

Solar Farm, Nyngan NSW
Noise Monitoring & Assessment

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1 INTRODUCTION

Infigen Pty Ltd propose to establish a solar farm near Nyngan NSW. It is a requirement of the Director-General of the Department of Planning that an Environmental Assessment (EA) be carried out for the development. The EA involves the identification of limits for noise from the development during the construction and operating periods.

Noise will occur from the solar farm during the construction phase. Significant levels of noise are not expected during everyday operation of the facility.

Heggies have carried out background noise monitoring relative to the site to assist in the determination of limits for construction noise. The monitoring results and their implications for noise limits are included in this report.

2 SUBJECT SITE

The subject site is located near Nyngan, which is approximately 460 km north west of Sydney.

Noise sensitive receivers in the vicinity of the proposed solar farm are both commercial and residential. The nearest receiver is a horse range (Targets Lodge), approximately 85 m from the subject site boundary. The nearest residential receivers are located approximately 160 m south of the subject site boundary (Residence 'A'). Other receivers are located at 'Springdale', approximately 400 m north of the development site, and on the outskirts of the Nyngan township, 600 m north of the site.

Refer to **Appendix A** for the location of the receivers relative to the subject site.

3 CONSTRUCTION NOISE

The following noise sources are anticipated during the construction of the solar farm:

- Increased truck and car traffic on local roads and on the subject site
- Noise from excavation equipment, including: rockbreakers; bulldozers; vibratory rollers and graders
- Noise from construction equipment including: generators; air compression power tools; vibratory piling and concrete pumps.

4 NOISE CRITERIA

In NSW, construction noise is currently assessed with reference to the Department of Environment and Climate Change (DECC) *Interim Construction Noise Guideline*, 2009. Recommended maximum levels for construction noise at noise sensitive locations are based on the Rating Background Level or RBL, as defined in Section 3.1 of the NSW *Industrial Noise Policy*, 2000.

4.1 Short Term Construction Noise (less than 3 weeks)

Construction noise with an anticipated duration of less than 3 weeks can be managed using a 'qualitative' approach under the *Interim Construction Noise Guideline*. The approach requires the preparation of a noise management plan which is to be kept on site. The plan is to include the following:

- Identification of nearby residences and other noise sensitive uses
- Description of approved hours of work and what work will be undertaken
- Description of what work practices will be applied to minimise noise

- Description of complaints handling process

(Reference: Part 5, *Interim Construction Noise Guideline*, 2009)

Recommended noise management procedures include:

- Operate high level noise equipment during recommended standard hours, as defined in the *Guideline*, only.
- Liaise with the potentially affected community by making the noise management plan available and by publicising times when noisy equipment will occur.
- Using best practical methods to minimise high levels of noise to the community.

4.2 Long Term Construction Noise (more than 3 weeks)

The Guideline provides recommended 'Management Levels' for construction activities with an anticipated duration of more than three weeks. The Management Levels are presented in **Table 1**.

Table 1: DECC Recommended Management Levels for Construction Noise, Residential Locations

Time of Day		Management Level, dBA Leq, 15 min	Guideline Comment / Classification
Recommended standard hours	Monday to Friday 7 am to 6 pm	RBL + 10	Noise affected
	Saturday 8 am to 1 pm	75	Highly noise affected
	All other times and public holidays	RBL + 5	Noise affected

Where the RBL is less than 30 dBA, the value of 30 is used for the determination of noise limits.

Higher management levels apply to non-residential land uses. Potentially relevant situations are listed in **Table 2**.

Table 2: DECC Recommended Management Levels for Construction Noise, Non-Residential Locations

Location	Management Level, dBA Leq, 15 min	Measurement Location
Classrooms	45	Internal
Hospitals	45	Internal
Places of worship	45	Internal
Active recreation areas (eg. sportsgrounds)	65	External
Passive recreation areas (eg. parks)	60	External
Commercial and industrial premises	75	External
Offices	70	External

Specific Management Levels are not provided for horse ranches. Heggies suggest designing for levels of 65 dBA measured externally (ie. the same as is recommended for outdoor recreation areas).

5 NOISE MONITORING

Attended and unattended background noise monitoring was undertaken at 'Springdale' to assist in the determination of construction noise Management Levels. Additionally, attended noise measurements were carried out at 44 Hoskins Street, Nyngan.

Details of the monitoring locations, monitoring periods and conditions are included in **Table 3**.

Table 3: Nyngan Noise Monitoring

Monitoring Location	UTM Coordinates	Approximate distance to solar farm boundary	Start date	End date	No. days full monitoring	Monitoring Conditions
'Springdale', "Adams Transport"	UTM 55 J 521743.47mE 6505776.20mS	400 m	Sat 11 Sept	Fri 17 Sept	5	Calm to moderately high winds.
44 Hoskins Street	UTM 55 J 518539.35mE 6506577.45mS	600 m	Attended measurements only.		-	Light southerly.

