

MACKA'S SAND PTY LTD

Environmental Noise Monitoring 2017

FINAL

September 2017



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Environmental Noise Monitoring 2017

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Macka's Sand Pty Ltd

Project Director: Bret Jenkins
Project Manager: Dave Davis
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Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

www.umwelt.com.au



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1.0 Introduction

1.1 Project background

Macka's Sand Pty Ltd (Macka's Sand) was granted Major Project Approval 08_0142 in September 2009 by the Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* to operate sand extraction operations at Salt Ash, approximately 25 kilometres north-east of Newcastle, in the Port Stephens Local Government Area of New South Wales (NSW) (refer to **Figure 1.1**).

Macka's Sand has approval to extract and process sand from Lot 218 and Lot 220 as shown on **Figure 1.1**. It has been estimated that approximately 11.4 million tonnes of sand resource will be extracted from Lot 220. Lot 218 has an identified resource of 9.6 million tonnes however Lot 218 has a potentially indefinite extraction life due to the ongoing movement of sand from the mobile dunes into the approved extraction area.

As of September 2017, no sand product has been transported along Lavis Lane from Lot 218, but rather along the Alternate Access Road which was approved under MOD 1 Major Project Approval 08_0142 in 2013 and modified to allow increased truck movements under MOD 2 Major Project Approval 08_0142 in March 2016.

It is noted that Lot 220 and Lot 218 sites are located in close proximity to the Williamstown Royal Australian Air Force (RAAF) Base, including Newcastle Airport commercial operations, and the area is occasionally subject to noise impacts from overhead aircraft movements. Noise impacts from these movements have been taken into consideration for the current assessment and are not considered to significantly influence the monitoring assessment.

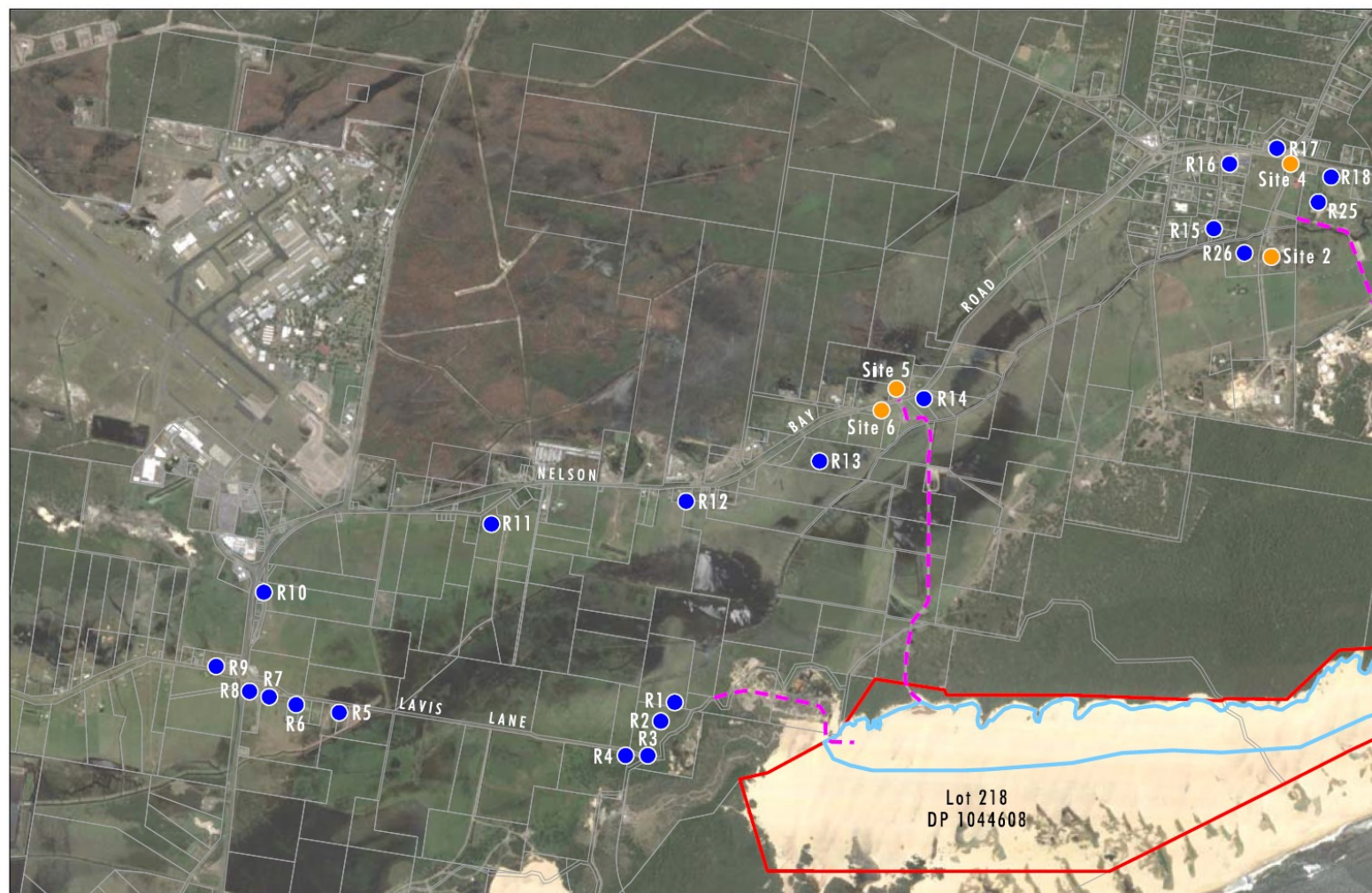
1.2 Scope

This Noise Monitoring Report has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Macka's Sand. The noise monitoring and reporting requirements for Macka's Sand are outlined in the Major Project Approval 08_0142, Environment Protection Licence (EPL) 13218 and the Macka's Sand Noise Management Plan (Umwelt 2016).

This report presents the results of attended noise monitoring undertaken in September 2017 as part of the ongoing noise monitoring program for Macka's Sand.

A glossary of terms and abbreviations used in this report is provided in **Appendix 1**.

Figure 1.1 – Site Location and Monitoring Locations



2.0 Assessment Criteria

The consent conditions for the project, outlined in the Macka's Sand Major Project Approval 08_0142 and EPL 13218, set the noise limits for all stages of the operations. The assessment criteria for the noise generated by the Project, except for the noise generated by the use of the Alternate Access Road, are presented in **Table 2.1**. The receiver locations are shown on **Figure 1.1**.

Table 2.1 Industrial Noise Impact Assessment Criteria, dB(A)

Location	Day ¹ LAeq, 15 min	Evening ¹ LAeq, 15 min	Night ¹ LAeq, 15 min	Night ¹ LA1, 1 min
R18 – 2692 Nelson Bay Road, Salt Ash	39	39	40	45
R1 – 39 Lavis Lane, Williamtown	39	39	39	45
R19 – 2758 Nelson Bay Road Salt Ash	36	36	37	45
R26 – 6 Oakvale Drive, Salt Ash	36	36	35	45
R27 – 10 Janet Parade, Salt Ash	36	35	35	45
R17 – 2645 Nelson Bay Road, Salt Ash	35	35	36	45
All other residences	35	35	35	45

¹ Day time is 7.00 am to 6.00 pm Monday to Saturday and 8.00 am to 6.00 pm Sundays and Public Holidays, evening is 6.00 pm to 10.00 pm and night time is 10.00 pm to 7.00 am Monday to Saturday and 10.00 pm to 8.00 am Sundays and Public Holidays (NSW Industrial Noise Policy (INP) EPA 2000).

The assessment criteria for the noise generated by the use of the Alternate Access Road are presented in **Table 2.2**. However, Project Approval 08_0142 MOD2 notes that 'the noise limits do not apply if the Proponent has an agreement with the relevant owner/s of these residences/land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.' Macka's Sand has written agreements with property owners and residents at 2344, 2353, 2367 and 2368 Nelson Bay Road.

Table 2.2 Alternate Access Road Noise Impact Assessment Criteria dB(A)

Location	Shoulder ¹ LAeq, 15 min	Day ¹ LAeq, 15 min	Evening ¹ LAeq, 15 min
2344 Nelson Bay Road, Williamtown	38	40	40
2353 Nelson Bay Road, Williamtown	39	41	41
2367 Nelson Bay Road, Williamtown	36	38	38
2368 Nelson Bay Road, Williamtown	38	40	40
All other residences	35	35	35

¹ Day time is 7.00 am to 6.00 pm Monday to Saturday and 8.00 am to 6.00 pm Sundays and Public Holidays, evening is 6.00 pm to 10.00 pm (NSW INP, EPA 2000). Shoulder is the period from 5.00 am to 7.00 am on Monday to Friday, but only for the use of the Alternate Access Road (see condition 4A of schedule 3 of Project Approval 08_0142 MOD2).

Condition 7 of Schedule 3 of Major Project Approval 08_0142 requires that road traffic noise generated by quarry operations does not exceed the criteria stipulated in **Table 2.3**.

Table 2.3 Traffic Noise Impact Assessment Criteria, dB(A)

Road	Day ¹	Night ¹
Lavis Lane, Oakvale Drive	60 LAeq, 1 hour	55 LAeq, 1 hour
Nelson Bay Road	60 LAeq, 15 hour	55 LAeq, 9 hour

1 Day time is 7.00 am to 6.00 pm Monday to Saturday and 8.00 am to 6.00 pm Sundays and Public Holidays, evening is 6.00 pm to 10.00 pm and night time is 10.00 pm to 7.00 am Monday to Saturday and 10.00 pm to 8.00 am Sundays and Public Holidays.

