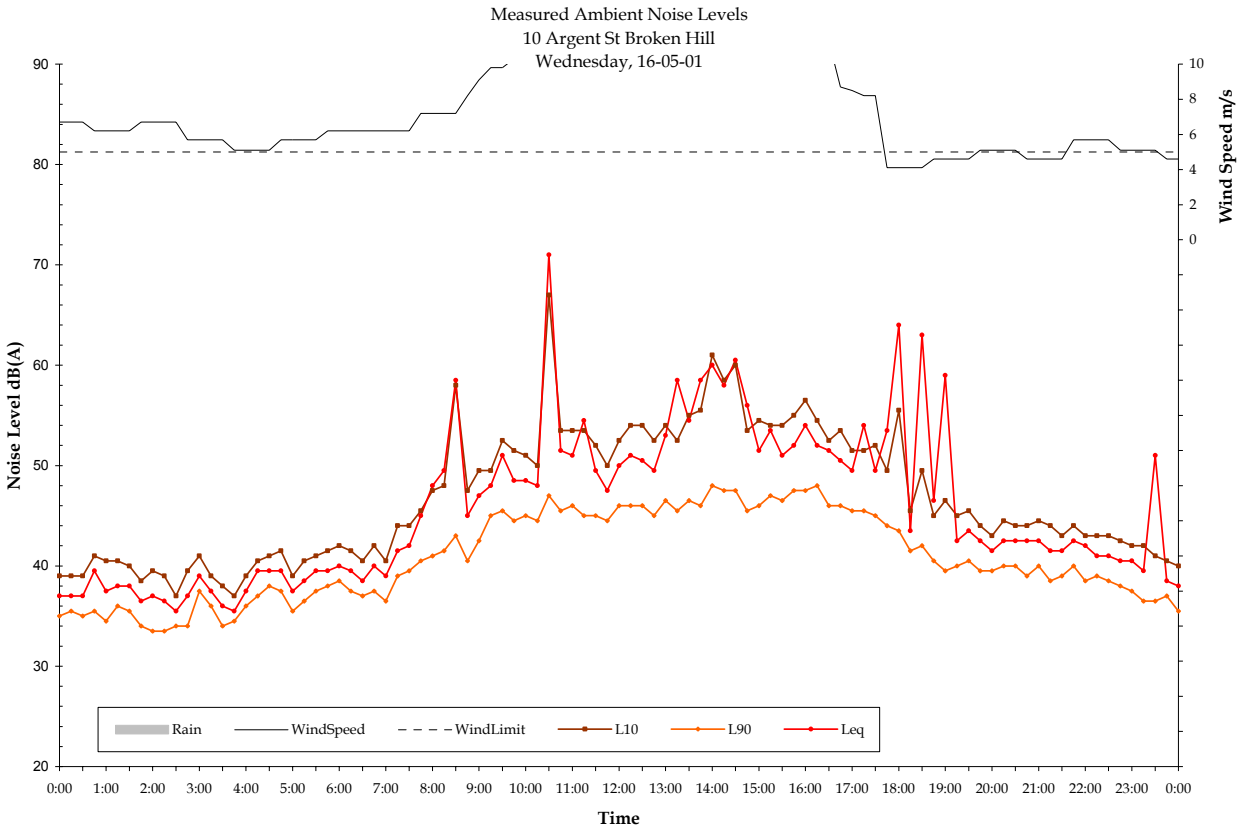

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Monday, 19-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

