aurecon

Project: Kerosene Vale Ash Repository Stage 2B

Construction Noise assessment

Reference: 236429

Prepared for: Delta Electricity

Revision: 2

2 July 2013

Document Control Record

Document prepared by:

Aurecon Australia Pty Ltd
ABN 54 005 139 873
Level 2, 116 Military Road
Neutral Bay NSW 2089
PO Box 538
Neutral Bay NSW 2089
Australia

T +61 2 9465 5599
F +61 2 9465 5598
E sydney@aurecongroup.com
W aurecongroup.com

Document control						aurecon
Report Title	Construction Noise assessment					
Document ID	236429-KV-REP-01-Rev1		**Project Number**		236429	
File Path	\\Aurecon.info\Shares\AUSYD\Projects\BG\236429\3.Project Delivery\Acoustics\KVAR Construction noise assessment-003\Report\KVAR Construction Noise assessment-Rev2.docx					
Client	Delta Electricity		**Client Contact**		Coleen Milroy	
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**
1	**26 June 2013**	Draft issue	AL	AL	RK	GM
2	**2 July 2013**	Minor modifications	AL	AL	RK	GM
Current Revision	**2**					

Approval			
Author Signature		Approver Signature	
Name	Akil Lau	Name	Graham Mackay
Title	Acoustic Consultant	Title	Technical Director

Kerosene Vale Ash Repository Stage 2B

Date | 2 July 2013
Reference | 236429
Revision | 2

Aurecon Australia Pty Ltd
ABN 54 005 139 873
Level 2, 116 Military Road
Neutral Bay NSW 2089
PO Box 538
Neutral Bay NSW 2089
Australia
T +61 2 9465 5599
F +61 2 9465 5598
E sydney@aurecongroup.com
W aurecongroup.com

Contents

Appendices

Index of Figures

Index of Tables

1 Introduction

1.1 Project understanding

Department of Planning and Infrastructure (DoP) Conditions of Approval (CoA) for Kerosene Vale Ash Repository (KVAR) Stage 2 include provisions for ash placement and its associated operations. Other works approved included construction activities associated with an assessment of coal resources and a proposed realignment of the Sawyers Swamp Creek, with creek realignment being part of necessary stabilization earthworks to the northern wall of the original Kerosene Vale Ash Dam (KVAD), should coal extraction proceed.

The construction works for stage 2B include:

- Excavation of an area within the approved site that will enable ash placement.
- Management of excavated materials for water management, haulage access and site catchment closure. Set-down locations for the soil materials excavated are allocated and include:
  - All permanent capping areas of the final form of Stage 2 as approved by DoP (Stage 2A and 2B);
  - The development of a water management area for storm water, that will include processing of water quality through a constructed wetland at a location (refer to Figure 1);
  - Upgrade of an existing access road to the south of the repository as previously approved for KVAR Stage 1.

Construction Environmental Management Plan (CEMP) was developed in consultation with Delta Electricity which includes provisions for site details, environmental impacts and management, as well as risk management and mitigation. Figure 1 shows the extent of KVAR ash repository area.

The construction activities were concentrated at Stage 2B and Surface Water Detention Pond during our site visit which included activities related to loading and unloading of earth, water spraying, levelling of the haul road, compacting earth, etc.

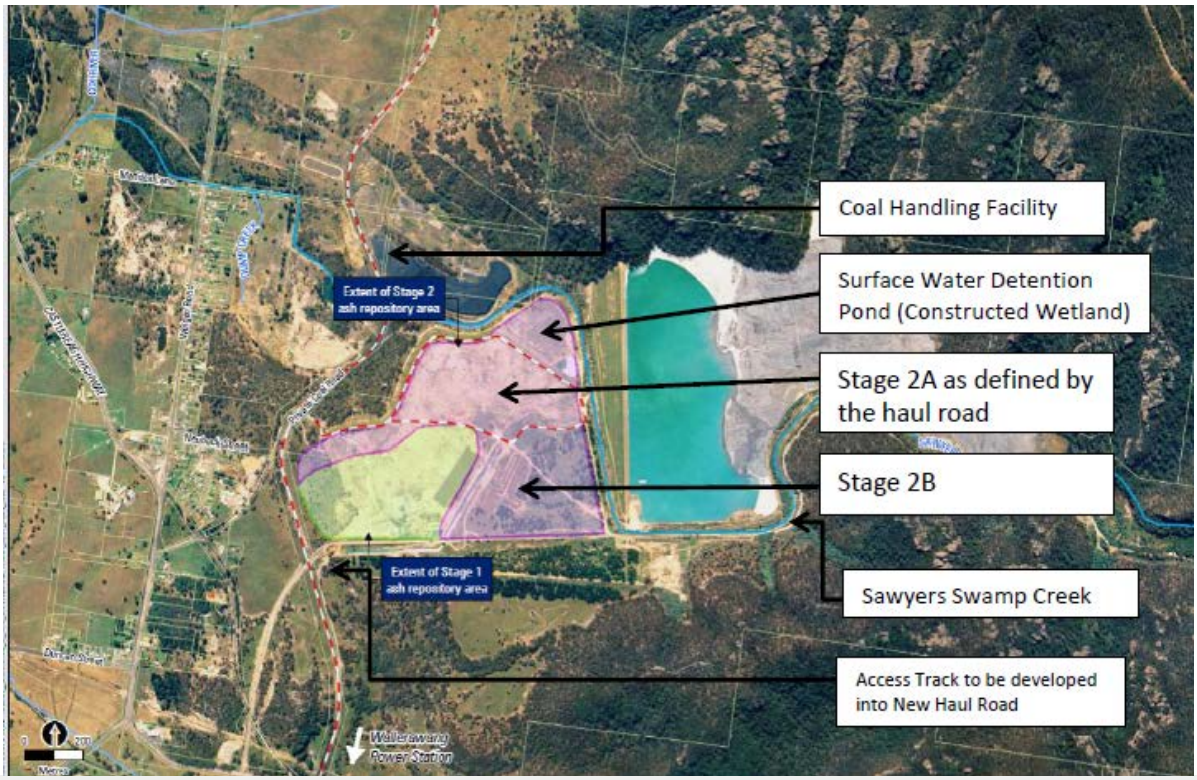

Figure 1 | Extent of KVAR Stage 2 Ash Repository Area

1.2 Scope of work

The scope of work includes a construction noise assessment comprising of attended noise measurements at three sensitive receiver locations to determine potential noise impacts arising from the construction activities at KVAR Stage 2B. Noise assessment and measurements were conducted in accordance with the *CEMP* for KVAR Stage 2B and *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.

