ACOUSTIC SSD DA REPORT (SSD 8865)

ST ANTHONY OF PADUA CATHOLIC SCHOOL, AUSTRAL

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

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1 INTRODUCTION

JHA Consulting Engineers has been engaged by Munns Sly Moore Architects to provide a noise and vibration impact assessment for the State Significant Development (SSD) Application for the proposed St Anthony of Padua Catholic School Development in Austral, NSW. The site is located at 125-165 Tenth Avenue and 140-170 Eleventh Avenue, Austral.

Secretary's Environmental Assessment Requirements (SEARs) have been issued, requiring the preparation of an Environmental Impact Statement (EIS) for the proposed development. This report addresses the requirements established by the Department of Planning and Environment (DoPaE) as part of the SSD process and has been prepares considering the following documentation:

- SEARs issued by the DoPaE.
- NSW EPA Noise Policy for Industry 2017.
- NSW DoP Development Near Rail Corridors and Busy Roads – Interim Guideline 2008.
- NSW DECCW Interim Construction Noise Guideline 2009.
- NSW DECC Assessing Vibration: a technical guideline 2006.
- State Environmental Planning Policy (Educational Establishment and Child Care Facilities) 2017.

This acoustic report demonstrates compliance with the aforementioned SEARs and has been prepared to accompany a SSD Application to the NSW DoPaE. This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Carry out noise surveys to determine existing ambient and background noise levels on site.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation for the following noise emissions:
  - Mechanical plant from the development to the surrounding receivers.
  - Generated road traffic.
  - Public address and school bells.
  - Outdoor playgrounds.
  - Activities within the performing arts theatre.
  - Indoor recreational centre.
  - Child care centre.
- Determine whether the relevant criteria can be achieved based on the proposed operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Provide recommendations for Construction Noise and Vibration Planning.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed use development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.
- Recommendations for vibration level criteria during construction phase.

The following documentation has been used for the preparation of this report:

- Site drawings of the proposed development.
- Noise data collected on site through the use of noise loggers and a hand held spectrum analyser.

This document and related work has been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001 and ISO 14001.

2 DESCRIPTION OF PROPOSAL

2.1 PROPOSED DEVELOPMENT

Austral is a suburb of Sydney in the local government area of the City of Liverpool. According to the 2016 Census of Population, there were 3,024 residents in Austral.

The site is bounded by 4th Avenue (to the West), 10th Avenue (to the South) and 11th Avenue (to the North) and is located within a rural environment characterised by light levels of activity during the day. Figure 1 shows the site location and nearest noise sensitive receivers.

Figure 1: Aerial view of site showing the location of the proposed development (red shadow), residential receivers (blue shadow), commercial receivers (orange shadow), place of worship receivers (green shadow), aged care receivers (purple shadow) and active recreation receiver (yellow shadow).

The St Anthony of Padua Catholic School Masterplan identifies the staged development of the School comprising educational buildings and associated facilities including a church, trade training centre, multi-purpose hall, childcare centre, indoor and outdoor sports facilities. The School is proposed to accommodate up to 2480 students plus 200 staff members.

Stage 1 works involves the construction and fit-out of educational buildings for years 1 to 12, specialist buildings with rooms for arts, workshops, laboratories, hospitality, administration building, a multi-purpose hall, a childcare centre plus carparks.

Figure 2 shows the proposed development layout as per latest architectural drawings.

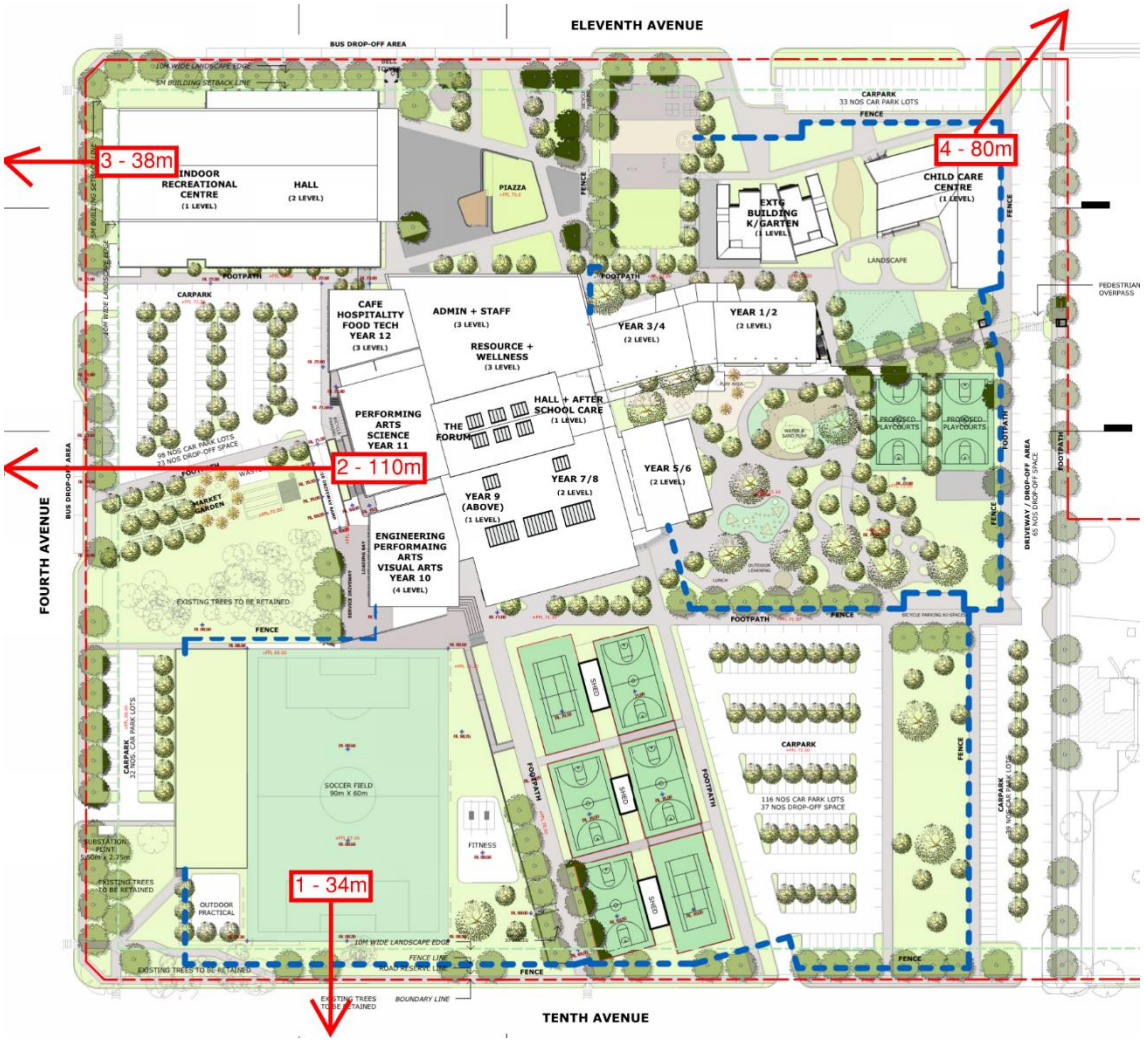


Figure 2: Site layout of the proposed development and distances.

Based on the proposed layout and the nearest noise sensitive receivers location, Table 1 shows a summary of most affected noise receivers plus assumed distances.

ID	*Sensitive Receiver*	*Receiver Type*	*Origin*	*Distance, m*
1	Tenth Avenue	Residential	Active Outdoor Space	34
2	Fourth Avenue	Residential	Performing Arts Theatre	110
3	Fourth Avenue	Residential	Indoor Recreational Centre	38
4	Tenth Avenue	Residential	Child Care Centre	80

Table 1: Nearest sensitive receivers surrounding the site location plus distances.

2.2 SEARS

The following items the SEARs have been found to be relevant. These are as follows:

"...

4. Environmental Amenity

- *Assess amenity impacts on the surrounding locality, including solar access, visual privacy, overshadowing and acoustic impacts.*
- *Identify any proposed use of the school outside of school hours (including weekends) and assess any resultant amenity impacts on the intermediate locality and proposed mitigation measures.*

...

10. Noise and Vibration

Identify and provide a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation, construction and operation, including consideration of any public address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities, and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.