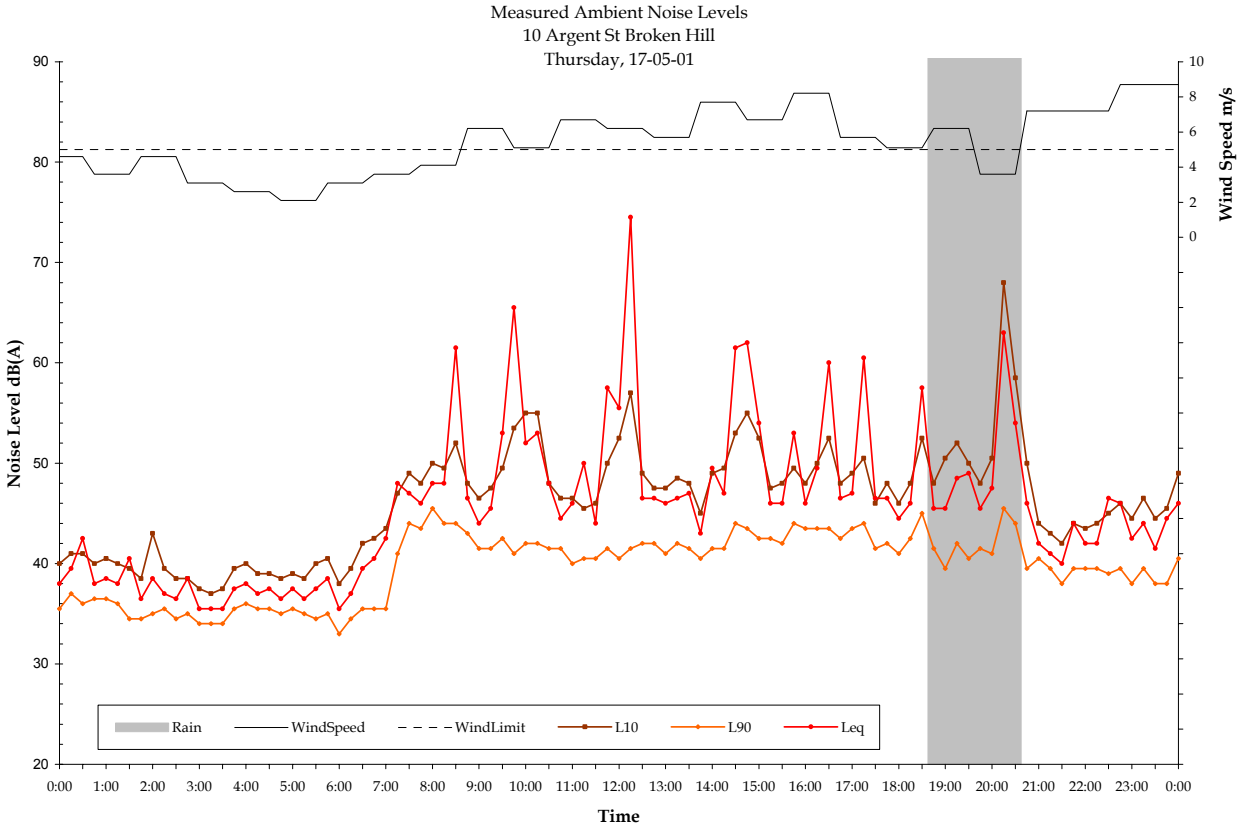

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Tuesday, 20-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

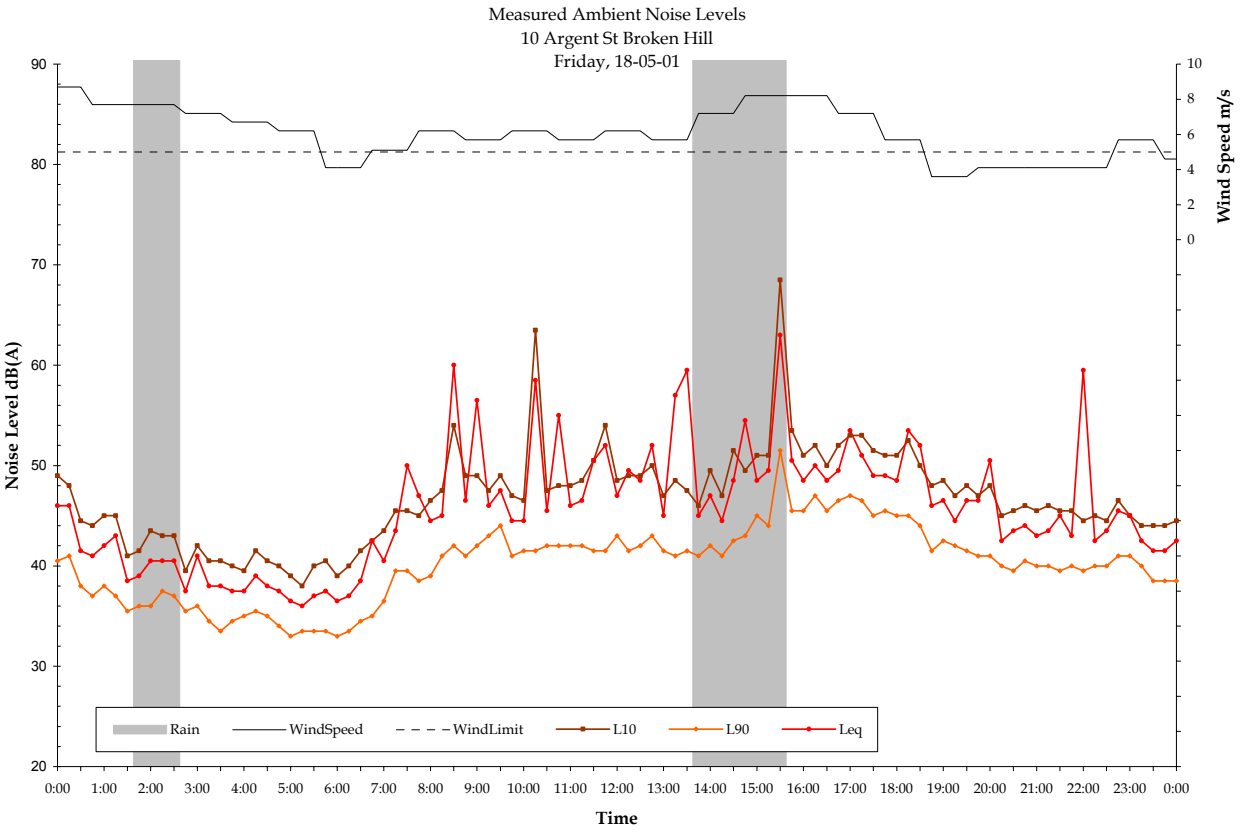

Measured Ambient Noise Levels
208 Carbon Street, Broken Hill
Wednesday, 21-02-07
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
Lmax
L10
L90
Leq