1.3 Measurement locations

As per the Ongoing Operational Noise Measurements report for Kerosene Vale Ash Repository Stage 2 (22 November 2011), noise monitoring for Stage 2B was conducted at the three most affected sensitive receiver locations and an additional reference location near the construction site. Table 1 and Figure 2 outline the noise measurement locations with respect to the construction site.

Table 1 | Representative noise measurement locations

Measurement location	Representative sensitive receiver	Map Coordinates	Elevation (m)	Approximate distance to construction site (m)
A	60 Skelly Road, Lidsdale NSW	33.39453ºS 150.08702ºE	915	1300
B	10 Skelly Road, Lidsdale NSW	33.39299ºS 150.08686ºE	914	1250
C	21 Neubeck Street, Lidsdale NSW	33.38925ºS 150.08661ºE	912	1200
D	Site 1	33.39146ºS 150.10077ºE	946	150
	Site 2	33.38633ºS 150.09802ºE	918	100

Figure 2 | Noise measurement locations

1.4 Construction activity

The contractor (JK Williams) operated the construction equipment and mobile plant at the construction site. List of construction equipment and the corresponding Sound Power Levels (supplied by Delta Electricity) are mentioned in the Table 2. Sound Power Levels for some of the equipment were referenced from *AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites*.

Table 2 | Construction equipment at KVAR Stage 2 site

Equipment type	Number of equipment on site during the survey	Sound Power Level of each equipment SWL dB(A)	Remarks
627G Wheel Tractor-Scraper	1	113	1 Wheel tractor was occasionally operating, dependant on the haul road surface conditions.
815F Soil Compactor*	1	113	1 Soil compactor and 1 track type tractor were continuously operating at each of the sites during the entire construction activity (except during the lunch break)
825G II Soil Compactor*	0	113	
D6T Track-Type Tractor	1	116	
D400E II Ejector Truck	2	117	2 Dump trucks and 2 Ejector trucks were continuously operating at the construction site, loading earth from site 1 and unloading it at site 2
Dump truck*	2	117	
Excavator*	2	107	1 Excavator was continuously operating at Site 1, excavating earth and loading onto the trucks. Another excavator was non-operational at Site 2.
Water cart*	1	107	1 Water cart was occasionally operating dependant on the haul road surface conditions
Light commercial vehicle*	1	106	1 Light commercial vehicle occasionally traversing inside the construction site.

*: Sound Power Levels referenced from AS 2436-2010

The construction activities during the site attendance on 18th – 19th June 2013 comprised of:

- 1 excavator loading continuously four dump trucks at Site 1;
- 4 Dump trucks periodically unloaded earth at Site 2;
- 1 Soil compactor operating continuously operating at Site 1;
- 1 Track type Tractor operating continuously operating at Site 2;
- 1 Scraper intermittently operating at Site 1 and haul road;

- 1 Water cart operated once during the two day survey;

The construction hours for all works as defined in the DoP approval part 2.3 (CoA) for construction works are as below with a 1 hour lunch break in between:

- 7:00am to 6:00pm, Mondays to Fridays, inclusive;
- 8:00am to 1:00pm, Saturdays; and
- No time on Sundays and public holidays.

Activities resulting in impulsive or tonal noise emissions (such as rock-breaking or rock hammering) were suggested to not continue for more than three continuous hours and provide a minimum one-hour respite period. These activities were limited to:

- 8:00am to 12:00pm, Mondays to Saturday; and
- 2:00pm to 5:00pm, Monday to Friday.

2 Noise criteria

2.1 Conditions of Approval

As per CEMP noise monitoring for Stage 2B has to be conducted at the three most affected sensitive receiver locations to ensure the increase in noise satisfy the requirement of Background noise + 10 dB(A). Routine noise monitoring conducted for the ash placement operations at Kerosene Vale Stage 2 was used as a benchmark for noise during normal operations versus noise generated from construction activities. The noise monitoring conducted over the 6th and 7th November 2011 by Aurecon was used for this purpose. In summary the noise criteria is as follows:

L_{A10} dBA (measured) ≤ L_{A90} dBA (Background noise) +10 dBA

Table 3 summarises the background noise levels at the three sensitive locations and the associated noise criteria.

Table 3 | Construction noise criteria

Location	Background noise levels[1] (L_{A90} dBA)	Noise criteria (L_{A10} dBA)
A	37	37+10 = 47
B	36	36+10 = 46
C	37	37+10 = 47

[1] Referenced from 6th – 7th November 2011 measurements conducted for ash placement operations at KVAR

3 Noise survey

3.1 Methodology

Attended day noise measurements were conducted on 18 – 19 June 2013 at the boundary of the nearest residential properties from the ongoing construction works. The background noise measurements including the averaged A-weighted noise levels (L_{Aeq}), maximum A-weighted noise levels (L_{Amax}) and statistical A-weighted L_{A90} and L_{A10} noise levels[2] were conducted using a Larson Davis 831 Type 1 sound level meter equipped with a L&D PRM831 pre-amplifier and a PCB 377B02 ½" microphone which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. Measurements were typically taken at a height of 1.2 m and at least 3.5 m from any reflecting structure other than the ground. The measurement period at each location consisted of 15 minutes. A Larson Davis CAL200 was utilised to calibrate the sound level meter before and after each series of measurements with no significant calibration drift noted. Measurements were typically taken in accordance with the Australian Standard *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.

Table 4 shows the equipment used for all the measurements performed on site. Attended noise measurements were conducted at three sensitive receiver locations and an additional reference location (as shown in Figure 2) using the Type 1 sound level meter. It should be noted that it was partly cloudy that day and low wind (< 1 m/s) conditions were prevalent during some of the noise measurements conducted on 19/06/2013.