5.1 Unattended Monitoring Results

Full background monitoring results are included in **Appendix C**. The graphs display statistical data in 15 minute intervals for the entire monitoring period. The statistical parameters displayed include:

- The L₉₀ noise level, that is the sound pressure that is exceeded 90% of each 15 minute measurement interval. The L₉₀ is used to calculate the RBL.
- The L_{eq} or A-weighted equivalent noise level (basically the average noise level). The L_{eq} is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
- The L₁₀ noise level, that is the sound pressure level that is exceeded 10% of the measurement interval. The L₁₀ approximates to the average maximum noise level.
- The L₁, that is the sound pressure level that is exceeded 1% of the measurement interval. The L₁ approximates to the maximum noise level.

The data obtained during long term monitoring has been used to calculate the RBL. As weather conditions were fine for a large percentage of the monitoring period, no data has been excluded from calculations.

The calculated RBLs for the monitoring site is included in **Table 4**.

Table 4: Rating Background Levels, Nyngan Solar Farm

	Rating Background Level (RBL) dBA		
	Day	Evening	Night
'Springdale', Mitchell Highway, Nyngan	32	40	31

Unusually high background noise levels were measured during the evenings on most days. The source of the raised levels is not apparent from the statistical data, however it is suspected to be due to insect activity. This type of noise can be seasonal. For this reason, it would be prudent to adopt the lower daytime RBL instead of the measured evening level, for the evening period.

5.2 Attended Noise Measurements and Observations

Attended noise measurements were carried out at 'Springdale' following deployment of the noise logger and at 44 Hoskins Street, on the edge of the township. Results are included in **Table 5**.

Table 5: Attended Noise Measurements, Nyngan

Location	Date	Start time	Duration	Descriptor	A weighted noise level	Comment
'Springdale'	11 Sept 2010	1136 h	15 mins	L90	22.4	Very light breeze, little ambient noise.
				Leq	36.7	
				L10	34.7	
44 Hoskins Street, Nyngan	11 Sept 2010	1309 h	13 mins	L90	36.3	Light breeze, ambient noise including leaf rustle, occasional tractor and animal noise
				Leq	46.3	
				L10	45.9	

The measured L90 background noise level was extremely low at 'Springdale' due its relative isolation from town and the calm conditions at the time of the attended measurement. Higher background noise levels were measured at Hoskins Street due to its proximity to the Nyngan township.

6 DECC MANAGEMENT LEVELS

The average measured RBL has been used to determine noise management levels for construction. Results are included in **Table 6**.

Table 6: Construction Noise Management Level, Nyngan Solar Farm

	Day	Evening	Night
Nyngan RBL	32	(32) estimated	31
Allowance	10	5	5
Noise Management Level	42	37	36

7 NOISE TO RESIDENCES

The level of noise produced at the subject site will vary during construction. For the purpose of predicting noise to residential locations, consideration has been given to noise generated by typical single items of construction equipment and to noise produced by a number of items operating concurrently.

Refer to **Table 7** for the items and combination of items considered.

The 'Total' figure provided in **Table 7** is considered to be representative of the typical maximum sound power level likely to be produced in one area of the site at any one time during construction of the solar farm.

The buffer zone between noise source and receiver locations required to meet the Management Levels has been calculated. Calculations have been made using the Concawe prediction method. *Concawe, the propagation of noise from petroleum and petrochemical complexes to neighbouring*

communities is a method of noise prediction developed for assessing environmental noise propagation from petrochemical plants. The method draws on both acoustic theory and extensive measurements of noise carried out in the field. Calculations takes into account the effects of ground absorption, winds and temperature inversion on noise propagation.

The Concawe model allows predictions to be carried out for a range of meteorological conditions, from conditions extremely favourable to the propagation of sound from the source to the receiver, ie. temperature inversions and favourable winds (Categories 5 and 6), to conditions unfavourable to the propagation of sound. For the purpose of this assessment, all calculations have been carried out assuming favourable meteorological conditions.

Calculations assume that 30% of the ground between the noise source and the receiver location is absorptive. During the winter months, the percentage of absorptive ground is likely to be greater, and lower noise levels can be expected.

The minimum buffer distances for achieving the noise Management Levels are included in **Table 7**.

Table 7: Typical Construction Sound Power Levels and Buffer Distances

Item	Sound Power Level, dBA	Management Level, Lp, dBA (day)	Buffer Distance, m
Rockbreaker	115	42	900
Grader	109	42	600
Compactor	113	42	800
Truck	109	42	800
TOTAL (all items operating at once)	118	42	1100

The distance of the residential receiver from the boundary of the subject site has been subtracted from the recommended buffer zone in **Table 8**. The resultant distance can be used to determine the area of the subject site wherein construction noise has the potential to exceed the Management Levels during intensive periods of construction.