Relevant Policies and Guidelines:

- *NSW EPA Noise Policy for Industry (2017)*
- *Interim Construction Noise Guideline (DECC)*
- *Assessing Vibration: A Technical Guideline 2006*
- *Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning 2008)*

..."

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys around the proposed site were conducted in order to establish the ambient and background noise levels of the site and surrounds.

Long-term noise monitoring was carried out from Thursday 5th to Thursday 12th April 2018 with a Rion NL-52 noise logger (Serial Number 1054192). The noise logger recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded.

The noise logger microphone was mounted 1.5 meters above the ground and windshield was used to protect the microphone. Weather conditions were generally calm and dry during the unattended noise monitoring.

On Thursday 5th April 2018, short-term noise measurements were carried out during day-time. Short-term noise measurements were carried out with a NTI XL-2 hand-held Sound Level Meter (Serial Number: A2A-13742-E0). The calibration of the SLM was checked before and after each use and no deviations were recorded.

JHA Consulting Engineers carried out the surveys, in accordance with the method described in the '*AS/NZS 1055:1997 Description and measurement of environmental noise, parts 1 and 2*'.

The SLM microphone was mounted 1.5 meters above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free field – i.e. more than 3 meters away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the each attended noise monitoring.

The long-term and short-term noise monitoring locations are shown in Figure 3.

Figure 3: Long-term noise monitoring location (L1) and short-term noise monitoring location (M1).

3.2 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site plus close to the nearest noise sensitive receivers. One short-term noise monitoring location was chosen as representative as follows:

- Location M1: Eleventh Avenue at the proposed site boundary.

From observations during the site visit, it is noted that at location M1 ambient and background noise levels are dominated by nature and intermittent traffic noise.

A summary of the results of the short-term noise monitoring are shown in Table 2.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB re 20μPa*									
			Overall dB(A)	*Octave Band Centre Frequency, Hz*								
				31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
M1	05/04/2018 14.10 – 14.25	$L_{90,15min}$	**39**	51	49	45	38	34	35	31	26	20
		$L_{eq,15min}$	**53**	63	60	54	48	46	47	44	44	46
		$L_{10,15min}$	**51**	66	63	56	49	45	47	43	38	34
	05/04/2018 14.30 – 14.45	$L_{90,15min}$	**39**	49	49	45	38	34	34	30	24	18
		$L_{eq,15min}$	**54**	59	64	56	52	50	51	45	41	34
		$L_{10,15min}$	**51**	62	63	58	49	46	47	43	39	30

Table 2: Short-term noise levels measured on site.

3.3 LONG-TERM NOISE MONITORING

The noise logger was located on the boundary of the proposed development site. This location was secured and considered to be representative of the typical ambient and background noise levels. The long-term noise monitoring location was chosen as follows:

- Location L1: Eleventh Avenue at the proposed site boundary.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW NPI, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs).

The background noise levels have been established in general accordance with the methodology described in the NSW NPI, i.e. the 10th percentile background noise level for each period of each day of the ambient noise survey. The median of these levels is then presented as the background noise level for each assessment period.

The background and ambient noise levels measured for each period are shown in Table 3.

Location	*L_{A90} Background Noise Levels, dB(A)*			*L_{Aeq} Ambient Noise Levels, dB(A)*		
	Day 7am-6pm	*Evening 6pm-10pm*	*Night 10pm-7am*	*Day 7am-6pm*	*Evening 6pm-10pm*	*Night 10pm-7am*
L1	37	38	33	54	51	47

Table 3: Long-term background and ambient noise levels measured on site.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Noise Emissions and Intrusive Noise
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - NSW EPA Noise Policy for Industry (NPI) 2017.
  - Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*.
  - State Environmental Planning Policy (Educational Establishments and Child Care Facilities - EECCF) 2017.
  - Association of Australasian Acoustical Consultants (AAAC) *'Guideline for Child Care Centre Acoustic Assessment'*.
- Traffic Noise
  - NSW Department of Planning (DoP) *'Development Near Rail Corridors or Busy Roads – Interim Guideline'* 2008.
  - NSW DECCW Road Noise Policy (RNP) 2011.
- Construction Noise and Vibration
  - NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DECC Assessing Vibration: A Technical Guideline 2006.

4.1 NOISE EMISSIONS AND INTRUSIVE NOISE

4.1.1 REGULATORTY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulation framework for the protection of the environment in New South Wales. The Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to development.

The assessment of "environmental impact" relies upon the use of acceptable noise criteria which either maybe defined in a Development Control Plan, or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

4.1.2 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent sets the Project Noise Trigger Level (PNTL's).

4.1.2.1 Intrusiveness Criteria

The NSW NPI defines the intrusiveness criteria as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15 minute period, does not exceed the background noise level by more than 5 dB(A) when beyond a minimum threshold."

Indicative Noise Amenity Area	*Period*	*Measured Rating Background Level (L_{A90}), dB(A)*	*Intrusiveness Criterion, dB(A)*
Residential rural (RU2)	Day	37	42
	Evening	38	43
	Night	33	38
Commercial	When in use	38	43
Active Recreation	When in use	38	43
Place of Worship	When in use	38	43

Table 4: Determination of the intrusiveness criterion for sensitive receivers.

4.1.2.2 Amenity Criteria

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level (L_{Aeq}), dB(A)*	*Amenity Criterion, dB(A)*
Residential rural (RU6)	Day	50	48 $L_{Aeq,15min}$ (50-5+3)
	Evening	45	43 $L_{Aeq,15min}$ (45-5+3)
	Night	40	38 $L_{Aeq,15min}$ (40-5+3)
Commercial	When in use	65	63 $L_{Aeq,15min}$ (65-5+3)
Active Recreation	When in use	55	53 $L_{Aeq,15min}$ (55-5+3)
Place of Worship	When in use	40*	63 $L_{Aeq,15min}$ (65-5+3)

Table 5: Determination of the amenity criterion for residential receivers. * Internal noise levels. Amenity Criteria have been adjusted considering a minimum sound transmission loss of 25 dB for fixed windows.

4.1.2.3 Project Noise Trigger Levels

The PNTL's are shown in Table 6 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point on or within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion*	*Amenity Criterion*
Residential rural (RU6)	Day	42	48
	Evening	43	43
	Night	38	38
Commercial	When in use	43	63
Active Recreation	When in use	43	53
Place of Worship	When in use	43	63

Table 6: Determination of PNTL's for the proposed development.

4.1.3 STATE ENVIRONMENTAL PLANNING POLICY EECCF 2017

Schedule 1 of the State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 provides the following development standards for noise levels.

"Air Conditioning

> *Noise level must not exceed 5dB above the rating background noise level when measured at the boundary of the most affected residential premises (or potentially most affected residential premises), determined in accordance with the Noise Policy.*
>
> *Source noise must not exhibit tonal noise, as defined in the Noise Policy (being noise containing a prominent frequency and characterised by a definite pitch).*
>
> *In these standards, the Noise Policy means the document entitled NSW Industrial Noise Policy (ISBN 0 7313 2715 2) published in January 2000 by the Environment Protection Authority."*

Schedule 2 of the State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 provides the following development standards for noise levels.

"6 - Noise

> *A new building or (if the development is an alteration or addition to an existing building for the purpose of changing its use) an existing building that is to be used for the purpose of a school or school-based child care must be designed so as not to emit noise exceeding an L_{Aeq} of 5 dB(A) above background noise when measured at any lot boundary."*

Schedule 4 of the State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 provides the following development standards for noise levels.

"Principle 5 - Amenity

> *Schools should provide pleasant and engaging spaces that are accessible for a wide range of educational, informal and community activities, while also considering the amenity of adjacent development and the local neighbourhood.*

Schools located near busy roads or near rail corridors should incorporate appropriate noise mitigation measures to ensure a high level of amenity for occupants.

Schools should include appropriate, efficient, stage and age appropriate indoor and outdoor learning and play spaces, access to sunlight, natural ventilation, outlook, visual and acoustic privacy, storage and service areas."

4.1.4 AAAC GUIDELINE FOR CHILD CARE CENTRE

There are no prescribed regulations or legislation that apply to noise from child care centres. Therefore, there is no prescribed noise criteria that can be used. Furthermore, we understand that common approach of "offensive noise" criteria is not appropriate for a planning situation such as this proposal.

Our noise assessment approach is based on:

- NSW tribunal decisions when assessing noise from the use of child care centres.
- *'Guideline for Childcare Centre Acoustic Assessment'* prepared by the Association of Australasian Acoustical Consultants (AAAC).