Table 4 | Sound pressure level measurement equipment

Equipment	Make	Model	Serial No.	Type	Last Calibration	Calibration Due
Sound Level Meter	LD	831	0001595	1	23.08.12	23.08.14
Calibrator	LD	CAL200	6345	1	14.03.12	14.03.14

3.2 Noise measurement results

Results of the noise monitoring are summarised in Table 5 below. Detailed results of continuous noise logging over the 15-minute period are shown in Appendix B. A list of operating construction equipment identified at the KVAR Stage 2B construction site is outlined in Section 1.4. Noise measurements conducted at Location D (Site 1) consisted of two 15 minute periods.

[2] For explanation of the acoustic terms please refer to the attached Glossary of Terminology in Appendix A

Table 5 | Results of environmental noise monitoring

Location	Date	Time	Measured sound Pressure Level, dB(A)				Note
			$L_{Aeq, 15min}$ #	$L_{A10, 15min}$ ^^	$L_{A90, 15min}$ ^	$L_{Amin, 15min}$ *	
Location A *(60 Skelly Road)*	18 June	11:40	48	50	46	44	Note 1
		15:33	50	51	47	45	
	19 June	09:54	53	55	48	46	
		15:50	51	52	47	44	
Location B *(10 Skelly Road)*	18 June	11:22	49	48	41	40	Note 2
		15:15	48	50	42	40	
	19 June	09:37	48	50	44	42	
		15:33	48	50	42	40	
Location C *(21 Neubeck Street)*	18 June	11:03	44	46	41	39	Note 3
		14:55	45	47	42	39	
	19 June	09:18	48	51	43	40	
		15:11	46	48	41	38	
Location D *(Site 1)**	18 June	10:17	57	60	51	46	Note 4
		14:11	66	64	48	43	
	19 June	08:12	64	67	59	54	
		14:23	67	69	58	51	
Location D *(Site 2)*	19 June	08:53	67	69	62	55	

*Note – * results based on an average of two 15 minute samples taken during each measurement time.*

Note 1 *(Residential premise - Location A)*

From our site observation at residential location A, the area is dominated by the noise resulting from the traffic along Castlereagh Highway, dump trucks moving on the KVAR haul road and operation of cooling towers at Wallerawang Power Station. There was no audible noise from the construction activities during our site attendance. Noise from birds and insects also contributed to the background noise at this location.

Note 2 *(Residential premise - Location B)*

Noise measurements at residential location B were dominated by the noise resulting from the dump trucks movements on the KVAR haul road and operation of cooling towers at Wallerawang Power Station. Noise from birds and insects also contributed to the background noise at this location. There was no audible noise from the construction activities during our site attendance. Intermittent traffic noise from Wolgan Road and Skelly Road was also clearly audible at this location.

Note 3 *(Residential premise - Location C)*

The background noise contributions at Location C were predominantly from the operation of the cooling towers in the Wallerawang Power Station, birds/insects/animals, distant traffic. Intermittent traffic noise from Wolgan Road was clearly audible and contributed to the ambient noise levels. Wallerawang Power Station cooling towers were audible during the entire measurement on both days. The trucks moving on the haulage road were partly visible from this location because of an earth mound blocking the line of sight, although the truck engine noise was clearly audible. There was no audible noise from the construction activities during our site attendance.

Note 4 *(Construction site - Location D)*

Noise from the mobile plants operating at the construction sites contributed to the background and ambient noise levels measured at this location. Earth from the ground was continuously excavated and loaded onto the 4 dump trucks periodically during the entire survey from Site 1 and uploaded at Site 2. One Soil Compactor was operating at each of the construction sites during the entire noise survey. Noise measurements during the 18 June 14:11 measurement (Site 1) shows higher L_{Aeq} levels because of the movement of water cart close to the measurement location (10-15m away).

4 Noise assessment

4.1 Measured noise level assessment

Table 6 compares the measured noise levels (most conservative L_{A10} dBA noise levels) with the developed noise criteria for three most sensitive receivers.

Table 6 | Measured noise level comparison

Location	Noise criteria (L_{A10} dBA)	Measured noise levels[3] (L_{A10} dBA)
A	≤ 47	55
B	≤ 46	50
C	≤ 47	51

Measured noise levels (L_{A10} dBA) at each of the measurement locations was contributed by the noise from cooling towers at Wallerawang Power Station and intermittent traffic moving on Castlereagh Highway and Wolgan Road. Noise from the construction activities was not audible at any of the measurement location during the noise survey. Therefore measured noise levels for each location do not conclusively represent the noise contribution from the construction activities occurring at the KVAR site. Subsequent Section 4.2 summarises the noise prediction conducted to assess the noise contribution from the construction activities.

4.2 Noise level prediction

Result of the measured noise level at the sensitive receiver boundary can be found in Table 5. Noise levels (LAeq) at all receiver locations were predominantly contributed by the cooling towers from Wallerawang Power Station and traffic noise. Noise from the construction site was inaudible at all the sensitive locations.

As the construction noise contribution from the KVAR was inaudible at any of the measurement locations, we have undertaken a desktop based noise prediction to conclusively assess the noise contribution from the construction activities. Table 7 summarises the noise prediction conducted to assess the noise contribution from the construction activities at the three sensitive receiver locations. Measured L_{A10} noise levels at Location D (worst case scenario during the afternoon measurement on 19 June), approximately 150m away from the construction site were used for the noise prediction based on spherical noise propagation.

[3] Most conservative L_{A10} dBA noise level for each measurement location.

Table 7 | Prediction of noise levels

Date & Time	Measured L_{A10} dBA at Location D, 150m away (a)	Noise prediction				Noise Criteria dBA	Compliance
		Attenuation due to air absorption and barrier (b)	Attenuation due to distance (c)		Final Noise level dBA (a)+(b)+(c)		
19 June, 14:23	69[4]	-7	1300m (Location A)	-19	43	≤ 47	Yes
			1250m (Location B)	-18	44	≤ 46	Yes
			1200m (Location C)	-18	44	≤ 47	Yes

Based on the noise prediction summarised in Table 7, the noise contribution from the construction activities comply with the noise criteria at all of the three sensitive receiver locations.

