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ACOUSTICAL REPORT

PROPOSED MIXED-USE DEVELOPMENT

2-12 & 1-15 CONFERTA AVENUE, ROUSE HILL NSW 2155

(TALLAWONG STATION PRECINCT SOUTH)

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ACOUSTICAL REPORT

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(TALLAWONG STATION PRECINCT SOUTH)

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1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was engaged to prepare an acoustical report for the proposed mixed-use development at 2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155 seeking approval for the construction of sixteen buildings over eight-storeys with associated basement level parking.

For the DA proposal, the acoustic adequacy of the proposed design must be assessed in terms of standard planning guidelines issued by Council in their Local Environment Plan (LEP) and Development Control Plan (DCP), and also in terms of other standard planning guidelines related to common sources of noise.

In accordance with Council guidelines and other standard planning instruments, Koikas Acoustics has determined the following acoustical components require an assessment at the current DA stage:

1. Road traffic along Schofields Road and Cudgegong Road, as well as Tallawong Metro Station/Line, and its impact on future occupants of the development.
2. Rail vibration assessment from the Tallawong Metro Station/Line, and the impact on future occupants of the development.
3. Mechanical plant noise emission from the proposed development to neighbouring dwellings (determine criteria only at DA stage).
4. Inter-tenancy sound insulation requirements for shared partitions within the building.
5. Construction noise and vibration plan of management.
6. Loading dock noise impact to surrounding and adjoining premises.
7. Noise impact assessment of arising from increased road traffic due to the development.
8. Noise impact assessment from the existing car park servicing the Tallawong Metro Station.

This report presents the results and findings of an acoustic assessment for the subject proposal. In-principle acoustic treatments and noise control recommendations are included (where required) so that the premises may operate in compliance with the nominated acoustic planning levels.

2.0 THE PROPOSAL

The development known as Tallawong Station Precinct South is proposed to occupy the following sites :

- 2 - 12 Conferta Ave, Rouse Hill, known as Lot 294 / DP1213279, and
- 1 - 15 Conferta Ave, Rouse Hill, known as Lot 293 / DP1213279.

The application is for a mixed-use development consisting of 987 residential units and 9,000sqm commercial/retail space over 16 buildings with a maximum of 8 storeys with basement parking levels.

The current development design can be seen in architectural drawings as prepared by Turner Studio, detailed in Table 1. All calculations and noise modelled scenarios conducted for this assessment are based on the architectural drawings detailed in the drawing list.

Table 1. Design drawings used in the assessment

Drawing Title	Drawing No.	Revision	Scale	Date	Job No.
Basement 03 & 02	DA-110-006	04	1:500	25/09/2020	18095
Basement 02 & 01	DA-110-007	04	1:500	25/09/2020	18095
Basement 01, Mezz. & Level 1	DA-110-008	04	1:500	25/09/2020	18095
Mezzanines, Level 01 & Level 02	DA-110-010	04	1:500	25/09/2020	18095
Level 01, Level 02 & Level 03	DA-110-020	04	1:500	25/09/2020	18095
Level 01, Level 02, Level 03 & Level 04	DA-110-030	04	1:500	25/09/2020	18095
Level 02, Level 03, Level 04 & Level 05	DA-110-040	04	1:500	25/09/2020	18095
Level 03, Level 04, Level 05 & Level 06	DA-110-050	04	1:500	25/09/2020	18095
Level 04, Level 05, Level 06 & Level 07	DA-110-060	04	1:500	25/09/2020	18095
Level 05, Level 06, Level 07 & Level 08	DA-110-070	04	1:500	25/09/2020	18095
Level 06, Level 07, Level 08 & Roof	DA-110-080	04	1:500	25/09/2020	18095
Level 07, Level 08 & Roof	DA-110-090	04	1:500	25/09/2020	18095
Level 08 & Roof	DA-110-100	03	1:500	04/05/2020	18095
Roof Level	DA-110-110	03	1:500	04/05/2020	18095
Combined Roof Plan	DA-110-120	03	1:500	04/05/2020	18095
Notes 1.	Detailed above are the plans and drawings available at the time of assessment. Where design changes are made without the prior knowledge of Koikas Acoustics, the assessment results and conclusions published within this report may be incorrect.				

The development location is situated in a primarily rural area with the following zoning:

- R2/R3 low-medium density residential zoning to the south and north, and distant west and east;
- B2 local centre zoning to the north;
- IN1 general industrial and B6 business zoning to the west, and
- SP2 infrastructure and RE1 public recreation to the east.

The development is surrounded by the following:

- Tallawong Metro Station to the north;
- Energy substation to the east;
- Public car park to the west, and
- Residential premises to the south and distance east.