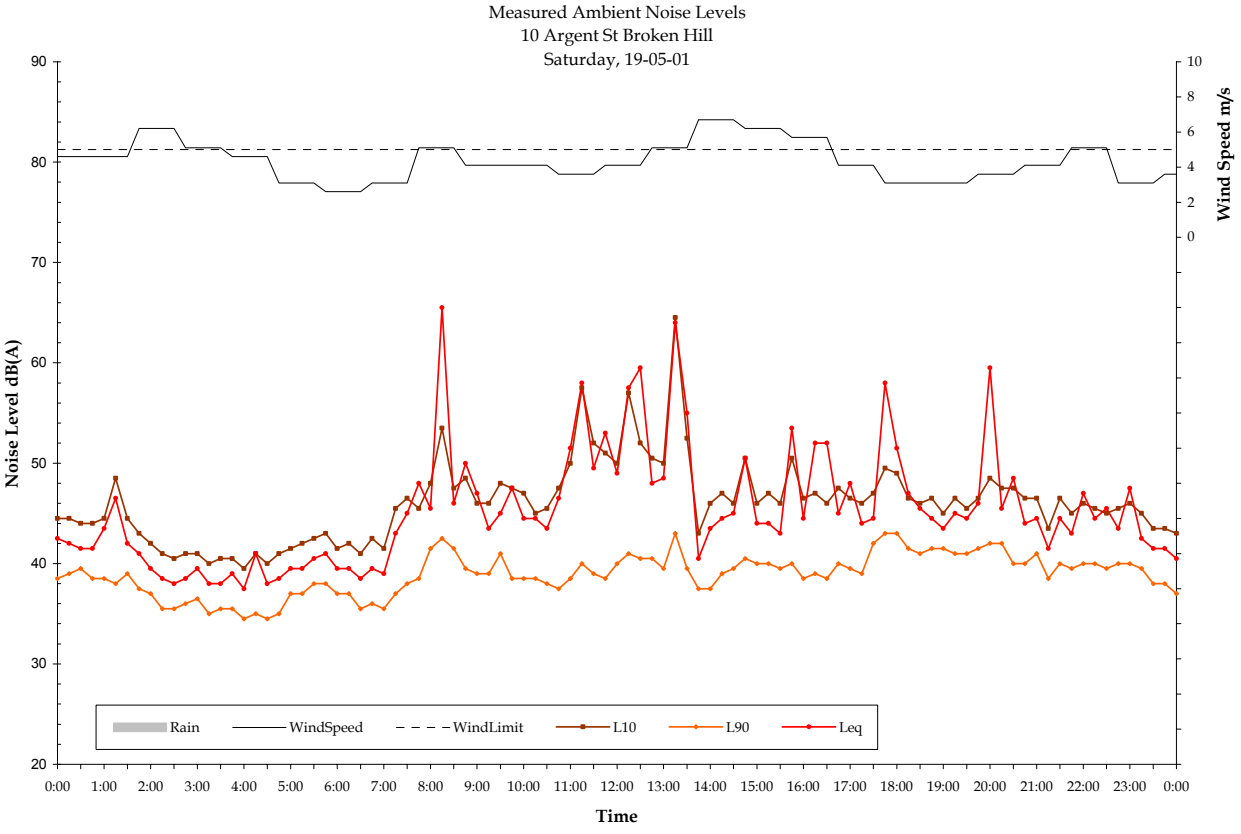

Measured Ambient Noise Levels
10 Argent St Broken Hill
Monday, 14-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

