

ROCLA CALGA SAND QUARRY OPERATIONAL NOISE ASSESSMENT

TG248-01F02 (REV 1) OPERATIONAL NOISE ASSESSMENT

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DOCUMENT CONTROL

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1 INTRODUCTION

Renzo Tonin & Associates was engaged to conduct an operational noise assessment of Rocla's Sand Quarry at Calga. This assessment has been conducted in response to complaints from the owner and resident at Australia Walkabout Wildlife Park (AWWP) which is located south of the quarry.

Rocla previously responded to complaints from AWWP in 2010 when compliance noise monitoring was conducted by Wilkinson Murray. The Wilkinson Murray study concluded that noise goals stated in the Development Consent for the quarry do not adequately consider the level of background noise at Walkabout Park generated by the F3 Freeway, making the set goals too stringent. Wilkinson Murray also concluded that the quarry operations are generally in compliance with the NSW Industrial noise Policy criteria of "background + 5dB".

Further to the Wilkinson Murray study, the resident at AWWP recently requested a second noise assessment of the quarry operations be conducted, which initiated this study.

This report includes the results of short term attended monitoring and long term unattended noise monitoring, and both included audio recordings to enable playback and analysis of the results.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 SITE DESCRIPTION

2.1 Australia Walkabout Wildlife Park

The residence at the Australia Walkabout Wildlife Park (AWWP) is located approximately 1km south of the quarry, with Peats Ridge Road approximately 300m to the east and the F3 Freeway 600m to the south east.

2.2 Calga Sand Quarry

2.2.1 Hours of Operation

The Calga Sand Quarry currently operates between the hours of 5am-6pm, Monday to Friday and 5am-4pm Saturday. Between the hours of 5am-7am, only 'delivery and distribution' activities occur which is typically a front end loader loading sales trucks. From 7am, extraction and processing activities also occur.

2.2.2 Plant & Equipment

The following table lists the plant and equipment that operates at the Calga Sand Quarry. The general location of the plant and equipment on the day of measurement has also been detailed and is shown in Figure 1 below and the location of the Australian Walkabout Wildlife Park is shown in Figure 2.

Table 1- Calga Sand Quarry Plant & Equipment

Plant & Equipment	Location
Komatsu 375-5 Dozer	Stage 3/3
Caterpillar 330cl Excavator	Stage 3/3
2 x Caterpillar 972H Front End Loader	Stage 3/3 & Washplant Area
2 x Caterpillar 740 Dump Truck	Stage 3/3 to Washplant Area
IT 938 Front End Loader	Stage 3/6
Caterpillar D11 Dozer	Stage 3/3
Washplant	Washplant Area
Finlay Mobile Jaw Crusher	Stage 3/3
Transfer Pump 5 (TP5)	TP5 (eastern end of site)
Powerscreen Chieftan 1700	Stage 3/6