Table 8: Distance from Subject Site Boundary for Achieving Management Levels (multiple items of equipment operating)

	Residence 'A' south of subject site	'Springdale'	44 Hoskins St (Nyngan township)
Distance required to achieve buffer, m	1100	1100	100
Distance of residence to subject site boundary, m	160	400	600
Recommended minimum distance for construction from subject site boundary for achieving management levels, m	940	700	500

In summary, construction activities that are carried out within approximately 1 km of the subject site boundary in the direction of Residence A have the potential to exceed Management Levels. Similarly, noisy construction activities carried out within 700 m of the subject site boundary in the direction of 'Springdale', and 500 m from the boundary in the direction of Nyngan, have the potential to exceed Management Levels.

In the instance that construction activities in the identified zones are likely to continue for more than 3 weeks, measures should be taken to control noise to residential locations. For construction periods of less than 3 weeks, the qualitative guidelines provided in the *Interim construction Noise Guidelines, 2009* should be followed.

8 NOISE TO COMMERCIAL PREMISES

The nearest commercial noise sensitive premise is the horse ranch approximately 85 m to the north of the subject site. Calculated buffer distances for achieving the Management Levels at the ranch are included in **Table 7**.

Table 9: Typical Construction Sound Power Levels and Buffer Distances for Horse Ranch

Item	Sound Power Level, dBA	Management Level, Lp, dBA (day)	Buffer Distance, m
Rockbreaker	115	65	160
Grader	109	65	100
Compactor	113	65	140
Truck	109	65	100
TOTAL (all items operating at once)	118	65	200

In summary, construction noise is predicted to meet the Management Levels at the nearest commercial premises provided that extended periods of construction do not take place within approximately 200 m of the ranch.

9 NOISE MITIGATION OPTIONS

Methods for controlling noise to residential receivers include:

- Temporary barriers installed around the construction area
- Quieter methods for carrying out the same process, eg. equipment fitted with silencing devices.
- Use modern, serviced equipment.
- Minimise the duration of activities
- Substitute tonal reversing beepers with less intrusive broadband beepers
- Carry out extremely noisy activities during weather conditions that do not favour the propagation of sound to noise sensitive locations
- Minimise the number of items of plant operating concurrently.

10 SUMMARY

A preliminary assessment of construction noise from the proposed Nyngan solar farm has been carried out in accordance with the NSW *Interim Construction Noise Guideline*, 2009.

Management Levels for construction noise have been determined through background noise monitoring at residential locations in the vicinity of the subject site. Areas of the subject site where construction noise is at risk of exceeding the Management Levels have been identified.

To comply with *Guideline*, construction activities carried out in the identified buffer zones for durations of more than 3 weeks are to be managed to control noise to residences. Conceptual options for noise control are included in **Section 9** of this report.

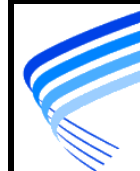
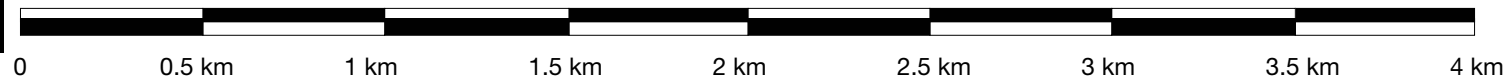
Construction activities carried out in the identified buffer zones for periods of less than 3 weeks are to be managed through qualitative methods, that is by restricting noisy activities to the recommended standard hours for construction and by keeping the community informed of the timing and duration of noisy activities.

11 CLOSURE

This report has been prepared by Heggies Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of NGH Environmental; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from Heggies.

Heggies disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.



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APPENDIX A: Nyngan Solar Farm

Site and Noise Receiver Locations
Reference: Google Earth

DRAWN
DW

DATE
28-Oct-10

SCALE
Approx. only

FILE
640.10006 DRAWINGS
20101025.XLS

JOB No.
640.10006

DRG. No.