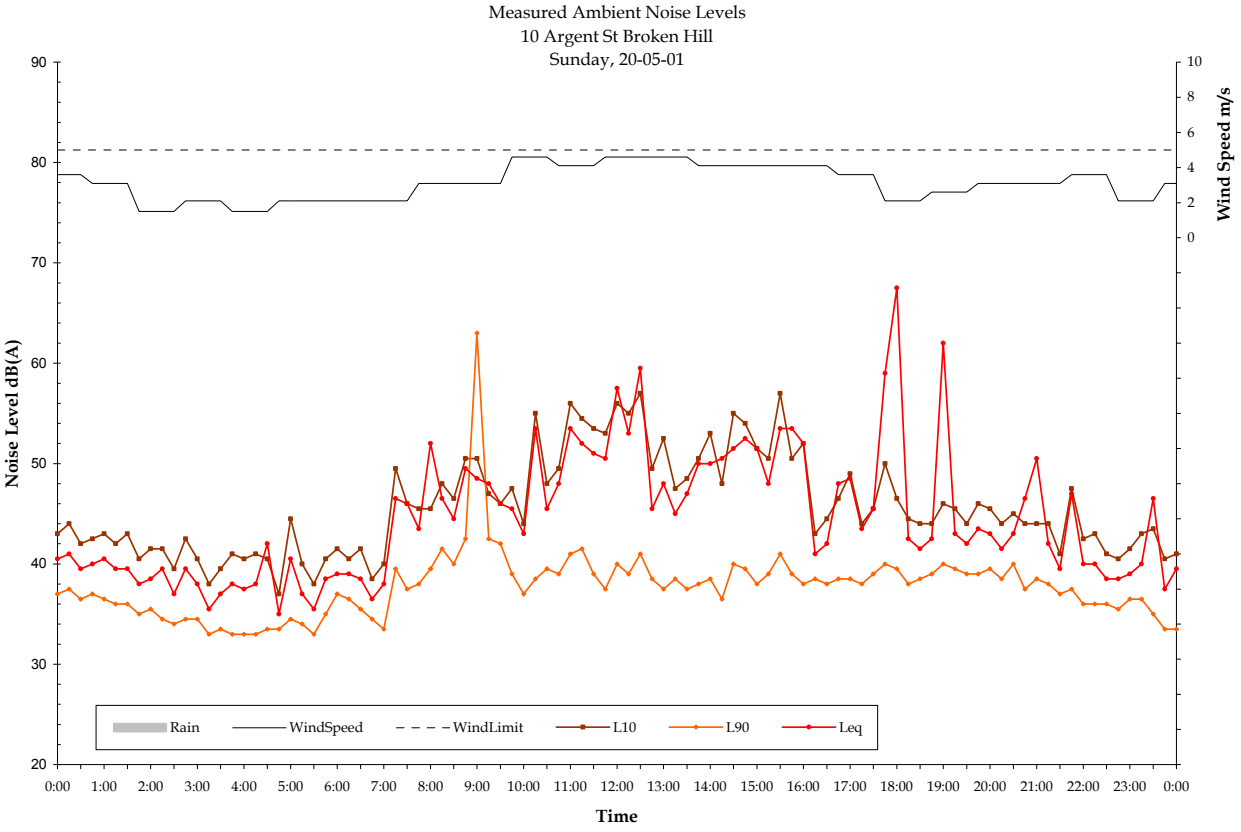

Measured Ambient Noise Levels
10 Argent St Broken Hill
Tuesday, 15-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

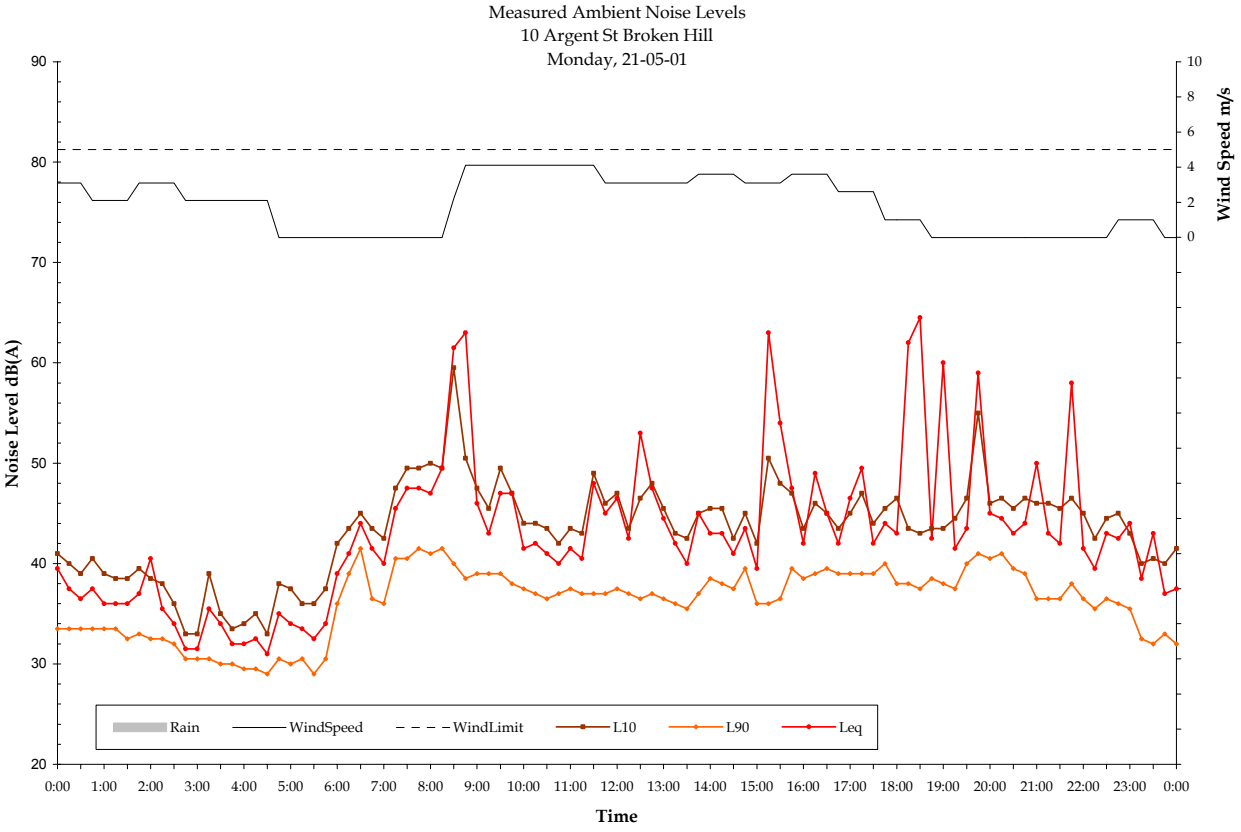

Measured Ambient Noise Levels
10 Argent St Broken Hill
Wednesday, 16-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