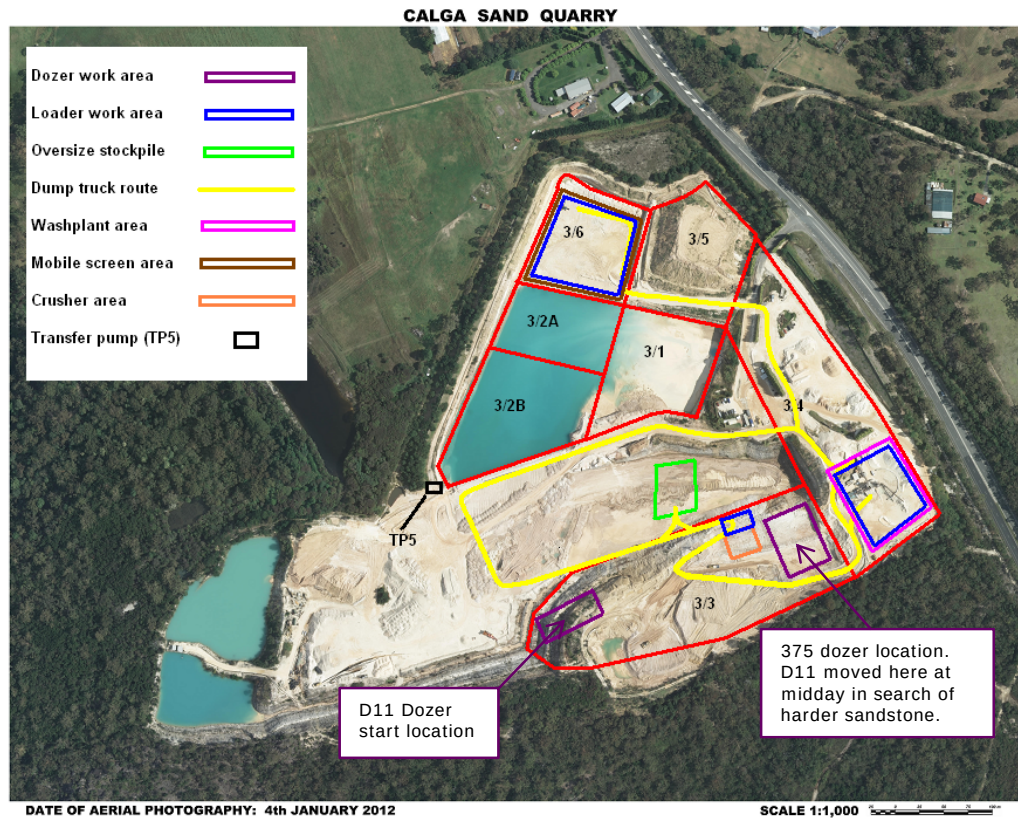


Figure 1 – Site Operations and Equipment Locations

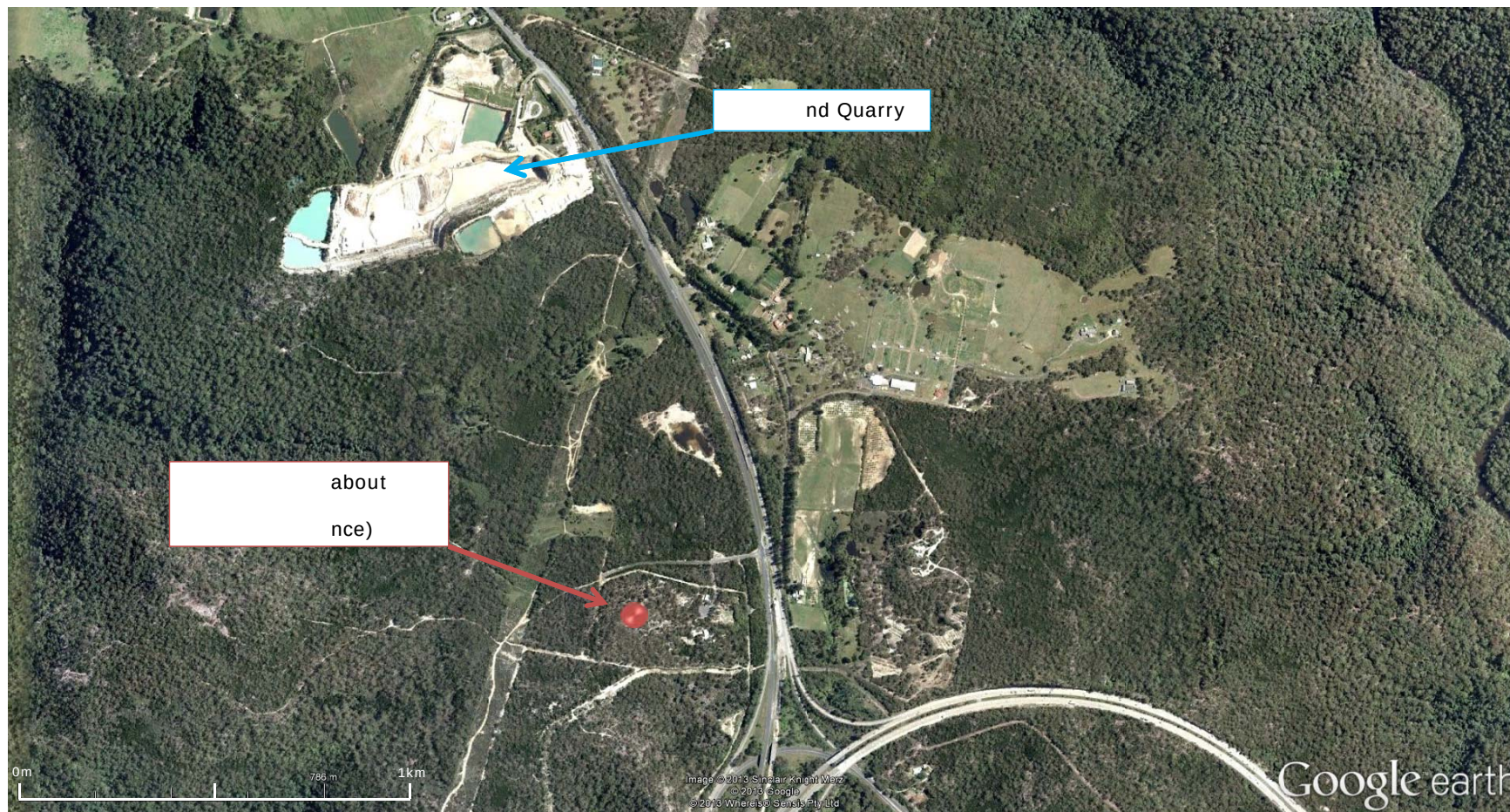


Figure 2 - Site Aerial and Surrounds

3 CRITERIA

3.1 Calga Sand Quarry Conditions of Consent

The operational noise criteria for the Calga Sand Quarry are contained in Table 1 of Schedule 3 of the Development Consent (DA 94-4-2004). There are specific noise criteria provided for certain residences to the north of the quarry, however any residence not specifically listed in the table, including the residence at AWWP to the south, is classified as “other residence”, to which the following criteria apply.

- 35 dBL_{Aeq,15min} at any time, Day, Evening or Night, nor
- 45 dBL_{A1,1min} during Night (10.00pm-7.00am) periods.

3.2 NSW Industrial Noise Policy (INP)

Since there is some question as to whether the above Consent criteria are applicable to AWWP considering its closer proximity to the F3 Freeway, the requirements of the Industrial Noise Policy (INP) are also presented here. The INP has two components:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for particular land uses for residences and other land uses.

3.2.1 Intrusive Noise

The INP recommends, in general, that the L_{Aeq} noise level from a newly-introduced source not exceed the background (L₉₀) noise level by more than 5dB(A). Regard must be given, however, to the extent of the existing background noise and whether such a level is appropriate for the specific development and land-use of the receiver area.

The intrusiveness of an industrial noise source may generally be considered acceptable if the L_{Aeq} (equivalent continuous A-weighted level of noise) from the source, measured over a 15 minute period, does not exceed the Rating Background Level (RBL) by more than 5dB(A). That is;

$$L_{Aeq,15min} \leq RBL + 5dB(A)$$

3.2.2 Protecting Noise Amenity

Section 2.2 of the INP provides guidelines to assist in the planning for noise controls. Table 2.1 recommends ‘acceptable’ and ‘maximum’ L_{Aeq} noise levels for different land uses. Where the existing noise level from industrial noise sources is close to the acceptable noise level, the noise level from any new sources must be controlled to preserve the amenity of an area. Table 2 below presents the INP amenity criteria that apply to the AWWP residence.

Table 2 – INP Recommended L_{Aeq} Noise Levels from Industrial Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L _{Aeq} Noise Level, dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

3.2.3 'Modifying Factor' Corrections

Where the character of the noise in question is assessed as particularly annoying (i.e. if it contains certain characteristics such as tonality, impulsiveness, intermittency, irregularity or dominant low frequency content), then a correction is to be added to the measured value to penalize the noise for its potential increase in annoyance.

Based on our site visit, measurements and analysis, no corrections need be applied to the measured levels for the quarry.

3.3 Wilkinson Murray Suggested Noise Criteria

Long term noise monitoring was conducted by Wilkinson Murray at AWWP in both 2006 as part of the Development Application for the Calga Sand Quarry Southern Extension and again in 2010 as part of the noise complaint monitoring. In their 2010 report, Wilkinson Murray suggests the noise criteria as shown in Table 3 should apply at the AWWP residence.

We note that there seems to be a typographic error in the Wilkinson Murray report and the day time criteria of 45dB(A) may have been intended to read 43dB(A) based on a 38 + 5 criterion.

Table 3 - Wilkinson Murray Measured Levels and Suggested Criteria

Period	RBL dB(A) (2010)	RBL dB(A) (2006)	Criterion (L _{Aeq} ,15min)
Day (7.00am-6.00pm)	38	41	45
Evening (6.00pm-10.00pm)	43	40	45
Night (10.00pm-7.00am)	37	33	38
Shoulder Period (5.00-7.00am)	42	37	42

3.4 Renzo Tonin Suggested Noise Criteria

Long term noise monitoring was conducted at the AWWP residence by Renzo Tonin & Associates from 14th May to 19th May 2013. The results of the noise monitoring are presented in Table 4.