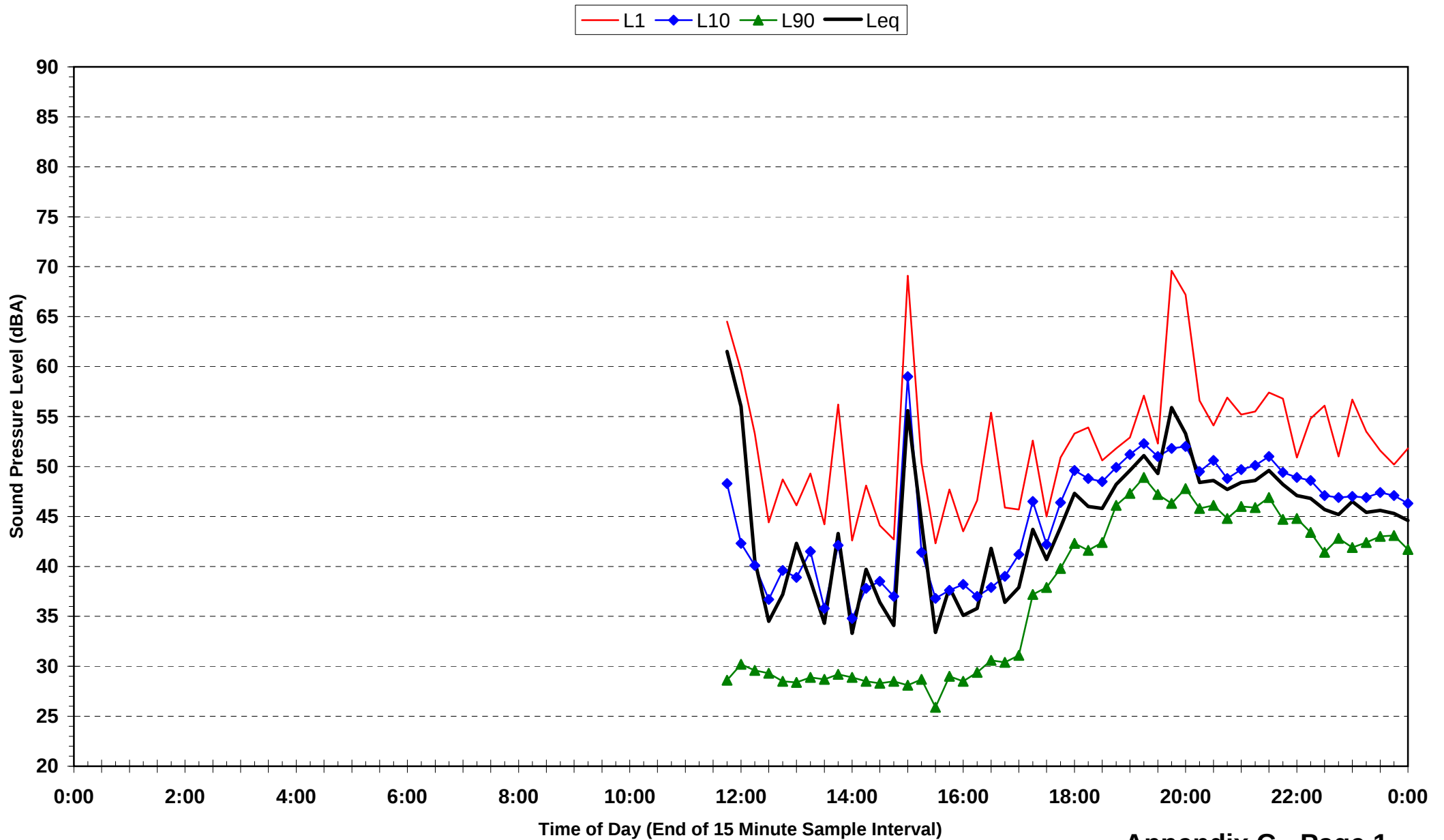
REVISION

WEATHER CONDITIONS DURING LONG TERM MONITORING FOR NYNGAN SOLAR FARM

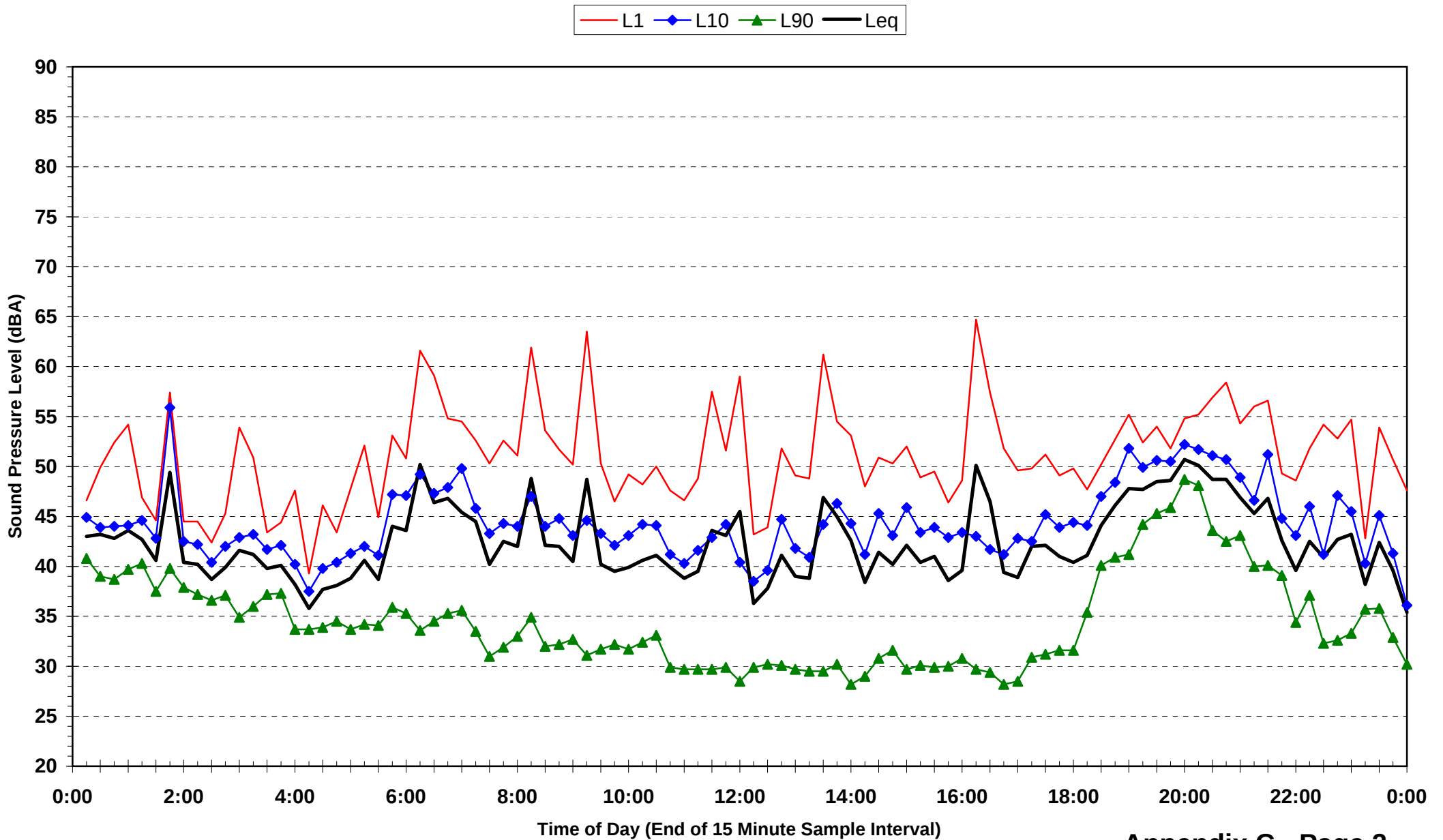
Dubbo Weather Station (Source: Bureau of Meteorology)

Day	Date	Rain	9 am		3 pm	
			Direction	Wind speed	Direction	Wind speed
Saturday	11 Sep 2010	0.6	S	7	SW	17
Sunday	12 Sep 2010	0	ESE	9	NNW	9
Monday	13 Sep 2010	0	WNW	19	W	19
Tuesday	14 Sep 2010	9	ENE	20	NW	11
Wednesday	15 Sep 2010	5.8	SW	28	WSW	26
Thursday	16 Sep 2010	0	W	15	SW	28
Friday	17 Sep 2010	0	SW	17	SW	22