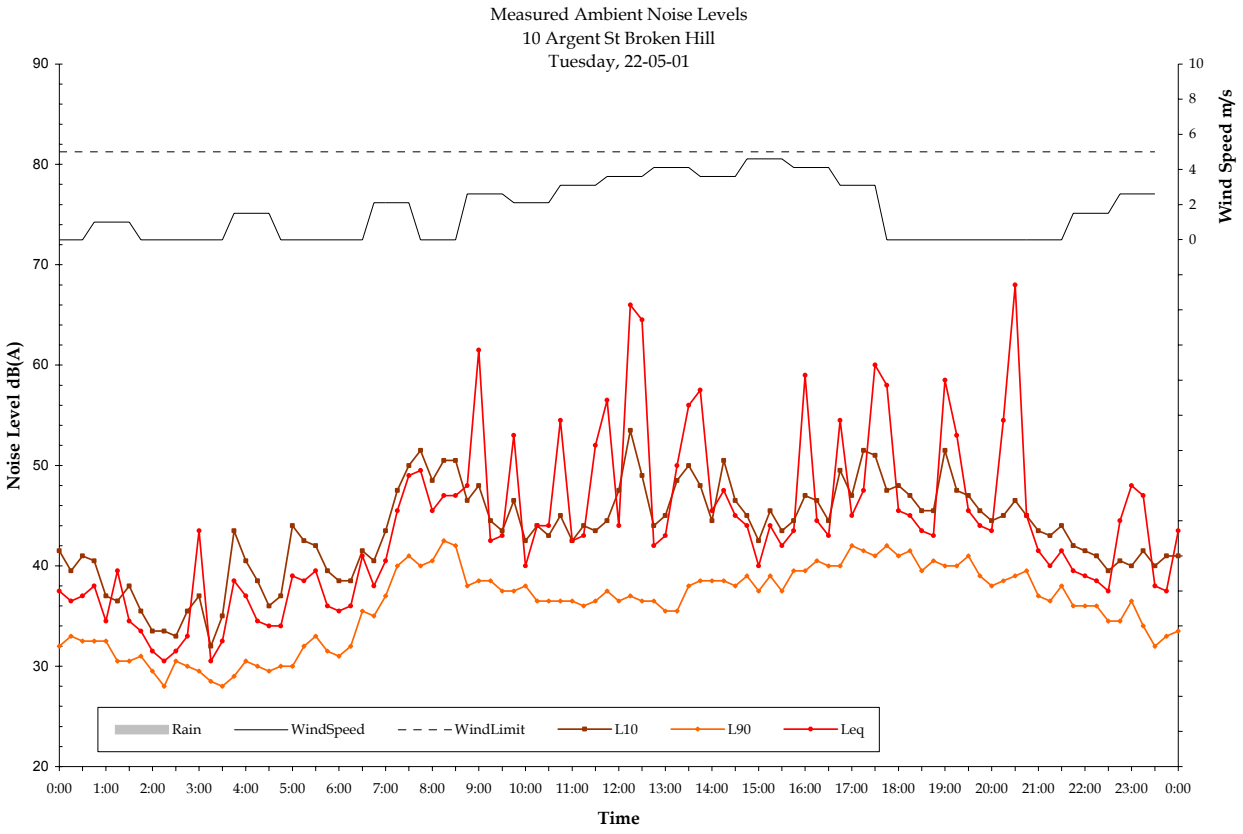

Measured Ambient Noise Levels
10 Argent St Broken Hill
Thursday, 17-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
10 Argent St Broken Hill
Friday, 18-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
10 Argent St Broken Hill
Saturday, 19-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
10 Argent St Broken Hill
Sunday, 20-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