Table 4 – Renzo Tonin & Associates Measured Levels and Suggested Criteria

Period	RBL dB(A) (2013)	Criterion (LAeq,15min)
Day (7.00am-6.00pm)	38	43
Evening (6.00pm-10.00pm)	33	38
Night (10.00pm-7.00am)	30*	35
Shoulder Period (5.00-7.00am)	33	38

*Note: *RBL was measured to be lower than 30dB(A) but was set to 30dB(A) in accordance with the INP*

Whilst the day time noise levels measured in May 2013 are consistent with those measured in 2010, the evening, night and shoulder periods are somewhat lower. This is likely due to the seasonable variations in background noise levels (possibly due to crickets and wildlife) as noise monitoring had previously been conducted during the summer months of December (2006) and February (2010).

Whilst the Calga Sand Quarry does not operate at during the evening or night periods, the corresponding background levels have also been presented for comparison.

Based on all available data we suggest that the following noise criteria are appropriate for the AWWP residence.

- Day (7.00am-6.00pm) 43dB(A) $L_{Aeq,15min}$
- Shoulder (5.00am-7.00am) 38dB(A) $L_{Aeq,15min}$

4 NOISE MONITORING RESULTS

4.1 Monitoring Location

Short term attended noise monitoring was conducted on the 15th May 2013 adjacent to the AWWP residence. The purpose of the monitoring was to quantify noise emission levels from the Calga Sand Quarry. The noise monitor was installed on the North-Western side of the dwelling facing the quarry in a similar location to the previous noise assessments.

4.2 Noise Monitoring Equipment

The equipment used for the noise measurements was a Brüel & Kjær Type 2250 precision sound level analyser which is a Class 1 instrument having an accuracy suitable for field and laboratory use. The instrument was calibrated prior and subsequent to measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

All instrumentation complies with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and carries current NATA certification (or if less than 2 years old, manufacturers certification).

4.3 Ambient Acoustic Environment

On the day of the attended noise measurements, the existing acoustic environment was dominated by nature, local traffic and operations from the Calga Sand Quarry. It was noted when arriving at the site on the afternoon of the 14th May that noise from the F3 Freeway was clearly audible, however when measuring on the 15th noise from the F3 Motorway was not audible. This was likely due to the different wind conditions on the two days.

4.4 Wind Conditions

Wind conditions on the 15th May were measured during each fifteen minute period at the logger location were possible. Wind was measured to be between 0-2m/s with wind gusts up to 3m/s blowing from the North / North-west, i.e. from the Calga Sand Quarry towards the AWWP residence. Wind conditions obtained from the Bureau of Meteorology at the Gosford weather station (as presented in the long term noise monitoring graphs) showed wind speeds between 0-5m/s throughout the day. In certain periods of the day, high winds caused the ambient noise to noticeably increase due to wind noise in trees.

4.5 Short Term Noise Monitoring Results

Table 5 presents the results of the attended noise monitoring. Attended noise monitoring was conducted continuously from 6:30am through to 6:00pm and site inspections of the Calga Sand Quarry were conducted periodically to ascertain the current site operations. Each fifteen minute period has been presented and a short description of the major noise sources has been provided. Results for the 5:00am to 6:30am period were obtained by listening to the audio recordings captured by the long term noise logger.

Noise monitoring results have been presented for each fifteen minute period and the coding of the table is as follows.

- **Bold** font indicates that quarry noise was the main contributor the measured noise levels during the period.
- Where ambient noise, traffic and wind were the dominate sources of noise and the quarry could not clearly be heard, these have been greyed.
- Regular font indicates a combination of quarry noise and ambient noise where the quarry could only sometimes be heard.
- *Italics* indicate results from a period of less than 15 minutes.

Table 5 - Short Term Noise Monitoring Results

Time		Level dB(A)			Comments				
Start Time	End Time	L _{Aeq}	L _{AFmax}	L _{AF90}	Plant & Equipment Operating	Audibility of Quarry Activity	Audible Noise	Ambient Noise	
								Wind	Other
5:00	5:15	40	60	28	• 972H front end loader loading sales trucks.	Low	Intermittent noise from trucks	Low	Traffic on Peats Ridge Road
5:15	5:30	43	57	33		Low	Intermittent noise from trucks	Low	Traffic on Peats Ridge Road
5:30	5:45	45	61	34		Low	Intermittent noise from trucks	Low	Traffic on Peats Ridge Road
5:45	6:00	42	56	35		Low	Intermittent noise from trucks	Low	Traffic on Peats Ridge Road
6:00	6:15	43	58	34		Low	Intermittent noise from trucks	Low	Traffic on Peats Ridge Road
6:15	6:30	49	75	35		Low	Intermittent noise from trucks	Low	Arrival On Site
6:30	6:45	46	62	39		Medium	Intermittent noise from trucks	Low	Some bird noise
6:45	7:00	44	62	38		Medium	Intermittent noise from trucks	Low	Some bird noise
7:00	7:15	44	59	38	• 375-5 dozer ripping and pushing sandstone in Stage 3/3. • 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3. • 972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks. • Two 740 dump trucks taking raw feed from Stage 3/3 to washplant. • 972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks. • IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. • Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. • Transfer pump 5 (TP5) in constant operation. • Washplant in full production.	Medium	Intermittent noise from mobile plant on site. Broadband reverse alarms.	Medium	Some bird noise
7:04	7:04	39	43	37		High	Broad Band Reverse Alarm	Low	-
7:15	7:30	47	59	42		Medium	Intermittent noise from mobile plant movements on site. Broadband reverse alarms.	Medium	Some bird noise
7:30	7:45	45	56	41		Medium - Low	Intermittent noise from mobile plant movements on site. Broadband reverse alarms.	Medium	Some bird noise
7:45	8:00	45	57	40		Medium - Low	Intermittent noise from mobile plant movements on site. Broadband reverse alarms.	Medium	Some bird noise
8:00	8:15	44	54	41		Medium - Low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
8:15	8:30	43	56	40		Medium - Low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
8:30	8:45	44	55	41		Medium	Intermittent noise from mobile plant movements on site	Medium	Some bird noise

