APPENDIX 16

Noise and Blasting Impact Assessment

HEGGIES

REPORT 30-1810-R1

Revision 0

Environmental Noise and Blasting Impact Assessment Austar Coal Mine

PREPARED FOR

Austar Coal Mine Pty Ltd
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17 SEPTEMBER 2008

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Environmental Noise and Blasting
Impact Assessment
Austar Coal Mine

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EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned by Austar Coal Mine Pty Ltd (Austar) to conduct an environmental noise and blasting assessment for construction and operation of the proposed underground coal mine to be located off Quorrobolong Road; approximately 2km south of Kitchener in the Hunter Valley, NSW.

Operational Noise Predictions

A computer model was used to predict noise emissions from the proposed Austar Surface Infrastructure Site (SIS). The Environmental Noise Model (ENM) used, has been produced in conjunction with the Department of Environment and Climate Change (DECC). Noise levels were predicted for the general operational scenarios contained within **Table 17** with the inclusion of the noise modelling assumptions detailed in **Section 7.1**.

Operational noise predictions from the proposed SIS are predicted to meet the project specific noise criteria, set in accordance with the NSW Industrial Noise Policy (INP), at all receiver locations under calm and prevailing weather conditions.

Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the proposed Austar SIS are likely to be less than those predicted.

Construction Noise Predictions

An assessment of noise impacts has been conducted for the construction of the SIS. Noise modelling predictions found that earthworks and construction noise emission will comply with the relevant criteria set within the Environmental Control Manual (ENCM) for the duration of the construction period.

Cumulative Impact Assessment

The cumulative impact of the proposed development with existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially noise sensitive areas.

Sleep Disturbance Assessment

The predicted L_{Amax} noise levels from the proposed Austar SIS will meet the sleep disturbance criteria at all locations surrounding the development.

Traffic Noise Assessment

A traffic noise assessment was conducted in accordance with the DECC Environmental Criteria for Road Traffic Noise (ECRTN) for traffic generated by the development. The assessment found that overall traffic noise levels with the inclusion of Quorrobolong Austar SIS generated traffic is within the constraints set within the ECRTN.

Blasting Assessment

The blast prediction results presented in **Section 9** demonstrate that predicted airblast and ground vibration levels will meet the DECC guidelines for blasting at all residences surrounding the development during the construction of mine shafts at the SIS.

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1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been commissioned by Austar Coal Mine Pty Ltd (Austar) to conduct an environmental noise and blasting assessment for construction and operation of the proposed underground coal mine to be located off Quorrobolong Road; approximately 2km south of Kitchener in the Hunter Valley, NSW.

The main objective of the noise assessment was to determine potential noise impacts from the proposed development and associated traffic movements on nearby residential locations.

The noise assessment has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the Department of Environment and Climate Change (DECC) NSW Industrial Noise Policy (INP) and associated Application Notes. Reference has also been made to the NSW Environmental Criteria for Road Traffic Noise (ECRTN). Where issues relating to noise are not addressed in the INP, such as sleep disturbance and construction noise goals, reference has been made to the NSW Environmental Noise Control Manual (ENCM).

2 PROJECT DESCRIPTION

2.1 Austar Coal Mine

Stage 3 of the Austar Coal Mine operation will involve long wall coal mining by the Longwall Top Coal Caving (LTCC) method and the construction and operation of the new Surface Infrastructure Site (SIS) to be located south-west of Kitchener, NSW. The use of existing coal conveyance, washing, handling, stockpiling and rail loading facilities at the Ellalong drift and pit top and the Pelton coal handling and preparation plant will continue in accordance with existing approvals held by Austar and therefore no further assessment of noise will be required. The use of Austar rail line will also continue in a manner consistent with the existing approvals and therefore an assessment of the rail line has not been undertaken as part of this report.

Initial construction activity at the Austar Stage 3 SIS will involve earthworks and site preparation. Acoustically significant plant and equipment to be utilised during the SIS earthworks and site preparation will consist of the following:

- Grader
- Excavator
- Roller
- Dozer (2 of)
- Articulated dump trucks (as required)

Construction of the mine shafts will generally involve drilling, blasting and removal of cuttings by winch and kibble. Mine shaft cuttings will ultimately be placed onsite to form the proposed acoustic bunding. Construction of administration, maintenance and ancillary buildings will also be completed. Acoustically significant plant and equipment to be utilised during the SIS construction works will consist of the following:

- Blasting drill rig
- Hydraulic winch and kibble
- Concrete boom pump
- Transit mixer
- Semi-trailer delivery trucks
- Crane (2 of)
- Hand-tools (eg. grinder)

Acoustically significant plant and equipment relevant to the proposed site operation will consist of the following:

- Ventilation fan and associated plant;
- Compressor plant;
- Nitrogen inertisation plant;
- Water storage pumps (3 of);
- Man and materials winder;
- Second egress winder;
- Employee cars;
- Light delivery and work trucks;
- Workshop activities (eg. grinder, impact noise); and
- Air-conditioning roof-top plant.

2.2 Acoustically Significant Plant and Equipment

2.2.1 Construction Plant and Equipment

The sound power levels of the major noise generating plant and equipment to be used in the construction of the SIS are given in **Table 1**. Further details of sound power levels used in the noise model are provided in **Appendix B**.

Table 1 Acoustically Significant Equipment Sound Power Levels (SWL)

Equipment	Sound Power Level (L_{A10}, dBA)
Earthworks	
Grader	111
Excavator	106
Dozer	110
Roller	110
Articulated dump trucks	102
Construction	
Blasting drill rig	110
Hydraulic winch	105
Genset	107
Transit mixer	111
Concrete boom pump	107
Delivery Truck	102
Crane	104
Hand tools (grinder)	104

2.2.2 Acoustically Significant Operational Plant and Equipment

Details of acoustically significant plant and equipment relevant to the operation of the SIS are displayed in **Table 2.** Further details of sound power levels used in the noise model are provided in **Appendix B**.

Table 2 Acoustically Significant Plant & Equipment Sound Power Levels (SWL)

Equipment	Sound Power Levels (L_{Aeq}, dBA)
Ventilation fan	108
Ventilation plant	98
Compressor plant	90
Nitrogen inertisation plant	101
Water storage pumps	97
Winders (electric motor & gearbox noise)	105
Light weight trucks	101
Employee vehicles – drive off	74
Workshop noise (Grinder)	96
Air-conditioning roof-top plant	93

2.3 Hours of Operation

Operation of the SIS will occur 24 hours/day 7 days/week.

2.4 Traffic

Employee light vehicles will contribute to most of the traffic generated by the development, with peak traffic flows generally occurring at shift start and finish times. It is also anticipated that approximately 10 heavy vehicle movements will occur throughout each day. **Table 3** shows the proposed employee shift times and the expected maximum traffic numbers generated during these times.

Table 3 Austar SIS Traffic Generation

Shift	Time	Projected Vehicle Movements Before & After Shift
Night Crew	11:30 pm to 8:00 am	43
Day Crew	6:30 am to 3:00 pm	43
General Day Staff	7:00 am to 4:00 pm	20
Other Staff	7:00 am to 4:00 pm	58

Employee vehicles will travel to site using Quorrobolong Road. This will have most significant noise impact on residential receivers to the north of the site located in Kitchener, along Cessnock Street, which eventually forms Quorrobolong Road.

3 SITE DETAILS

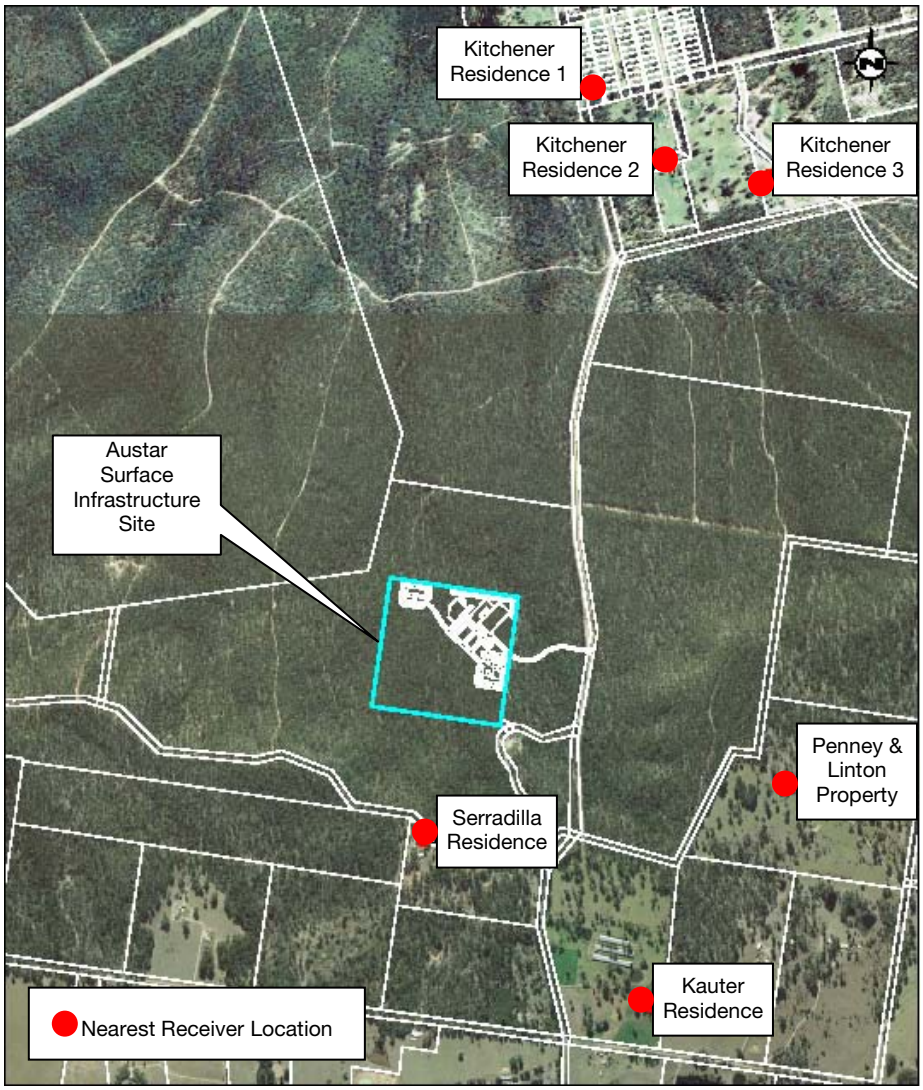
The new SIS will be located approximately 1.5 km south-west from Kitchener, near Cessnock, NSW. The site will include upcast and downcast ventilation shafts, bath house, workshop, electrical sub station, store, service boreholes and offices on 16 hectares of Austar owned land and bordered by former State Forrest and Werakata State Conservation Area.

The proposed site is bounded in all directions by rural landscapes with dense bushland vegetation, with Quorrobolong Road to the east to form the main access route to the site.

The nearest potentially affected receivers are residents located in Quorrobolong to the south and south-west, and Kitchener to north-east. All nearby potentially affected receivers are considered rural as prescribed in the NSW INP, that is, the ambient noise environment is dominated by natural noise sources with minimal traffic flow and no existing industrial noise contribution.