Compulsory Land Acquisition Criteria, as set out in Condition 5 of Schedule 3 of Major Project Approval 08_0142, are outlined in **Table 2.4** for night time noise levels and are applicable upon Macka's Sand receiving written request for acquisition from the landowner.

Table 2.4 Land Acquisition Criteria, dB(A)

Property location	Night ¹ LAeq, 15 min
R1 to R4	42
R20 to R23	41
All other privately-owned residences	40

1 Night time is 10.00 pm to 7.00 am Monday to Saturday and 10.00 pm to 8.00 am Sundays and Public Holidays (NSW INP, EPA 2000).

Additional noise mitigation measures, as required in Condition 8 of Schedule 3 of Major Project Approval 08_0142, must be undertaken if noise levels exceed the criteria in **Table 2.5**.

Table 2.5 Additional Noise Mitigation Criteria

Property location	Night ¹ LAeq, 15 min
R1 to R4	40
R20 to R23	39
All other privately-owned residences	38

1 Night time is 10.00 pm to 7.00 am Monday to Saturday and 10.00 pm to 8.00 am Sundays and Public Holidays (NSW INP, EPA 2000).

Additionally, EPL 13218 for sand extraction operations on Lot 218 and Lot 220 Salt Ash, requires that noise from the premises must not exceed the limits specified in **Table 2.6**.

Table 2.6 EPL 13218 Condition L6.1 Noise Limits, dB(A)

Location	Day ¹ LAeq, 15 min	Evening ¹ LAeq, 15 min	Night ¹ LAeq, 15 min	Night ¹ LA1, 1 min
Residences north of private haul road servicing Lot 220	-	40	40	45
Residence R27	36	36	35	45
Residences R1 – R8	39	39	39	45
All other residences	-	36	35	45

- 1 Day time is 7.00 am to 6.00 pm Monday to Saturday and 8.00 am to 6.00 pm Sundays and Public Holidays, evening is 6.00 pm to 10.00 pm and night time is 10.00 pm to 7.00 am Monday to Saturday and 10.00 pm to 8.00 am Sundays and Public Holidays (NSW INP, EPA 2000).

3.0 Assessment Methodology

Attended noise surveys are used to quantify and describe the acoustic environment around a site. Typically the results are compared with the noise criteria defined in the relevant project approvals to assess compliance. Attended monitoring is often considered the preferred method for determining compliance with prescribed limits because it allows for an accurate assessment of the contribution, if any, from an industrial noise source to measured ambient noise levels.

The compliance assessment methodology for Macka's Sand involved the following activities:

- Attended noise monitoring surveys to measure the ambient noise levels in the surrounding region and to assess the sand extraction operation's contribution to measured noise levels; and
- Comparison of the attended noise monitoring results with all relevant noise impact assessment criteria to assess compliance of the sand extraction operation with the relevant project approvals and EPL criteria.

Compliance with the sleep arousal criteria is determined by comparing the LA1,1minute noise levels measured during the night period attended noise surveys with the sleep arousal criteria outlined in the development consents and EPLs under which the site operates.

Measurements of industrial noise levels at Site 6 are taken to be representative of industrial noise levels received at Site 5, as Site 5 is slightly farther than Site 6 from Lot 218 and from the Alternative Access Road, therefore compliance with the criteria at Site 6 also indicates compliance at Site 5. Similarly, since Site 4 is farther from Lot 220 than Site 2, industrial noise levels from Lot 220 received at Site 4 would be less than industrial noise levels measured at Site 2. Therefore compliance with the criteria at Site 2 also indicates compliance at Site 4.

Compliance monitoring of the site-generated road traffic noise contribution from Lot 220 was undertaken at Noise Monitoring Site 4 (Lot 2 DP 818198). Compliance monitoring of the site-generated road traffic noise contribution from Lot 218 was undertaken at Noise Monitoring Site 6 (2352 Nelson Bay Road, Williamtown).

Road truck movements along Oakvale Drive past Noise Monitoring Site 4 during the monitoring period were associated with vehicles servicing not only Macka's Sand but the adjoining businesses of Macka's Sand and Soil Supplies and Sibelco Australia. Macka's Sand heavy vehicle log data and attended truck logging during the traffic noise logging program was used to correlate heavy vehicle activity along Oakvale Drive associated with the transport of product from Lot 220. Macka's Sand heavy vehicle log data and audio files were used to correlate heavy vehicle activity entering and leaving the Alternate Access Road to Lot 218.

The Macka's Sand site generated LAeq,1hour road traffic noise contribution was determined as the equivalent continuous noise level from all truck movements relevant to Macka's Sand from Lot 220 at Noise Monitoring Site 4 and from Lot 218 at Noise Monitoring Site 6, occurring per hour of the assessment period. The calculated noise levels at the façade of the residence of Noise Monitoring Site 4, as well as at the façade of Noise Monitoring Site 5 resulting from hourly traffic movements associated with the Project during the night and day period were then assessed against relevant road traffic criteria. For this assessment, the measured traffic noise levels at site 6 were taken to be representative of the noise levels received at Site 5 due to the similar offset distances from Nelson Bay Rd. Measured traffic noise levels were adjusted with a correction of +2.5 dB(A) LAeq(1hour) to account for the reflection of sound from the buildings' facades.

4.0 Noise Monitoring Program

4.1 Industrial noise

The purpose of the attended noise monitoring program was to quantify and describe the ambient noise environment in the region surrounding the Lot 220 and Lot 218 extraction sites and to interpret the results to account for the contribution of Macka's Sand operations to the surrounding noise environment. During the attended noise monitoring program, the noise sources contributing to the ambient noise environment were recorded, with particular attention focussed on the contribution from operations at Lot 220 and Lot 218. The weather conditions over the monitoring period were also recorded.

Attended noise measurements were undertaken with a Type 1, Svantek 959 noise and vibration analyser, Serial Number 12918. During the attended noise surveys, the noise meter was calibrated using a Brüel & Kjær Type 4231 Noise Meter Calibrator, Serial Number 2130702. The noise monitor was run using three measurement profiles (Z- (Linear), C- and A- Weighting) and recorded A-weighted 1/3 octave noise levels at 1 second intervals over a 15 minute measurement period. Meteorological data was collected during each of the attended monitoring periods using a Kestrel 4500 weather monitor, Serial Number 665400, positioned within 5 metres and at a corresponding height to the noise monitoring microphone.

Attended noise monitoring was conducted in accordance with the NSW Industrial Noise Policy (EPA 2000) guidelines and the relevant sections of Australian Standard AS1055-1997, 'Acoustics – Description and Measurement of Environmental Noise'.

4.2 Traffic noise

The purpose of the road traffic noise monitoring program was to determine the contribution of Macka's Sand related road truck movements to the surrounding noise environment. During the road traffic monitoring program, attended logging of truck passbys was undertaken at Noise Monitoring Site 4 to assist in correlating heavy vehicle truck movements along Oakvale Drive with Macka's Sand heavy vehicle log data. As only heavy vehicles related to Macka's Sand extraction operation utilise the Alternate Access Road to Lot 218, it was assumed that all vehicles entering and leaving the intersection of the Alternate Access Road and Nelson Bay Road were attributable to Macka's Sand operations.

The noise logger microphones were installed in the free field at approximately the same offset distance from Nelson Bay Road of the residential façades most affected by Macka's Sand generated road traffic noise and at an approximate height of 1.2 metres above the ground level of the dwelling. Trucks passing the noise logger located at Noise Monitoring Site 4 from 6.00 am to 7.00 am and 7.00 am to 8.00 am, 11 September 2017 were observed and the passby time logged to assist in distinguishing noise generated by Macka's Sand heavy vehicles from those servicing Macka's Sand and Soil and Sibelco Australia.

Table 4.1 Traffic Noise Monitoring Program

Monitoring location	Logger type	Serial no.	Measurement
Site 4	Larson Davis LD831	0004379	11/09/2017 06:00 to 07:00 and 11/09/2017 07:00 to 08:00
Site 6	SVAN 959 SLM	12918	11/09/2017 06:00 to 07:00 and 11/09/2017 07:15 to 08:15

4.3 Monitoring locations

The monitoring locations used during the attended noise monitoring program are described in **Table 4.2** and shown on **Figure 1.1**.

Table 4.2 Noise Monitoring Locations

Noise monitoring location	Description
Site 1	Private residence R27, 10 Janet Parade, Salt Ash MGA E = 399542, MGA N = 6370639
Site 2	Opposite private residence R26, 6 Oakvale Drive, Salt Ash (adjacent to Oakvale Farm) MGA E = 397917, MGA N = 6370880
Site 4	Private residence Lot 2 DP 818198 (Corner of Oakvale Drive and Nelson Bay Road, Salt Ash) MGA E = 398078, MGA N = 6371444
Site 6	Private residence 2344 Nelson Bay Road, Williamstown MGA E = 395639, MGA N = 6370005

Note R24 to R27 descriptors are adopted from 'Noise Management Plan for Sand Extraction Operations' (Umwelt 2016).

The 2017 attended industrial noise monitoring program included monitoring at Noise Monitoring Sites 1, 2, and 6. Attended monitoring of industrial noise was conducted for 15 minute periods during periods of suitable meteorological conditions. It is considered that Site 2 is generally representative of Site 4 and Site 6 is generally representative of Site 5 for the day, evening and night time periods. Lot 220 does not currently undertake extraction operations during the evening period.

Road traffic noise monitoring was conducted for one hour periods at Noise Monitoring Sites 4 and 6, during the night time period on 11 September 2017 and at the same locations during the day period also on 11 September 2017.