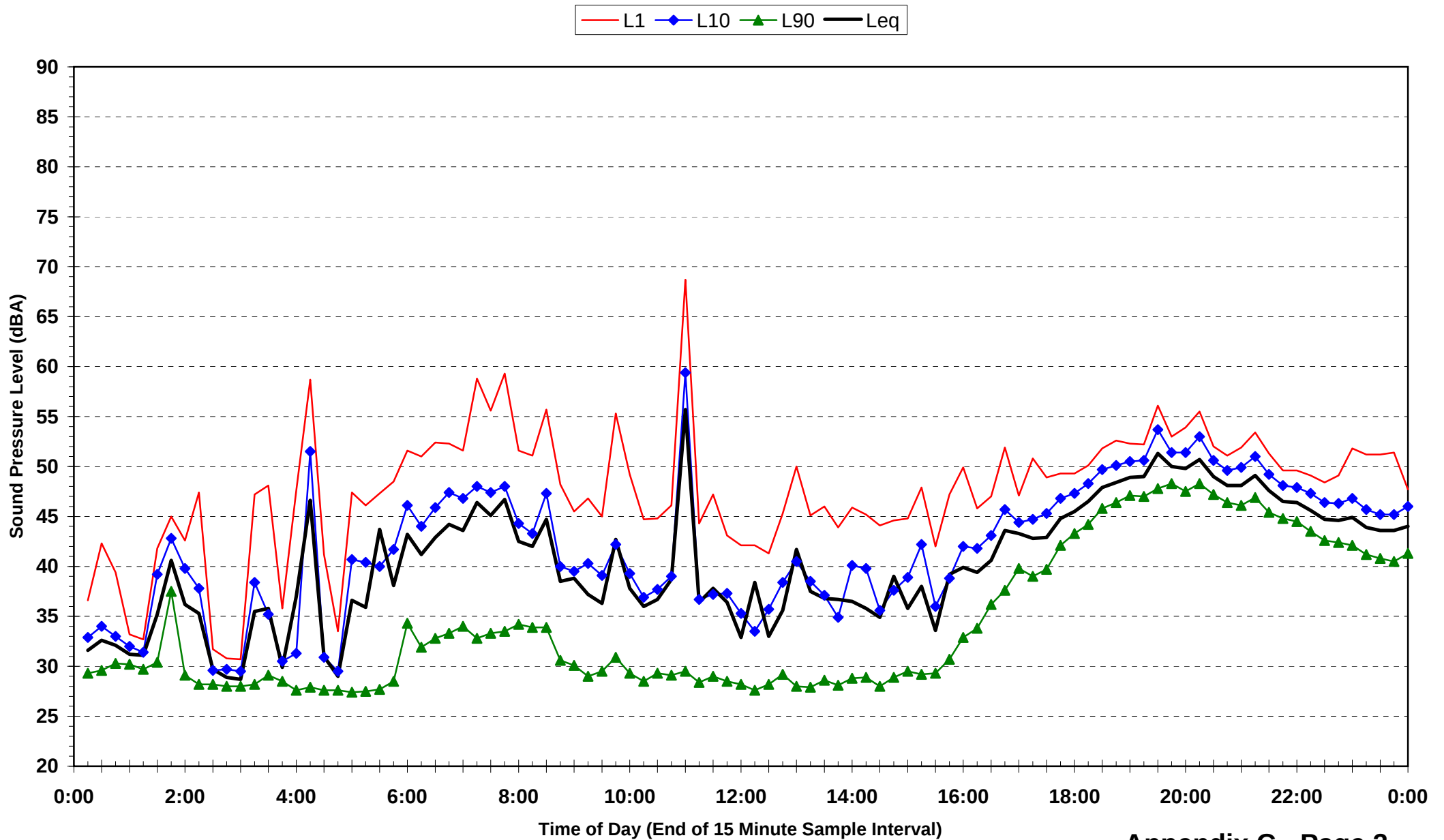
Statistical Ambient Noise Levels
'Springdale', Nyngan - Saturday 11 September 2010



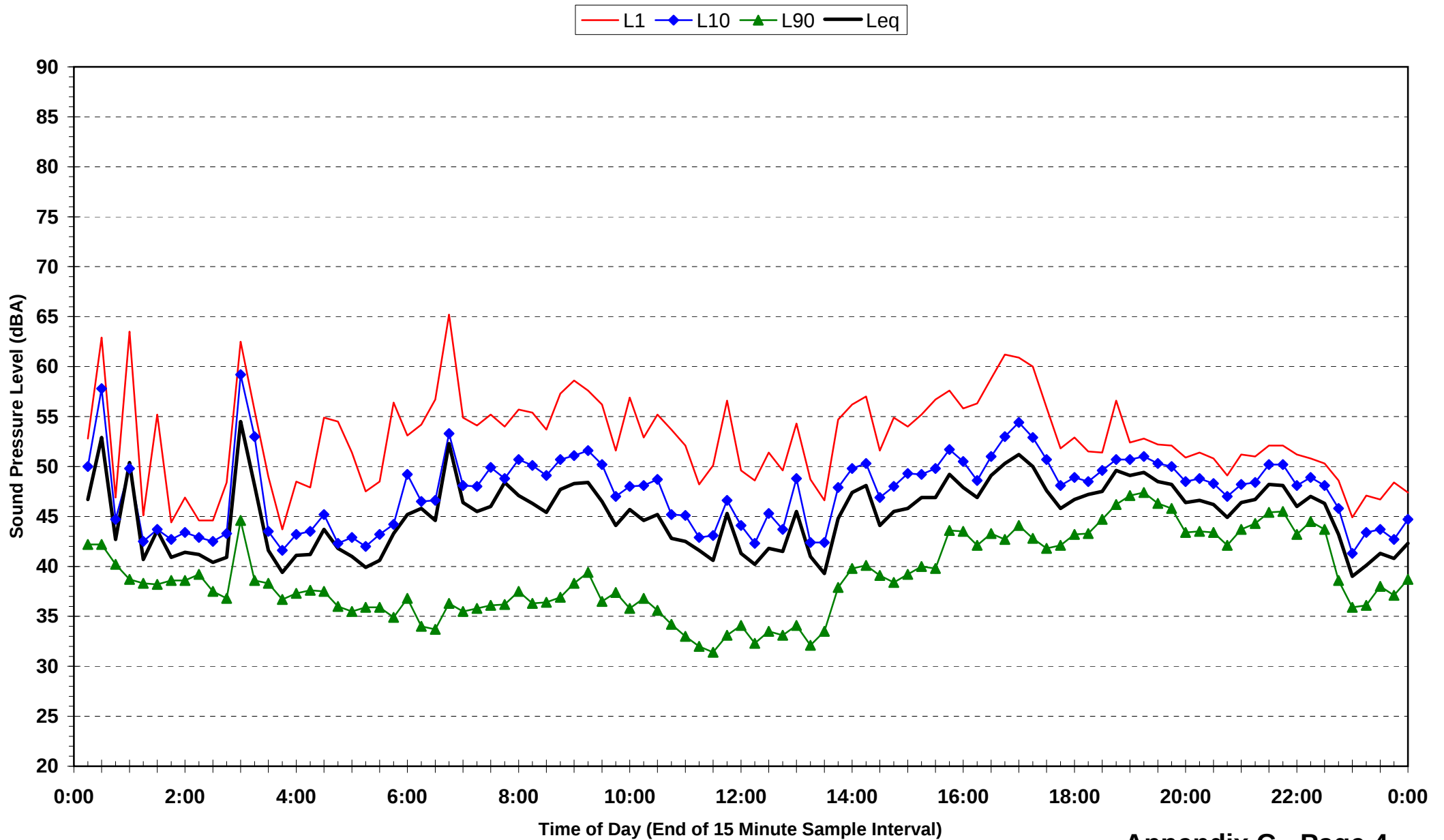
Statistical Ambient Noise Levels
'Springdale', Nyngan - Sunday 12 September 2010