Figure 1 shows the proposed location of the SIS in relation to the nearest potentially effected receivers.

Figure 1 Site Location Map



4 IMPACT ASSESSMENT PROCEDURES

4.1 INP General Objectives

Responsibility for the control of noise emission in New South Wales is vested in Local Government and the Department of the Environment and Climate Change (DECC). The Industrial Noise Policy (INP) was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the DECC to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

4.2 Project Specific Noise Criteria

The INP defines two separate noise criteria; one to account for intrusive noise and the other to protect the amenity of particular land uses. The project specific noise criteria then become the most stringent of either the amenity or intrusive criteria.

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}).

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion.

An extract from the INP that relates to the amenity criteria is given in **Table 4** and **Table 5**.

Table 4 Amenity Criteria – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal	All	Noisiest 1 hour period	35	40
- external			50	55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Daytime 7.00 am – 6.00 pm; Evening 6.00 pm – 10.00 pm; Night-time 10.00 pm – 7.00 am
On Sundays/Public Holidays, Daytime 8.00 am – 6.00 pm; Evening 6.00 pm – 10.00 pm; Night-time 10.00 pm – 8.00 am.
The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 5 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 4**

Application Notes to the INP were updated and released in July 2006. The purpose of these notes is to '*assist industry and acoustical consultants develop noise impact assessments and apply the provisions of the NSW Industrial Noise Policy, with the aim of reducing processing time.*' These Application Notes have also been referenced in the determination of project-specific noise criteria for this project.

4.3 Assessing Sleep Disturbance

The DECC has acknowledged that the relationship between maximum noise levels and sleep disturbance is not currently well defined. Criteria for assessing sleep disturbance has not been identified under the INP and hence, sleep arousal has been assessed using the guidelines set out in the ENCM Chapter 19-3 and the guidance provided in the Environmental Criteria for Road Traffic Noise (ECRTN).

To avoid the likelihood of sleep disturbance the ENCM recommends that the $L_{A1(1minute)}$ noise level of the source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am).

4.4 Road Traffic Noise

The Environment Protection Authority released the "*Environmental Criteria for Road Traffic Noise*" in May 1999. The policy sets out noise criteria applicable to different road classifications for the purpose of defining traffic noise impacts.

4.5 Construction Noise

The construction noise goals are based upon the ENCM, Chapter 171, which sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts. This document presents a staged approach, where different levels of noise can be tolerated for different periods of time, generally with higher noise levels corresponding to a shorter time period. Based upon this document the construction noise design goals outlined in **Table 6** would normally apply to a construction project.

Table 6 Construction Site Noise Goals

Total Construction Period	Acceptable LA_{10} Noise Level[1]
4 weeks and under	Background LA_{90} plus 20 dBA
4 weeks to 26 weeks	Background LA_{90} plus 10 dBA
Greater Than 26 Weeks	Background LA_{90} plus 5 dBA

1. Applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No audible construction work is to take place on Sundays or Public Holidays.

Such noise level goals allow for a short period of intense, noisy activity typically required by most construction sites, while still catering for long term amenity of the adjoining residences by reducing the noise limit for activities occurring over a longer duration.

5 EXISTING ACOUSTICAL AND METEOROLOGICAL ENVIRONMENT

5.1 General Methodology

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, "Sound Level Meters" and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

5.2 Unattended Continuous Noise Monitoring

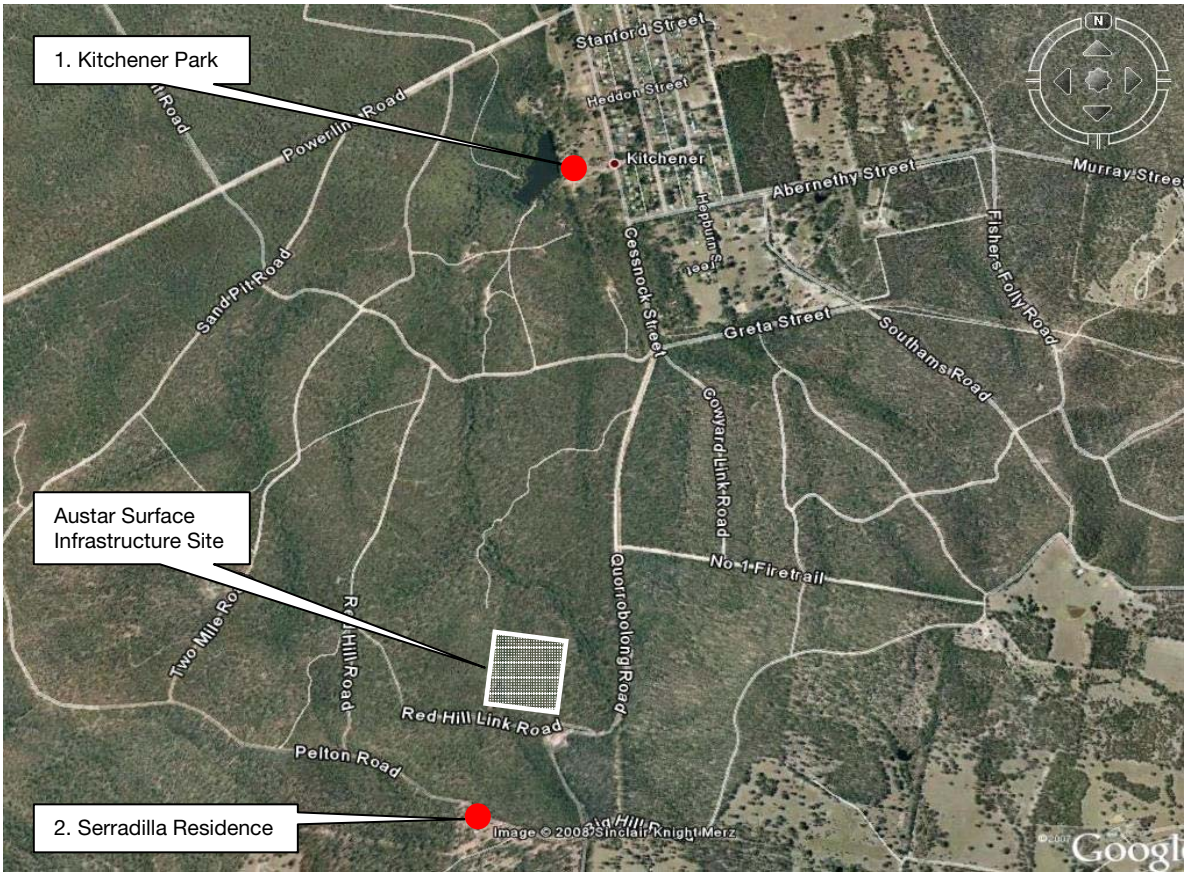
Background noise levels were monitored by Heggies. The objective of the background noise survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the proposed development.

Background noise levels were monitored at two separate locations, considered to be representative of the nearest potentially affected receivers, from Wednesday 19 September 2007 to Wednesday 26 September 2007, inclusive. Details of monitoring locations and equipment are provided in **Table 7**. Monitoring locations are shown graphically in **Figure 2**.

Table 7 Noise Monitoring Details

Location	Address/Description	Equipment
1	Kitchener Park	ARL Type 215 (S/N 194592)
2	Serradilla Residence	ARL Type 316 (S/N 16-203-526)

Figure 2 Noise Logging Locations



The noise loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and reflections from adjacent buildings.

Weather data for the survey period was obtained from Cessnock approximately 5 km from the noise monitoring locations. Noise data corresponding to periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) were discarded in accordance with INP data exclusion methodology. A summary of the results of the background surveys is given in **Table 8**. Results are displayed graphically in **Appendix A1 and A2**.

Table 8 Summary of Existing Ambient Noise Levels

Location	Period	Background L_{A90} Noise Level	Measured $L_{Aeq(Period)}$	Estimated Existing Industrial Contribution L_{Aeq}
1 Kitchener Park	Day	33 dBA	48 dBA	< 44 dBA
	Evening	< 30 dBA	37 dBA	< 39 dBA
	Night	< 30 dBA	43 dBA	< 34 dBA
2 Serradilla Residence	Day	< 30 dBA	45 dBA	< 44 dBA
	Evening	32 dBA	40 dBA	< 39 dBA
	Night	< 30 dBA	45 dBA	< 34 dBA

Note: Daytime 7.00 am – 6.00 pm; Evening 6.00 pm – 10.00 pm; Night-time 10.00 pm – 7.00 am
On Sundays/Public Holidays, Daytime 8.00 am – 6.00 pm; Evening 6.00 pm – 10.00 pm; Night-time 10.00 pm – 8.00 am
The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level.
L_{Aeq} – The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

5.3 Operator Attended Noise Monitoring

Operator attended noise measurements were conducted during the daytime period at each noise logger location. Each measurement was conducted over a 15 minute period using a Bruel & Kjaer 2250 one third octave band integrating sound level meter (S/N 2473295). The results of the operator attended noise measurements are given in **Table 9**. Ambient noise levels given in the table include all noise sources such as road and rail traffic, insects, birds, as well as any other industrial operations.

Table 9 Operator Attended Noise Survey Results

Location	Date/ Start time/ Weather	Primary Noise Descriptor (dBA re 20 μPa)					Description of Noise Emission, Typical Maximum Levels L_{amax} (dBA) and Estimated Existing L_{Aeq} Contribution
		L_{amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
1 Kitchener Park	27/09/2007 1150 Day Calm Temp=24°C	55	47	43	33	40	Birds/insects dominant 40-47 Car pass-by ~ 46 People in park < 33 No mine contribution
2 Serradilla Residence	27/09/2007 1130 Day Calm Temp=24°C	61	56	49	36	46	Birds/insects 40-45 Distant traffic/near traffic < 36 Aircraft noise 54-58 Distant pump or compressor noise ~33

Results of the operator attended noise surveys indicate that the acoustical environment is dominated by natural sounds (birds/insects) with little or no contribution from traffic and existing industrial operations.

5.4 Effects of Meteorology on Noise Levels

5.4.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration. Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

Weather data was obtained, for a period of 12 months, from a Cessnock weather station. This data was analysed to determine the frequency of occurrence of winds up to speeds of 3 m/s for daytime, evening and night in each season. A summary of the most frequently occurring winds is contained within **Table 10**, **Table 11** and **Table 12**. The percentage occurrence figures provided in **bold** text exceed the 30% threshold.

Table 10 Seasonal Frequency of Occurrence of Wind Speed Intervals – Daytime

Period	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Summer	0.7%	ENE±45°	2.3%	6.1%	8.4%
Autumn	6.7%	NNE±45°	6.1%	7.8%	14.0%
Winter	5.4%	NNW±45°	3.2%	11.1%	14.3%
Spring	2.0%	NNE±45°	2.8%	5.0%	7.8%

Table 11 Seasonal Frequency of Occurrence of Wind Speed Intervals – Evening

Period	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Summer	0.6%	SSE±45°	2.4%	15.5%	17.9%
Autumn	11.8%	SSW±45°	15.6%	23.6%	**39.1%**
Winter	14.1%	SSW±45°	9.3%	14.2%	23.5%
Spring	6.0%	S±45°	9.1%	24.4%	**33.4%**

Table 12 Seasonal Frequency of Occurrence of Wind Speed Intervals – Night

Period	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Summer	15.8%	S±45°	10.5%	27.8%	**38.3%**
Autumn	43.4%	SSW±45°	12.5%	11.8%	24.3%
Winter	24.4%	NNW±45°	3.2%	9.4%	12.6%
Spring	36.0%	SSW±45°	11.6%	16.1%	27.7%

Seasonal wind records indicate that certain winds are a feature of the area. The frequency of winds below 3 m/s is above the 30% threshold during autumn and spring evenings and summer nights. Modelling under prevailing wind was therefore conducted as part of this investigation.