Prevailing ambient noise conditions on-site and in the local area are generally the result of typical environmental noise such as traffic and localised commercial/domestic noise sources.

The subject site and surrounding properties are identified on the aerial photograph included as Figure 1.

Figure 1. Aerial photo of the subject site, surrounding area and logger locations (image source – Google Earth)

3.0 UNATTENDED AMBIENT NOISE SURVEY

Existing external ambient noise levels were measured by installing a sound level meter data logger in the following locations (see Figure 1):

- Monitoring Location A – Fronting Schofields Road;
- Monitoring Location B – Fronting Cudgegong Road near Schofields Road;
- Monitoring Location C – Fronting Cudgegong Road near Themeda Avenue, and
- Monitoring Location D – Fronting Themeda Avenue and Tallawong Metro Station/line.

Two Type 1 precision Svantek 977, one Type 1 precision Svantek 957 and one Type 1 precision BSWA 801 noise loggers were used for the survey. The installed locations meant that the microphones were approximately 1.5 metres above the ground level in free field conditions. These meters were placed to measure existing ambient and traffic noise levels pertaining to the surrounding area.

The instrument was set-up to measure A-frequency and 'Fast' time-weighted noise levels. Noise level data was stored within the logger memory at 15-minutes intervals for about one week between Tuesday 3rd and Monday 9th December 2019.

Calibration readings were taken before and after each survey with a NATA calibrated and certified Larson Davis CAL200 precision acoustic calibrator. No system drift was observed for this meter.

BOM weather records for the nearest available weather station indicate that inclement weather conditions did not adversely impact on the noise survey.

Table 2. Summary of noise logger results [dB]				
Location	**Period, T** [1]	**Ambient noise level** LAeq	**Rating background level** LA90	**Traffic noise level** LAeq,Period
Monitoring Location A **(Schofields Rd)**	Day	69	50	69
	Evening	68	52	
	Night	65	38	64
Monitoring Location B **(Cudgegond Rd, near Schofields Rd)**	Day	60	46	60
	Evening	59	48	
	Night	55	35	55
Monitoring Location C **(Cudgegond Rd, near Themeda Ave)**	Day	58	43	58
	Evening	56	46	
	Night	52	35	52
Monitoring Location D **(Themeda Ave)**	Day	51	41	51
	Evening	50	44	
	Night	46	34	46
Notes 1.	The NSW EPA NPI refers to Night as 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.			
2.	Refer to **Appendix A** for unattended noise logger graphs.			

4.0 ATTENDED RAIL NOISE AND VIBRATION SURVEYS

Rail noise and vibration surveys were conducted by Koikas Acoustics Pty Ltd on the 10th December 2019 around the subject premises. The location of the surveys can be seen in Figure 1.

The assessment procedure of AS 2377-2002 considers that a minimum of 10 rail pass-by events should be recorded in order to acquire reliable noise and vibration data. Koikas Acoustics measured 5 rail pass-by events during the period of the survey from 11 am-12 pm, however, this data was supplemented with the unattended noise logging conducted along Themeda Avenue.

Noise measurements were taken with a Type 1 NTi XL2-TA spectrum analyser sound level meter. The instrument was field calibrated with a Larson Davis CAL200 Precision Acoustic Calibrator before and after the survey. No system drift was recorded. The Sound Exposure Level (SEL) of each pass-by event was recorded in dB(A).

A summary of the surveyed data is included below.

Table 3. Rail noise and vibration survey results

Description	Value	Measurement result
Noise from train pass-by	SEL	75 dB(A)

Notes
1. SEL = Sound Exposure Level
2. Some pass-by events were not audible above the ambient road traffic noise.
3. Train pass bys to the west of Tallawong Metro Station are significantly quieter as this is the end of the metro train line and trains travel at slow speeds for maintenance.

Rail vibration levels were measured with a Vibrock V901. The survey data was subsequently analysed in accordance with ISO2631-2:2003 to appropriate a Vibration Dose Value (VDV) in $m/s^{1.75}$ for each measured train pass-by event.

No vibrations were measurable from the metro train pass-bys at the nearest most-vibration sensitive location (refer to Figure 1). Non-measurable vibration levels are significantly below the human comfort thresholds recommended in the DEC guideline, as such, Koikas Acoustics expects a low probability of adverse comment and no further mitigation measures are required to mitigate rail vibrations.

5.0 EXTERNAL NOISE AND VIBRATION INTRUSION ASSESSMENT

Calculating the level of traffic noise that is transmitted through a façade and into a room is dependent upon the external façade noise level, the sound insulation performance of the building façade (inclusive of all building components), and the level of acoustic absorption that is present within the subject room.