The AAAC guideline is addressed for assessment of childcare centres and its noise level criterion for outdoor spaces have been considered as adequate by NSW tribunal decisions. As children do not play outdoors continuously for long periods of time, and as the duration of time for children playing outside is reduced, the overall noise annoyance reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration.

Table 7 shows the noise level criterion proposed by the AAAC guideline for assessing noise from outdoor spaces. These are the noise levels which it is considered that complaints are unlikely.

Use of outdoor area	*Noise Level Criteria*	*Criterion*
Up to 2 hours (total) per day	$L_{Aeq,15min}$ noise level from outdoor area not to exceed the existing background noise level ($L_{A90,15min}$) plus 10 dB $L_{Aeq,15min} < L_{A90,15min} + 10$ dB(A)	$L_{Aeq,15min} \leq 47$ dB(A)
More than 2 hours (total) per day	$L_{Aeq,15min}$ noise level from outdoor area not to exceed the existing background noise level ($L_{A90,15min}$) plus 5 dB $L_{Aeq,15min} < L_{A90,15min} + 5$ dB(A)	$L_{Aeq,15min} \leq 42$ dB(A)

Table 7: Noise level criterion for the roof-top playground area as per AAAC guideline.

4.2 TRAFFIC NOISE

4.2.1 DEVELOPMENT NEAR RAIL CORRIDORS OR BUSY ROADS – INTERIM GUIDELINE

The guideline details the application of clauses 85, 86, 87, 102 and 103 of the Infrastructure State Environmental Planning Policy (SEPP) which is required to be used when a development is adjacent to a rail corridor, a freeway, a toll-way, a transit-way or a road with an annual average daily traffic volume (AADT) of more than 40,000 vehicles.

At this stage, there are no rail corridors neither busy roads adjacent to the proposed development site or planning to develop. Therefore, we understand that this guideline does not apply for this project.

4.2.2 NSW ROAD NOISE POLICY

The NSW DECC Road Noise Policy (RNP) establishes criteria for traffic noise from:

- *Existing roads*
- *New road projects*
- *Road development projects*
- *New traffic generated by developments*

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above the existing noise levels. An increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.3 CONSTRUCTION NOISE AND VIBRATION

4.3.1 NOISE CRITERIA

As per the SEARs requirements for the proposed construction activities, noise criteria are established in accordance with the NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.

The recommended hours for normal construction works are as follows:

- Monday to Friday: 7.00 to 18.00
- Saturday: 8.00 to 13.00
- No work on Sundays or public holidays

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level by more than 10 dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the construction noise level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75 dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background level by more than 5 dB(A).

  It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. They are as follows:

- Retail outlets: $L_{Aeq,15min}$ 70dBA (external)
- Places of Worship: $L_{Aeq,15min}$ 45dBA (internal)
- Active recreation areas: $L_{Aeq,15min}$ 60dBA (external)

Table 8 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Residential receivers	Noise affected / External	52	38
	Highly noise affected / External	75	N/A
Commercial	External	65	65
Active Recreation	External	65	65
Place of Worship	Internal	45	45

Table 8: ICNG construction airborne noise criteria for sensitive receivers surrounding the site.

Where reference is made to an internal noise level, an external noise level 10 dB above the internal noise levels are applied which should achieve the internal noise level where a window is adequately opened to provide natural ventilation.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40 dB(A) (internal)
- Night: $L_{Aeq,15min}$ 35 dB(A) (internal)

The internal noise levels are assessed at the centre of the most affected habitable room.

4.3.2 VIBRATION CRITERIA

4.3.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed a document, 'Assessing Vibration: A Technical Guideline' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 *'Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'*.

The guideline does not however address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time).

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Vibration criteria for continuous and impulsive vibration are presented in Table 9 below, in terms of vibration velocity levels.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-9}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Critical working areas	When in use	0.10 [100 dB]	0.20 [106 dB]	0.10 [100 dB]	0.20 [106 dB]
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]
Workshops	When in use	0.80 [118 dB]	1.60 [124 dB]	13.00 [142 dB]	26.00 [148 dB]

Note: Day-time is 7.00 to 22.00 and night-time is 22.00 to 7.00

Table 9: Continuous and impulsive vibration criteria applicable to the site.

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 10 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*Vibration Dose Values, $m/s^{1.75}$*	
		Preferred	*Maximum*
Critical working areas	When in use	0.10	0.20
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80
Workshops	When in use	0.80	1.60

Table 10: Intermittent vibration criteria applicable to the site.

4.3.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:1993 *'Structural Vibration – Effects of Vibration on Structures'* and British Standard BS 7385.2:1993 *'Evaluation and Measurement for Vibration in Buildings'* are to be adopted.

Structural type	*r.m.s. velocity, mm/s*			
	Foundation			*Plane of floor uppermost full storey*
	Less than 10Hz	*10 to 50Hz*	*50 to 100Hz*	*Frequency mixture*
Commercial, industrial or similar	20	20 to 40	40 to 50	40
Dwellings or similar	5	5 to 15	15 to 20	15
Particularly sensitive	3	3 to 8	8 to 10	8

Table 11: DIN 4150.3 Guideline values of vibration velocity for evaluating the effects of short-term vibration.

Structural type	*Peak particle velocity, mm/s*	
	4 to 15Hz	*15Hz and above*
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s @ 4Hz increasing to 20mm/s @ 15Hz	20mm/s @ 15Hz increasing to 50mm/s @ 40Hz and above

Table 12: BS 7385.2 Guideline values of vibration velocity for evaluating cosmetic damage.

5 NOISE IMPACT ASSESSMENT AND RECOMMENDATIONS

Noise break-out from the proposed development has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant from the development to the surrounding receivers.
- Noise emissions from traffic generated by the proposed development.
- Noise emissions from recess and lunch bells, public address systems.
- Noise emissions from outdoor playgrounds.
- Noise emissions from indoor activities – i.e. use of halls for music, sports, etc.
- Noise emissions from child care centre.

Each of these noise sources has been considered in the noise impact assessment. The noise impact assessments have considered the following:

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Lowest measure background noise levels at the nearest noise sensitive receiver have been used to provide a worst-case scenario.

5.1 MECHANICAL PLANT ROOMS

Noise from proposed development plant rooms should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the noise sensitive receivers.

At this stage, final mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions. A preliminary review has been undertaken for the building services / plant rooms.

Noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant to the nearest sensitive receivers meets the noise level criteria.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
    - In-duct attenuation
    - Noise enclosures as required
    - Sound absorptive panels
    - Acoustic louvres as required
    - Noise barriers as required

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures.

5.2 ROAD TRAFFIC NOISE

The student and staff member population following the construction of the development will potentially increase the number of vehicles in the surrounding roads, with a potential increase in traffic noise exposure for the residential receivers located along these roads.

The traffic impact report for the proposed development prepared by Colston Budd Rogers & Kafes Pty Ltd provides an analysis of the additional traffic from the proposed development for the year 2036. This is summarised in the Table 13.

Road	*Location*	*Weekday Morning*		*Weekday Afternoon*	
		2036 base	*Plus development*	*2036 base*	*Plus development*
Edmondson Avenue	North of Eleventh Avenue	1,610	+350	1,920	+350
	North of Tenth Avenue	1,500	+240	1,480	+240
	South of Tenth Avenue	1,340	+520	1,660	+520
Fourth Avenue	North of Eleventh Avenue	770	+260	870	+260
	North of Tenth Avenue	670	+220	940	+220
	South of Tenth Avenue	610	+370	620	+370

Table 13: 2036 two-way peak hour traffic flows plus traffic generated by the proposed development.

Noise traffic impact due to the proposed development has been assessed based on the traffic data presented in Section 5.1.2 and the prediction of the traffic noise calculated in accordance with the Calculation of Road Traffic Noise (CoRTN) published by the UK Department of the Environment.

As noted in Section 4.2.2, when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational) the NSW Road Noise Policy (RNP) states that an increase up to 2 dB in relation to existing noise levels is anticipated to be insignificant.

As shown in Table 14, the increase of noise levels in the year 2036 due to the proposed development, is less than the maximum allowable increase of 2 dB(A).