5.0 Monitoring Results

5.1 Industrial noise

Industrial noise monitoring was undertaken for 15 minutes during periods of suitable meteorological conditions. The attended noise monitoring was undertaken during the following time periods:

- Day:
 - Site 1: 10:31 am to 10:46 am, 11 September 2017
 - Site 2: 9:44 am to 9:59 am, 11 September 2017
 - Site 6: 7:16 am to 7:31 am, 11 September 2017
- Evening:
 - Site 1: 7:28 pm to 7:43 pm, 11 September 2017
 - Site 2: 6:55 pm to 7:10 pm, 11 September 2017
 - Site 6: 8:09 pm to 8:24 pm, 11 September 2017
- Night:
 - Site 1: 6:46 am to 7:01 am, 29 September 2017
 - Site 2: 6:16 am to 7:01 am, 29 September 2017
 - Site 6: 6:20 am to 7:35 am, 11 September 2017

The monitoring results shown in **Figure 5.1** to **Figure 5.9** and **Table 5.1** to **Table 5.3** include:

- The recorded overall A-weighted noise levels at 1 second intervals over a 15 minute measurement period;
- The results of a 1000 Hz low pass filter at 1 second intervals over the 15 minute measurement period;
- An assessment of the maximum LA1,1minute noise level recorded over the 15 minute measurement period for night period measurements; and
- The LAeq, 15minute and LA90, 15minute noise levels for the 15 minute measurement period.

Comments regarding the noise sources contributing to the ambient noise levels are also presented on **Figure 5.1** to **Figure 5.9**.

An assessment of the results from the attended noise monitoring program and the corresponding meteorological conditions are provided in **Section 5.3.1**.

5.1.1 Day period attended monitoring (11 September 2017)

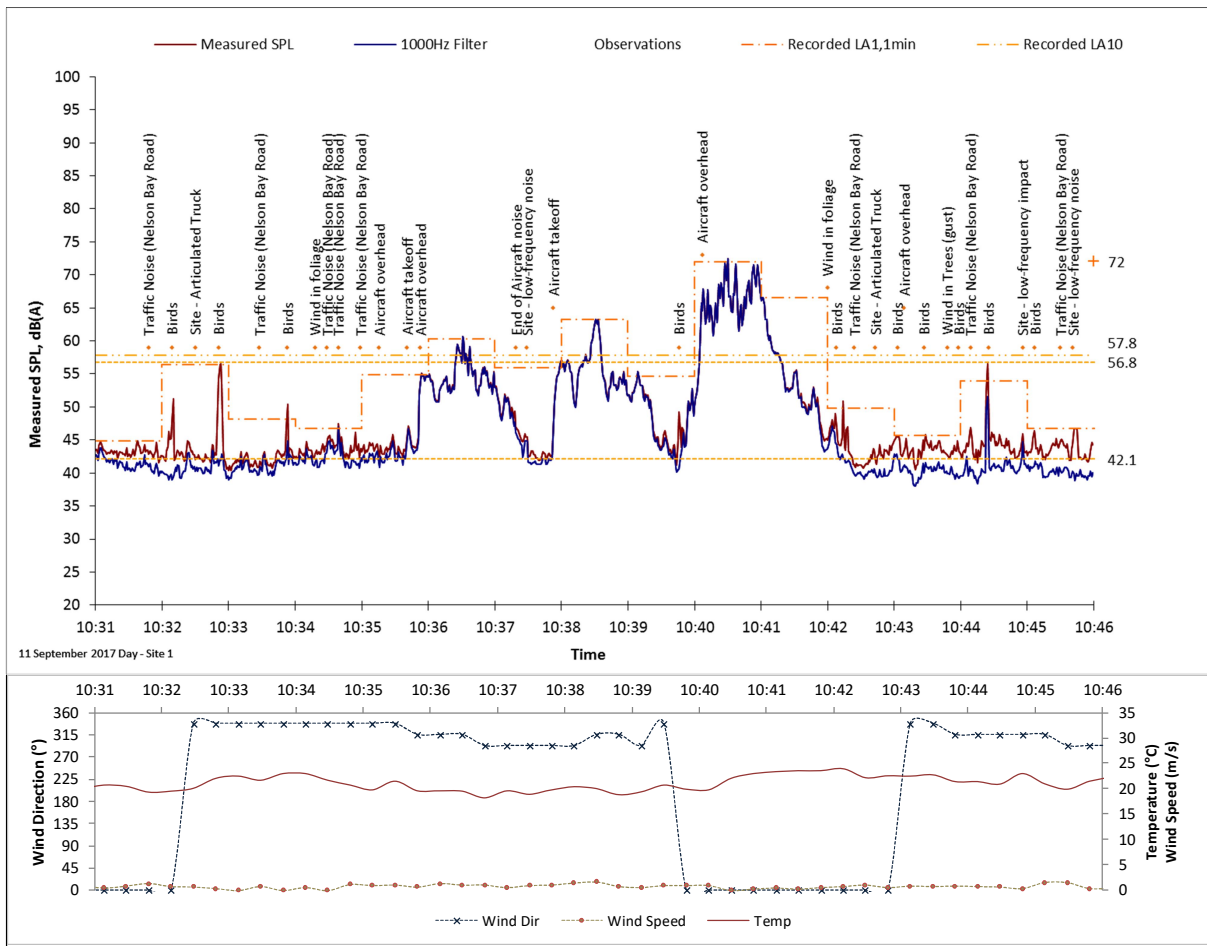


Figure 5.1

Site 1, 10:31, 11 September 2017

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The results in **Figure 5.1** indicate that the ambient noise environment at monitoring location Site 1 was dominated by road traffic noise from Nelson Bay Road, birds calls and when present, aircraft noise. Other noise contributions resulted from wind in the trees and extraction operations at Macka’s Sand which were audible at times in the background.

The LAeq,15minute noise contribution from Macka’s Sand was estimated to be less than 23 dB(A).

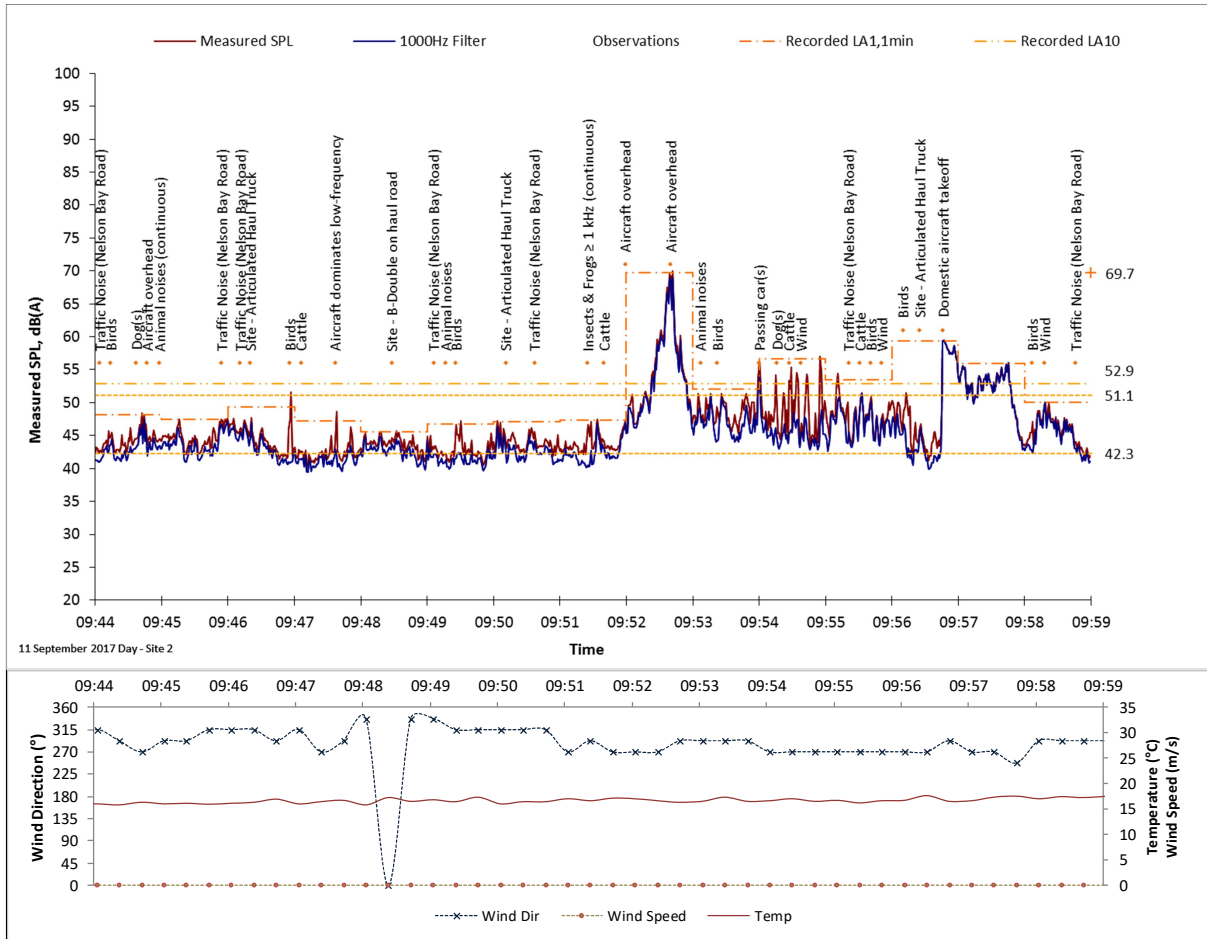


Figure 5.2

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Site 2, 9:44, 11 September 2017

The results in **Figure 5.2** indicate that the ambient noise environment at monitoring location Site 2 was dominated by traffic noise from Nelson Bay Road. Other noise contributions resulted from domestic aircraft, noise from Oakvale Farm, trucks on the private access road and Macka’s Sand off road trucks. Intermittent noise sources included dogs, birds and the wind.

The LAeq,15minute noise contribution from Macka’s Sand was estimated to be 27 dB(A).