In accordance with *AS3671-1989 Acoustics – Road traffic noise intrusion*, the prediction of façade traffic noise levels considers a forecast increase in traffic volumes over a 10-year planning period. In the absence of RMS traffic volume data for the specific road corridor, Koikas Acoustics has adopted a forecast 2% p.a. increase in traffic volumes over a 10-year period.

5.1 ACOUSTICAL REQUIREMENTS

5.1.1 ISEPP/DOP

In accordance with Clause 102 of the State Environmental Planning Policy (Infrastructure) 2007, hereafter referred to as ISEPP, development for residential, place of public worship, hospital, educational facility or child care centre use must be designed to consider the indoor noise amenity of future occupants.

Where the development is for residential use, and the site is adjacent to a classified road that carries an annual daily traffic volume of more than 20,000 vehicles, and that the consent authority considers is likely to be impacted by road noise or vibration, maximum allowable indoor traffic noise levels are defined as:

- L_{Aeq} 35 dB in any bedroom in the building between the hours of 10 pm and 7 am.
- L_{Aeq} 40 dB elsewhere in the building (excluding a garage, kitchen bathroom or hallway) at any other time.

ISEPP requires that before any application is determined under which this clause applies, consideration must be given to guidelines that are issued by the Director-General. It is the understanding of Koikas Acoustics that the Director-General has issued guidelines relating to the determination of suitable indoor noise levels for development with open windows allowing natural ventilation of indoor areas. The Director-General has recommended under this condition (open windows) that indoor noise levels should not exceed:

- L_{Aeq} 45 dB in any bedroom in the building between the hours of 10 pm and 7 am.
- L_{Aeq} 50 dB elsewhere in the building (excluding a garage, kitchen bathroom or hallway) at any other time.

The NSW Department of Planning (DoP) supports the design targets of ISEPP and the Director-General guidelines within their road/rail noise guidelines (*Development near rail corridors and busy roads, Interim Guideline 2008*). The DoP guideline further defines the duration under which noise levels are assessed, being $L_{Aeq\ 9\ hours\ (10\ pm\ to\ 7\ am)}$ for bedrooms and $L_{Aeq\ 15\ hours\ (7\ am\ to\ 10\ pm)}$ elsewhere.

A summary of the applied traffic noise planning levels is included in Table 4.

Table 4. Design criteria for internal spaces			
Description	**Area**	**Period**	**L_{Aeq} (Period) [dB]**
Windows and doors closed	Bedrooms	10 pm to 7 am	35
	Living areas	at any time	40
Windows & doors open (natural ventilation)	Bedrooms	10 pm to 7 am	45
	Living areas	at any time	50
Notes 1.	Assessment period for bedrooms taken as the 9 hours period between 10 pm and 7 am. Assessment period for living areas taken as the 15 hours period between 7 am and 10 pm.		

5.1.2 DECC 2006

The rail vibration criteria as stated in the NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008 states:

Vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in Assessing Vibration: a technical guideline (DECC 2006). Table 2.4 of Assessing Vibration: a technical guideline (DECC 2006) outlines the relevant rail noise vibration criterion.

Table 5. Acceptable vibration dose values for intermittent vibration				
Location	**Daytime ($m/s^{1.75}$)**		**Night-time ($m/s^{1.75}$)**	
	Preferred Value	**Maximum Value**	**Preferred Value**	**Maximum Value**
Critical Areas	0.10	0.20	0.10	0.20
Residential Areas	**0.20**	**0.40**	**0.13**	**0.26**
Offices, schools, educational institutions, places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

5.2 FAÇADE TRAFFIC NOISE LEVELS

The noise sources were modelled in a computer program called Cadna/A, which is a software package developed by DataKustik. Cadna/A incorporates a computer-aided drafting (CAD) program that utilises the height of the ground, the position of buildings and other structures to run through a set of algorithms and calculate at user-defined grid points and user input receiver locations the overall sound pressure level and frequency dependant noise level spectrum. It then interpolates the calculated noise levels at each of the grid points to produce noise level contours.

The noise level calculations take into account the propagation of sound from a sound source as a function of its distance, the shielding effects of barriers and buildings, the attenuation and reflection off the ground and buildings.

Receiver locations were assigned in the computer model at representative positions to determine the resultant noise levels at surrounding premises. The predicted noise levels at these locations were used to provide recommendations on appropriate building noise mitigation measures that would achieve the required noise reductions so as to comply with the nominated noise criterion.