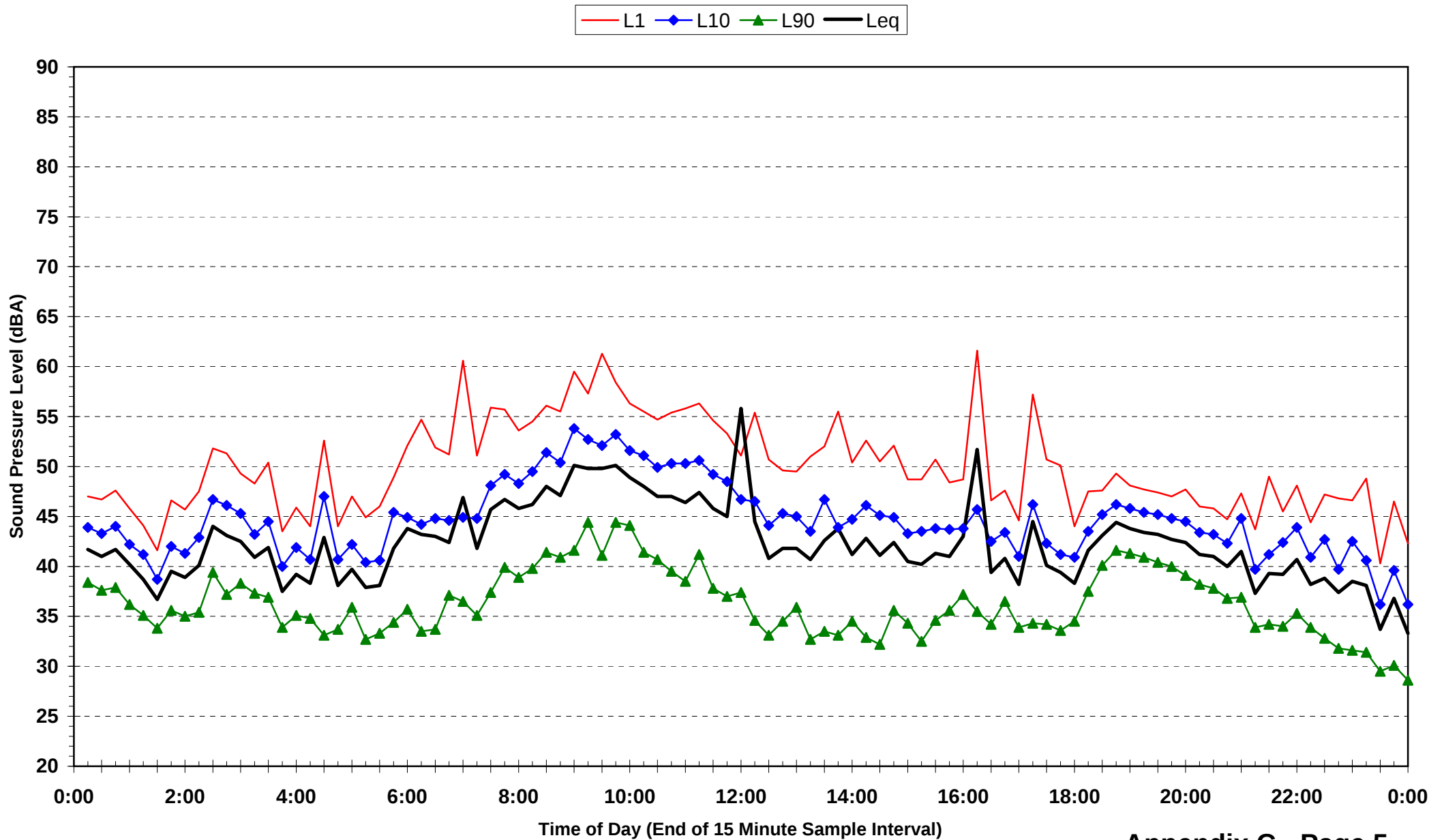
Statistical Ambient Noise Levels
'Springdale', Nyngan - Monday 13 September 2010