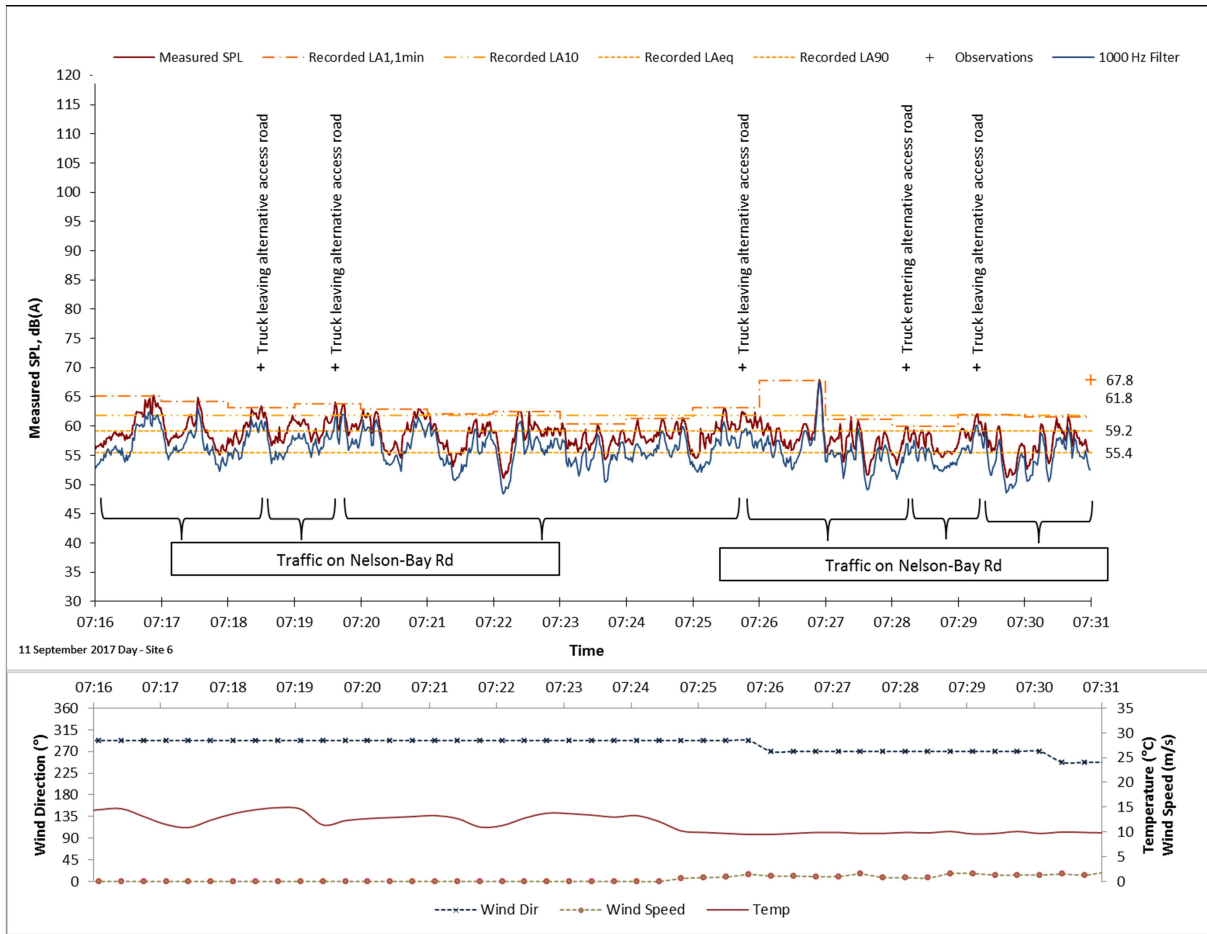


Figure 5.3

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Site 6, 07:16, 11 September 2017

The results in **Figure 5.3** indicate that the ambient noise environment at monitoring location Site 6 was dominated by traffic on Nelson Bay Road. Other noise contributions included trucks entering and leaving the alternate access road to Lot 218.

Macka's Sand sand extraction operations from Lot 218 were not audible at the time of monitoring.

The LAeq,15minute noise contribution from Macka's Sand alternate access road was estimated to be less than 40 dB(A).

5.1.2 Evening period attended monitoring (11 September 2017)

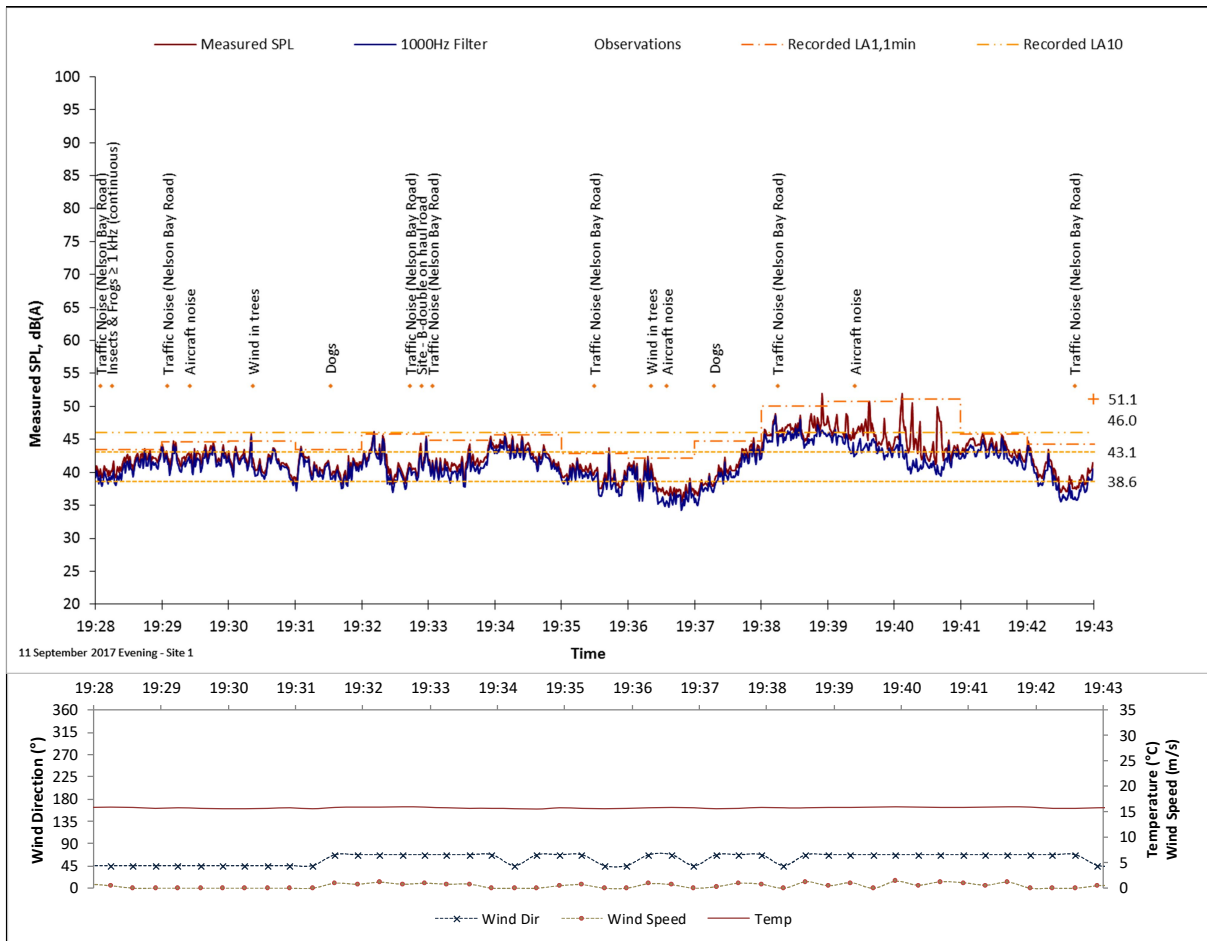


Figure 5.4

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Site 1, 07.28 pm , 11 September 2017

The results in **Figure 5.4** indicate that the ambient noise environment at monitoring location Site 1 was dominated by noise from traffic on Nelson Bay Road and when present, aircraft noise. Other noise contributions resulted from insects, dogs barking, wind in the trees and trucks entering and leaving Macka’s Sand on the private access road.

The LAeq,15minute noise contribution from Macka’s Sand Alternate Access Road was estimated to be less than 20 dB(A).