5.4.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

Meteorological data obtained for the area does not contain information regarding the occurrence of temperature inversions. The proposal is for operations to be undertaken 24 hours a day, seven days a week. Hence, a worst case scenario has been assumed and the occurrence of temperature inversion during the night-time period has been considered as part of this noise assessment.

6 PROJECT SPECIFIC NOISE CRITERIA

6.1 Operational Noise Criteria

The noise emission design criteria for the proposed development have been established with reference to the INP outlined in **Section 4** of this report.

The acoustical environment in the vicinity of the proposed development typifies a rural environment; that is, *an acoustical environment that is dominated by natural sounds, having little or no road traffic*.

The existing L_{Aeq} noise levels in the vicinity of the subject site are dominated by natural sounds and include no noise from existing industrial operations.

With regard to intrusive noise criteria, the INP Application Notes state the following:

> *The results of long term unattended background noise monitoring can sometimes determine that the calculated Rating Background Level (RBL) for the evening or night period is higher than the RBL for the daytime period. ...*
>
> *...The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific noise levels for a particular development, it is generally recommended that the intrusive noise level for evening be set at no greater than the intrusive noise level for daytime. The intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening. Alternative approaches to these recommendations may be adopted if appropriately justified.*

Evening background noise levels at Location 2 were determined to be higher than those measured during the daytime period. A background level of 32 dBA was measured during the evening period at this location. This is typical of background levels in a predominantly rural environment. Furthermore, since average noise levels are significantly higher during the daytime (L_{Aeq} 45 dBA) compared to the evening period (L_{Aeq} 40 dBA), the intrusive criteria for the both the day and evening periods has been based on the evening background noise level.

The INP also states that where the rating background level (the level used for assessment purposes) is found to be less than 30 dBA, then it is set to 30 dBA.

The resulting operational project specific noise criteria for the proposed development are shown in **Table 13**.

Table 13 Project Specific Noise Criteria – Austar Coal Mine

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$	Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria $L_{Aeq(15minute)}$
1 Kitchener Residences	Day	38 dBA	50 dBA	38 dBA
	Evening	35 dBA	45 dBA	35 dBA
	Night	35 dBA	40 dBA*	35 dBA
2 Serradilla & Kauter Residence Penney and Linton Property	Day	37 dBA	50 dBA	37 dBA
	Evening	37 dBA	45 dBA	37 dBA
	Night	35 dBA	40 dBA	35 dBA

The INP states that these criteria have been selected to protect at least 90% of the population, living in the vicinity of industrial noise sources, from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

6.2 Construction Noise Design Goals

The noise design goals for construction activity at the Austar Surface Infrastructure Site are shown in **Table 14**.

Table 14 Construction Noise Design Goals

Location	Acceptable LA_{10} Noise Level (4 weeks and under)	Acceptable LA_{10} Noise Level (between 4 and 26 weeks)	Acceptable LA_{10} Noise Level (> than 26 weeks)
1 Kitchener	53	43	38
2 Serradilla Residence	52	42	37

The construction noise design goals are applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No audible construction work is to take place on Sundays or Public Holidays.

6.3 Sleep Disturbance Noise Goals

The sleep disturbance noise goals for each area, based on information contained in the Environmental Noise Control Manual (ENCM) would be based on a night-time background level of 30 dBA. Hence, the sleep disturbance noise goal at the nearest residential locations would be 45 dBA based on the ENCM.

The ECRTN provides further guidance with regard to sleep disturbance and calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The DECC policy document acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the ECRTN provides that maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions and one or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA (inside dwellings) are not likely to significantly affect health and wellbeing.

6.4 Road Traffic Noise Goals

Road traffic noise criteria are set out in the ECRTN. The criteria recommended in the policy document are based on the functional categories of the subject roads, as applied by the RTA. All traffic to/from the proposed development will utilise Quorrobolong Road. The nearest receivers that will potentially be affected by an increase in road traffic are located in Kitchener, approximately 20 m from the road. Quorrobolong Road has been classified as a collector road and the relevant noise goals are provided in **Table 15**.

Table 15 Road Traffic Noise Goals

Type of Development	Criteria		
	Day 7 am – 10 pm	**Night 10 pm – 7 am**	**Where Criteria are Already Exceeded**
Land use developments with potential to create additional traffic on collector road	$L_{Aeq(1hour)}$ 60 dBA	$L_{Aeq(1hour)}$ 55 dBA	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

7 ASSESSMENT OF NOISE IMPACTS

7.1 Operational Noise Modelling

A computer model was used to predict noise emissions from the proposed development. The Environmental Noise Model (ENM) used has been produced in conjunction with the DECC. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process (provided by Austar). The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

Prediction of noise under calm and prevailing atmospheric conditions (temperature inversion and prevailing winds) was conducted at the nearest potentially affected noise-sensitive receivers. Atmospheric parameters under which noise predictions were made are given in **Table 16**.

Table 16 Meteorological Parameters for Noise Predictions

	Temperature	**Humidity**	**Wind Speed**	**Wind Direction** (degrees from north)	**Temperature Gradient**
Calm (All periods)	20°C	65%	N/A	N/A	N/A
Temperature Inversion (Night)	10°C	90%	N/A	N/A	3°C/100 m
SSW Wind (Evening)	20°C	65%	3 m/s	202.5°	N/A
Southerly Wind (Evening & Night)	10°C	65%	3 m/s	180°	N/A

The operational scenario modelled during each period is summarised in **Table 17**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period.

The worst case acoustical scenario will occur during shift start and finish times when employees enter and leave the site. During this time, all other mobile plant and equipment is assumed to operate continuously. The number of employee vehicles expected to enter/leave the site during the peak periods in a typical 15-minute period are shown in **Table 17**. This worst case acoustical scenario is applicable only to day (7pm to 6 pm) and night (10 pm to 7 am) operational periods. No shift changes are proposed to occur during the evening assessment period (6pm to 10 pm) and therefore typical operation has been assumed.

Other assumptions made in modelling the proposed development include the following:

- All acoustically significant plant and equipment operates simultaneously.
- Mobile noise sources were modelled at typical locations and assumed to operate in repetitive cycles.
- All proposed acoustic bunding has been modelled at a height of 3.5 m.
- The ventilation fan outlet has been directed to the west.
- Man and material winder and second egress winder motors are enclosed.

Table 17 Operational Scenario Considered in Noise Model

Plant and Equipment	Day (peak Period)	Evening	Night (Peak period)
Compressor Plant	✓	✓	✓
Nitrogen Inertisation Plant	✓	✓	✓
Ventilation Fan and Plant	✓	✓	✓
Water Pump	✓(2)	✓ (2)	✓(2)
Second egress winder	✓	✓	✓
Man and material winder	✓	✓	✓
Workshop Noise	✓	✓	✓
Roof-top air conditioning plant	✓ (2)	✓ (2)	✓ (2)
Employee vehicles[1]	✓ (39)[2]		✓ (30)[3]
Light delivery & work trucks	✓ (6)	✓ (6)	✓ (6)

Notes: [1] Traffic movement data sourced from the Austar Coal Mine Traffic Study conducted by GHD Pty Ltd.

[2] Based on a total of 78 vehicle movements between 4:00-4:30pm, equating to 39 movements for a typical 15-minute period.

[3] Based on a total of 121 vehicle movements between 6:00-7:00am, equating to 30 movements for a typical 15-minute period.

7.2 Construction Noise Modelling

Construction noise sources outlined in **Section 2** of this report were included in the environmental noise model to assess noise contribution from the site preparation (earthworks) and construction of the Austar Surface Infrastructure Site.

As construction exceeds the 26 week period the limiting criteria will be at its most stringent therefore predicted noise levels have been assessed against the 26 weeks and over criteria as set out in the ENCM.

7.3 Operational Noise Predictions

Noise emission levels were predicted from the proposed operation for the typical operational scenario described in **Table 17** including the noise modelling assumptions described in **Section 7.1**. Noise from all sources that contribute to the total noise from the site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness etc). The appropriate modifying factors, as outlined in the INP, have been applied where these characteristics are considered to be present. **Table 18** contains the operational noise modelling results.

Table 18 Predicted Austar SIS Noise Levels

Location	Period	Predicted Noise Level LAeq(15minute) (dBA)				Project Specific Noise Criteria (LAeq)
		Calm	Inversion	S Wind	SSW Wind	
Kitchener Residence 1	Day	<30	n/a	n/a	n/a	38 dBA
	Evening	<30	n/a	35	34	35 dBA
	Night	<30	34	35	n/a	35 dBA
Kitchener Residence 2	Day	<30	n/a	n/a	n/a	38 dBA
	Evening	<30	n/a	35	35	35 dBA
	Night	<30	34	35	n/a	35 dBA
Kitchener Residence 3	Day	<30	n/a	n/a	n/a	38 dBA
	Evening	<30	n/a	33	33	35 dBA
	Night	<30	34	33	n/a	35 dBA
Serradilla Residence	Day	31	n/a	n/a	n/a	37 dBA
	Evening	31	n/a	<30	<30	37 dBA
	Night	31	35	<30	n/a	35 dBA
Kauter Residence	Day	<30	n/a	n/a	n/a	37 dBA
	Evening	<30	n/a	<30	<30	37 dBA
	Night	<30	<30	<30	n/a	35 dBA
Penney & Linton Property	Day	<30	n/a	n/a	n/a	37 dBA
	Evening	<30	n/a	<30	<30	37 dBA
	Night	<30	<30	<30	n/a	35 dBA

The predicted noise contribution from each scenario were found to be within INP noise guidelines at the nearest residential locations during all assessed periods.

7.4 Cumulative Noise Assessment

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and consent limits) are established with a view to maintaining acceptable noise *amenity* levels for residences. Therefore, the cumulative impact of the proposed development with existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially noise sensitive areas.

7.5 Construction Noise Predictions

Earthworks and Construction noise was predicted at each of the receiver locations shown in **Figure 1**. A summary of the results of these predictions is contained within **Table 19.**

Table 19 Predicted $L_{A10(15minute)}$ Construction Noise Emission

Location	Predicted Noise Level L_{A10} dBA		Construction Design Goal L_{A10} dBA
	Earthworks	Construction	
Kitchener Residence 1	26	27	38
Kitchener Residence 2	28	28	
Kitchener Residence 3	28	28	
Serradilla Residence	35	34	37
Kauter Residence	19	19	
Penney & Linton Residence	25	24	

Ambient L_{A10} noise levels are predicted to meet the relevant criteria at all residential locations during the site preparation (earthworks) and construction of the Austar SIS.