A calibrated Cadna/A noise model was used to predict external façade traffic noise levels. Maximum levels are predicted to be $L_{Aeq\ 15\ hour}$ 68 dB / $L_{Aeq\ 9\ hour}$ 63 dB along the southern façade of the buildings fronting Schofields Road. Reduced noise exposure along the sides of the buildings will result from the limited field of view of traffic and partial noise shielding from adjacent buildings. The least noise-exposed façade of the buildings are those fronting Conferta Avenue where a high level of noise shielding is generated by the subject building and surrounding buildings. Refer to **Appendix B** for Cadna noise contour maps and **Appendix C** for noise intrusion calculations.

5.3 RECOMMENDED CONSTRUCTION MATERIALS

Indoor noise levels were calculated to determine the acoustic performance of the proposed building facade.

The noise modelling and subsequent analysis conclude the following:

5.3.1 External walls

Table 6. External walls recommendations	
Recommended construction	**Area to which the recommendation applies**
The double-brick wall system consisting of: • 110mm brick; • 50mm gap with brick ties, and • 110mm brick. Alternatively, the concrete wall system consisting of: • AFS 162; • 64mm steel stud, and • 13mm plasterboard.	All external walls

5.3.2 Ceiling/roof

Table 7. Ceiling/roof recommendations	
Recommended construction	**Area to which the recommendation applies**
150mm concrete slab	All ceiling/roof areas

5.3.3 Glass windows and doors

Recommendations for glass windows and doors are included in Table 8.

Table 8. Glazing recommendations			
Room	**Glass recommendation**	**Maximum percentage of glazing area to external wall**	**Seals**
Fronting Schofields Road Bedroom with one external façade (no balcony)	10.38mm laminated glass	90 %	Q-lon and fin
Fronting Schofields Road Bedroom with one external façade (with balcony)	10.38mm laminated glass	60 %	Q-lon and fin
Fronting Schofields Road Bedroom with two external facades (no balcony)	10.38mm laminated glass	60 %	Q-lon and fin
Fronting Schofields Road Bedroom with two external facades (with balcony)	10.38mm laminated glass	40 %	Q-lon and fin
Fronting Schofields Road Kitchen/dining/living area with one external facade	10.38mm laminated glass	40 %	Q-lon and fin
Fronting Schofields Road Kitchen/dining/living area with two external facades	10.38mm laminated glass	30 %	Q-lon and fin
All other areas	6.38mm laminated glass	-	Q-lon and fin

In addition to the minimum glass recommendation, the installed window/glazed door systems (inclusive or framing and seals) must achieve a minimum acoustic rating of:

- Rw 31 for 6.38mm laminated glass;
- Rw 34 for 10.38mm laminated glass;
- and comply with Notes 1 to 5 below.

Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing predicted to achieve satisfactory acoustic performance. Design factors such as safety, thermal or energy efficiency are outside the scope of this report and should be assessed accordingly. It is the Client's responsibility to ensure all glazed windows and sliding doors installed on-site to meet all building design requirements.

Notes

1. Window frames should be tightly fitted to the external wall minimising any air gaps. Any air gaps present should be packed with timber and an appropriate acrylic sealant such as Knauf Bindex (or approved equivalent).
2. All open-able windows and glazed door systems should be airtight when closed.
3. Q-lon type seals or the equivalent should be fitted along the perimeter of all glazing systems to minimise air gaps. For sliding glass systems that cannot incorporate Q-lon seals, heavy-duty fin-type seals such as Schlegel SilentFin could be used. If the windows/doors are not designed to be air-tight when closed, the reduced performance of the windows/doors could compromise the acoustic integrity of the building facade.
4. Recommended glass systems have been calculated based on current architectural drawings as established within this report.
5. High performing glazed window and door systems, can be supplied by Eco Aluminium.
   Mob 0475 770 272. Web: www.ecoaluminium.com.au.
   Other reputable suppliers can also be considered.

5.3.4 Timber entry doors

Any timber entry doors to the residential units should be a minimum 35-40 mm thick solid-core timber with acoustic perimeter and door bottom seals. Suitable acoustic seals could be Raven type RP10/RP10si door frame/perimeter seals and RP8si door bottom seals, or an approved equivalent from another manufacturer.

5.3.5 Ventilation

In the event of high external traffic noise levels, naturally ventilating rooms through the opening of windows and/or doors may not be suitable. This is due to the level of traffic noise being transmitted through the open doors resulting in a breach of the applied noise criterion.

As a general rule, where windows or doors opened sufficiently to provide natural ventilation to a room, the indoor noise level is 10dB below the outside noise level. Therefore, a window or sliding door to a room may be opened to provide natural ventilation where the outdoor noise level does not exceed 10dB above the

“Windows open” criteria as detailed within this report.