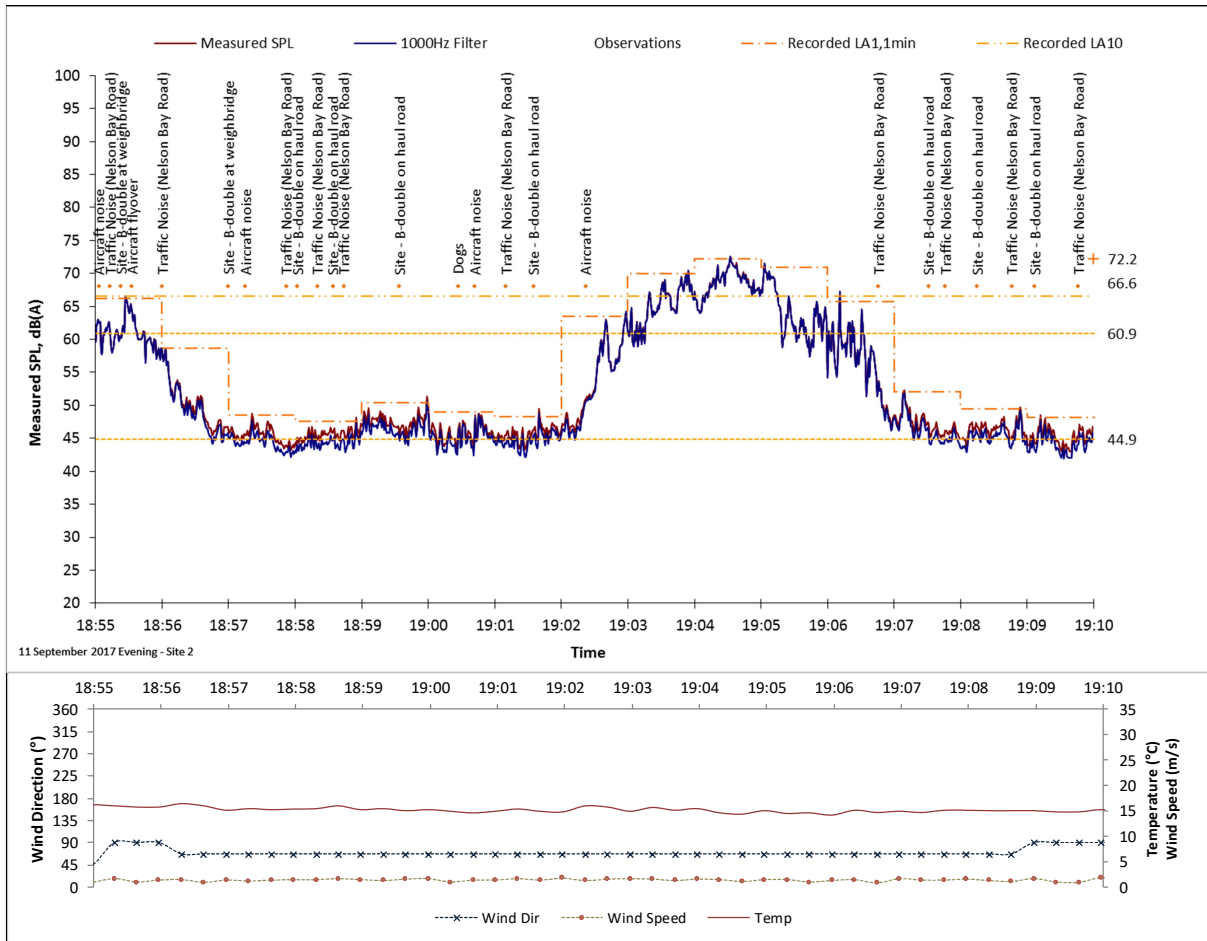


Figure 5.5

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Site 2, 06.55 pm , 11 September 2017

The results in **Figure 5.45** indicate that the ambient noise environment at monitoring location Site2 was dominated by road traffic noise from Nelson Bay Road and when present, aircraft noise. Intermittent noise sources included dogs barking.

The LAeq,15minute noise contribution from Macka’s Sand private access Road was estimated to be less than 35 dB(A).

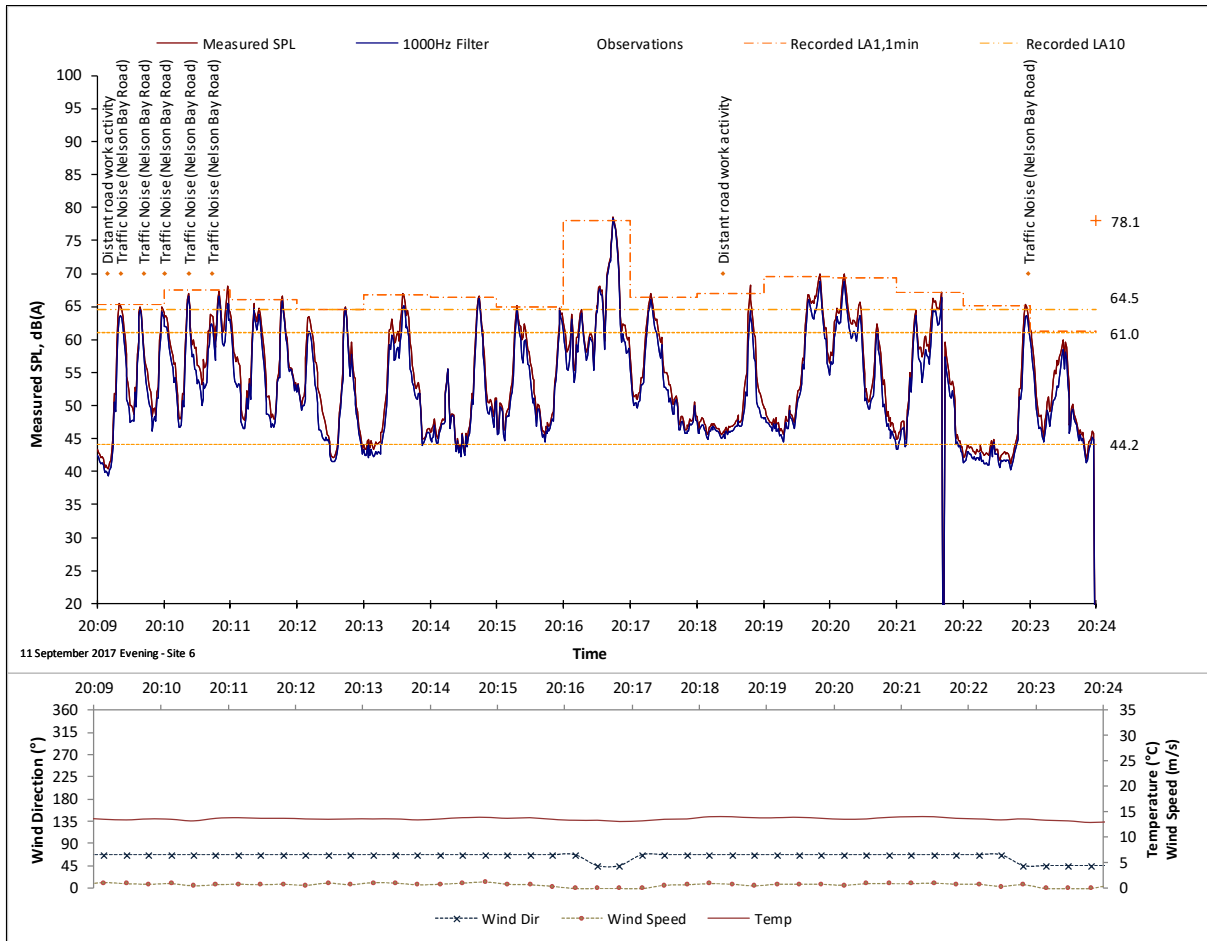


Figure 5.6

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Site 6, 08.09 pm , 11 September 2017

The results in **Figure 5.6** indicate that the ambient noise environment at monitoring location Site 6 was dominated by noise from traffic on Nelson Bay Road and distant road work activity. Other noise contributions resulted from insects and frogs. No trucks entered or left Macka’s Sand via the Alternate Access Road.

Macka’s Sand sand extraction operations from Lot 218 were not audible at the time of monitoring.

5.1.3 Night period attended monitoring (11 and 29 September 2017)

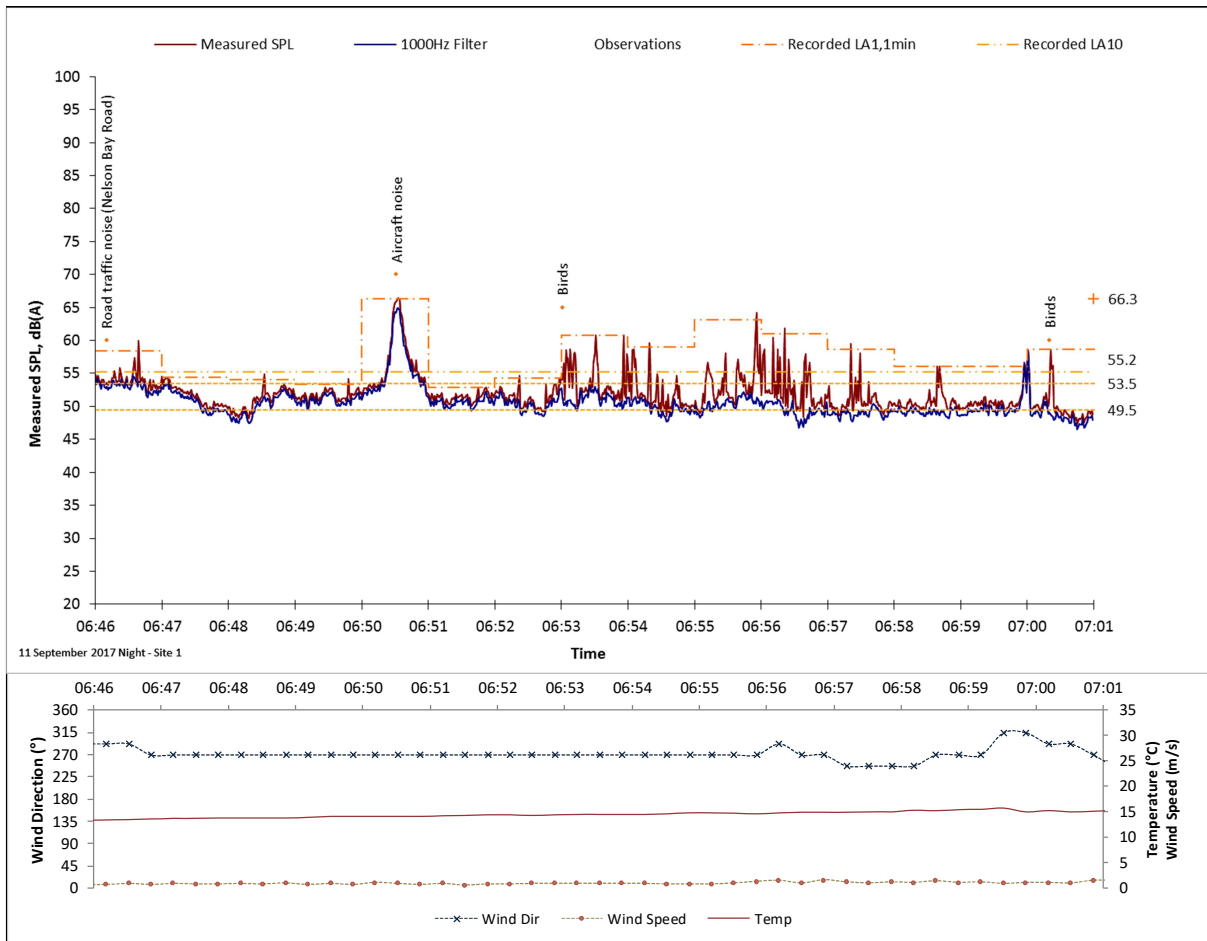


Figure 5.7

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Site 1, 06.46 am, 29 September 2017

The results in **Figure 5.7** indicate that the ambient noise environment at monitoring location Site 1 was dominated by traffic on Nelson Bay Road, birds calls and when present, aircraft noise. Other noise contributions resulted from wind in the trees as well as trucks and in-pit activity at Macka’s Sand that were occasionally audible.