Time		Level dB(A)			Comments				
Start Time	End Time	L _{Aeq}	L _{AFmax}	L _{AF90}	Plant & Equipment Operating	Audibility of Quarry Activity	Audible Noise	Ambient Noise	
								Wind	Other
8:45	9:00	43	56	39	972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks.	Medium	Intermittent noise from mobile plant movements on site	Medium-low	Some bird noise
9:00	9:15	42	54	38		Low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
					- IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. - Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - Transfer pump 5 (TP5) was in constant operation. - Washplant in full production.				
9:15	9:30	44	58	40	375-5 dozer ripping and pushing sandstone in Stage 3/3. 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3.	Medium - low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
9:30	9:45	44	56	40		Medium	Intermittent noise from mobile plant movements on site	Medium-high	Some bird noise
					972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks.				
9:45	10:00	43	54	40	Two 740 dump trucks taking raw feed from Stage 3/3 to washplant.	Low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
10:00	10:15	43	52	40		Medium - low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
10:15	10:30	44	54	40	IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6.	Medium - Low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
10:30	10:45	44	53	41		Low	Intermittent noise from mobile plant movements on site	Medium-high	Some bird noise
					- Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - Transfer pump 5 (TP5) in constant operation. - Washplant in full production.				
10:45	11:00	43	52	40	375-5 dozer ripping and pushing sandstone in Stage 3/3. 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3.	Low	Intermittent noise from mobile plant movements on site	Medium	Some bird noise
11:00	11:15	44	55	40		Medium	Intermittent noise from mobile plant movements on site	Medium-high	Some bird noise
					972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks.				
11:15	11:30	45	52	40	Two 740 dump trucks taking raw feed from Stage 3/3 to washplant.	Low	Intermittent noise from mobile plant movements on site	Medium-high	Some bird noise

Time		Level dB(A)			Comments				
Start Time	End Time	L _{Aeq}	L _{AFmax}	L _{AF90}	Plant & Equipment Operating	Audibility of Quarry Activity	Audible Noise	Ambient Noise	
								Wind	Other
11:30	11:45	46	54	42	972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks. - IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. - Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - D11 dozer (Hired machine) ripping sandstone in Stage 3/3 developing entry road to new washplant and admin area on Stage 2, and ripping in same area as 375-5 between 10:45am and 12:00pm. - Transfer pump 5 (TP5) in constant operation.	Low	Intermittent noise from mobile plant movements on site.	Medium-high	Some bird noise
11:45	12:00	45	54	40	375-5 dozer ripping and pushing sandstone in Stage 3/3. 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3.	Very low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	High	Some bird noise
12:00	12:15	44	51	39	972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks. - Two 740 dump trucks taking raw feed from Stage 3/3 to washplant. 972H front end loader loading oversize from washplant into dump trucks and loading sales trucks. - IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. - Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - D11 dozer (Hired machine) ripping sandstone in Stage 3/3 developing entry road to new washplant and admin area on Stage 2, and ripping in same area as 375-5 between 10:45am and 12:00pm. - Transfer pump 5 (TP5) in constant operation.	Medium	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	Medium	Some bird noise
12:07	12:09	42	46	40	375-5 dozer ripping and pushing sandstone in Stage 3/3. 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3. 972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks. - Two 740 dump trucks taking raw feed from Stage 3/3 to washplant. 972H front end loader loading oversize from washplant into dump trucks and loading sales trucks. - IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. - Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - D11 dozer (Hired machine) ripping sandstone in Stage 3/3 developing entry road to new washplant and admin area on Stage 2, and ripping in same area as 375-5 between 10:45am and 12:00pm. - Transfer pump 5 (TP5) in constant operation.		D11 Ripper in Stgace 3/3 area. Audible sound of rock ripping.	Medium-low	-
12:15	12:30	48	58	41	375-5 dozer ripping and pushing sandstone in Stage 3/3. 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3.	-	Lmax from wind noise. Dominated by wind noise.	High	-
12:30	12:45	48	56	43	972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks.	Very low	Lmax from wind noise. Dominated by wind noise.	High	-
12:45	13:00	50	60	42	Two 740 dump trucks taking raw feed from Stage 3/3 to washplant.	-	Lmax from wind noise. Dominated by wind noise.	High	-

Time		Level dB(A)			Comments				
Start Time	End Time	L _{Aeq}	L _{AFmax}	L _{AF90}	Plant & Equipment Operating	Audibility of Quarry Activity	Audible Noise	Ambient Noise	
								Wind	Other
13:00	13:15	50	60	45	972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks.	-	Lmax from wind noise. Dominated by wind noise.	High	-
13:15	13:30	44	56	39	- IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. - Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - Transfer pump 5 (TP5) in constant operation.	Very low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	High	-
13:30	13:45	47	57	40	375-5 dozer ripping and pushing sandstone in Stage 3/3. 330cl excavator loading Finlay mobile jaw crusher with raw feed from Stage 3/3.	Very Low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	High	-
13:45	14:00	45	57	40	972H front end loader, loading raw feed from Stage 3/3 into 2 – 740 dump trucks. - Two 740 dump trucks taking raw feed from Stage 3/3 to washplant.	Very Low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	Medium - high	Some bird noise
14:00	14:15	46	59	41	972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks. - IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6.	Low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	Medium - high	Some bird noise
14:15	14:30	47	56	41	- Dump trucks loaded by 972H front end loader, taking oversize from washplant to oversize stockpile on Stage 2. - Transfer pump 5 (TP5) in constant operation.	-	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	High	Some bird noise
14:30	14:45	48	56	42	Washplant in full production.	Very Low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	High	-
14:45	15:00	48	56	43		-	Lmax from wind noise. Dominated by wind noise.	High	Some bird noise
15:00	15:15	48	58	42		-	Lmax from wind noise. Dominated by wind noise.	High	Some bird noise
15:15	15:30	44	54	39	972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks. - Dump trucks taking oversize from washplant to oversize stockpile on Stage 2.	Very Low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	High	Some bird noise