For this development, the habitable spaces on the western, eastern and southern facades of Buildings 2D.1, 2D.2, 2D.3, 2E.1 and 2C.2 (most exposed facades to Schofields Road) are all not suitable for natural ventilation through open windows/doors. Therefore, windows and doors will need to be closed in order to achieve the acoustic criteria. The design of the ventilation to these rooms is to consider windows and doors being closed.

All other rooms may be naturally ventilated through open windows/doors.

For rooms requiring an alternate source of ventilation other than open windows/doors, the following may be considered (subject to review by a ventilation expert):

- Borrowed air from elsewhere in the dwelling/unit
- Incorporating a component of fresh air into a ducted air conditioning system
- Installing a small air supply fan and acoustically treated duct into a ceiling bulkhead

Koikas Acoustics advises that for those habitable spaces that require an additional source of mechanical ventilation, a local outside air fan ducted will be installed on the external façade and supply outside air to the habitable spaces. A detailed assessment of the mechanical ventilation systems should be conducted at the CC stage to ensure the noise impact through the system is adequate attenuated.

The provision of adequate airflow to apartments through a mechanical ventilation system achieves the intent of the ADG. Koikas Acoustics also notes the provision of natural cross ventilation and acoustic privacy are not mutually exclusive, as both are not required at all times. The NSW Department of Planning (DoP) supports the design targets of ISEPP and the Director-General guidelines within their road/rail noise guidelines and recommend a 10 dB less stringent indoor design levels for spaces utilising natural ventilation.

It is important to note that any proposed ventilation solution should be reviewed by a suitably qualified ventilation expert.

Any penetrations in the walls or roof to accommodate ventilation system/s should not impact the acoustic integrity of the building façade. An acoustical engineer should review any proposed ventilation solution that proposes a penetration of the building façade.

6.0 MECHANICAL PLANT AND BUILDING USE NOISE IMPACTS

Mechanical plant and equipment on this project could include air conditioning condensers units where they are installed in the development and other ventilation plant required for basement levels and garbage rooms etc.

6.1 ACOUSTICAL REQUIREMENTS

6.1.1 EPA Noise Policy for Industry

Noise emission design targets have been referenced from the NSW Environmental Protection Authority Noise Policy (EPA) for Industry (NPfI). The NPfI replaces the former Industrial Noise Policy, also prepared by the EPA.

The NPfI is designed to assess environmental noise impacts associated with scheduled activities prescribed within the Protection of the Environment Operations Act 1997, Schedule 1. It is also commonly used as a reference tool for establishing suitable planning levels for noise generated by mechanical plant and equipment and noise emission from commercial operations.

The guideline applies limits on the short term intrusive nature of a noise or noise-generating development (project intrusive noise level), as well as applying an upper limit on cumulative industrial noise emissions from all surrounding development/industry (project amenity noise level).

The most stringent of the project intrusive noise level and project amenity noise level is applied as the **project noise trigger level**. The project noise trigger level is the point, above which noise emission from a source or development site would trigger a management response.

To be able to define the more stringent of the intrusive and amenity noise levels, the underlying noise metrics must be the same. As the intrusive noise level is defined in terms of a $L_{Aeq\ 15\ minutes}$ and the amenity noise level is defined in terms of a $L_{Aeq\ Period}$, a correction +3dB correction is applied to the project amenity noise level to equate the $L_{Aeq\ Period}$ to $L_{Aeq\ 15\ minutes}$.

6.1.2 Offensive Noise (POEO Act 1997 definition)

In the definitions of the Protection of the Environment Operations Act 1997, ‘offensive noise’ means noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

6.1.3 Protection of the Environment Operations (Noise Control) Regulation 2017

Clause 45 of the regulation requires that air conditioning units installed on residential premises must not emit noise that is audible within a habitable room in any other residential premises between the hours of 10 pm and 7 am (Monday to Friday) or 10 pm and 8 am (Saturday, Sunday and public holidays).

6.2 PROJECT NOISE TARGETS

This noise is assessed in accordance with the planning levels contained within the NPfI. Acoustic planning levels are largely determined in relation to the existing environmental noise levels. Noise surveys conducted for this assessment show that environmental noise levels can differ based on the location of a particular receiver and its orientation to major contributors of noise in the area, such road corridors and commercial operations.