7.6 Sleep Disturbance Assessment

In assessing sleep disturbance, typical L_{Amax} noise levels of plant and equipment to be used at the subject site during the night was used as input to the ENM acoustic model and predictions were made at the nearest residential areas under calm and adverse weather conditions at night. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be less than the L_{Amax}.

A summary of the predicted maximum noise levels at the most affected locations are contained within **Table 20**.

Table 20 Predicted Sleep Disturbance Noise Levels

Location	Period	Predicted Noise Level LAeq(15minute) (dBA)			Project Specific Noise Criteria (LAeq)
		Calm	Inversion	S Wind	
Kitchener Residence 1	Night	< 30	35	43	45 dBA
Kitchener Residence 2	Night	< 30	39	44	45 dBA
Kitchener Residence 3	Night	< 30	39	42	45 dBA
Serradilla Residence	Night	33	37	< 30	45 dBA
Kauter Residence	Night	< 30	< 30	< 30	45 dBA
Penney & Linton Property	Night	< 30	< 30	< 30	45 dBA

The predicted L_{Amax} noise levels from the proposed SIS will meet the sleep disturbance criteria at all locations for all operational scenarios.

8 ROAD TRAFFIC NOISE ASSESSMENT

Access to the Austar SIS will be from Quorrobolong Road. The increase in traffic volume expected from the operation of the mine has the potential to affect residences in Kitchener, which are generally located approximately 20 m from Cessnock Street which eventually forms Quorrobolong Road. This impact is likely to be greatest during morning and afternoon peak periods.

To determine the increase in traffic noise levels during peak periods, Annual Average Traffic Data (AADT) was obtained for Quorrobolong Road. The AADT data provided information regarding existing traffic numbers, and 2013 traffic numbers with and without Austar SIS operation. The increase in overall traffic noise level was then calculated using the existing measured noise levels and the predicted increase in traffic numbers. Traffic data used in the calculations is presented in **Table 21**.

Table 21 Existing & Predicted Traffic Volumes

Year	Road	Traffic Volume (Both Directions)		Heavy Vehicles (%)	
		AM Peak	PM Peak	AM Peak	PM Peak
2008	Quorrobolong Road (existing traffic)	56	49	9	6
2013	Quorrobolong Road (without Austar SIS)	63	55	9	6
2013	Quorrobolong Road (with Austar SIS)	91	93	6	4

Notes: AM peak period AADT data is between 8-9am
PM peak period AADT is between 4-5pm

The morning start time for most Austar employees is between 6:00 am and 7:00 am. This represents the Austar morning peak traffic period and therefore controlled by the ECRTN night-time criteria. As a conservative measure, AATD in the 8:00 am to 9:00 am peak has been used to assess traffic noise levels between 6:00 am and 7:00 am. The afternoon peak period for Austar employees will generally occur between 4:00 pm to 5:00 pm and therefore is controlled by the ECRTN day-time criteria. Afternoon peak traffic volume data has been used for the afternoon peak traffic noise assessment.

Table 22 shows the existing traffic noise levels and the predicted 2013 traffic noise levels, both with and without Austar operation, in comparison to the relevant traffic noise criteria.

Table 22 Road Traffic Noise Predictions

Year	Year	Traffic Noise Level L_{eq} (1hour)		ECRTN Collector Road Criteria L_{eq} (1hour)	
		Day	Night	Day	Night
2008	Kitchener Residence (existing traffic)	58 dBA	53 dBA	60 dBA	55 dBA
2013	Kitchener Residence (without development)	59 dBA	54 dBA		
2013	Kitchener Residence (with development)	61 dBA	55 dBA		

The predicted traffic noise level meets the ECRTN criteria for the night-time period during Austar Mine operation. An exceedance of the day-time criteria by 1 dBA is predicted during the afternoon peak period; however, the level is within 2 dBA of the predicted noise level without Austar Mine operation. In accordance with the ECRTN criteria set within **Table 15**, this predicted noise level is therefore considered to be acceptable.

9 CONSTRUCTION BLASTING

9.1 Blasting Practice

Minor blasting will be required to construct the man and materials shaft, ventilation shaft and ballast drop hole. The proposal is for more than one blast to be conducted on a daily basis throughout the construction period.

It is envisaged that blast design will remain relatively constant throughout mine shaft construction. An MIC of approximately 8 kg is expected to be used.

9.2 Blasting Emissions Criteria

The DECC has set down guidelines for blasting based on human comfort levels. The guidelines have been adapted from the ANZECC Guidelines "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration"* and are as follows:

Airblast

The recommended maximum level for airblast is 115 dB Linear Peak.

The level of 115 dB may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 120 dB Linear Peak at any time.

Ground Vibration

The recommended maximum level for ground vibration is 5 mm/s (peak particle velocity [ppv]). It is recommended that a level of 2 mm/s be considered as a long term regulatory goal.

The ppv level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

Times and Frequency of Blasting

Blasting should only generally be permitted during the hours of 9.00 am to 5.00 pm Monday to Saturday. Blasting should not take place on Sundays or Public Holidays.

Blasting should generally take place no more than once per day.

9.3 Assessment of Blasting Impacts

In order to predict the levels of blast emissions (ground vibration and airblast) at the surrounding receivers from the proposed SIS, the measured ground vibration and airblast levels from blasting operations during a shaft construction of similar nature, conducted in 2003, were used to develop blast emissions site laws.

9.4 Blast Emissions Site Laws

For each site law, using statistical analysis of the measured data and assuming a log-normal distribution of data, a 95% confidence line and 50% confidence levels were determined. The ground vibration and airblast criteria advocated by the DECC and ANZECC (refer to **Section 9.1**), cater for the inherent variation in emission levels from a given blast design by allowing a five percent exceedance of a general criterion up to a (never to be exceeded) maximum. Correspondingly, the "5% exceedance" (95% confidence) levels have been used in the blast emission site laws.

The 5% site laws for ground vibration and airblast are:

Ground Vibration

$PVS\ (5\%) = 243 \times (SD_1)^{-1.50}$

Airblast

$SPL(5\%) = 164 - 22 * \log (SD_2)$

where PVS (5%) and SPL (5%) are the levels of ground vibration (Peak Vector Sum - mm/s) and airblast (dB Linear) respectively, above which 5% of the total population (of data points) will lie, assuming that the population has the same statistical distribution as the underlying measured sample.

SD_1 and SD_2 are the ground vibration and airblast scaled distances, where:

$$SD1 = \frac{\text{Distance}}{\sqrt{\text{MIC}}} \quad (m.kg^{-0.5})$$

and,

$$SD2 = \frac{\text{Distance}}{3\sqrt{\text{MIC}}} \quad (m.kg^{-0.33})$$

where MIC is maximum instantaneous explosive charge in kg.

Predicted Levels of Blast Emission

The levels of airblast and ground vibration have been predicted using the developed site laws for the SIS for each of the three shaft constructions. The maximum instantaneous charge (MIC) for each blast will be approximately 8 kg.

A summary of the results for the closest affected receivers is contained within **Table 23** to **Table 25**.

Table 23 Blasting Prediction Man and Materials Shaft

Residential Location	Predicted Mine Blasting Level*	
	Airblast dB Linear	Ground Vibration mm/s
Kitchener Residence 1	< 100	0.01
Kitchener Residence 2	100	0.02
Kitchener Residence 3	100	0.02
Serradilla Residence	108	0.06
Kauter Residence	102	0.02
Penney & Linton Property	104	0.03

Note: * Predicted level based on MIC of approximately 8 kg

Table 24 Blasting Prediction Ventilation Shaft

Residential Location	Predicted Mine Blasting Level*	
	Airblast dB Linear	Ground Vibration mm/s
Kitchener Residence 1	< 100	0.01
Kitchener Residence 2	100	0.02
Kitchener Residence 3	< 100	0.02
Serradilla Residence	107	0.05
Kauter Residence	101	0.02
Penney & Linton Property	102	0.02

Note: * Predicted level based on MIC of approximately 8 kg

Table 25 Blasting Prediction Ballast Drop Hole

Residential Location	Predicted Mine Blasting Level*	
	Airblast dB Linear	Ground Vibration mm/s
Kitchener Residence 1	< 100	0.01
Kitchener Residence 2	101	0.02
Kitchener Residence 3	100	0.02
Serradilla Residence	107	0.06
Kauter Residence	101	0.02
Penney & Linton Property	103	0.03

Note: * Predicted level based on MIC of approximately 8 kg

The blast prediction results presented in **Table 23** to **Table 25** demonstrate that predicted airblast and ground vibration levels will meet the DECC guidelines for blasting at all residences surrounding the development during shaft constructions at the SIS.

Additionally, given the small scale of the proposed blasting operation, it is unlikely that significant impact would be perceived by nearest receivers from a single blast. On this basis and the predicted low vibration and airblast levels, it is considered that more than one blast per day would be acceptable.

10 CONCLUSION

Heggies has conducted a noise and blasting impact assessment for the construction and operation of the proposed SIS, located south west of Kitchener, NSW. The assessment concludes that Austar SIS operation will comply with the NSW INP noise goals at all assessed residential receivers during the day, evening and night-time periods.

Construction noise is predicted to meet the relevant noise goals at all assessed residential locations throughout the earthworks and construction period.

Maximum noise levels during the night-time period have been assessed and predicted to be below the recommended sleep disturbance noise goals.

The proposed increase in road traffic volumes during full operation of the Austar SIS has been assessed. The traffic noise generated by the development is predicted to meet the criteria and conditions set by the ECRTN.

Results of blast predictions indicate that airblast and ground vibration levels will meet the DECC guidelines for blasting at all residences surrounding the development during the construction of mine shafts at the SIS.