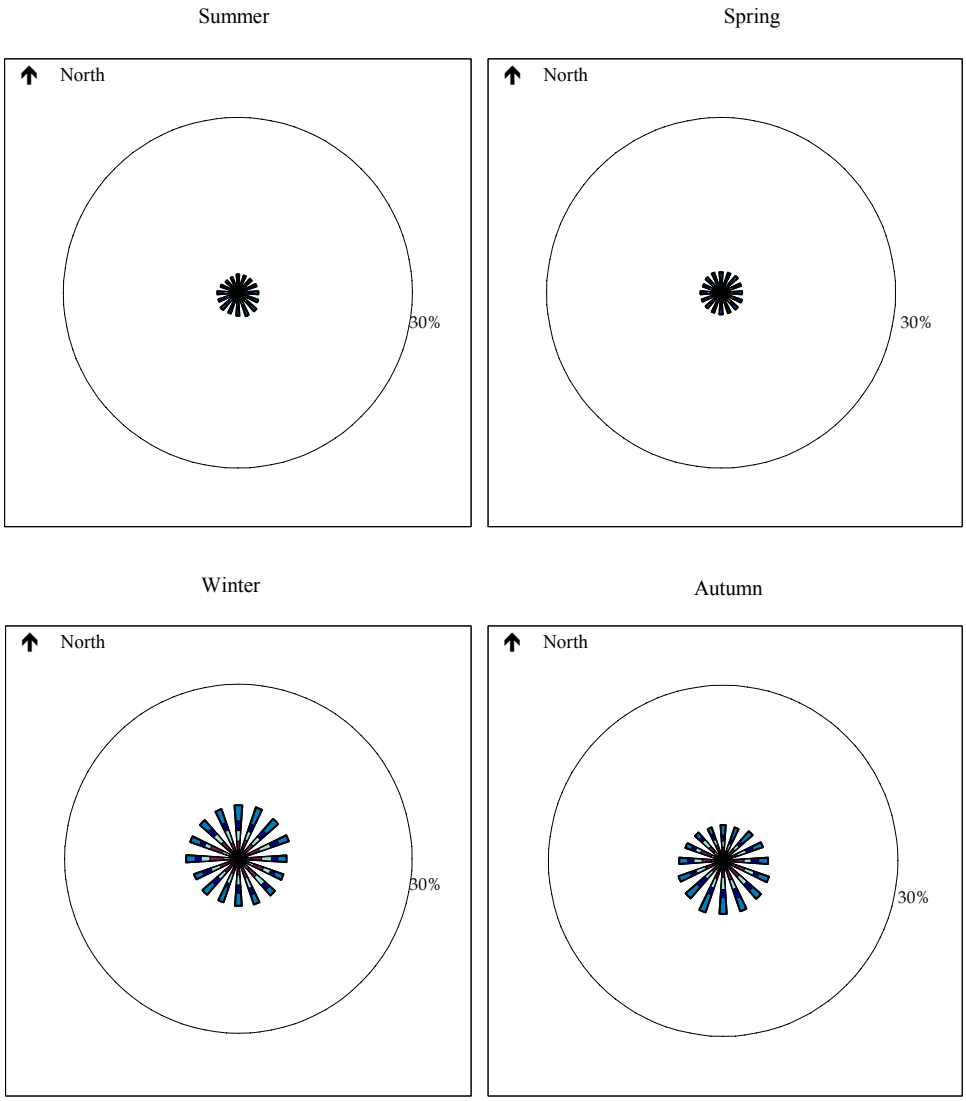

Measured Ambient Noise Levels
10 Argent St Broken Hill
Monday, 21-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

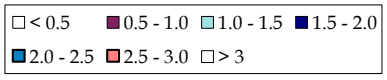

Measured Ambient Noise Levels
10 Argent St Broken Hill
Tuesday, 22-05-01
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
80
70
60
50
40
30
20
10
8
6
4
2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00