The following NPfI planning levels apply for this project:

Table 9. NPfI planning levels

Period, T (Note 1)	**Monitoring Location A – Schofields Road**								
	Intrusive		**Amenity**					**Project noise trigger level**	
	RBL	**RBL + 5**	**Area classification**	**Recommended amenity noise level**	**High traffic area**	**Project amenity noise level**	**+3dB correction**		
Day	50	55	Urban	60	Yes	59	62	55	-
Evening	52	57	Urban	50	Yes	58	61	57	-
Night	38	43	Urban	45	Yes	55	58	43	30
Period, T (Note 1)	**Monitoring Location B & C – Cudgegong Road**								
	Intrusive		**Amenity**					**Project noise trigger level**	
	RBL	**RBL + 5**	**Area classification**	**Recommended amenity noise level**	**High traffic area**	**Project amenity noise level**	**+3dB correction**		
Day	43	48	Urban	60	No	55	58	48	-
Evening	46	51	Urban	50	Yes	46	49	49	-
Night	35	40	Urban	45	Yes	42	45	40	27
Period, T (Note 1)	**Monitoring Location D – Themeda Avenue**								
	Intrusive		**Amenity**					**Project noise trigger level**	
	RBL	**RBL + 5**	**Area classification**	**Recommended amenity noise level**	**High traffic area**	**Project amenity noise level**	**+3dB correction**		
Day	41	46	Urban	60	No	55	58	46	-
Evening	44	49	Urban	50	No	45	48	48	-
Night	34	39	Urban	45	No	40	43	39	26

Notes 1. The NSW EPA Industrial Noise Policy refers to the following time periods, Day – 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sunday and public holidays, Evening – 6 pm to 10 pm Monday to Sunday, Night – 10pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday and public holidays.

2. The amenity criterion is based on the area classification of the site as being 'urban' and has been corrected for an assessment in areas of high traffic and for existing industrial noise where applicable.

3. Project noise amenity level = recommended noise amenity level – 5dB, except where specific circumstances are met, such as high traffic.

4. Inaudibility is generally achieved when the noise is 8-10 dB below the background noise level.

Surrounding commercial properties must also not be exposed to noise that exceeds $L_{Aeq\ Period\ (business\ hours)}$ 60 dB during business hours.

6.3 DESIGN SCENARIOS

Mechanical plant noise assessment is normally undertaken once final mechanical design and specification have been completed for CC Stage.

The noise from the Endeavour Energy substation was negligible, no further noise mitigation measures are required during design stage. Further assessment of the noise from the substation services would be done at the CC stage

7.0 INTER-TENANCY NOISE

The following recommendations are expected to satisfy the relevant provisions of the BCA sound insulation requirements between tenancies. Options have been provided in all cases that consider a range of standard constructions.

All wall systems should be installed in accordance with general installation guidelines included in the BCA and as per relevant manufacturer installation guidelines/requirements.

Alternate systems and design may be considered to those recommended within this report provided that they are approved by an appropriately qualified acoustical engineer/consultant.

7.1 ACOUSTICAL REQUIREMENTS

7.1.1 BCA

In Class 2 or 3 buildings, the BCA acoustical Performance Requirements state that separating walls and floors must provide insulation against the transmission of airborne or impact generated sound sufficient to prevent illness or loss of amenity for the occupants.

A wall/ floor partition is considered to satisfy BCA Performance Requirements where it is shown to:

- Have a laboratory tested acoustic rating that meets or exceeds the Deemed-to-Satisfy provisions of F5.4 to F5.7, or
- Complies with Specification F5.2, or
- Is tested on-site to achieve the minimum acoustic performance as defined within *Verification Methods* FV5.1 and FV5.2.

The Deemed-to-Satisfy provisions applying to this specific development are summarised below:

Table 10. BCA acoustic design requirements			
Partition	**Detail**	**Airborne sound**	**Impact sound**
Floor	Separating SOU's, or an SOU from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or part of a different classification	Rw + Ctr ≥ 50	Ln,w ≤ 62
Wall *See notes 1 and 2*	Separating SOU's	Rw + Ctr ≥ 50	Not applicable
	Separating a habitable room (other than a kitchen) in one SOU from a bathroom, sanitary compartment, laundry, kitchen in another SOU	Rw + Ctr ≥ 50	Discontinuous construction
	Separating an SOU from a plant room or lift shaft	Rw ≥ 50	Discontinuous construction
	Separating an SOU from a stairway, public corridor, public lobby or the like, or part of a different classification	Rw ≥ 50	Not applicable
Door	Located in a wall separating an SOU from a stairway, public corridor, public lobby or the like	Rw ≥ 30	Not applicable
Services	Duct, soil, waste or water supply pipes located in a wall or floor cavity and serves or passes through more than one SOU (including a stormwater pipe)	Rw + Ctr ≥ 40 (habitable) Rw + Ctr ≥ 25 (other)	Not applicable
Pumps	A flexible coupling must be used at the point of connection between the service's pipes in a building and any circulating or another pump.		
Notes 1.	Where a wall is to achieve a sound insulation rating and has a floor above, the wall must continue to either the underside of the floor or to the ceiling which has a comparable sound insulation rating to the wall.		
2.	Where a wall is to achieve a sound insulation rating and has a roof above, the wall must continue to either the underside of the roof or to the ceiling which has a comparable sound insulation rating to the wall.		
3.	As defined by the BCA, a 'habitable room' means a room used for normal domestic activities such as bedroom, living room, lounge room, music room, television room, kitchen dining room, study, playroom, family room, home theatre and sunroom.		