[4] Most conservative measurement conducted during the afternoon on 19 June 2013.

5 Recommendations

5.1 Noise management measures

As per the noise assessment, noise from the KVAR Stage 2B construction activity complies with the stipulated noise criteria and there is no requirement for any additional noise management measures to the employed at this stage. Below is the list of general noise management measures that can be applied if noise complaints are received specifically relating to KVAR construction activities. The construction project managers could apply one or more of the following management measure to mitigate the noise complaints based on the nature and severity of the complaint (in the event of complaints received from the community are received):

- Avoid the coincidence of noisy plant/machine working simultaneously close together and adjacent to sensitive receivers.
- Construction trucks and other heavy machinery to use loop tracks as much as possible on the site to minimise the amount of reversing activities, i.e. managed through the Construction Traffic and Transport Management Plan.
- Consider the use of alternative warning system to the conventional single tone reversing alarm, such as broadband sound reversing alarm (e.g. BBS-TEK Backalarms) and warning lights.
- Installation of appropriate silencer/muffler on the engine exhaust for each truck working at KVAR construction site.
- The use of light machinery (e.g. smaller excavators and dozers) during operation when working close to western site boundaries.

6 Conclusion

Construction noise assessment consisting of attended noise monitoring at KVAR has been carried out by Aurecon on 18 and 19 June 2013 in accordance with *CEMP* for KVAR Stage 2B and Australian Standard "*AS1055.1-1997 Acoustics – Description and measurement of environmental noise, Part 1: General procedures*" using a Type 1 LD 831 sound level meter.

Environmental survey results revealed that the background noise at all the three sensitive receiver locations were due to the noise from Wallerawang Power Station cooling towers and distant traffic. Noise from construction activities from KVAR was inaudible at any of the sensitive locations during the entire noise survey.

Based on the noise assessment, the construction noise resulting from the operation of equipment and mobile plant at the KVAR construction site on 18 and 19 June 2013, comply with the *CEMP* Noise Management plan and the projects Conditions of Approval at all the representative residential receivers. There is no requirement for any additional or modified noise management measures to the employed at this stage.

7 References

- Office of Environment & Heritage (OEH) *Interim Construction Noise Guideline (ICNG).*
- Australian Standard *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.
- Australian Standard *AS 2436-2000 Guide to noise and vibration control on construction demolition and maintenance sites*.
- Delta Electricity Western Region – Construction Environmental Management Plan (CEMP) December 2011 for Kerosene Vale Ash Repository Stage 2B Wallerawang Power Station.
- Kerosene Vale Ash Repository Stage 2-Ongoing operational noise measurements (22 November 2011) by Aurecon.

Appendix A
Glossary of terms

Term	Definition
Sound Pressure Level	Sound or noise is the sensation produced at the ear by very small fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range (from 20 microPascals to 60 Pascals). A scale that compresses this range to a more manageable size and that is best matched to subjective response is the logarithmic scale, rather than a linear scale.
Sound Pressure Level (Lp)	Is defined as: $L_P = 10\log_{10}\left(\frac{p^2}{p_{ref}^2}\right)dB$ In the above equation, p is the sound pressure fluctuation (above or below atmospheric pressure), and p_{ref} is 20 microPascals (2×10^{-5} Pa), the approximate threshold of hearing. To avoid a scale which is too compressed, a factor of 10 is included, giving rise to the decibel, or dB for short.
A-Weighted Decibel (dB(A)) & Loudness	In some circumstances, the sound pressure level is expressed as C-Weighted decibels, instead of the more common A-Weighted. The C-Weighting filter is designed to replicate the response of the human ear above 85 dB, and places a greater weighting on low frequency noise.
L_{Aeq}	The time averaged C-weighted sound pressure level for a time interval, as defined in AS1055.1. It is generally described as the equivalent continuous C-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time. It can be considered as the average sound pressure level over the measurement period.
L_{Ceq}	The time averaged C-weighted sound pressure level for a time interval, as defined in AS1055.1. It is generally described as the equivalent continuous C-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time. It can be considered as the average sound pressure level over the measurement period.
L_{An}	The sound level, which, for a specified time interval, in relation to an investigation of a noise, means the A-weighted sound pressure level that is equalled or exceeded for n% of the interval. Commonly used percentages are 1, 10, 90 & 99%.
L_{Cpk}	The peak C-weighted sound pressure level for a time interval.

$L_{Cmax,T}$	The average maximum C-weighted sound pressure level, which, for the specified time interval, means the C-weighted sound pressure level during the interval obtained by using the fast time weighting and arithmetically averaging the maximum sound levels of the noise during the interval. Under certain conditions the 10th percentile noise level, $L_{C10,T}$, can represent the average maximum C-weighted sound pressure level.
L_{A10}	A-weighted noise level which is exceeded for only 10% of the measuring period. It is usually used as the descriptor for intrusive noise level and represents ambient road traffic noise in general.
L_{A90}	A-weighted noise level which is exceeded for 90% of the measuring period. It is usually used as the descriptor for background noise level during the measurement period.
L_{Amin}	Minimum A-weighted noise level detected during the measuring period. It refers to the minimum background noise detected.
Octave	Frequency bands allow a representation of the spectrum associated with a particular noise. They are an octave wide, meaning that the highest frequency in the band is just twice the lowest frequency, with all intermediate frequencies included and all other frequencies excluded. Each octave band is described by its centre frequency.
Maximum Exposure Time (Hours)	The maximum possible time a person can be safely exposed to a specific noise level (L_{Aeq}).