Statistical Ambient Noise Levels
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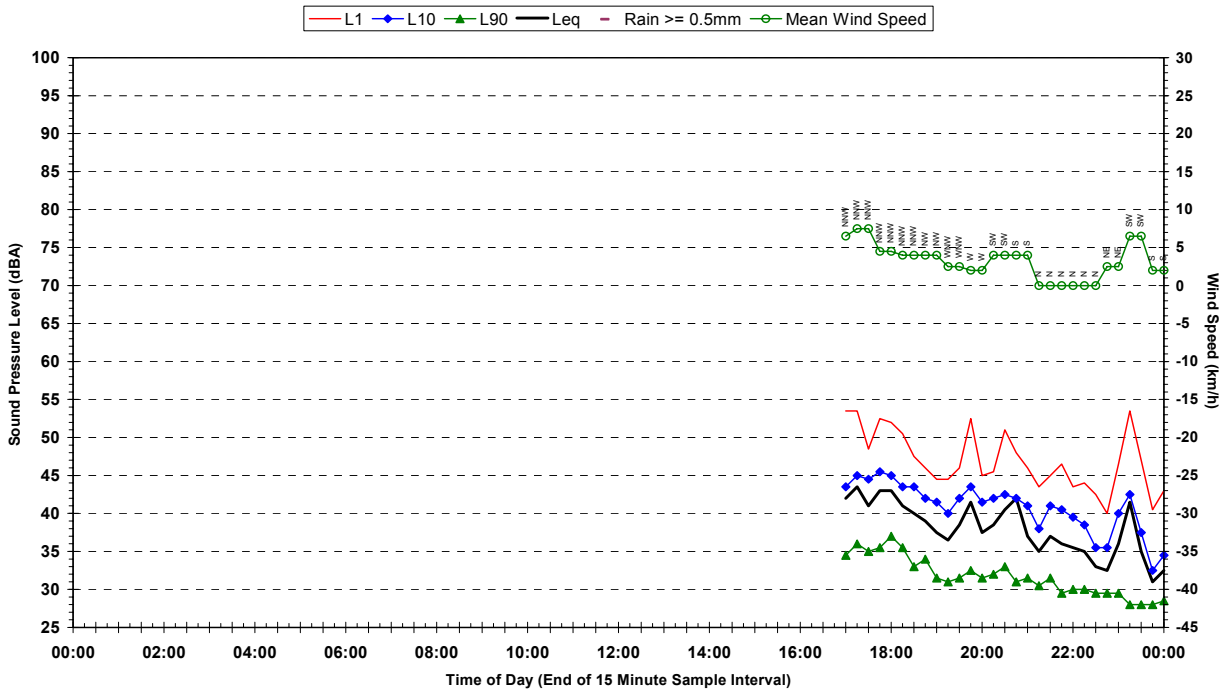
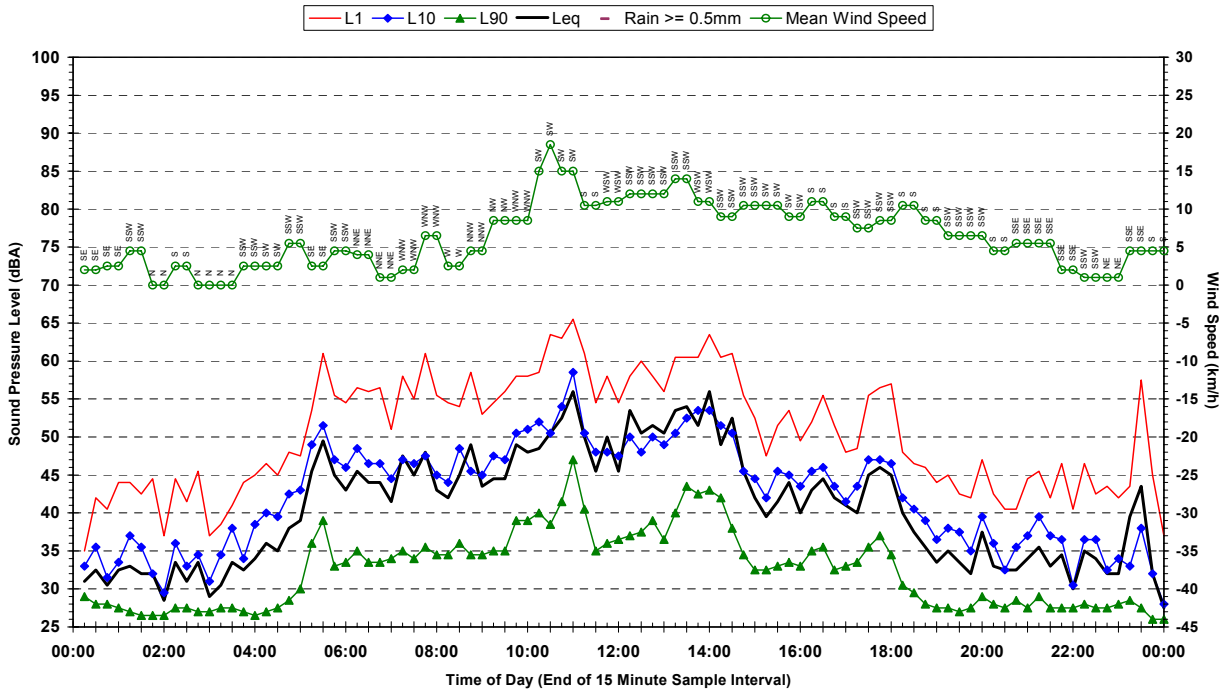
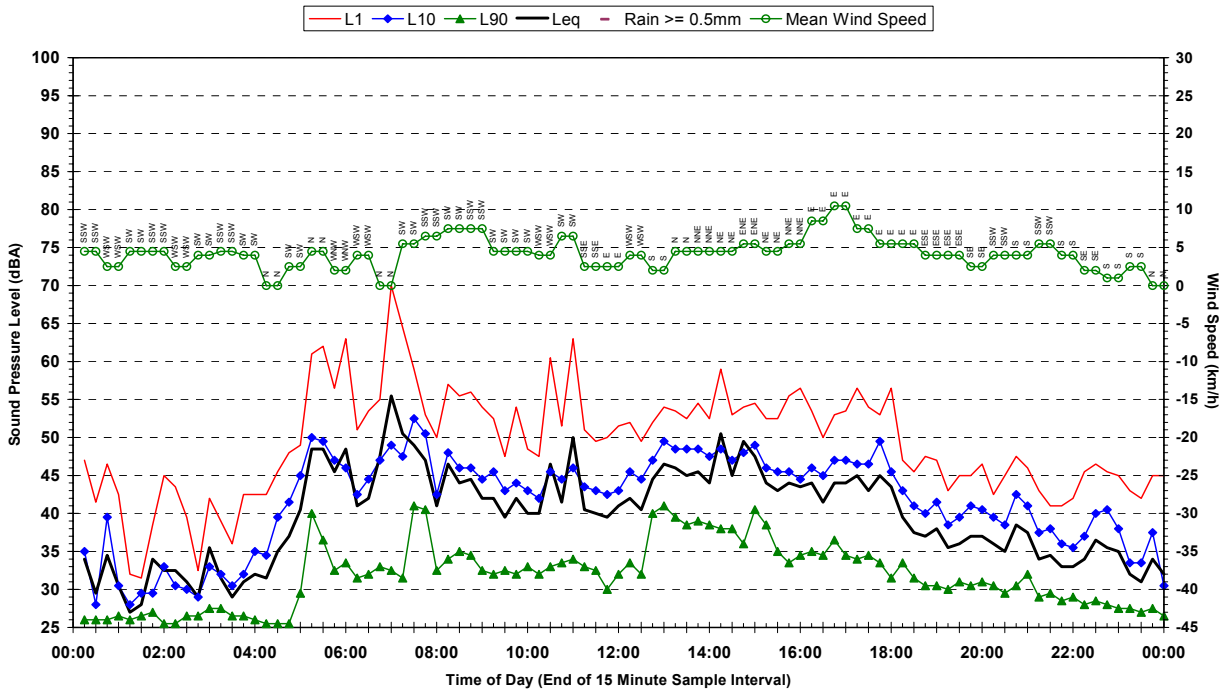


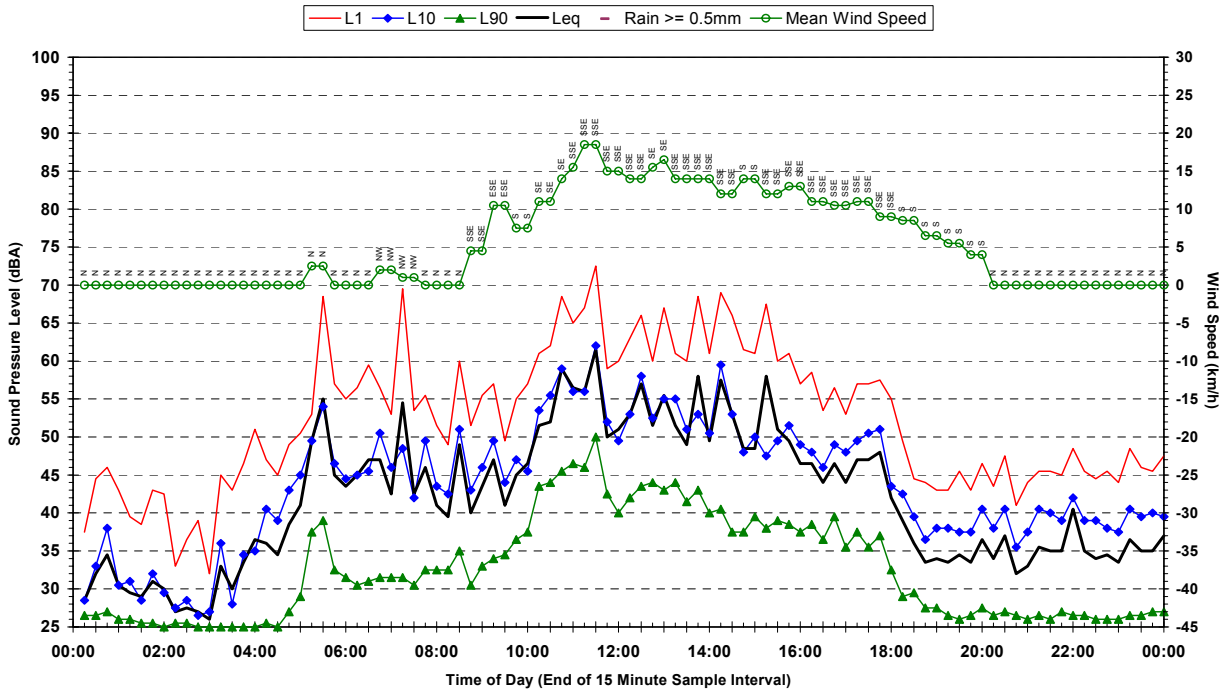
Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Thursday 20 September 2007



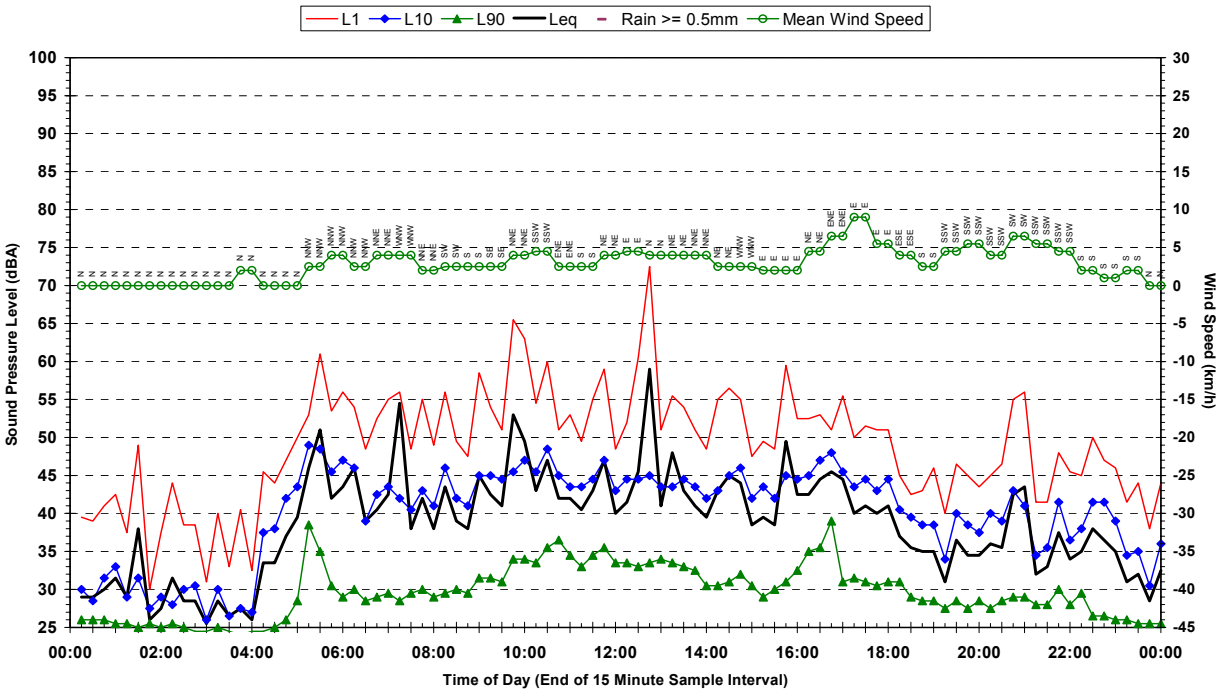
Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Friday 21 September 2007