7.2 PROPOSED PARTITION WALLS

Koikas Acoustics has been advised that the proposed intertenancy wall systems are to be constructed with the 60mm Pronto Panel in conjunction with stud wall framing. Various wall systems are presented below with the predicted acoustic rating and their use. Acoustic ratings are based on Insul V9.0.22 with a tolerance of 3 rating point, unless otherwise specified.

Wall System 1:

- 13mm standard plasterboard;
- 28mm furring channel with 25mm insulation (14kg/m^3)
- 60mm Pronto Panel;
- 20mm air gap;
- 64mm steel stud with 75mm insulation (14kg/m^3), and
- 13mm standard plasterboard.

This wall system is predicted to achieve an R_w +C_{tr} 53 and is of discontinuous construction. This wall system can be used between SOU's and any other area.

Wall System 2:

- 13mm Fyrchek plasterboard;
- 60mm Pronto Panel;
- 20mm air gap;
- 64mm steel stud with 75mm insulation (14kg/m^3), and
- 13mm Fyrchek plasterboard.

This wall system was measured by Day Design Pty Ltd (Test Report: 5518-1d, Dated: 08/12/2014) to achieve an R_w +C_{tr} 51 and is of discontinuous construction. This wall system can be used between SOU's and any other area.

Wall System 3:

- 5mm sand/cement render;
- 60mm Pronto Panel;
- 20mm air gap;
- 64mm steel stud with 75mm insulation (14kg/m^3), and
- 13mm standard plasterboard.

This wall system is predicted to achieve an R_w 56 and is of a discontinuous construction and can be used between a SOU and a stairway, public corridor, public lobby, plant room or lift shaft.

Wall System 4:

- 60mm Pronto Panel;
- 20mm air gap;
- 64mm steel stud with 75mm insulation (14kg/m^3), and
- 13mm standard plasterboard.

This wall system is predicted to achieve an R_w 55 and is of discontinuous construction. This wall system can be used between a SOU and a stairway, public corridor, public lobby, plant room or lift shaft.

7.3 ALTERNATIVE PARTITION WALLS

Table 11 recommends several partition wall systems that are capable of achieving the required acoustic performance.

Table 11. Alternative partition wall systems

Wall type	**BCA design standard**	**Construction**
Inter-tenancy wall	Rw + Ctr ≥ 50 Discontinuous	*Partition wall between sole-occupancy units – Separating a habitable room (other than a kitchen) in one unit from a bathroom, sanitary compartment, laundry or kitchen in an adjoining unit* **[AFS]** AFS 162 Logicwall, 20mm cavity, 64mm steel studs with 75mm thick Tontine TSB4 insulation within the stud cavity, 10mm Soundcheck. **[Masonry]** Two leaves of 110mm clay brick masonry, 50mm cavity between the leaves (where brick ties are used they are to be of the resilient type), 13mm cement render to each side. *BCA D.T.S.* **[Concrete]** 125mm concrete panel, 20mm cavity, 64mm steel studs, 70mm polyester insulation (9kg/m^3) between the studs, 13mm plasterboard fixed to studs. *BCA D.T.S.* **[Hebel]** 13mm Fyrchek, 75mm Hebel Powerpanel, 35mm cavity, 64mm steel studs with 100mm S6 polyester insulation, 13mm Fyrchek/Aquachek. **[Lightweight]** 2x64mm steel studs, 20mm cavity, 60mm polyester insulation (11kg/m3) positioned between one row of studs, 2x13mm fire resistant plasterboard each side.
	Rw + Ctr ≥ 50	*Partition wall between sole-occupancy units* **[AFS]** AFS 162 Logicwall panel, paint or render finish. **[AFS]** AFS 162 Logicwall panel, 28mm furring channel, Tontine TSB2 insulation within the framing cavity, 13mm plasterboard. **[Masonry / Hebel / Lightweight]** As above. **[Concrete]** 200mm concrete panel, 13mm cement render of each face. *BCA D.T.S.*
Common wall	Rw ≥ 50 Discontinuous	*Partition wall between sole-occupancy unit and plant room or lift shaft* As above for inter-tenancy wall partitions that satisfy discontinuous construction
	Rw ≥ 50	*Partition wall between sole-occupancy unit and stairway, public corridor, public lobby or the like or part of a different classification* **[AFS]** AFS 150 Logicwall panel, paint or render finish. **[AFS]** AFS 162 Logicwall panel, paint or render finish. **[Masonry]** Single leaf 150mm brick masonry with 13mm cement render on each face. **[Concrete]** 125mm thick concrete panel. **[Hebel]** 13mm Gyprock CD, 75mm Hebel Powerpanel, minimum 20mm cavity, 64mm steel framing with 50mm glasswool insulation, 13mm Gyprock CD. **[Lightweight]** 92mm steel studs, 60mm polyester insulation (11kg/m3) positioned between the studs, 2x13mm fire-resistant plasterboard each side.
Services shaft wall	Rw+Ctr ≥40	*Services shaft wall to habitable room within unit* **[Masonry]** 110mm brick masonry with 13mm cement render on each face. *BCA D.T.S.* **[Concrete]** 100mm thick concrete panel. *BCA D.T.S.* **[Lightweight]** 2x13mm plasterboard, pipe lagging (Soundlag 4525C, Acoustilag 45)
	Rw+Ctr ≥25	*Services shaft wall to non-habitable room within unit* **[Lightweight]** 2 layers of 13mm plasterboard