The LAeq,15minute noise contribution from Macka’s Sand was estimated to be less than 32 dB(A).

The LA1,1minute noise contribution from Macka’s Sand was estimated to be less than 41 dB(A), resulting from trucks and in-pit activity.

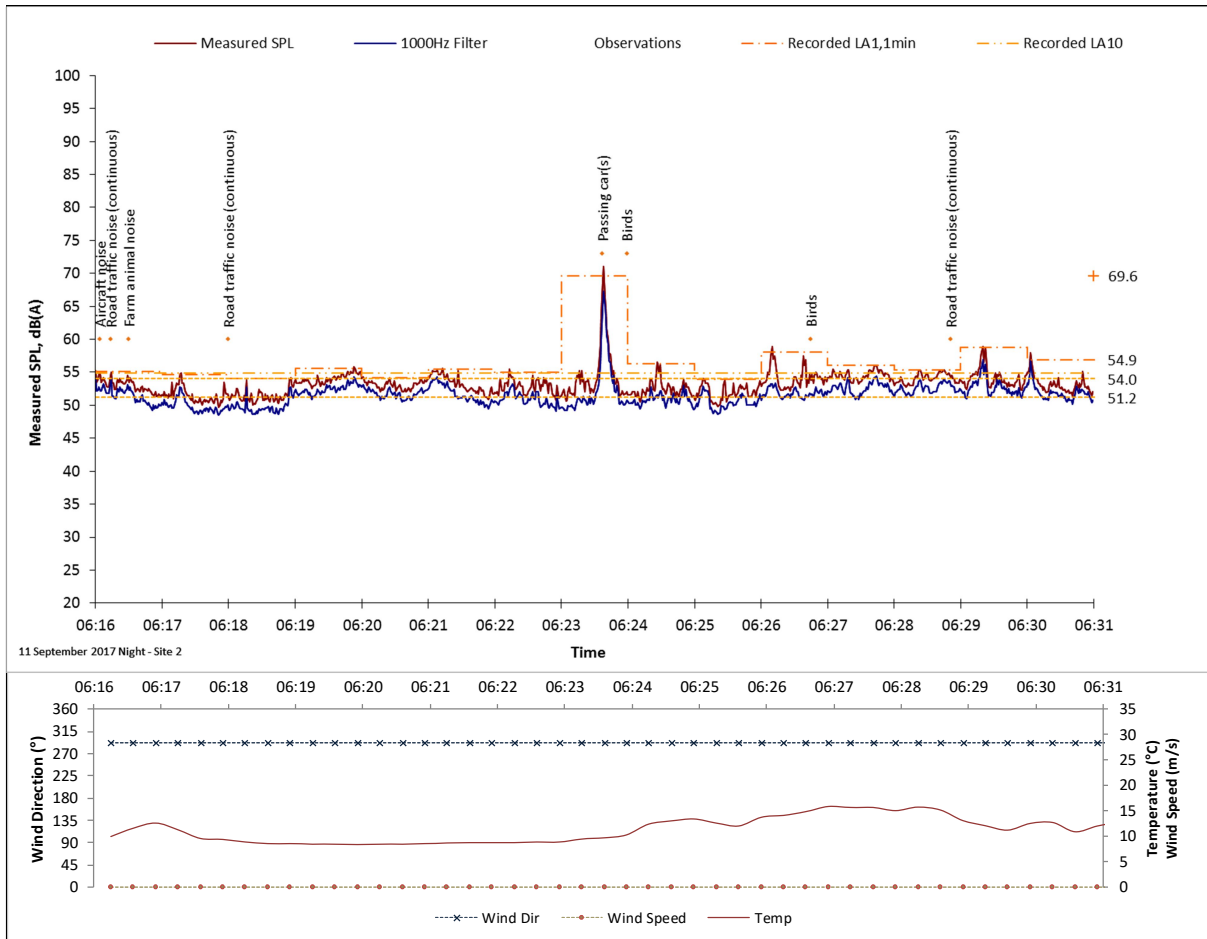


Figure 5.8

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Site 2, 06.16 am, 29 September 2017

The results in **Figure 5.8** indicate that the ambient noise environment at monitoring location Site 1 was dominated by traffic on Nelson Bay Road and farm animal noise. Other noise contributions resulted from local rural noise sources including birds, a passing car, as well as trucks at Macka’s Sand that were occasionally audible.

The LAeq,15minute noise contribution from Macka’s Sand was estimated to be less than 32 dB(A).

The LA1,1minute noise contribution from Macka’s Sand was estimated to be less than 45 dB(A), resulting from trucks.

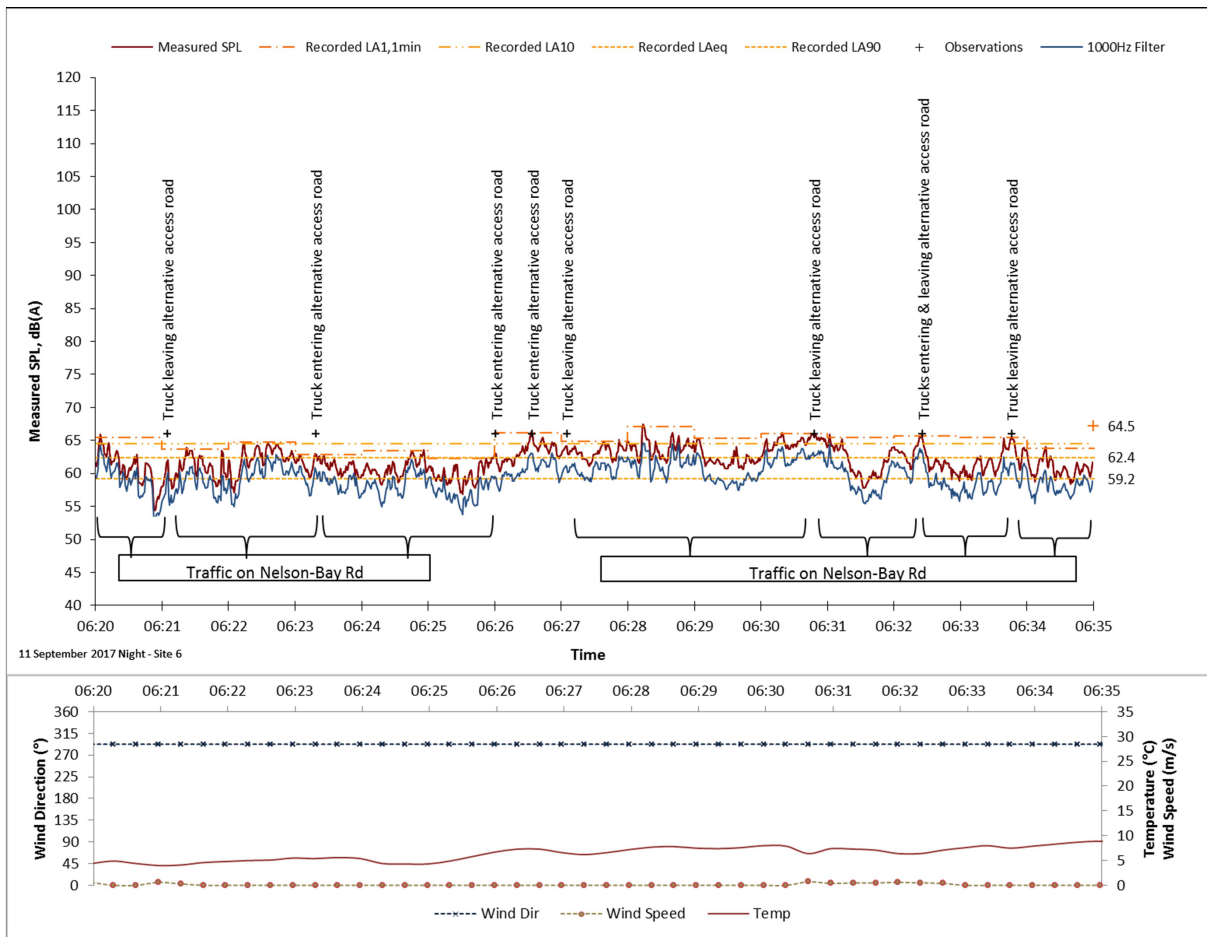


Figure 5.9

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Site 6, 06.20 am , 11 September 2017

The results in **Figure 5.9** indicate that the ambient noise environment at monitoring location Site 6 was dominated by noise from traffic on Nelson Bay Road. Other noise contributions resulted from birds and trucks entering and leaving Macka’s Sand via the Alternate Access Road.