Time		Level dB(A)			Plant & Equipment Operating	Comments			
Start Time	End Time	L _{Aeq}	L _{AFmax}	L _{AF90}		Audibility of Quarry Activity	Audible Noise	Ambient Noise	
								Wind	Other
15:30	15:45	43	57	39	- IT 938 front end loader, loading raw feed from stockpile into Powerscreen Chieftan 1700 screen to produce Bricklaying mortar sand on Stage 3/6. - Transfer pump 5 (TP5) in constant operation. - Washplant in full production.	Very Low	Lmax from site (impact noise spike). Dominated by wind noise. Intermittent noise from mobile plant movements on site.	Medium - high	Some bird noise & noise from AWWP
15:45	16:00	42	52	39		Very Low	Lmax from wind noise. Dominated by wind noise. Intermittent noise from mobile plant movements on site.	Medium - high	Some bird noise
16:00	16:15	43	55	39		Low	Intermittent noise from mobile plant movements on site.	Medium - high	-
16:15	16:30	41	52	38		Medium - Low	Intermittent noise from mobile plant movements on site.	Medium	-
16:30	16:45	41	51	37		Medium - low	Intermittent noise from mobile plant movements on site.	Low	-
16:45	17:00	40	52	36		Medium - low	Intermittent noise from mobile plant movements on site.	Low	-
17:00	17:15	41	49	38		Low	Intermittent noise from mobile plant movements on site.	Low	Some bird noise
17:15	17:30	41	54	37		Low	Intermittent noise from mobile plant movements on site. Broadband reverse alarms.	Low	-
17:30	17:45	40	55	36		Very Low	Intermittent noise from mobile plant movements on site.	Low	-
17:45	18:00	39	51	34		Very Low	Intermittent noise from mobile plant movements on site.	Low	-

5 DISCUSSION OF RESULTS & CONCLUSIONS

Noise emissions from the Calga Sand Quarry were audible at various times throughout the day at the Australia Walkabout Wildlife Park (AWWP) residence. From the measurements it is determined that;

- Between 5am and 7am, whilst some engine and machine noise was audible, it was not clearly from the quarry and considering that only one loader was operating, it was more likely from trucks on Peats Ridge Road. Since the quarry was effectively inaudible its emissions are not considered intrusive or offensive during this period.
- After 7am when extraction and processing activities were occurring, the quarry was more audible however the measured L_{Aeq} levels stayed much the same. This was due to Peats Ridge Road noise decreasing whilst site noise increased. It was not obvious that the washplant, crusher, bulldozers or excavator were the source of the audible noise after 7am. Rather, the most audible activity seemed to be engine noise from haul trucks as they travel from the jaw crusher up to the washplant area, and are at the highest point on the site.
- Sand extraction works occurring low down in the pit in Stage 3/3 with the 375 bulldozer, excavator and jaw crusher did not seem to increase noise levels over the dumping and loading activities occurring at the washplant area.
- Measured noise levels at the AWWP residence during times when the quarry was audible were in the range of 42 – 47dB(A). These were measured during a typical worst case scenario when wind of up to 3m/s was blowing in the direction from the quarry to the AWWP residence. These measured levels include ambient noise such as local traffic and wildlife noise, which contributes approximately 1dB(A) to the measured levels.
- Whilst the Development Consent noise goal for the AWWP residence is currently 35dB(A), this seems to be a blanket goal established for residences where specific background noise data was unavailable. There is now sufficient data to suggest that a more appropriate goal in accordance with the INP would be 43dB(A) during the day, and 38dB(A) during the shoulder period of 5am – 7am.
- The most likely cause of audible noise was emitted from mobile plant movement near wash plant area. The following activities occur at the washplant area;
 - 972H front end loader feeding washplant from surge pile, loading oversize from washplant into dump trucks and loading sales trucks.
 - Two 740 dump trucks taking raw feed from Stage 3/3 to washplant.
 - Dump trucks loaded by 972H front end loader, taking oversize waste from washplant to stockpile on Stage 2.

- Site noise was intermittent, with the movement of mobile plant being most audible. Broad band reverse alarms were at times audible, however the engine noise of mobile plant was more dominant.
- Operation of the standard 375 dozer was not audible, however the D11 dozer was audible for a short period whilst ripping in hard sandstone. The noise emissions from ripping in hard sandstone were compliant with the 43dB(A) day time goal.
- The walls of the quarry pit were likely providing enough shielding from activities in Stage 3/3 for plant and equipment to be generally inaudible.

The findings of this study are:

- Although the Development Consent for the quarry currently applies a 35dB(A) noise criterion for the AWWP residence, based on noise monitoring conducted by ourselves and others, more appropriate noise criteria would be;
 - o Day (7.00pm-6.00pm) 43 dBL_{Aeq,15min}
 - o Shoulder (5.00pm-7.00am) 38 dBL_{Aeq,15min}
- The above criteria apply only to noise generated by the quarry. If these proposed criteria above were adopted, then based on the measurement results and taking into account contributions from the ambient environment, the daytime criteria can potentially be exceeded by up to 3dB(A) during the worst case when wind is blowing from the quarry towards the AWWP residence.
- In addition to the worst case wind being prevalent on the day of testing, Rocla also created a worst case operational scenario by operating all equipment concurrently, including the D11 dozer which is only temporarily on site.
- We expect there would be many days, particularly when wind is blowing from the south, that the quarry would be mostly inaudible at the AWWP residence, as was the case on the 14th May during our initial inspection of AWWP.
- To reduce site noise levels we recommend inspection of the two 740 dump trucks and the front end loader working at the washplant to determine the current level of noise mitigation treatment on both the induction and exhaust side of the engines. Further mitigation and mufflers could be fitted, if reasonable and feasible to do so.
- Noise studies by others have suggested that Lmax noise levels from the quarry are not loud enough to cause sleep disturbance in the early morning at the AWWP residence and we concur with this assertion.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background Noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A):	A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
Lmax	The maximum sound pressure level measured over a given period.
Lmin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