Road	*Location*	*Weekday Morning*	*Weekday Afternoon*
		Increase $L_{Aeq,1h}$, dB(A)	
Edmondson Avenue	North of Eleventh Avenue	+1	+1
	North of Tenth Avenue	+1	+1
	South of Tenth Avenue	+1	+1
Fourth Avenue	North of Eleventh Avenue	+1	+1
	North of Tenth Avenue	+1	+1
	South of Tenth Avenue	+2	+2

Table 14: Predicted noise level increase due to traffic movements from the proposed development.

Therefore, the traffic increase will not result in any noticeable change in traffic noise levels and is expected to meet the NSW Road Noise Policy recommendations.

5.3 PUBLIC ADDRESS, SCHOOL BELL SYSTEMS AND TOWER BELL

Noise from proposed development public address, school bell systems and tower bell should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers.

At this stage, public address, school bell systems and tower bell selections have been not made; therefore, it is not possible to undertake a detailed assessment of the public address, school bell and tower bell noise emissions.

The EPA notes numerous reports of community concern arising from inadequate design and installation as well as inappropriate use of school public address and bell systems. EPA considers that appropriate design, installation and use of those systems can both:

- Meet the proponent's objectives of proper administration of the school and ensuring safety of students, staff and visitors, and
- Avoid interfering unreasonably with the comfort and repose of occupants of nearby residences.

The Public Address, School Bell Systems and Tower Bell shall be designed, installed and operated such that the systems does not interfere unreasonably with the comfort and repose of occupants of nearby residences. It is anticipated that the noise impact to the nearest sensitive receivers will be negligible.

5.4 OUTDOOR PLAYGROUNDS

Noise break-out from the outdoor playgrounds has the potential to impact on the nearest noise sensitive receivers.

The key source it will be students in the outdoor playgrounds during recesses or sport activities. It is assumed that the vocal effort of the students communicating will be generally 'normal' speech. The noise assessment has assumed the following:

- Students talking 'normal' speech to provide worst-case scenario.
- For every two students only one will be speaking at any given time with a 'normal' voice.
- A maximum number of 100 students will be at the same time on a playground.

The L_{eq} noise source level (at 1 m) of 50 students talking simultaneous is expected to be 72 dB(A).

The assessment of the noise impact of the students in the nearest residential receiver during day-time is presented in Table 15.

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ of 50 students talking 'normal' at 1m	72
Distance attenuation (34 m), dB	-31
Resulting level at residential boundary	41
Noise Level Criterion day-time / Complies?	42 / Yes

Table 15: Noise assessment at nearest residential sensitive receiver – students with 'normal' voices.

The predicted noise level meets the noise criteria at the nearest residential noise sensitive receiver.

5.5 PERFORMING ARTS THEATRE

The Performing Arts Theatre is anticipated to host events that include amplified music/public address system internally. The expected noise impacts from the Performing Arts Theatre has been assessed at the nearest sensitive receivers, using the methodology and assumptions given below.

The assessment was made considering the proposed layout as shown on the architectural drawings. The following assumptions have been made for the assessment:

- Events occurring during night time hours (most stringent noise criteria)
- Doors and windows shut during events
- Typical sound power levels for concerts and events

The noise levels inside the Performing Arts Theatre during a concert, and form the basis of the expected worst-case noise emission from the proposed use, is expected to be 100 dB(A).

The building envelope of the Performing Arts Theatre will need to provide the following minimum sound insulation performance in order to meet the noise level criteria in the nearest residential receiver during night-time.

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ of Live Band	100
Increase in reverberant field, dB	3
Distance attenuation (110 m), dB	-41
Correction for sound insulation rating and façade surface	22
Noise Level Criteria during night-time, $L_{Aeq,15min}$	38
Minimum sound insulation rating R_w, dB	**46**

Table 16: Noise assessment for Live Band noise break-out to the nearest sensitive receiver to the West.

5.6 INDOOR RECREATIONAL CENTRE

Sport activities within the Indoor Recreational Centre will be held regularly plus assemblies and occasional out of hours event such as speech night. A noise assessment of the Indoor Recreational Centre has been conducted at the nearest residential receiver. The noise assessment has considered the types of sporting activities expected to use the facility as and assessed against noise levels measured from previous similar projects.

The noise levels used within the assessment considers the following types of noise sources:

- Noise from bouncing balls,
- Noise from small sized crowds/spectators,
- Referee whistle noise,
- Intermittent shouting from players/participants,
- General noise from sporting activities (futsal and basketball),
- Amplified speech.

The noise levels inside the Indoor Recreational Centre are expected to be 86 dB(A).

The building envelope of the Indoor Recreational Centre will need to provide the following minimum sound insulation performance in order to meet the noise level criteria in the nearest residential receiver during day-time (most stringent noise level criteria).

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ within Indoor Recreational Centre	86
Increase in reverberant field, dB	3
Distance attenuation (38 m), dB	-32
Correction for sound insulation rating and façade surface	26
Noise Level Criteria during night-time, $L_{Aeq,15min}$	38
Minimum sound insulation rating R_w, dB	**45**

Table 17: Noise assessment for sports within the Indoor Recreational Centre noise break-out to the nearest sensitive receiver to the West.

5.7 CHILD CARE CENTRE

Noise break-out from the child care centre has the potential to impact on the nearest noise sensitive receivers. The key noise source it will be children playing in the outdoor area. It is assumed that the vocal effort of the children will be generally 'raised' or 'loud' speech.

The child care centre will operate only during day-time. Therefore, the noise assessment has been carried out only for day-time period. It is assumed that the outdoor playground area will have different activities areas. If so, it can be stated that children will be spread around these activities areas instead of being gathered.

The noise impact assessment has considered the following:

- Noise level emissions as per Table 18.
- Full capacity of the outdoor playground area with 125 children.
- Background noise levels at the nearest noise sensitive receiver have been used to provide worst-case scenario.

The L_{eq} Sound Power Level of 1 child talking with different vocal efforts are shown below in Table 18.

Description	*Sound Pressure Level, dB re 20µPa*								
	Overall dB(A)	*Octave Band Centre Frequency, Hz*							
		63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
L_{eq} of 1 child talking 'raised'	**74**	49	58	62	68	69	66	61	58
L_{eq} of 1 child talking 'loud'	**82**	56	66	71	75	78	75	70	67

Table 18: Octave Band Sound Power Level likely to be generated by a child.

Predicted noise levels at the nearest noise residential receiver associated with the outdoor playground are shown in the following tables for the different scenarios.

Calculation	*Overall Sound Pressure Level dB(A)*
L_{eq} of 125 children talking 'raised' at 1m in the active area	86
Building attenuation / screening	-15
Distance (80 m) attenuation	-38
Resulting level at residential receiver	33
Noise Level Criterion day-time (more than 2 hours) / Complies?	42 / Yes

Table 19: Noise assessment at nearest noise sensitive receiver – children with 'raised' voices.

Calculation	*Overall Sound Pressure Level dB(A)*
L_{eq} of 125 children talking 'loud' at 1m in the active area	94
Building attenuation / screening	-15
Distance (80 m) attenuation	-38
Resulting level at residential receiver	41
Noise Level Criterion day-time (max. 2 hours) / Complies?	42 / Yes

Table 20: Noise assessment at nearest noise sensitive receiver – children with 'loud' voices.

For the 'raised' and 'loud' voice scenarios, the predicted $L_{Aeq,15min}$ noise level from the use of the outdoor playground area at the nearest noise sensitive receiver meet the noise level criteria.

6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Currently the project is at an early design stage and a detailed construction program is not yet full defined. This section of the assessment provides general recommendations only and provides applicable criteria together with best noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan.

Any noise from demolition and construction activities to be carried out on site must not result in "offensive noise" to any sensitive noise receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

6.1 RELEVANT CODES AND STANDARDS. CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 4.3 of this report contains the relevant legislation, codes and standards plus construction noise and vibration criteria for this project.

6.2 CONTROL ELEMENTS

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a Construction Noise and Vibration Management Plan, and undertake noise and vibration monitoring for the duration of the project.

6.2.1 WORKING HOURS

Recommended standard hours of work in the ICNG are as follows:

- Monday to Friday: 7.00 to 18.00
- Saturday: 8.00 to 13.00
- Sundays and Public Holidays: No excavation or construction works

6.2.2 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort.

Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.

- Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operate plant in a quietest and most effective manner.
- Where appropriate, limit the operating noise of equipment.
- Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- Where appropriate, obtain acoustic test certificates for equipment.