Appendix B
Photos of construction site

Figure 3 | Construction site – Site 1

Figure 4 | Construction site – Site 2

Appendix C
Noise monitoring graphs

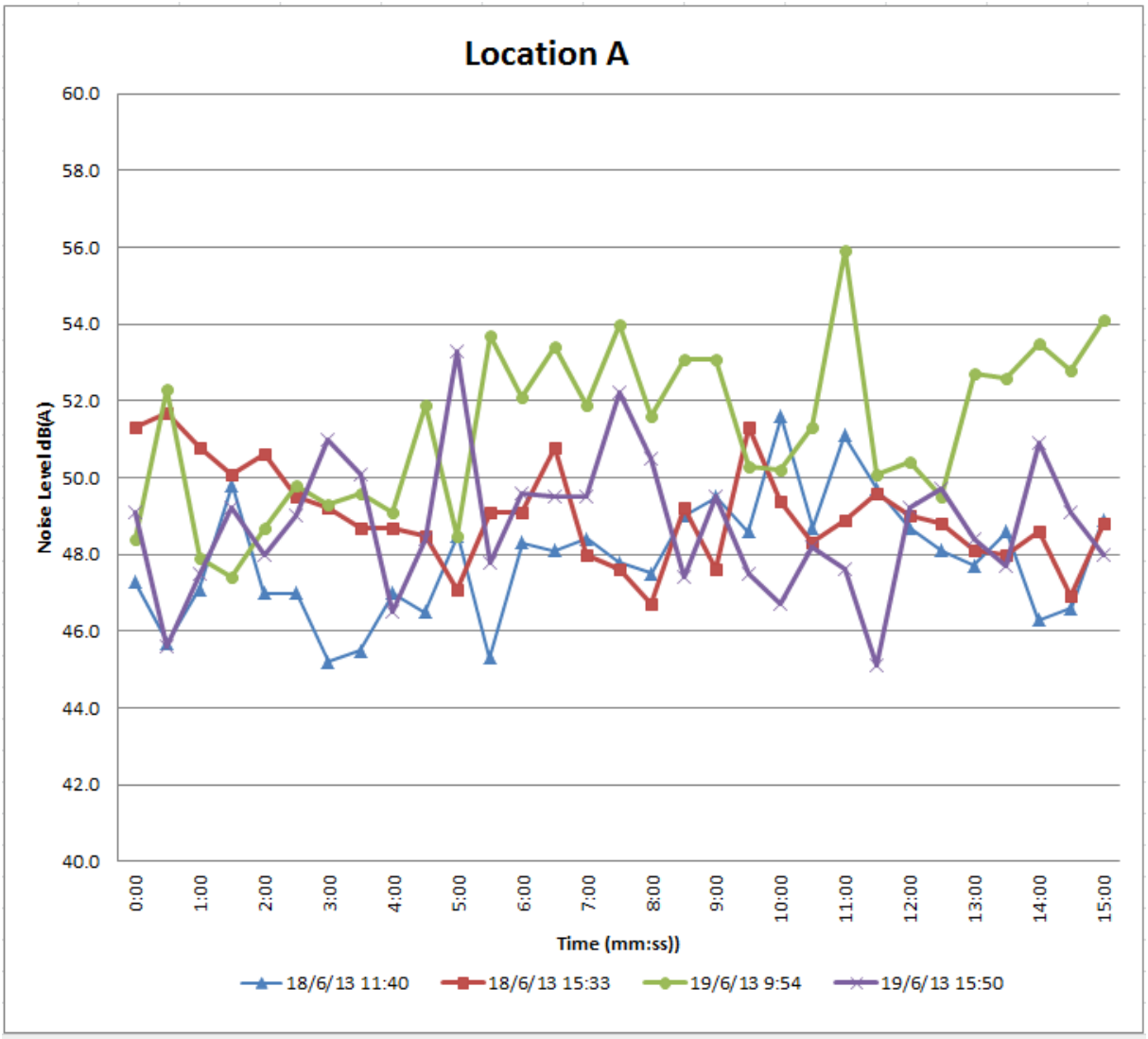

Figure 5 | Location A

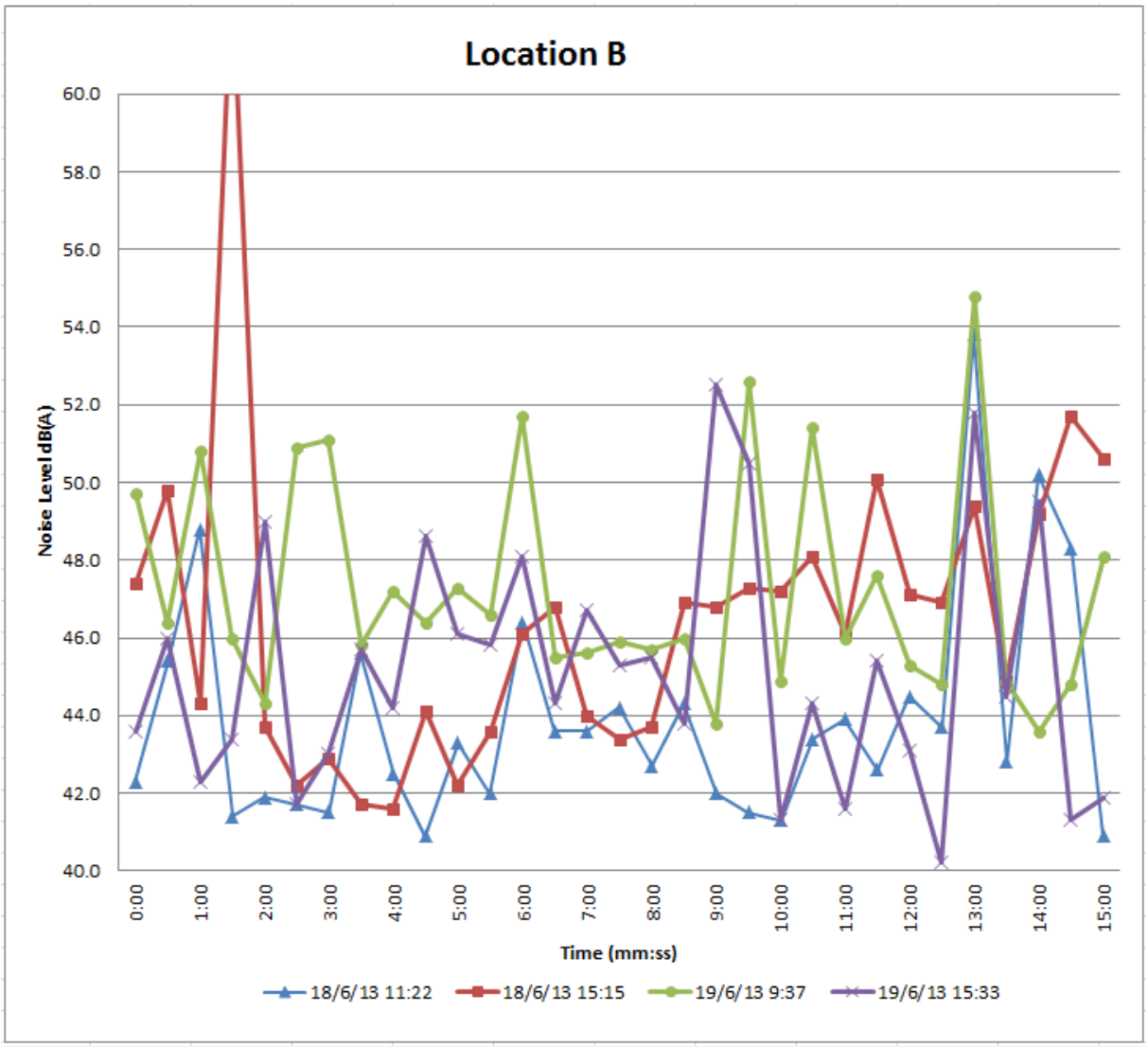

Figure 6 | Location B