Macka’s Sand sand extraction operations from Lot 218 were not audible at the time of monitoring.

The LAeq,15minute noise contribution from Macka’s Sand Alternate Access Road was estimated to be less than 38 dB(A).

5.2 Traffic noise

Traffic noise monitoring was undertaken at two monitoring locations during the night time from 6.00 am to 7.00 am and during the day time from 7.00 am to 8.00 am 11 September 2017.

Attended logging of heavy vehicle passbys at Noise Monitoring Site 4 during the traffic noise impact monitoring period was used in conjunction with the Macka's Sand heavy vehicle data log to assist in identifying Macka's Sand heavy vehicle passbys in the traffic noise logger results.

The night and day time monitoring results presented in **Section 5.3.2** include:

- The Macka's Sand site generated $L_{Aeq,1hour}$ road traffic noise contribution determined as the equivalent continuous noise level from all site truck movements occurring per hour of the assessment period; and
- The recorded $L_{Aeq,1hour}$ Nelson Bay Road traffic noise contribution noise levels occurring per hour of the assessment period.

An assessment of the results from the road traffic noise monitoring program is provided in **Section 6.2**.

5.3 Assessment of monitoring results

5.3.1 Industrial noise

During the attended noise monitoring program, the ambient noise levels surrounding the Macka's Sand site were recorded with particular attention paid to the contribution of the Macka's Sand site operations.

The results of the attended noise monitoring program, summarised in **Table 5.1** to **Table 5.3** indicate that under the meteorological conditions at the time of monitoring the Macka's Sand site was complying with LA1,1minute industrial noise assessment criteria during the night time period and with the LAeq,15minute industrial noise assessment criteria, during the evening, night and day time monitoring periods, outlined in the development consents and EPLs under which Macka's Sand operates. Site related assessment criteria for industrial noise are summarised in **Section 2.0**.

**Table 5.1 Summary of Attended Industrial Noise Monitoring, dB(A),
Day Time Period: 07:16 to 09:59 on 11 September 2017**

Location	Monitoring period	Measure	Measured noise level	Estimated contribution from Macka's Sand	Meteorological conditions
Site 1	10:31 – 10:46	LA90, 15 min	42.1	-	Wind WNW to NW at 0.7 to 1.0 m/s, gusting to 1.6 m/s; 0/8 okta, 21°C, 38%RH
		LAeq, 15 min	56.8	< 25	
		LA1, 1 min	72.0	-	
Site 2	9:44 – 9:59	LA90, 15 min	42.3	-	Calm conditions, 4/8 okta, 17°C, 54%RH
		LAeq, 15 min	51.1	< 30	
		LA1, 1 min	69.7	-	
Site 6	07:16 – 07:31	LA90, 15 min	55.4	Sand extraction operations not audible; < 40 Alternate Access Road	Calm, gusting to 0.6 m/s from the W; 0/8 okta; 13°C; 90% RH
		LAeq, 15 min	59.2		
		LA1, 1 min	67.8		

**Table 5.2 Summary of Attended Industrial Noise Monitoring, dB(A),
Evening Time Period: 6.55 pm to 8.24 pm on 11 September 2017**

Location	Monitoring period	Measure	Measured noise level	Estimated contribution from Macka's Sand	Meteorological conditions
Site 1	19:28 – 19:43	LA90, 15 min	38.6	-	Wind ENE at 0.0 to 0.8 m/s, gusting to 1.3 m/s; 4/8 okta, 16°C, 78%RH
		LAeq, 15 min	43.1	< 20	
		LA1, 1 min	51.1	-	

Location	Monitoring period	Measure	Measured noise level	Estimated contribution from Macka's Sand	Meteorological conditions
Site 2	18:55 – 19:10	LA90, 15 min	44.9	-	Wind ENE at 1.4 to 1.6 m/s, gusting to 1.8 m/s; 4/8 okta, 15°C, 78% RH
		LAeq, 15 min	60.9	< 35	
		LA1, 1 min	72.2	-	
Site 6	20:09 – 20:24	LA90, 15 min	44.2	-	Wind ENE at 0.7 to 0.8 m/s, gusting to 1 m/s; 4/8 okta, 15°C, 78% RH
		LAeq, 15 min	61.0	Sand extraction operations not audible.	
		LA1, 1 min	78.1	Sand extraction operations not audible.	

Table 5.3 Summary of Attended Industrial Noise Monitoring, dB(A), Night Time Period: 6.16 am to 7.00 am on 29 September 2017

Location	Monitoring period	Measure	Measured noise level	Estimated contribution from Macka's Sand	Meteorological conditions
Site 1	6:46 – 7:00	LA90, 15 min	49.5	-	Wind W at 0.9 to 1.0 m/s, gusting to 1.4 m/s; 0/8 okta, 15°C, 63%RH
		LAeq, 15 min	53.5	< 32	
		LA1, 1 min	66.3	< 41	
Site 2	6:16 – 6:31	LA90, 15 min	51.2	-	Calm conditions, 0/8 okta, 11°C, 77% RH
		LAeq, 15 min	54.0	< 32	
		LA1, 1 min	69.6	< 45	
Site 6	6:20 – 6:35	LA90, 15 min	59.2	-	Calm conditions, 0/8 okta, 11°C, 77% RH
		LAeq, 15 min	62.4	Sand extraction operations not audible < 38 Alternate Access Road	
		LA1, 1 min	67.1	Sand extraction operations not audible	

5.3.2 Traffic noise

The results from the road traffic noise monitoring undertaken at Noise Monitoring Site 4 and Site 6 are presented in **Table 5.4** and **Table 5.5**.

Table 5.4 Road Traffic Noise Level Contributions, Noise Monitoring Site 4, dB(A)

Day/night period	Start of assessed period	End of assessed period	Site 4 measured traffic noise level L _{Aeq, 1 hour}	Macka's Sand heavy vehicle noise level contribution, L _{Aeq, 1 hour}
Night	6:00	7:00	62	52
Day	7:00	8:00	62	54

Table 5.5 Road Traffic Noise Level Contributions, Noise Monitoring Site 6, dB(A)

Day/night period	Start of assessed period	End of assessed period	Site 5 measured traffic noise level L _{Aeq, 1 hour}	Macka's Sand heavy vehicle noise level contribution, L _{Aeq, 1 hour}
Night	6:00	7:00	64	51
Day	7:00	8:00	62	46

The results indicate that road traffic associated with Macka's Sand operations was generating L_{Aeq,1hour} noise levels during the night time noise monitoring period of 52 dB(A) and 51 dB(A) at Sites 4 and 6 respectively, and 54 dB(A) and 46 dB(A) during the day time noise monitoring period. Over the same assessed periods, road traffic at Site 4 and Site 6 generated L_{Aeq,1hour} noise levels of 62 dB(A) and 64 dB(A) during the night time period and 62 dB(A) and 62 dB(A) during the day time period at Sites 4 and 6 respectively.

The traffic noise level contribution from Macka's Sand trucks was found to be 8 to 16 dB(A) less than the total traffic noise levels at Sites 4 and 6.

6.0 Assessment of compliance

6.1 Industrial noise

The measured industrial noise levels from the Macka's Sand site contributing to the ambient noise environment in the surrounding area and the relevant noise assessment criteria are collated in **Table 6.1**, **Table 6.2** and **Table 6.3** for the day, evening and night periods respectively. **Table 6.4** presents the results and the relevant assessment criteria for noise generated by traffic travelling on the Alternate Access Road to Lot 218.

Noise levels at Site 4 are expected to be less than noise levels at Site 2, as Site 4 is farther from Lot 220 than Site 2 hence noise levels will reduce with the increased distance. Therefore if the criteria are equivalent at Sites 2 and 4, then compliance at Site 2 indicates compliance at Site 4.

Similarly, noise levels at site 5 are expected to be less than noise levels at Site 6, as Site 5 is farther from Lot 218 than Site 6 hence noise levels will reduce with the increased distance. Therefore if the criteria are equivalent at Sites 5 and 6, then compliance at Site 6 indicates compliance at Site 5.

Table 6.1 Night Time Industrial Noise Levels –Sand Extraction Activities versus Noise Criteria, dB(A)

Location	LAeq, 15minute		LA1,1minute	
	Noise criteria	Macka's Sand noise level contribution	Noise criteria	Macka's Sand noise level contribution
Site 1	35	<32	45	<41
Site 2	35	<32	45	<45
Site 4 ¹	35	<32	45	<45
Site 5 ²	35	Not Audible	45	Not Audible
Site 6	35	Not Audible	45	Not Audible

1 Based on noise levels measured at Site 2

2 Based on noise levels measured at Site 6

Table 6.2 Day Time Industrial Noise Levels –Sand Extraction Activities versus Noise Criteria, dB(A)

Location	LAeq, 15minute	
	Noise criteria	Macka's Sand noise level contribution
Site 1	36	<25 (11/09/2017)
Site 2	36	<30 (11/09/2017)
Site 4 ¹	35	Not audible
Site 5 ²	35	Not audible

Location	LAeq, 15minute	
	Noise criteria	Macka's Sand noise level contribution
Site 6	35	Not audible

1 Based on noise levels measured at Site 2

2 Based on noise levels measured at Site 6

Table 6.3 Evening Industrial Noise Levels –Sand Extraction Activities versus Noise Criteria, dB(A)

Location	LAeq, 15minute	
	Noise criteria	Macka's Sand noise level contribution
Site 1	35	<20
Site 2	36	<35
Site 6	35	Not audible

1 Estimated based on noise level measured at Site 6

Table 6.4 Industrial Noise Levels – Alternate Access Road to Lot 218

Location	Period	LAeq, 15minute	
		Noise criteria	Macka's Sand noise level contribution
Site 5 ¹	Day Time (07:16 – 07:31)	41	<40
Site 6	Day Time (07:16 – 07:31)	40	<40
Site 5 ¹	Evening (20:09 – 20:24)	40	n/a
Site 6	Evening (20:09 – 20:24)	40	n/a
Site 5 ¹	Night Time/Shoulder (06:20-06:35)	39	<38
Site 6	Night Time/Shoulder (06:20-06:35)	38	<38

1 Estimated based on noise level measured at Site 6

The results from the Macka's Sand compliance noise monitoring presented in **Table 6.1** indicate that during the night time period of attended monitoring, Macka's Sand was complying at all sites with the LA1,1minute criteria outlined in the development consents and EPLs under which the Macka's Sand operates (refer to **Table 2.1** to **Table 2.6**).