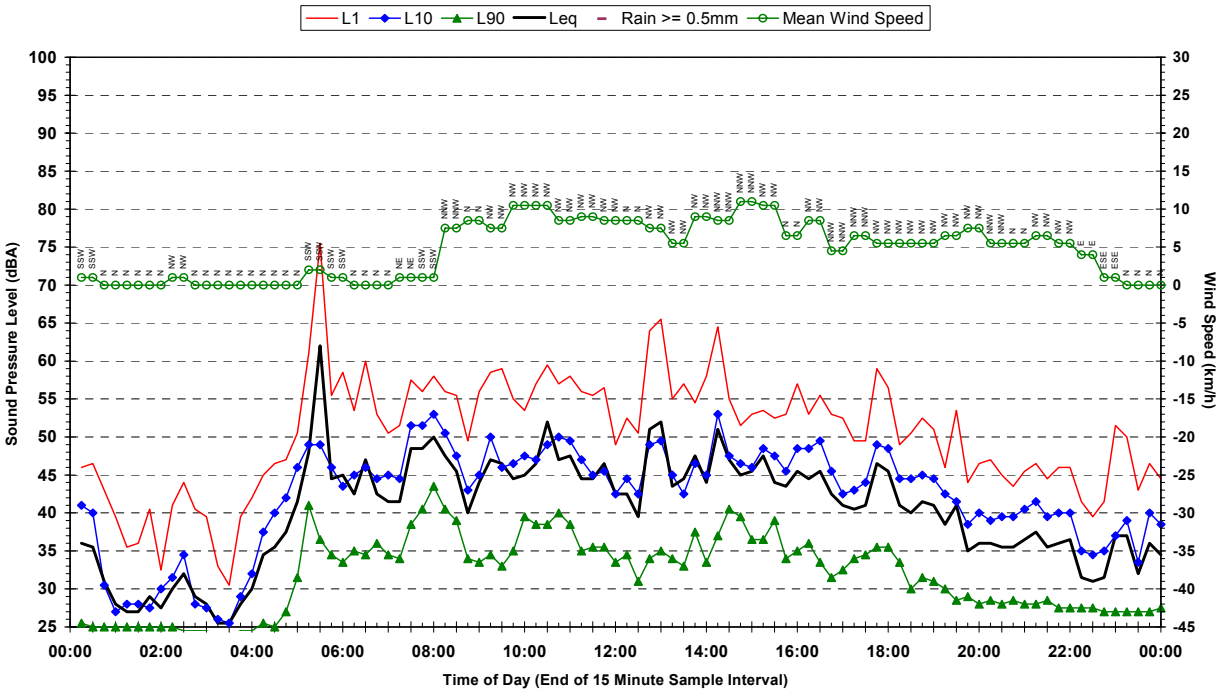
Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Saturday 22 September 2007



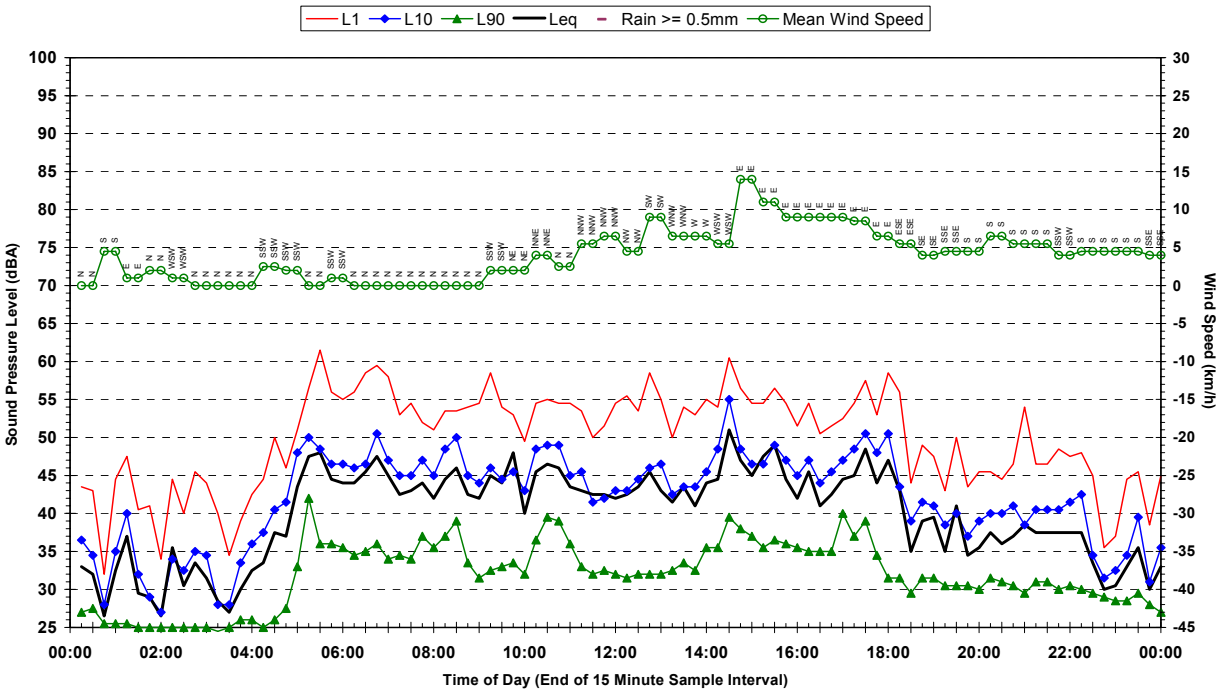
Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Sunday 23 September 2007



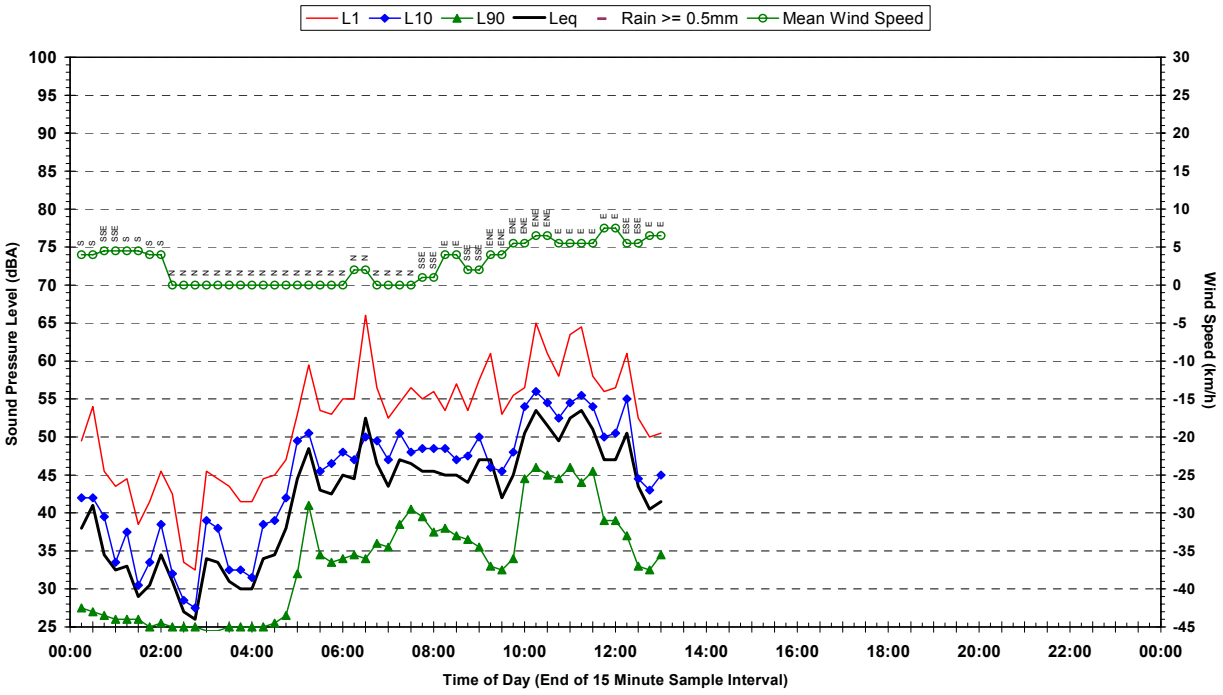
Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Monday 24 September 2007



Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Tuesday 25 September 2007



Statistical Ambient Noise Levels
Kitchener Park, Kitchener - Wednesday 26 September 2007



Statistical Ambient Noise Levels
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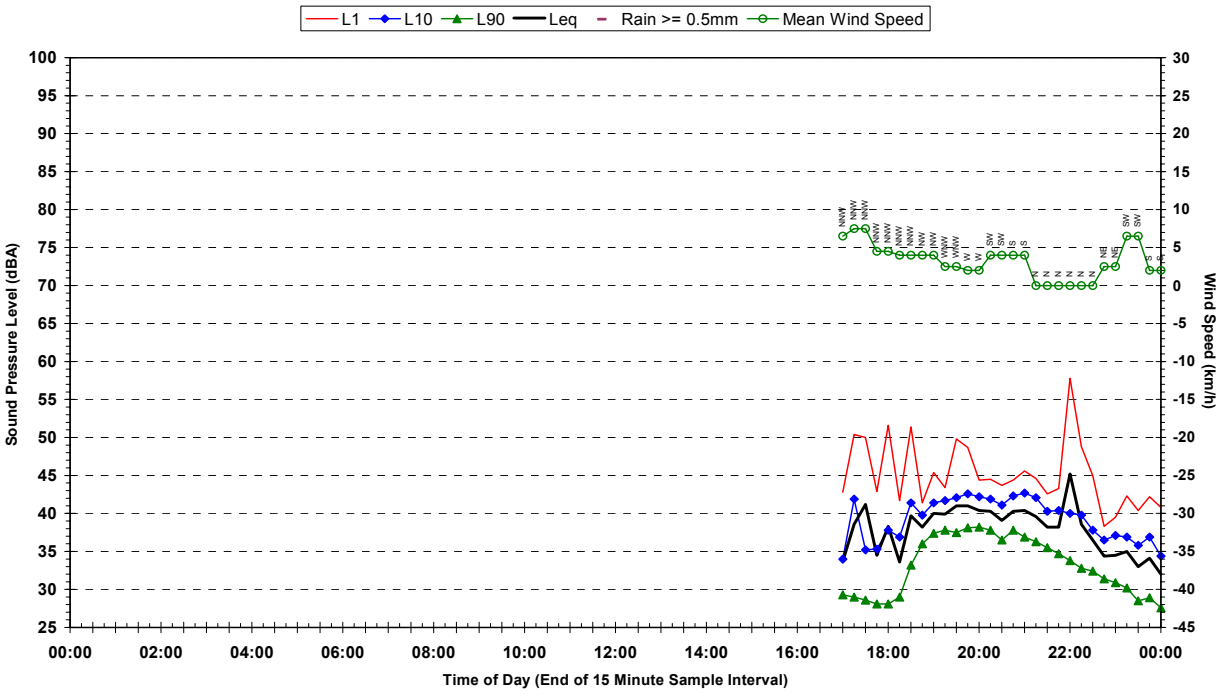