- *On site noise management.* Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms, particularly during night or out-of-hours works.
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
  - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.
  - Have a documented complaints process and keep register of any complaints.
  - Give complaints a fair hearing and provide for a quick response.
  - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that

any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.2.3 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds ether the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

7 SUMMARY AND CONCLUSIONS

A noise assessment has been carried out for the proposed development of St Anthony of Padua Catholic School at Austral. This report forms part of the documentation package to be submitted to the Department of Planning as part of the State Significant Development Application.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development. Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

At this stage, mechanical plant selections have not been made. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the mechanical plant of the proposed development to the nearest sensitive receivers.

The traffic noise impact due to number of vehicles due to the proposed development – based on the information provided in the traffic report – is anticipated to be insignificant, as the noise levels will not increase more than 2 dB at the sensitive noise receivers.

At this stage, public address, school bell systems and tower bell have not been selected. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the public address, school bell systems and tower bell of the proposed development to the nearest sensitive receivers.

External noise emissions associated with the outdoor playgrounds have been assessed. The noise impact predicted at the nearest residential receiver is 1 dB(A) above the noise level criteria and at this early stage, this is not considered to be a significant exceedance for the purpose of this assessment.

The Performing Arts Theatre building envelope will need to provide a minimum sound insulation performance of R_w46 in order to meet the noise level criteria in the nearest residential receiver during night-time for the worst-case scenario noise emissions – concert with a noise level of 100 dB(A).

The building envelope of the Indoor Recreational Centre will need to provide a minimum sound insulation performance of R_w45 in order to meet the noise level criteria in the nearest residential receiver during day-time (most stringent noise level criteria).

Child care centre outdoor playground area noise impact has been assessed. Predictions show that noise level criteria will be met when the playground will be a full-capacity and children will communicate with a 'raised' and 'loud' vocal effort.

Potential construction noise and vibration impacts on the surroundings have been presented in this report and recommendations based on the relevant guidelines are provided. There will be times / situations when construction noise associated with demolition, earthworks, excavation and new-build works are likely to exceed the stated criteria, particularly when works occur in the areas closer to sensitive receivers or with direct view between the receivers and the works.

If, during construction works, an item of equipment exceeds the stated airborne noise and / or vibration criteria at any sensitive location, the additional noise / vibration control measures presented in this report, together with construction best practices, shall be considered to minimise noise and vibration impacts on the sensitive receivers.

Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, having given regard to the above listed conclusions, it is the finding of this assessment that the SSD application should not be refused on the grounds of excessive noise and vibration generation.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical plant, modifications to the buildings and introduction of any additional noise sources.