The results from the Macka's Sand compliance noise monitoring presented in **Table 6.1**, **Table 6.2**, **Table 6.3** and **Table 6.4** indicate that during the day, evening and night periods of attended monitoring,

Macka's Sand was complying at all sites with the LAeq,15minute criteria for sand extraction operations and traffic travelling on the Alternate Access Road to Lot 218, as outlined in the development consents and EPLs under which the Macka's Sand operates (refer to **Table 2.1** and **Table 2.6**).

6.2 Traffic noise

The measured heavy vehicle noise levels from the Macka's Sand operation contributing to the road traffic noise levels are presented in **Table 6.5** for the night and day time assessment periods.

Table 6.5 Macka's Sand Road Traffic Noise Level Contribution, dB(A)

Road	Period	Noise criteria	Noise level contribution LAeq,1hour
Lavis Lane, Oakvale Drive as measured at corner of Oakvale Drive and Nelson Bay Road (Site 4)	Night	55 LAeq, 1hour	52
	Day	60 LAeq, 1hour	54
Nelson Bay Road as measured at 2352 Nelson Bay Road (Site 6)	Night	55 LAeq, 9hour	51
	Day	60 LAeq, 15 hour	46

The results from the Macka's Sand road traffic compliance noise monitoring presented in **Table 6.5** indicate that road traffic associated with Macka's Sand was generating noise levels during both the night and day periods below relevant road traffic noise criteria outlined in the development consents and EPLs under which the Macka's Sand site operates (refer to **Table 2.3**).

7.0 Statement of compliance

7.1 Industrial noise

Results of the attended industrial noise monitoring program conducted on 11 September and 29 September 2017, indicate that at the time of monitoring, Macka's Sand was complying with the industrial noise assessment criteria at all sites as outlined in the Macka's Sand Major Project Approval 08_0142 and EPL 13218 for the meteorological conditions experienced at the time of monitoring.

7.2 Traffic noise

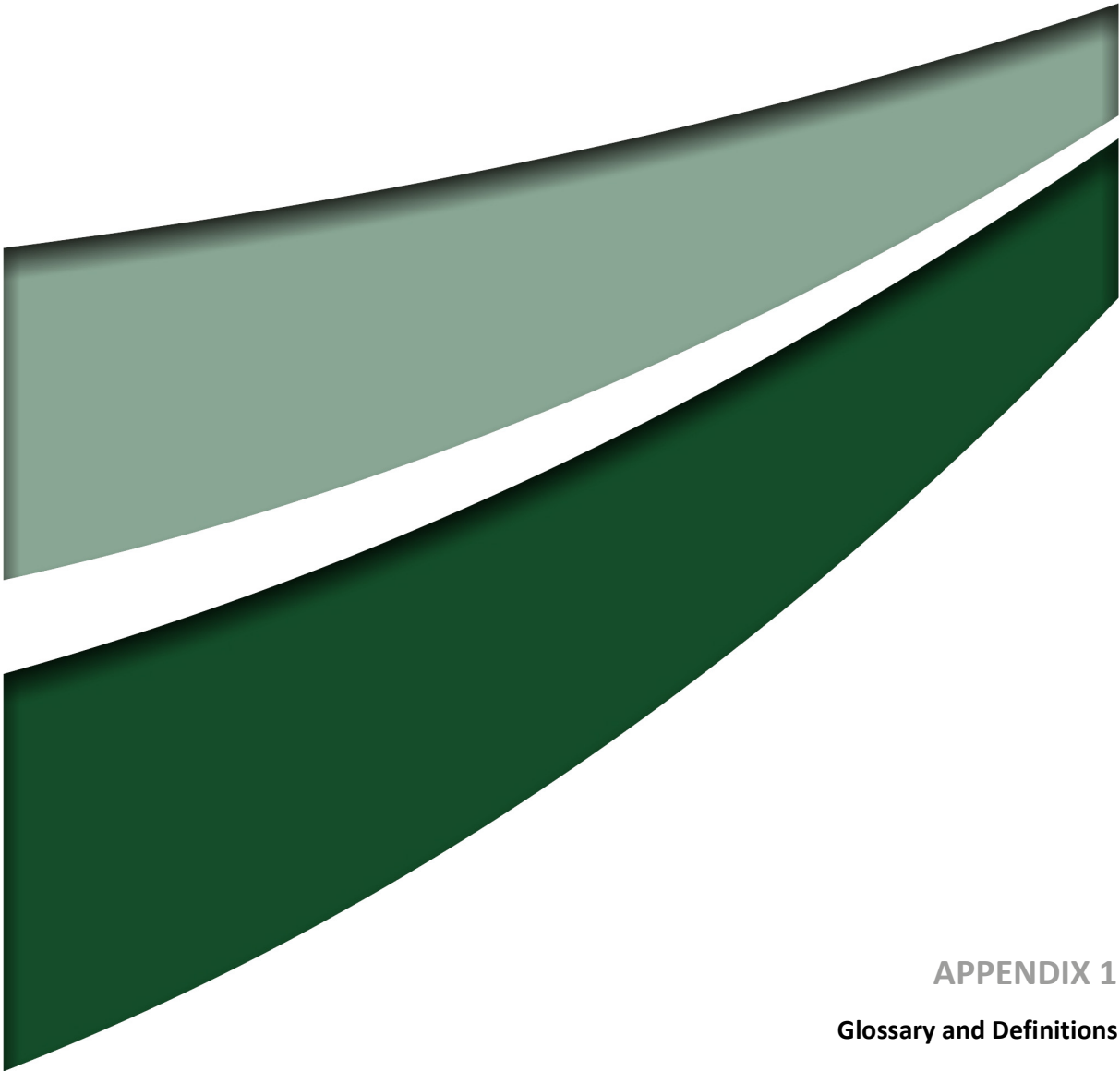
Based on the results of the road traffic noise monitoring program conducted from 6.00 am to 7.00 am and 7.00 am to 8.15 am, 11 September 2016 at the private residence on the corner of Oakvale Drive and Nelson Bay Road, as well as at 2352 Nelson Bay Road, it is concluded that at the time of monitoring Macka's Sand was complying with the road traffic noise assessment criteria at all sites as outlined in the Macka's Sand Major Project Approval 08_0142 and EPL 13218 for the meteorological conditions experienced at the time of monitoring.

8.0 References

Australian Standard AS1055-1997. *'Acoustics – Description and Measurement of Environmental Noise.*

NSW Environment Protection Authority 2000. *New South Wales Industrial Noise Policy.*

Umwelt (Australia) Pty Limited, 2016. *Noise Management Plan for Sand Extraction Operations.*



APPENDIX 1

Glossary and Definitions

Appendix 1 – Glossary and Definitions

1/3 Octave	Single octave bands divided into three parts.
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment background level – A single-figure background noise level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24 hour period of the monitoring period). It is determined by taking the lowest 10th percentile of the L90 level for each assessment period.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A), dBA	Decibels A-weighted.
dB(L), dB(Lin)	Decibels Linear or decibels Z-weighted.
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second – one oscillation per second equals 1 hertz.
LA10	The percentile sound pressure level exceeded for 10 per cent of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source.
LA90	Background Noise Level. The percentile sound pressure level exceeded for 90 per cent of the measurement period with 'A' frequency weighting calculated by statistical analysis.
LAm _{ax}	The maximum of the sound pressure levels recorded over an interval of one second.
LA1,1minute	The measure of the short duration high-level noises that cause sleep arousal. The noise level is measured as the percentile sound pressure level that is exceeded one per cent of measurement period with 'A' frequency weighting calculated by statistical analysis during a measurement time interval of one minute.

LAeq,t Equivalent continuous sound pressure level – The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting.

LAn Percentile level – A measure of the fluctuation of the sound pressure level which is exceeded 'n' per cent of the observation time.

RBL Rating background level – The overall single figure background level representing each assessment period over the whole monitoring period determined by taking the median of the ABLs found for each assessment period.

SPL (dBA) Noise: Sound pressure level – The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by:

$$\text{SPL} = 10 \cdot \log_{10} (p/p_0)^2$$

where p is the rms sound pressure in pascals and p₀ is the sound reference pressure at 20 μPa. decibels.

SWL Sound power level – a measure of the energy emitted from a source as sound and is given by:

$$\text{SWL} = 10 \cdot \log_{10} (W/W_0)$$

where W is the sound power in watts and W₀ is the sound reference power at 10-12 watts.



Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

Perth

PO Box 783
West Perth WA 6872
7 Havelock Street
West Perth WA 6005

Ph. 1300 793 267

Canberra

PO Box 6135
56 Bluebell Street
O'Connor ACT 2602

Ph. 02 6262 9484

Sydney

50 York Street
Sydney NSW 2000

Ph. 1300 793 267

Brisbane

Level 11
500 Queen Street
Brisbane QLD 4000

Ph. 1300 793 267