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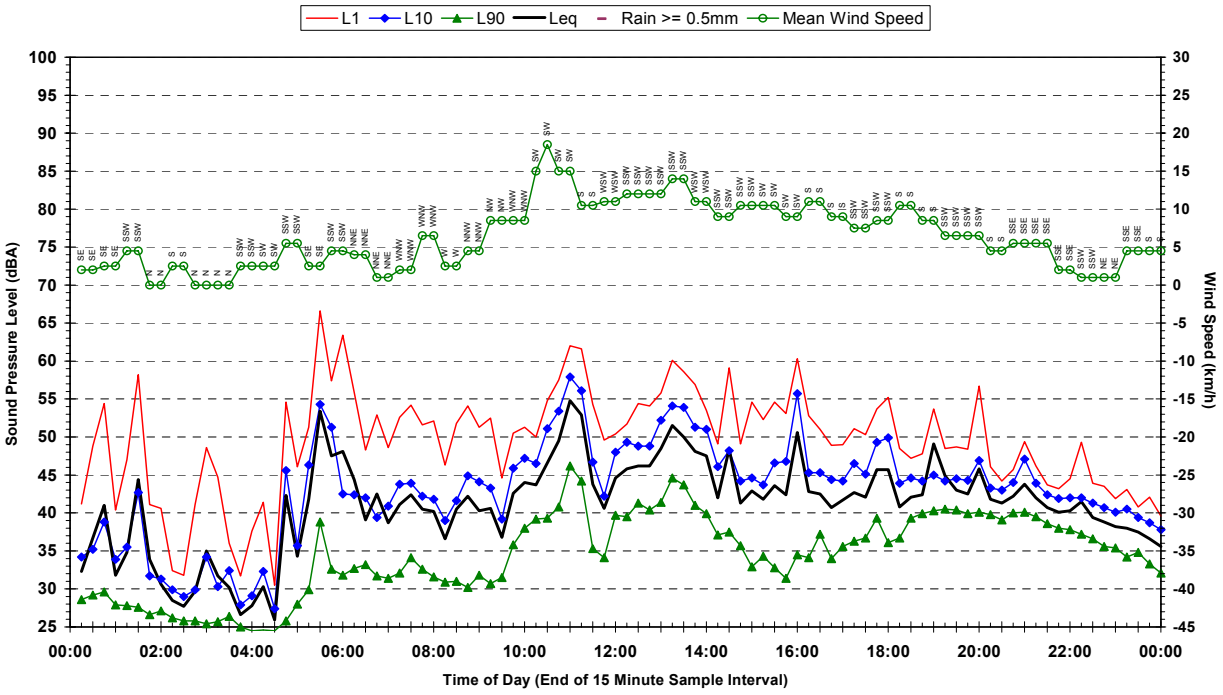

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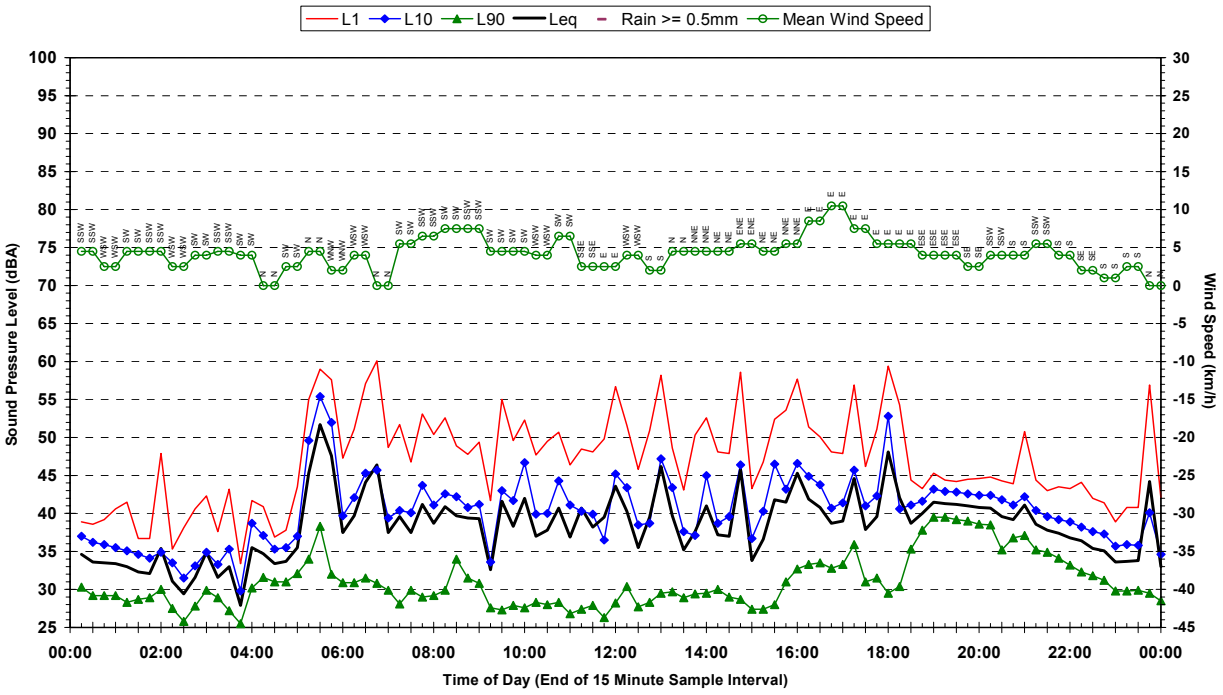

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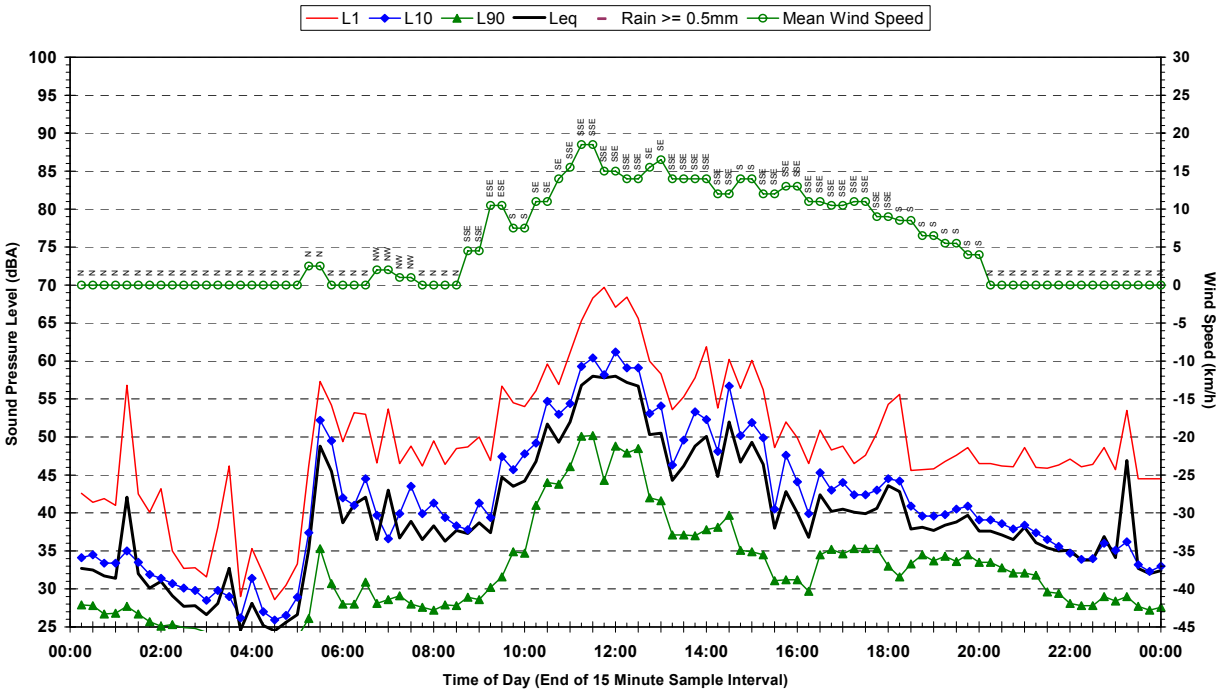
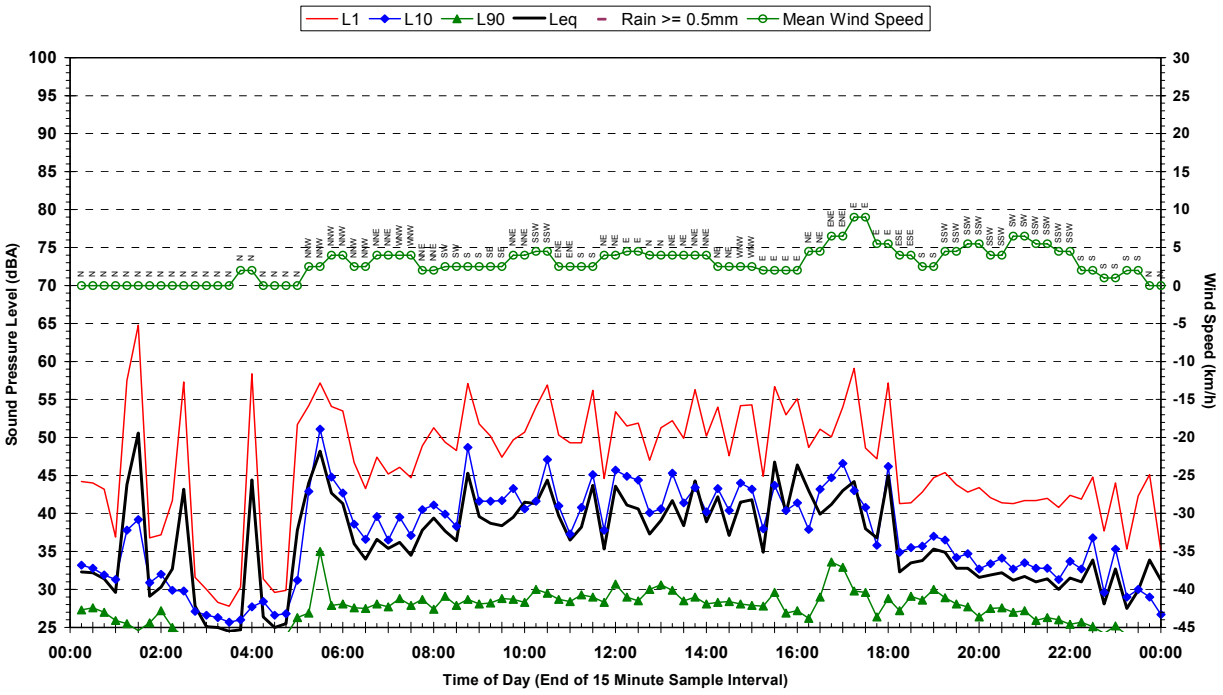
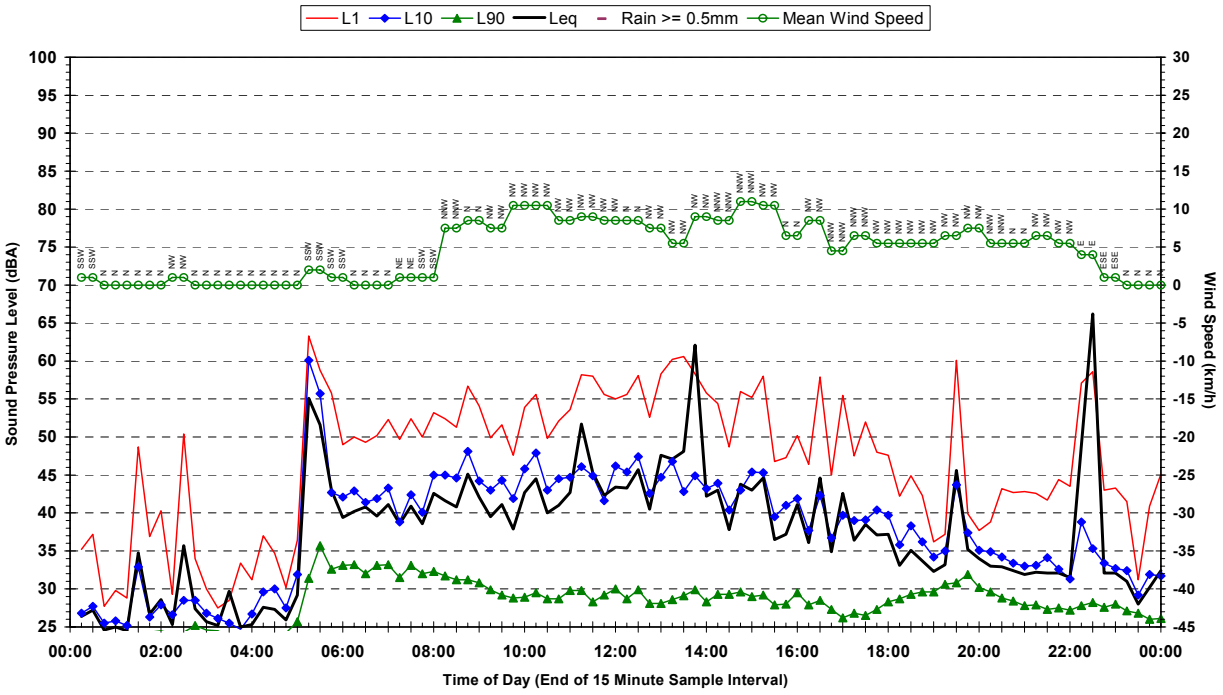
Serradilla Residence, Qourrobolong - Saturday 22 September 2007