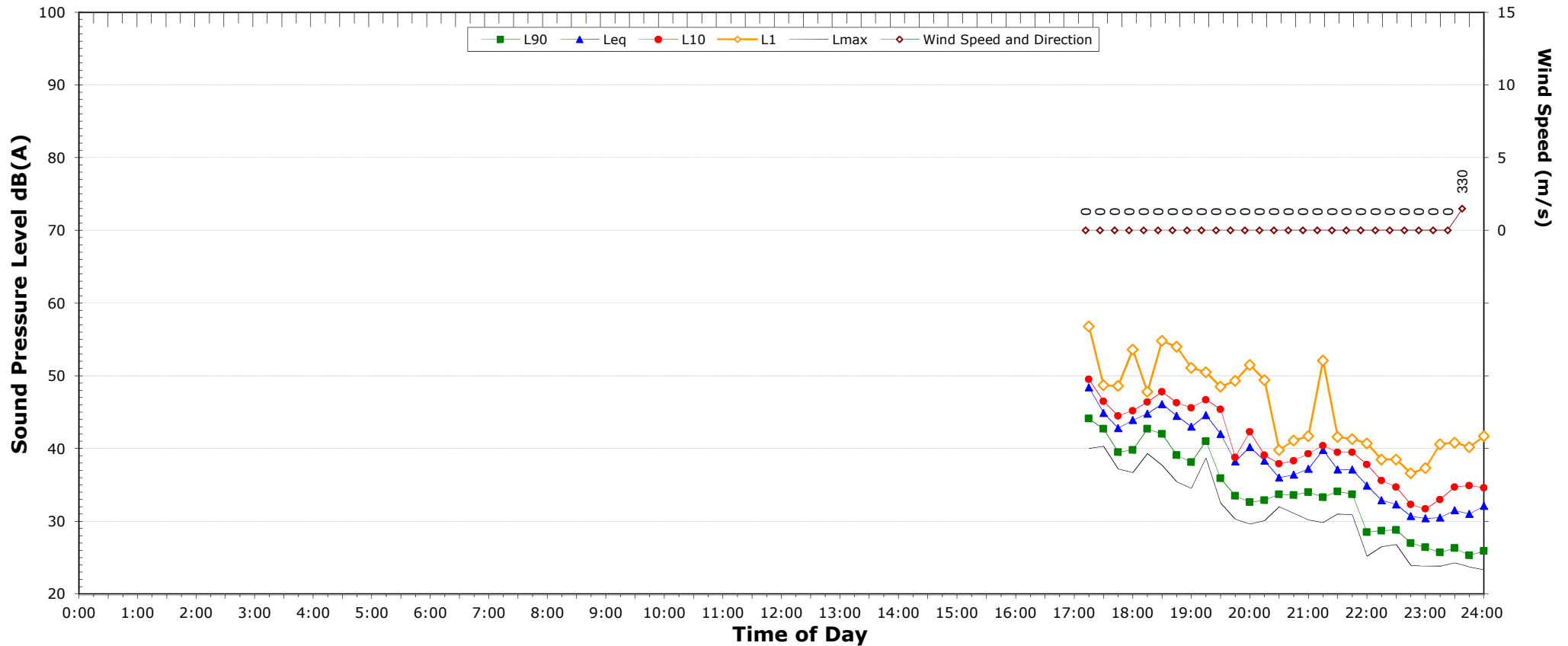
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B - NOISE MONITORING GRAPHS

EXISTING AMBIENT NOISE LEVELS

Australain Walkabout Wildlife Park

Tuesday, 14 May 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	-	32.6	22.4
Leq	-	41.5	40.3

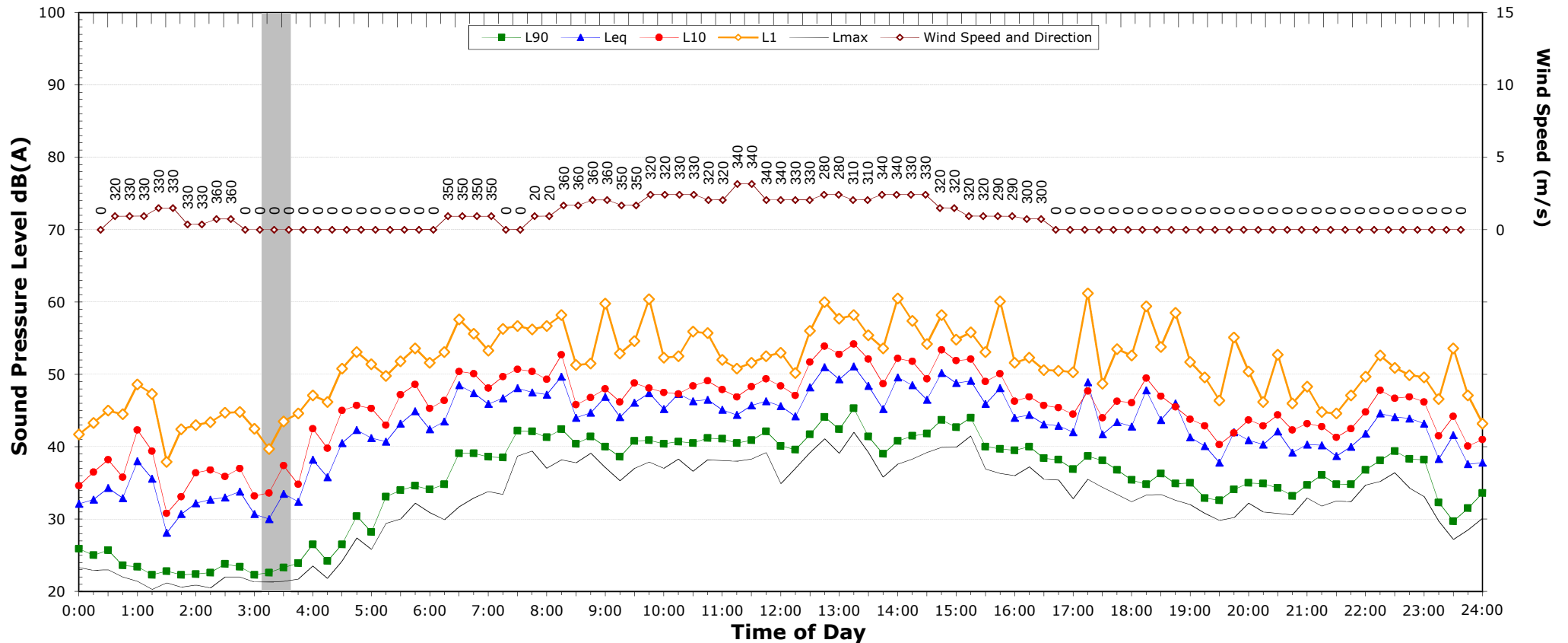
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

Australain Walkabout Wildlife Park

Wednesday, 15 May 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	38.2	32.9	30.5
Leq	47.1	42.3	43.4