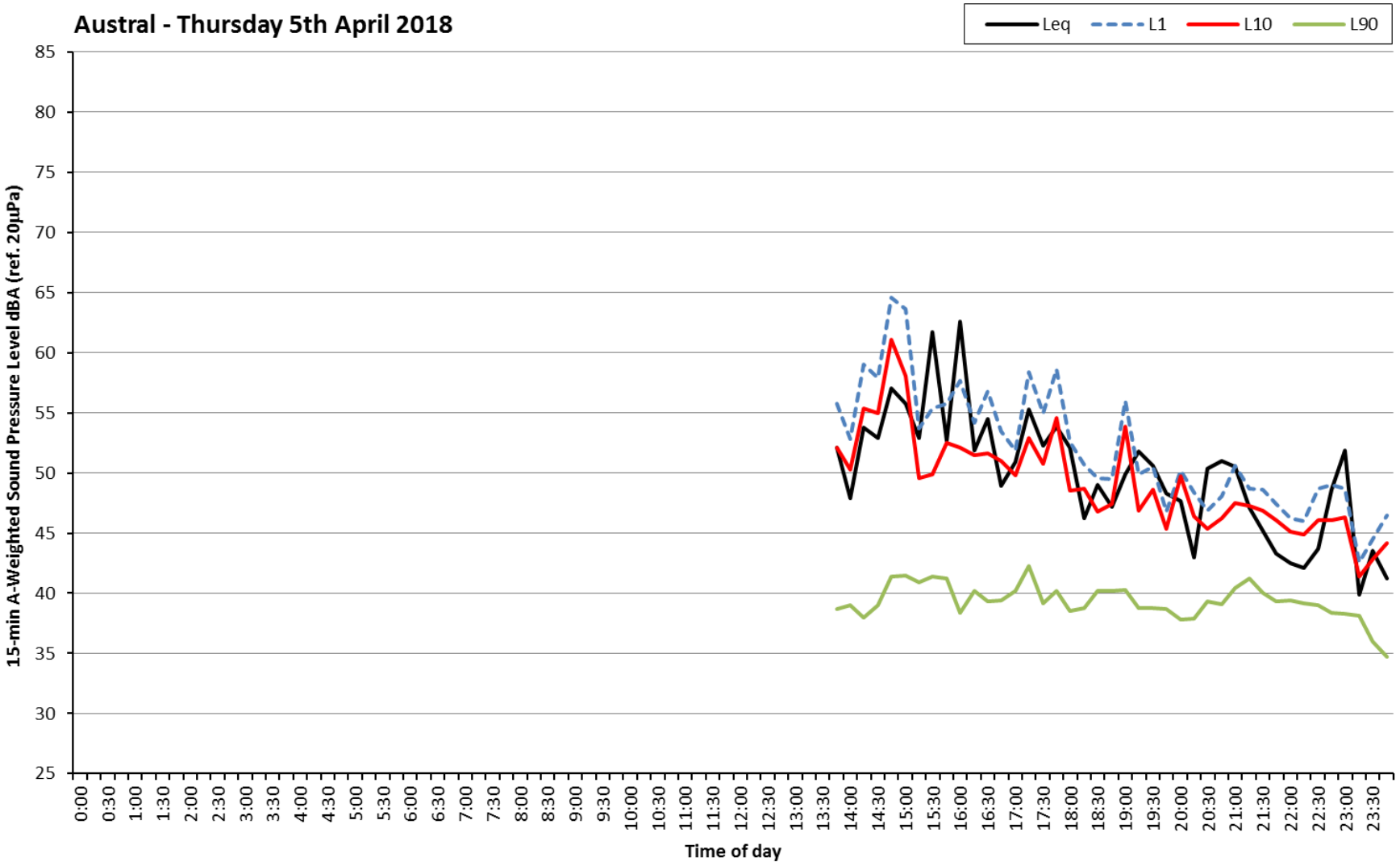
APPENDIX A: LONG-TERM MONITORING RESULTS

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.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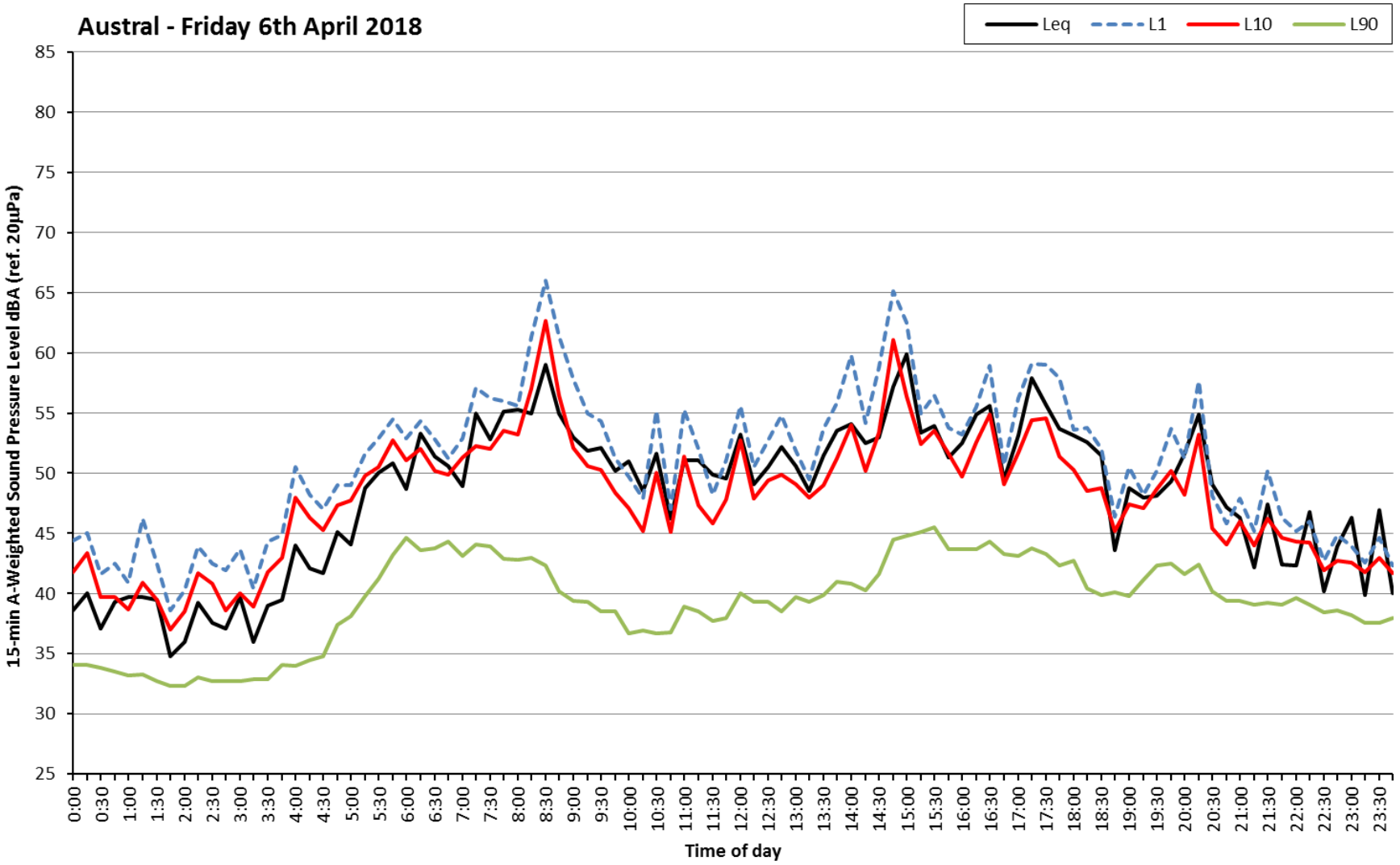
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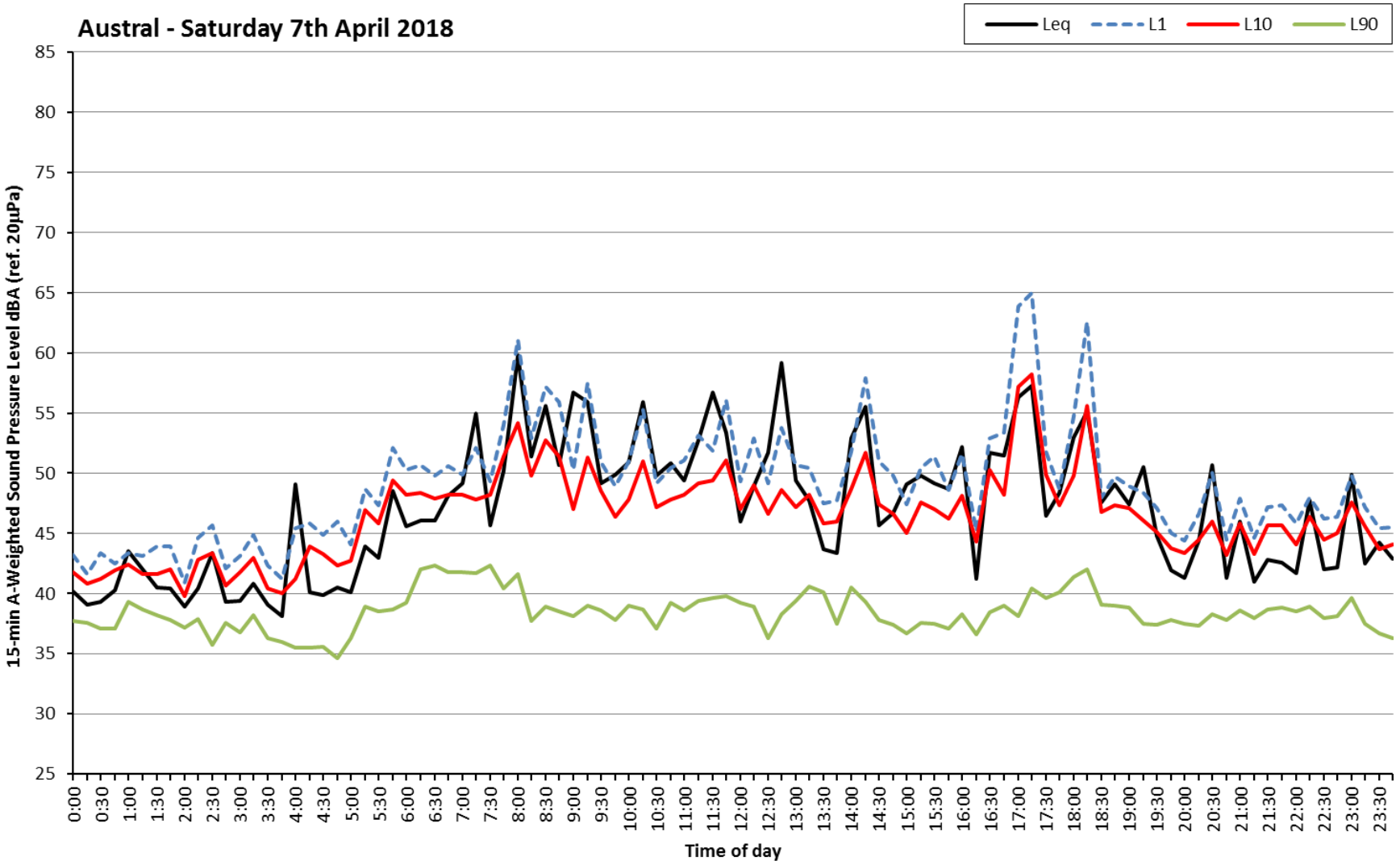