Annex B

Vector Wind Roses

Day

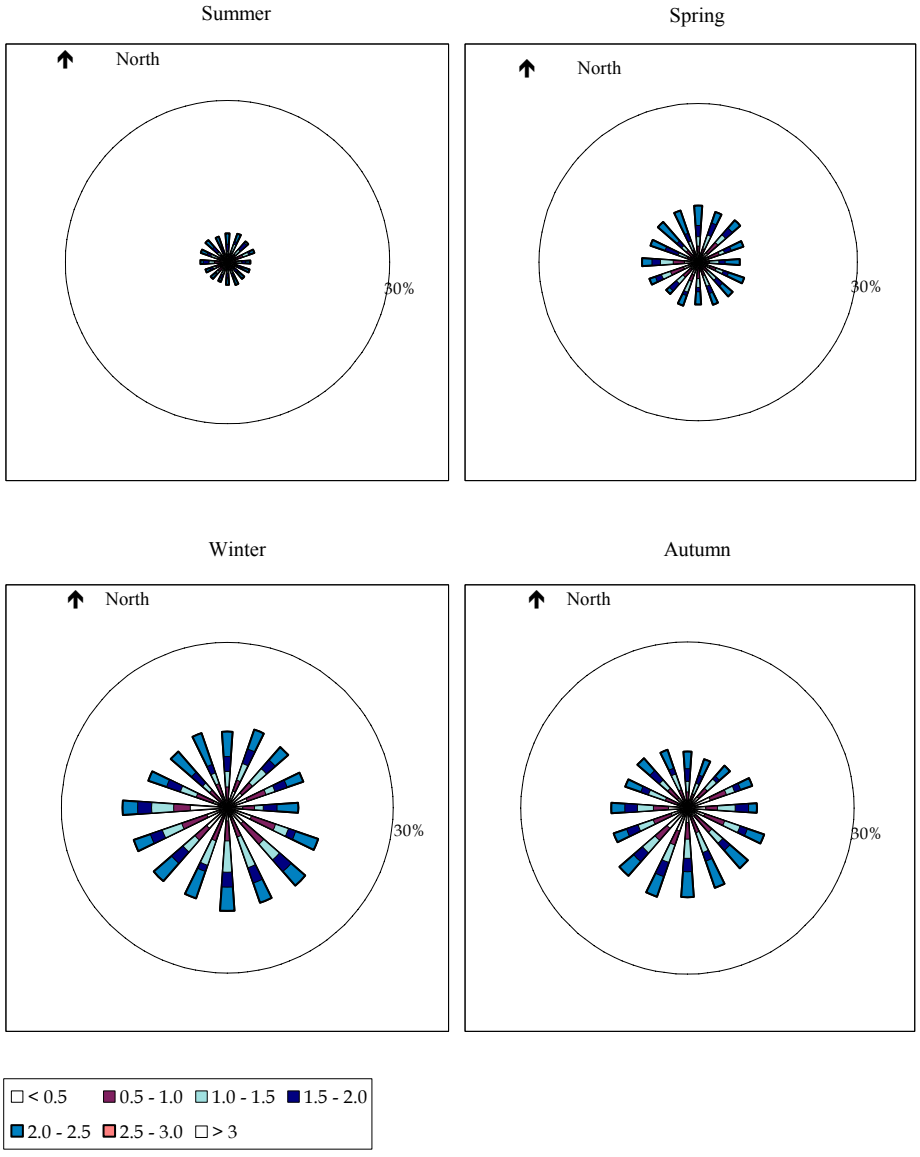




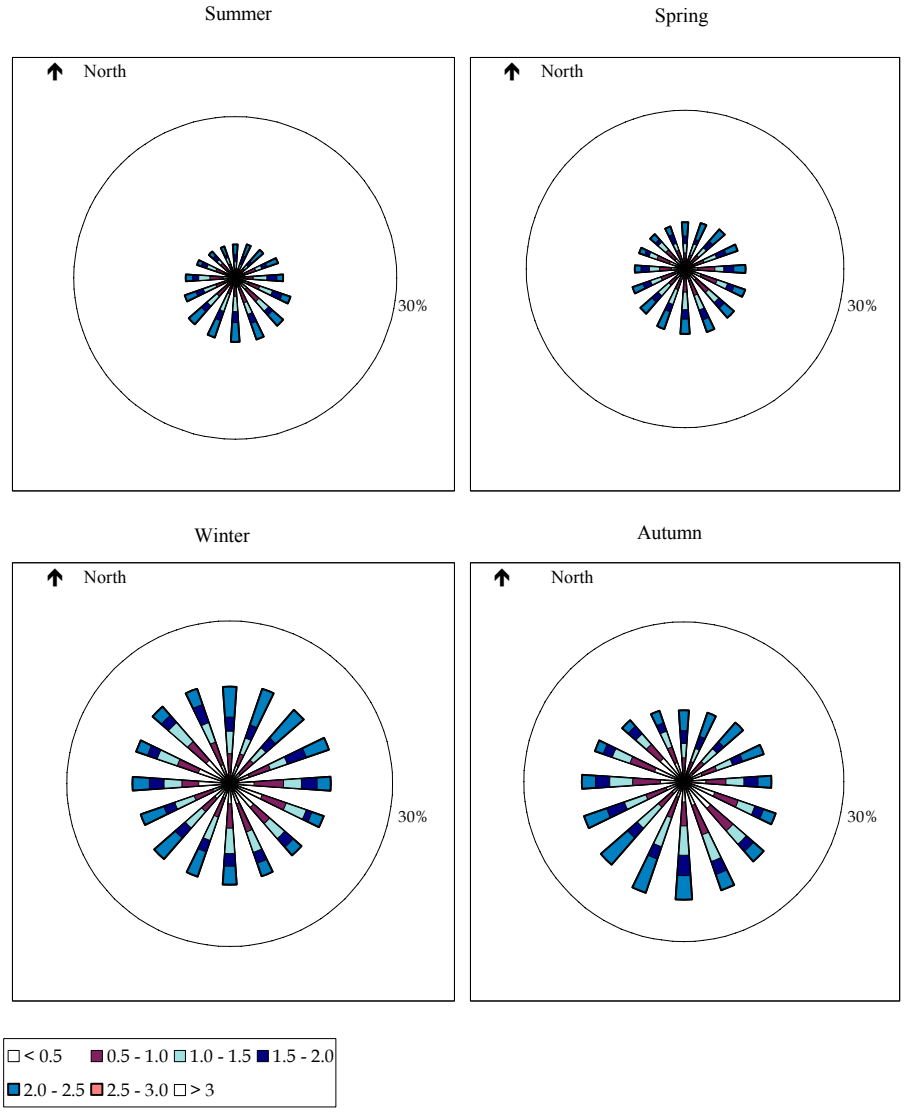
Data Source: Broken Hill Airport
Data Range: Hourly, 01-01-04 to 30-12-06

The segments of each arm represent the six valid wind speed classes, with increasing windspeed from the centre outwards. The length of each arm represents the vector components (for each direction) of wind speeds 3m/s or below as a proportion of the total time for the period .
The circle represents the 30% occurrence threshold.