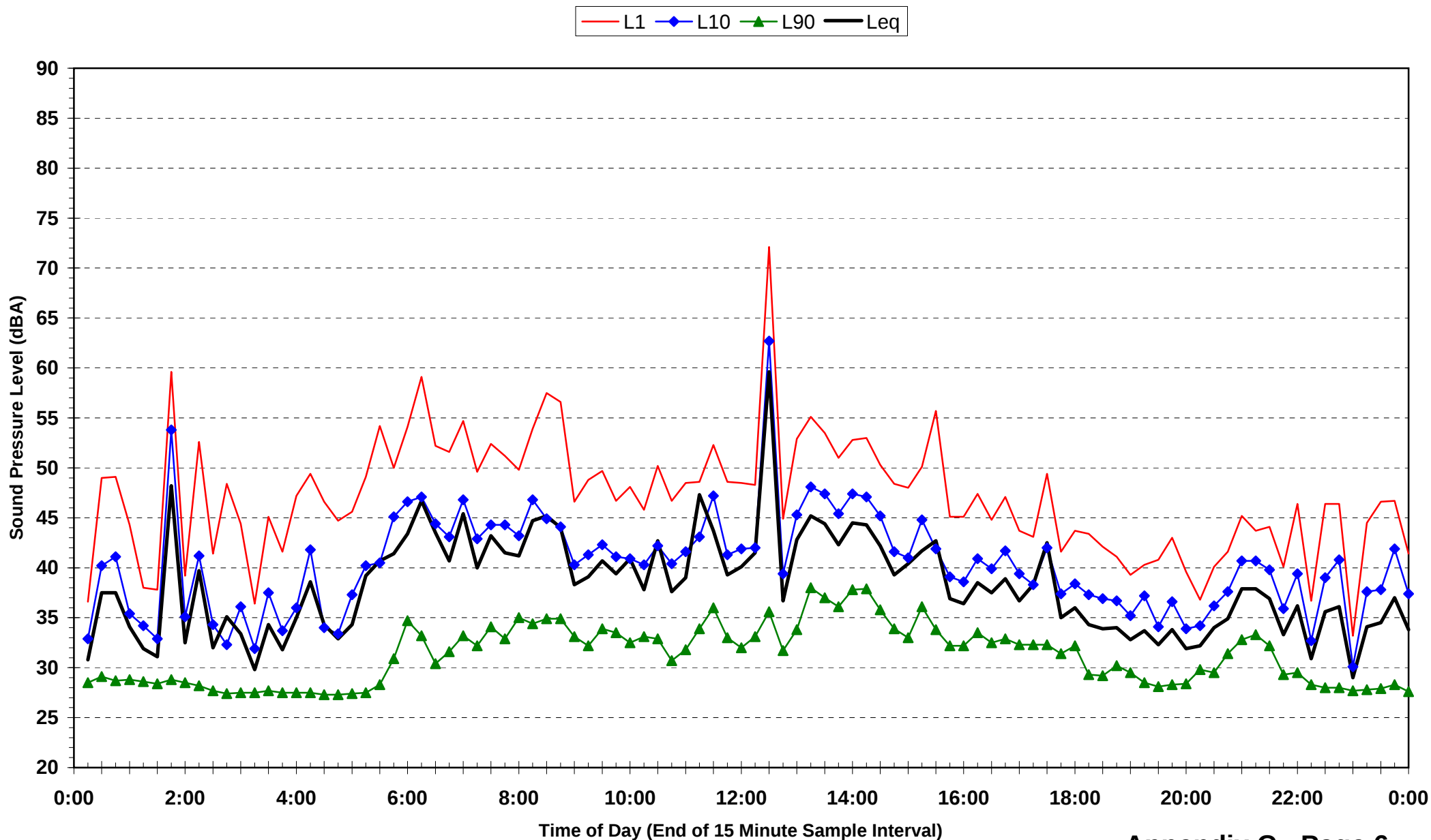
Statistical Ambient Noise Levels
'Springdale', Nyngan - Tuesday 14 September 2010



Statistical Ambient Noise Levels
'Springdale', Nyngan - Wednesday 15 September 2010



Statistical Ambient Noise Levels
'Springdale', Nyngan - Thursday 16 September 2010



Statistical Ambient Noise Levels
'Springdale', Nyngan - Friday 17 September 2010