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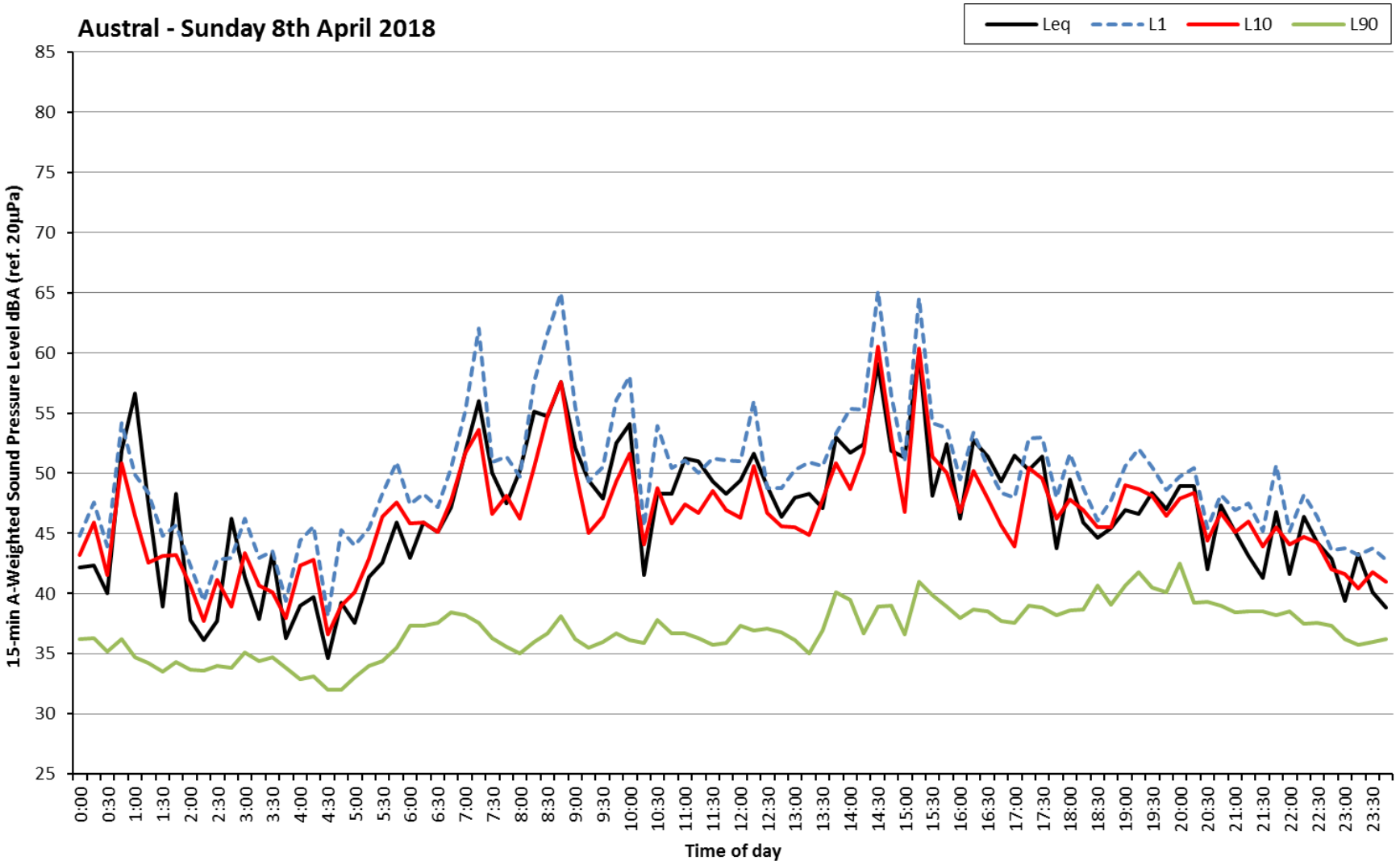
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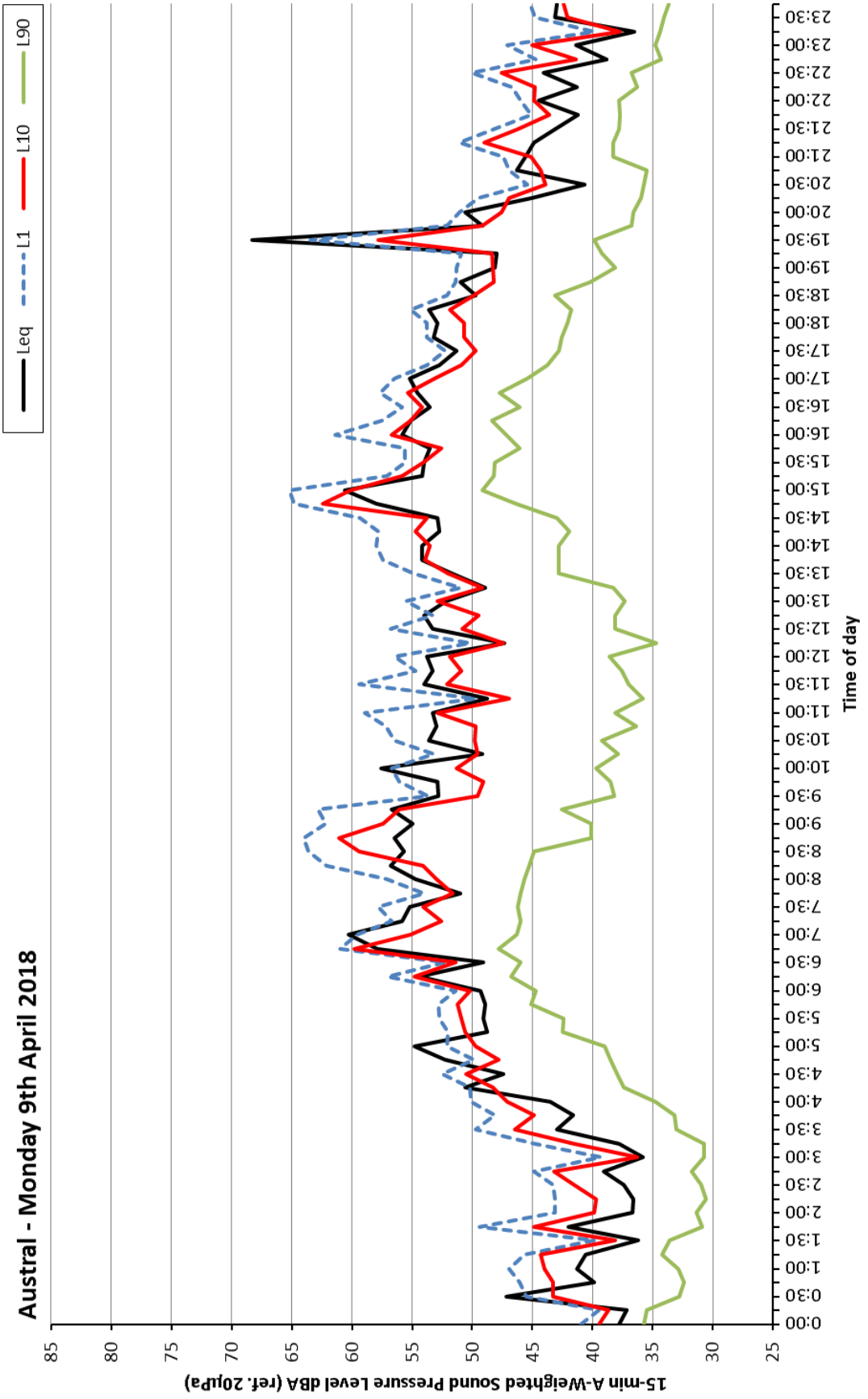
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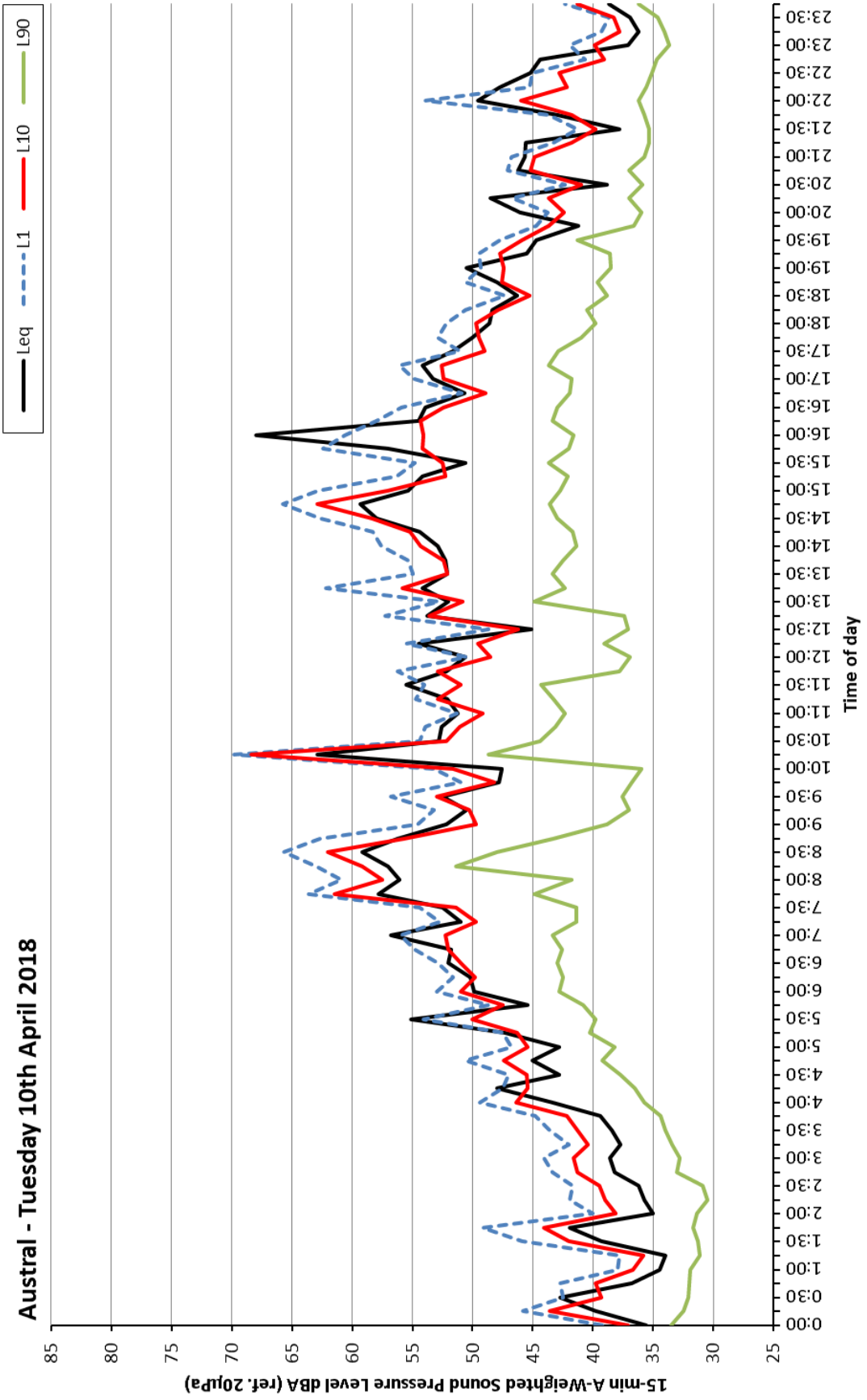