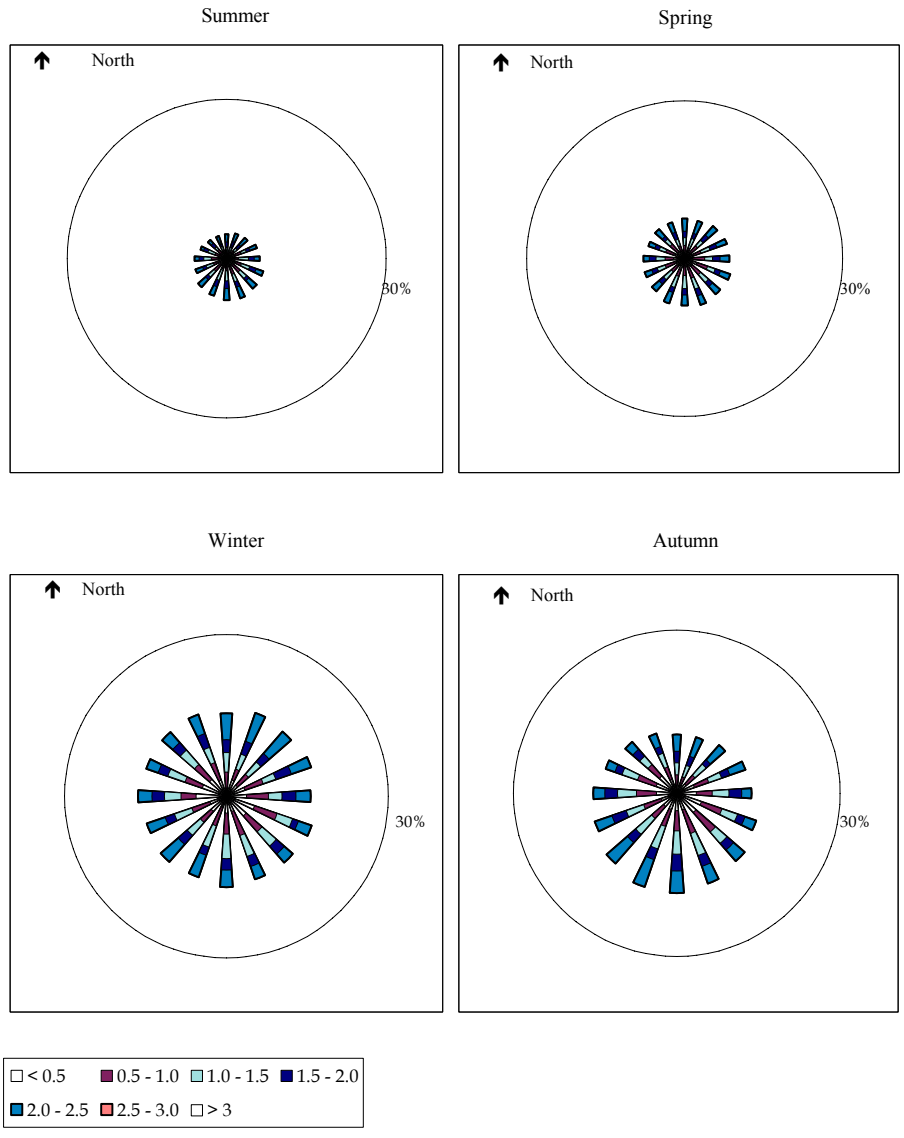
Evening


Summer
North
30%
Spring
North
30%
Winter
North
30%
Autumn
North
30%
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
> 3

Night


Summer
North
30%
Spring
North
30%
Winter
North
30%
Autumn
North
30%
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
> 3

Night - Combined Wind and Inversions



Annex C

Site Plan And Modelled Equipment Positions

Legend

- Stage 1 Equipment Location
- Process Plant
- Rasp Mine/CML 7 Boundary
- Project Area

Figure C.1

Day Modelled Equipment Locations (Open Cut/Construction)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS08	Suffix No:	R2
Date:	02/10/2007	Drawing size:	A4
Drawn by:	DH	Reviewed by:	JK
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

N

0 100 200 300m

ERM

Legend

- Equipment Location
- Process Plant
- Rasp Mine/CML 7 Boundary
- Project Area

Figure C.2

Day Modelled Equipment Locations (Underground)

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS09	Suffix No:	R2
Date:	02/10/2007	Drawing size:	A4
Drawn by:	DH	Reviewed by:	JK
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

N

0 100 200 300m

ERM

Legend

- Equipment Location
- Process Plant
- Rasp Mine/CML 7 Boundary
- Project Area

Figure C.3

Night Modelled Equipment Locations

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS10	Suffix No:	R2
Date:	02/10/2007	Drawing size:	A4
Drawn by:	DH	Reviewed by:	JK
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

N

0 100 200 300m

ERM

Legend

- Rail Spur
- Process Plant
- Rasp Mine/CML 7 Boundary
- Project Area

Figure C.4
Day Rail Spur Modelled Locations

Client:	Broken Hill Operations Pty Ltd		
Project:	Rasp Mine Environmental Assessment		
Drawing No:	0063850s_AC_GIS11	Suffix No:	R2
Date:	02/10/2007	Drawing size:	A4
Drawn by:	DH	Reviewed by:	JK
Source:	Aerial: Dept of Lands NSW		
Scale:	Refer to Scale Bar		

N

0 100 200 300m

ERM

Annex D

Stability Class Derivation From PDS Consultancy

Modified PGT stability class distribution for Broken Hill (NSW)

	Percentage Distribution of Stability Class		
Stability/Year	2006	2005	2004
G	2.0	0.8	0.9
F	11.5	10.8	10.3
E	19.5	18.7	19.9
D	47.3	50.3	48.4
C	13.6	13.4	13.4
B	5.7	5.3	6.4
A	0.5	0.6	0.6

Data Source

1. Broken Hill AWS Data- BoM, NSW (Regional Office).

2. Cobar Cloud data–National Climate Centre- Bureau of Meteorology, Melbourne.

Anemometre Height **:10m**

Table 1: Modified Pasquill stability calsses

Surface Wind Speed m/s at 10m	Daytime incoming solar radiation				Within 1 h before sunset or after sunrise	Night-time cloud amount(Oktas)			
	Strong (>600)	Moderate (300-600)	Slight (<300)	Overcast		0-1	2-3	4-7	8
≤ .5						G	F	F	F
≤ 2	A	A-B	B	C	D	F	F	F	D
≤ 3	A-B	B	C	C	D	F	F	E	D
≤ 5	B	B-C	C	C	D	E	E	D	D
≤ 6	C	C-D	D	D	D	D	D	D	D
> 6	C	D	D	D	D	D	D	D	D

Additional Notes

The PDS consultancy method for determining the percentage occurrence of stability class is in accordance with the methodology recommended by the EPA, Victoria (AQS, CES).

As detailed above, Broken Hill meteorological data and Cobar cloud data were used in the calculation. This approach is justified given:

- use of off-site cloud observations is widely acceptable in understanding the practical difficulty of obtaining on-site cloud data;
- stability class is less sensitive to the amount of cloud and mainly dependant on wind speed. Therefore on-site wind speed is strongly recommended as has been used for the calculations for this Project; and
- 'G' stability occurs with light wind conditions, practically no cloud and during the night time.