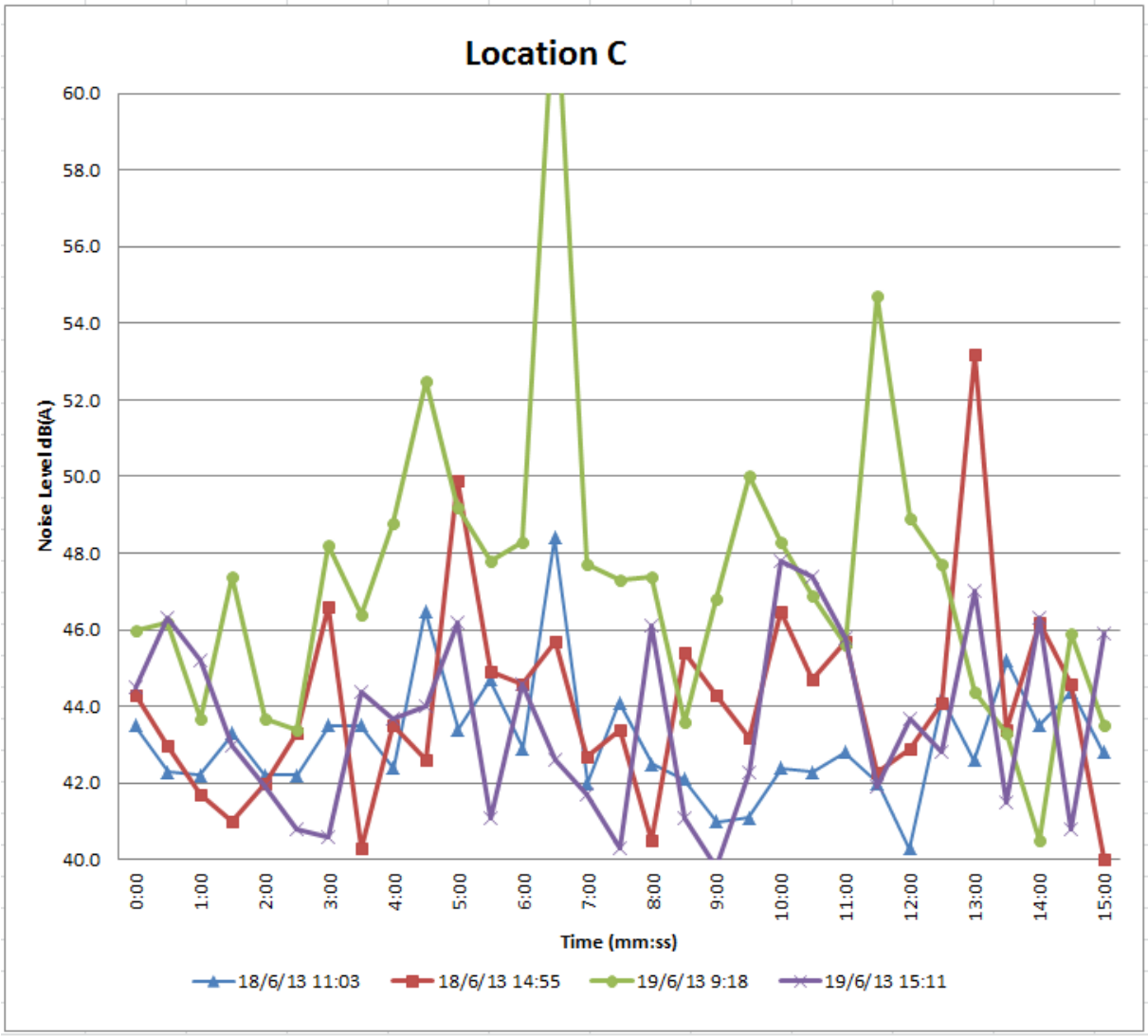

Figure 7 | Location C

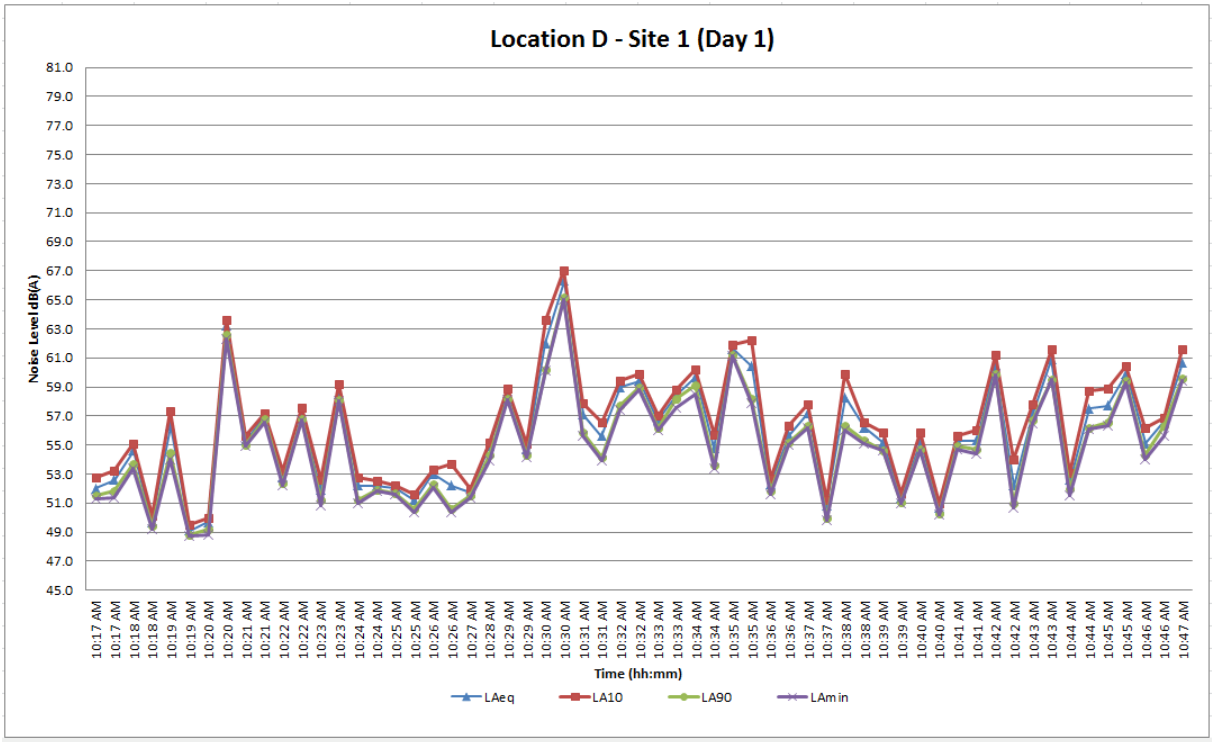

Figure 8 | Location D-Site 1 (Day 1)-10:17

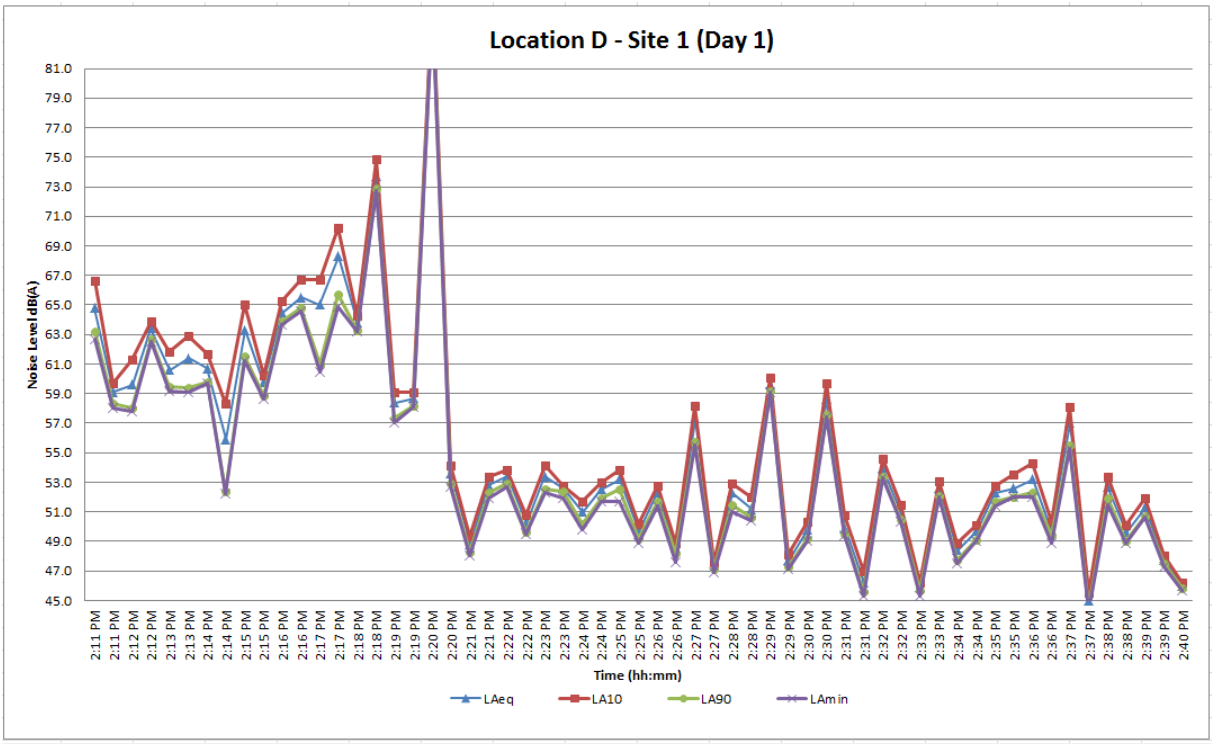

Figure 9 | Location D-Site 1 (Day 1)-14:11

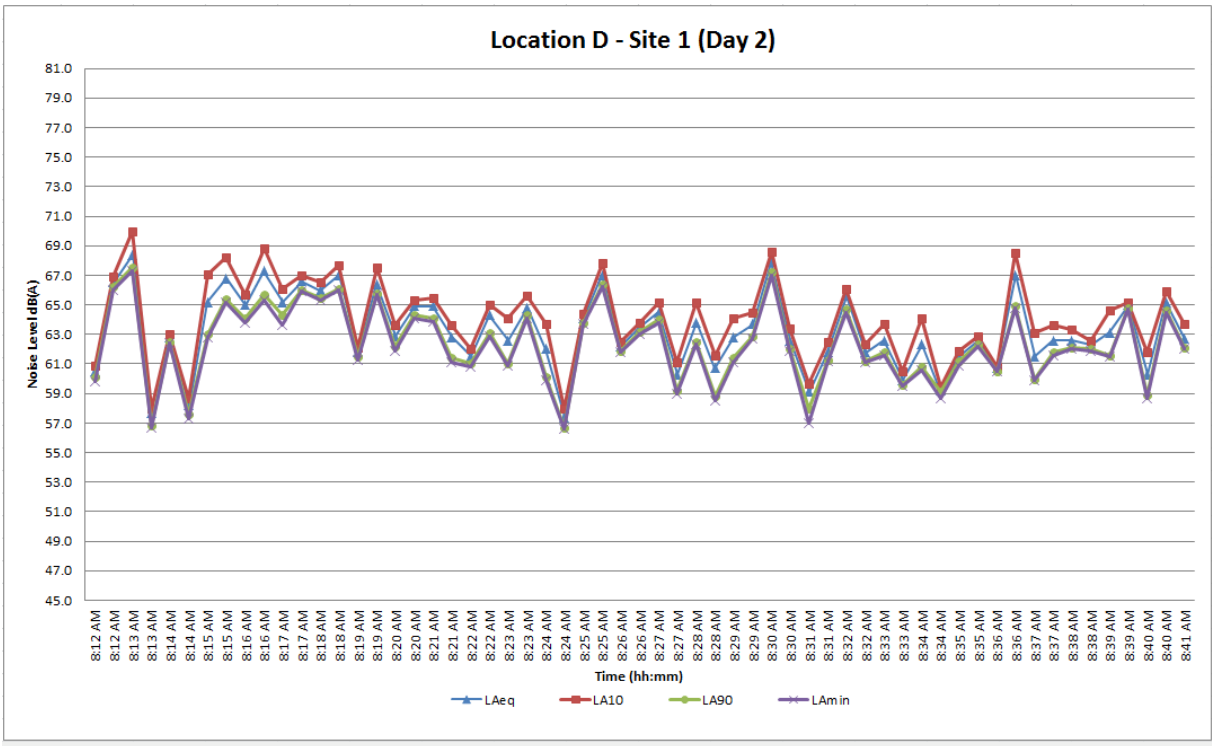

Figure 10 | Location D-Site 1 (Day 2)-08:12