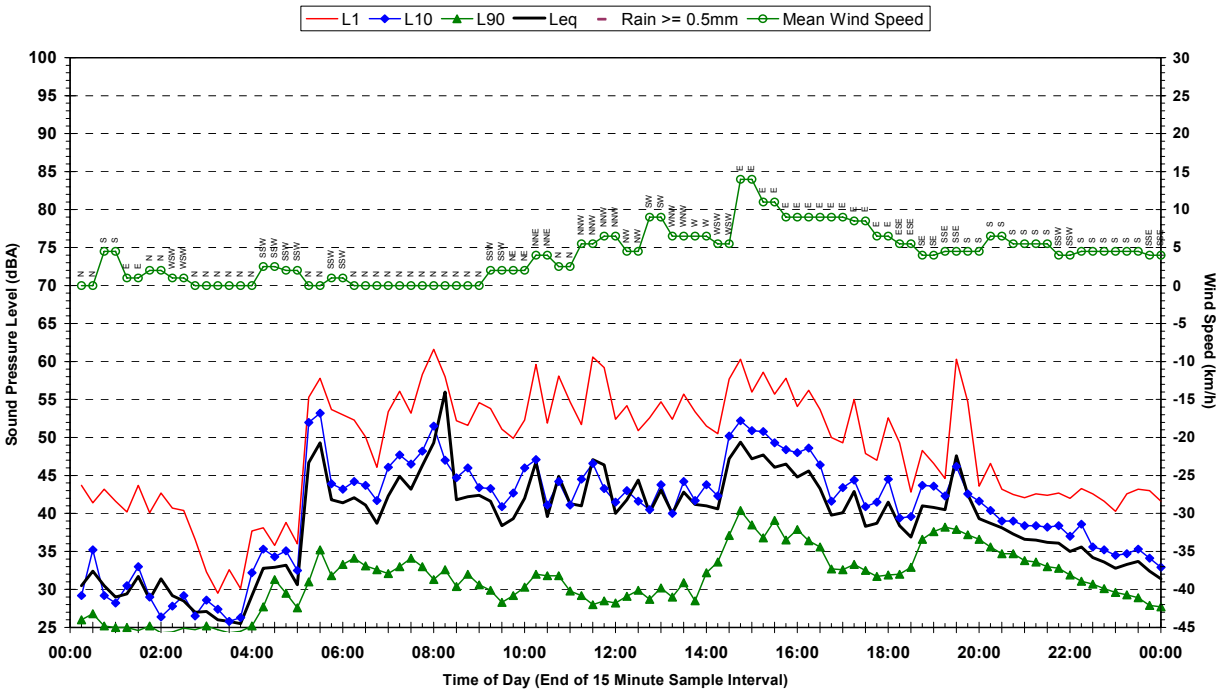
Statistical Ambient Noise Levels
Serradilla Residence, Qourrobolong - Sunday 23 September 2007



Statistical Ambient Noise Levels
Serradilla Residence, Qourrobolong - Monday 24 September 2007



Statistical Ambient Noise Levels
Serradilla Residence, Qourrobolong - Tuesday 25 September 2007



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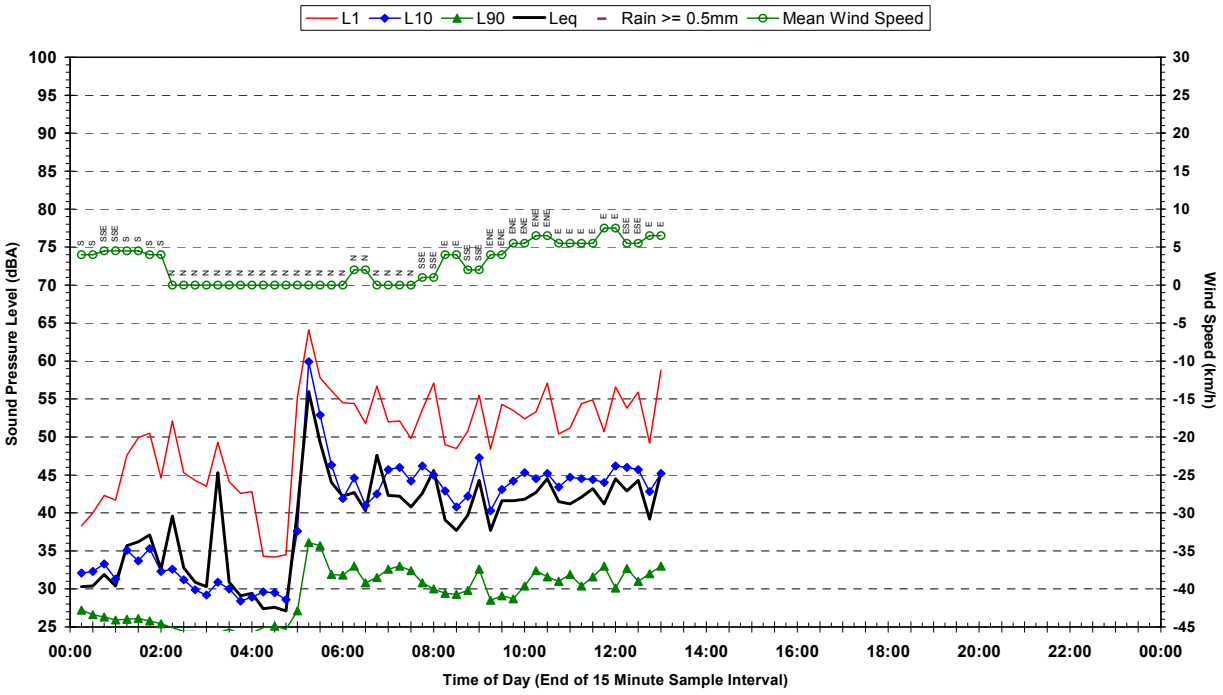

Equipment Description	Octave Band centre Frequency – dBL re 1pW										dBA Overall
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Operational Plant & Equipment (L_{Aeq})											
Ventilation fan	118	116	117	111	104	97	96	93	86	86	108
Ventilation plant	111	109	105	101	96	91	85	79	68	68	98
Compressor plant	81	82	89	90	90	83	81	75	69	69	90
Nitrogen inertisation plant	101	105	110	103	98	94	91	86	82	82	101
Water storage pumps	93	92	99	95	91	89	91	91	84	84	97
Winders (electric motor & gearbox noise)	96	98	100	100	100	100	100	97	90	90	105
Light weight trucks	102	103	94	91	92	94	95	94	89	89	101
Employee vehicles – drive off	79	82	70	67	69	70	67	59	51	52	74
Workshop Noise (Grinder)	55	61	57	59	67	76	87	92	92	92	96
Air-conditioning roof-top plant	98	98	95	92	87	85	90	74	60	60	93
Earthworks & Construction Plant & Equipment (L_{A10})											
Scraper	111	116	115	109	107	106	104	97	92	92	111
Drill rig	106	105	111	105	110	103	100	95	91	91	110
Hydraulic winch	96	98	100	100	100	100	100	97	90	90	105
Excavator	104	107	110	102	104	100	97	93	88	85	106
Dozer 10	108	112	111	108	110	103	101	99	93	93	110
Compactor flat	99	104	109	112	107	105	102	96	90	90	110
Dump Truck	96	104	106	99	100	98	92	85	77	77	102
Genset	109	112	113	110	101	102	99	93	84	76	107
Transit Mixer	103	108	108	105	106	107	105	99	94	86	111
Concrete boom pump	100	106	113	110	104	98	97	92	88	88	107
Delivery Truck	96	104	106	99	100	98	92	85	77	77	102
Crane	103	109	99	99	102	100	96	92	90	90	104
hand tools (grinder)	63	67	65	67	75	84	95	100	100	95	104