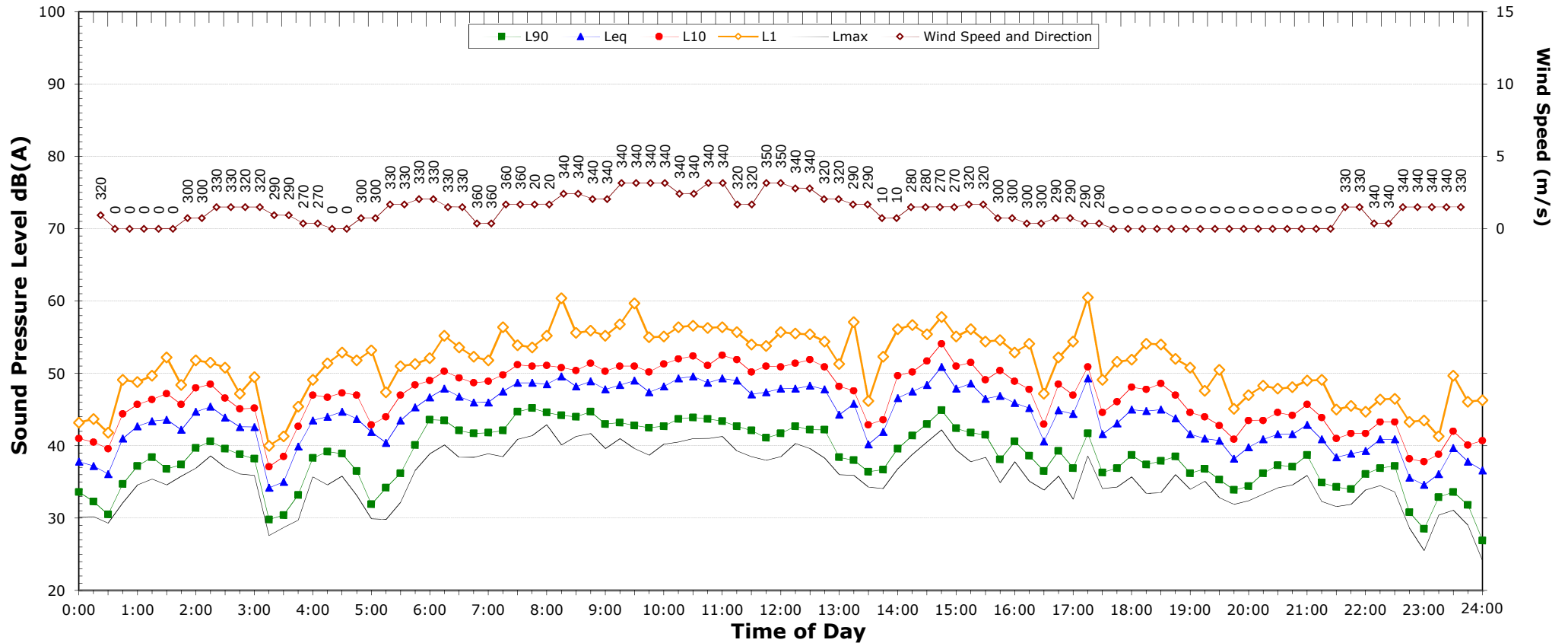
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

Australain Walkabout Wildlife Park

Thursday, 16 May 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	36.9	34.0	28.5
Leq	47.6	41.7	41.5

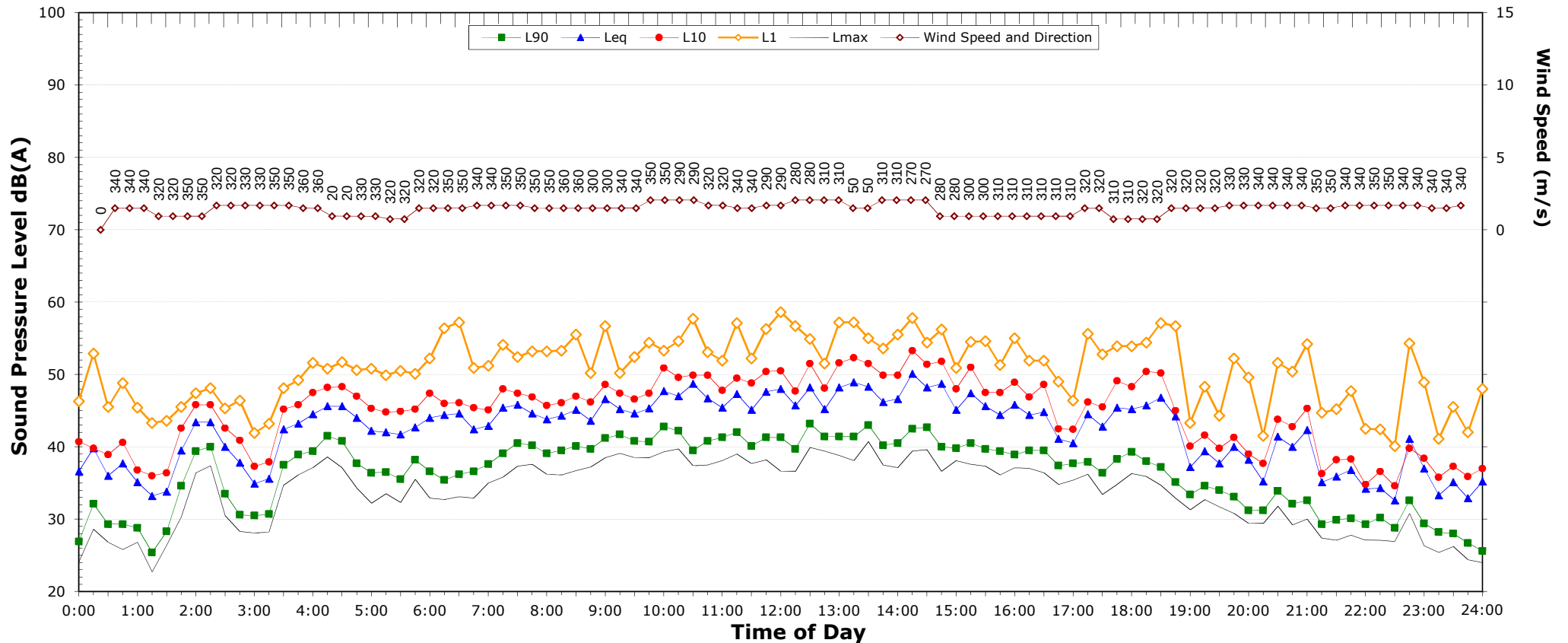
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

Australain Walkabout Wildlife Park

Friday, 17 May 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	38.3	29.3	23.9
Leq	46.3	41.1	36.3