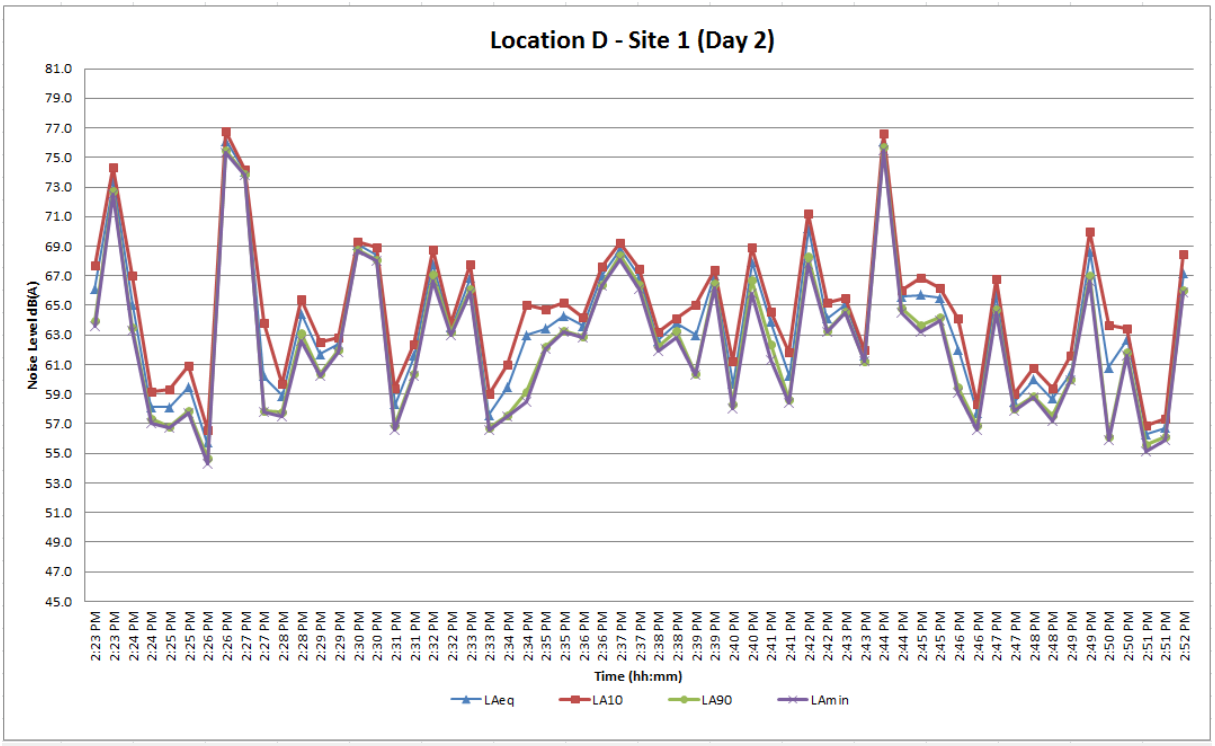

Figure 11 | Location D-Site 1 (Day 2)-14:23

Aurecon Australia Pty Ltd
ABN 54 005 139 873
Level 2, 116 Military Road
Neutral Bay NSW 2089
PO Box 538
Neutral Bay NSW 2089
Australia
T +61 2 9465 5599
F +61 2 9465 5598
E sydney@aurecongroup.com
W aurecongroup.com

Aurecon offices are located in:
Angola, Australia, Botswana, China, Ethiopia, Hong Kong, Indonesia, Lesotho, Libya, Malawi, Mozambique, Namibia, New Zealand, Nigeria, Philippines, Singapore, South Africa, Swaziland, Tanzania, Thailand, Uganda, United Arab Emirates, Vietnam.