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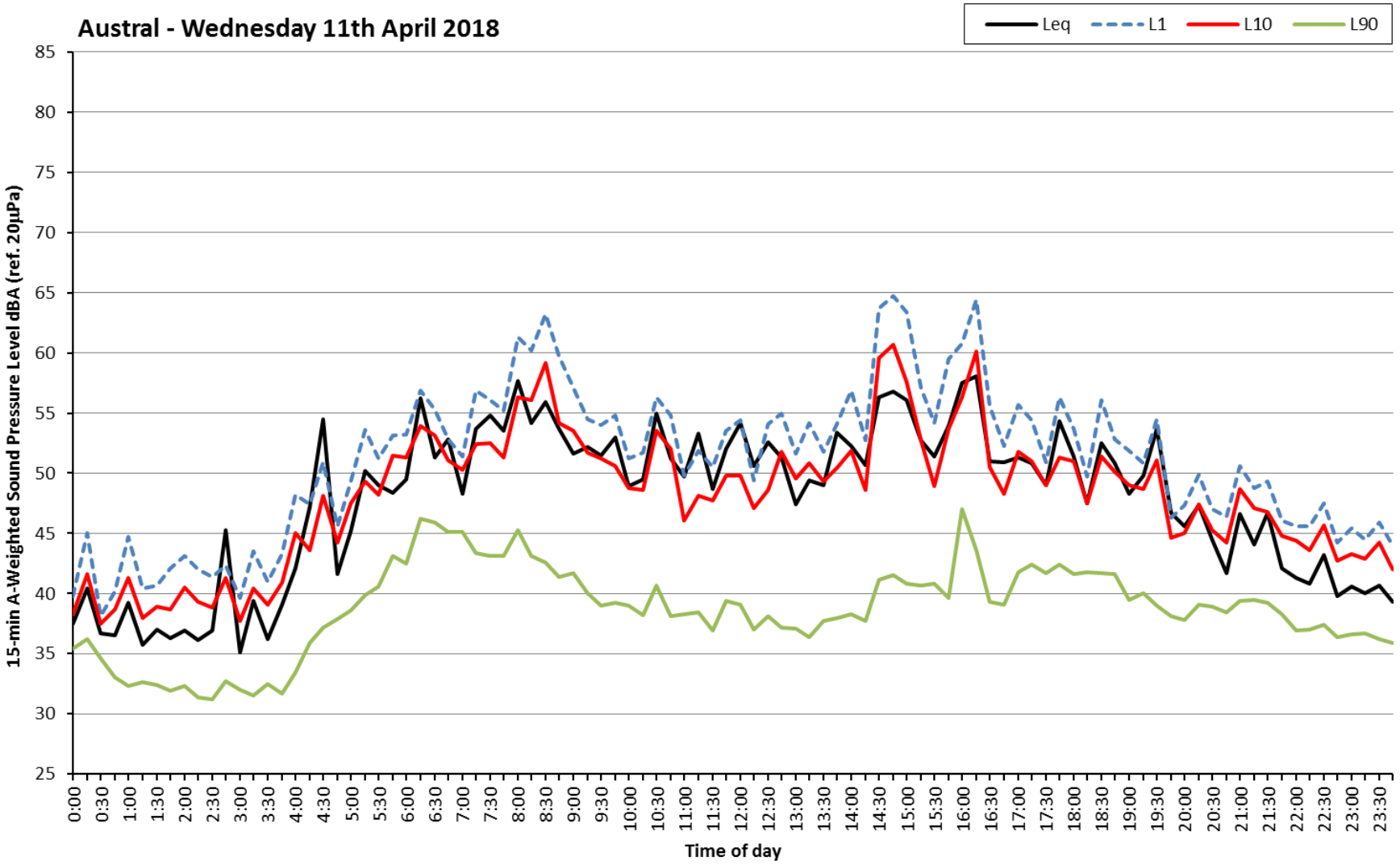
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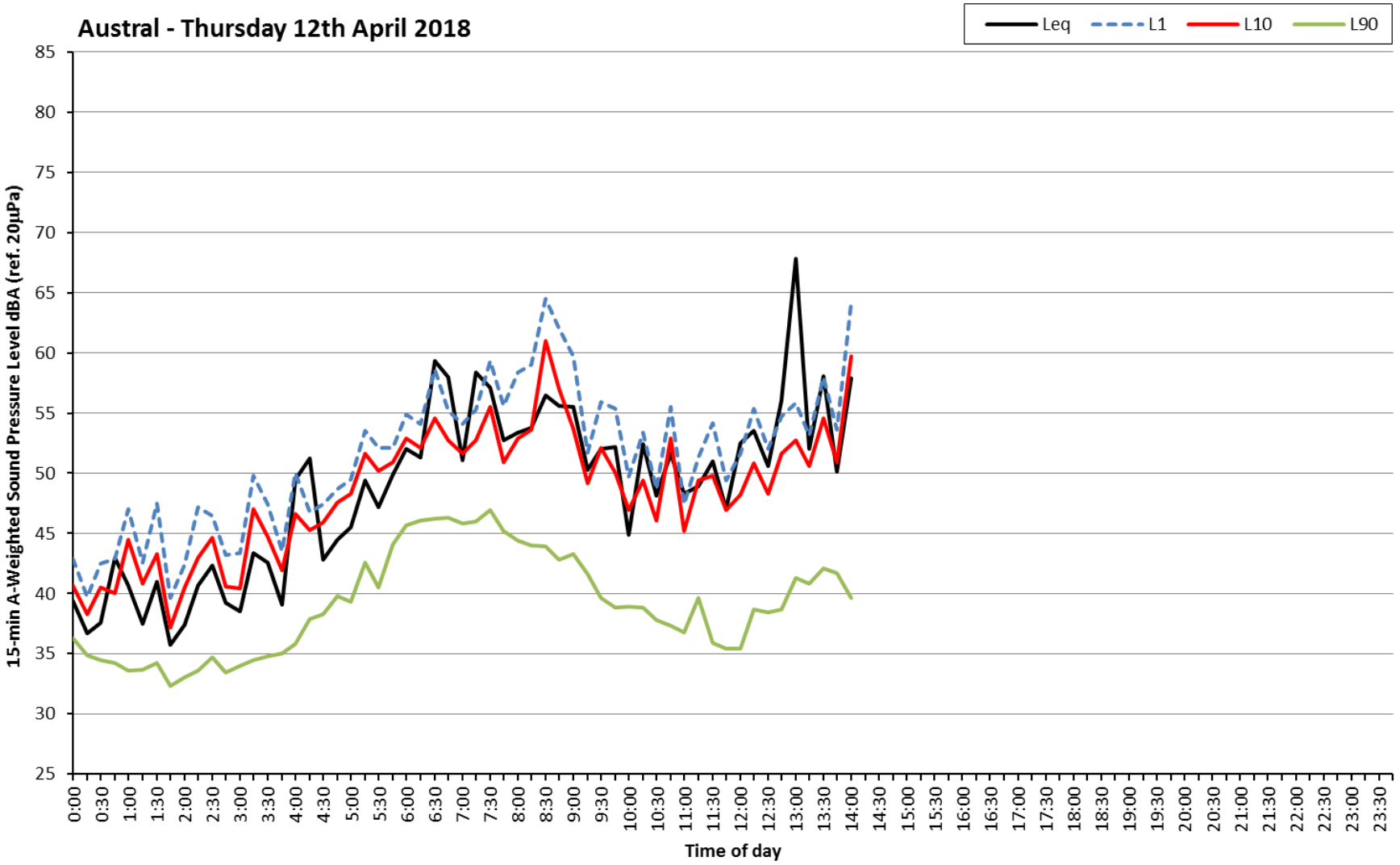
Austral - Thursday 12th April 2018
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
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Time of day