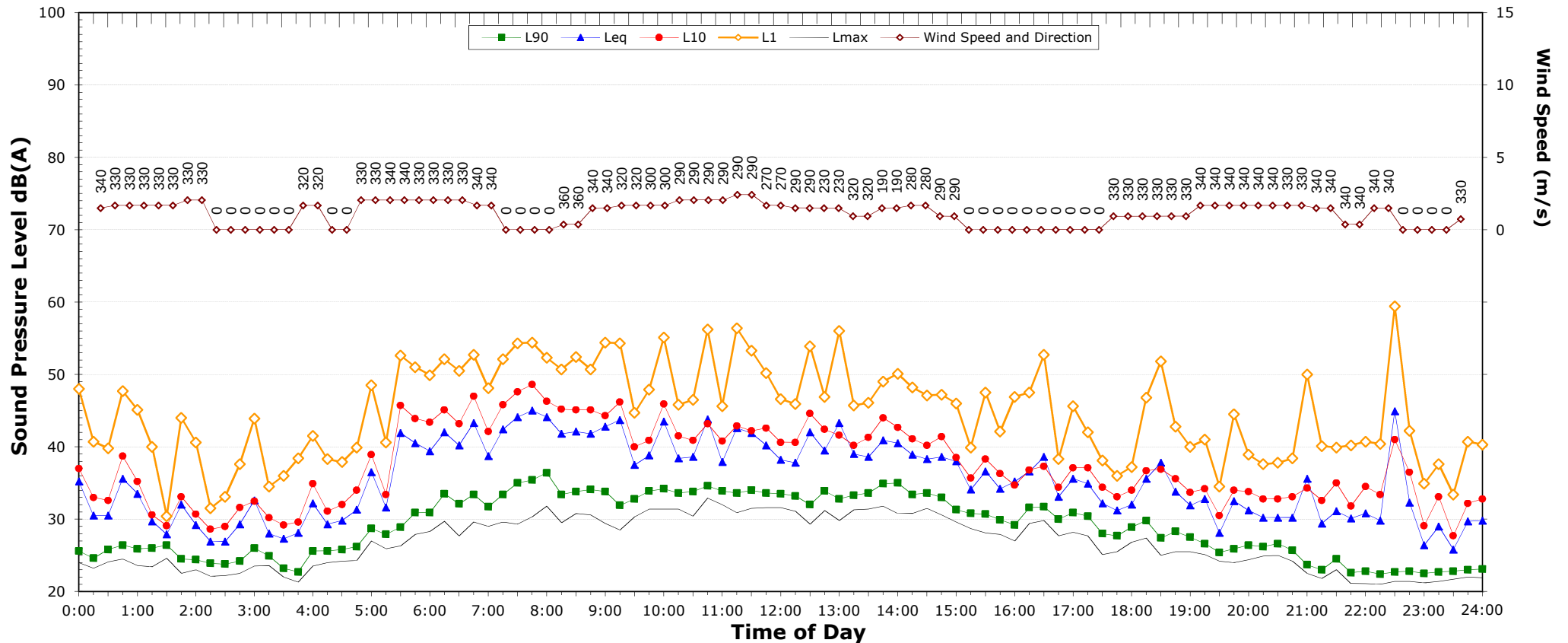
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

Australain Walkabout Wildlife Park

Saturday, 18 May 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	29.9	22.8	20.6
Leq	40.4	32.8	35.1

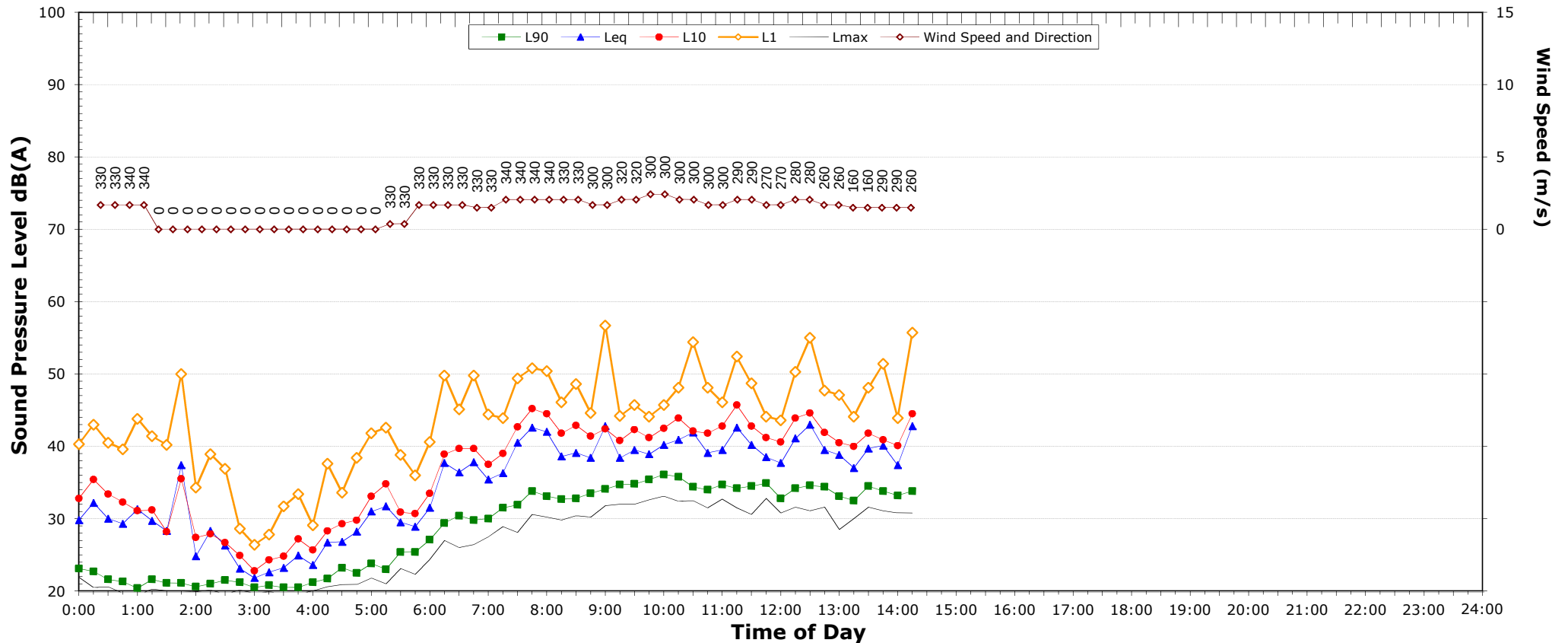
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

Australain Walkabout Wildlife Park

Sunday, 19 May 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night ²
	7am-6pm	6pm-10pm	10pm-7am
L ₉₀	-	-	-
Leq	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)