Notes:

1. Recommendations within the above table are based on published acoustic data obtained from the manufacturer's website.
2. Laboratory tests of the AFS 162 Logicwall on its own showed non-compliance with the BCA requirement of Rw + Ctr 50. However, an investigation by PKA Consulting concludes that the poor acoustic performance was due to factors not related to the wall system, but rather the test facility. It is expected that the acoustic performance will satisfy the BCA condition. This conclusion is supported by numerous field tests that indicate compliance with the BCA verification methods rating.
3. All installation of proprietary type wall systems must be in accordance with the relevant installation guidelines and manuals.
4. *BCA D.T.S.* = BCA Deemed-to-Satisfy construction. These wall systems are to be installed as per "Construction Deemed-to-Satisfy" notes included within Specification F5.2 of Volume One of the BCA. Where these systems are installed correctly in accordance with the BCA they do not require compliance testing to verify acoustic performance.

7.4 RECOMMENDED PARTITION FLOOR/CEILING

The following floor/ceiling assemblies are recommended to achieve the BCA minimum acoustic rating requirements.

Table 12. Floor system recommendations

	System 1 – Tile floor
Floor covering:	Selected tiles
Additional layers:	n/a
Underlay:	Regupol 4515 (4.5mm), A1 Rubber Acoustamat 3mm, Damtec Standard 2-4mm, Uniroll RF700 (5mm) under screed or RFC750 (4.5mm) under direct-stick tile, or other approved products
Floor slab:	200mm concrete
Ceiling cavity:	Minimum 70mm **(Note 1)**
Cavity insulation:	n/a
Ceiling material:	10mm Superchek or 13mm Soundcheck (Note 2)
	System 2 – Timber floor
Floor covering:	Engineered timber or laminate timber
Additional layers:	n/a
Underlay:	Regupol 4515 (4.5mm), A1 Rubber Acoustamat 3mm, Damtec Standard 2-4mm, Uniroll RF700 (5mm), or other approved products
Floor slab:	200mm concrete
Ceiling cavity:	Minimum 70mm **(Note 1)**
Cavity insulation:	n/a
Ceiling material:	10mm Superchek or 13mm Soundcheck (Note 2)
	System 3 – Carpet floor
Floor covering:	Carpet
Additional layers:	n/a
Underlay:	Carpet underlay such as Dunlop Carpetmate Standard or similar
Floor slab:	200mm concrete
Ceiling cavity:	100mm **(Note 1)**
Cavity insulation:	n/a
Ceiling material:	10mm Superchek or 13mm Soundcheck (Note 2)

Notes
1. The suspended ceiling must be fixed to light steel grid type system such as Rondo Key-lock or similar.
2. With ceiling cavities in excess of 100mm, standard 13mm plasterboard could be used.

The impact isolation requirements and floor system recommendations are applicable to external balconies that are situated above internal areas of another SOU below. The BCA also does not distinguish between habitable or non-habitable spaces, therefore, the above recommendations also apply to wet areas such as bathrooms etc.

Hard floor coverings such as tiles must not make contact with any walls or joinery such as kitchen benches, cupboards etc. During the installation of hard floor coverings, temporary spacers of 5-10mm should be used to isolate the floor covering from walls and/or joinery with the resulting gaps filled with a suitable mastic type sealant or off-cut of rubber underlay material.

Alternative floor/ceiling systems could be considered provided that the acoustic performance is tested or assessed by a consulting acoustical engineer to be compliant with the sound insulation performance requirements of the BCA.

The above floor systems have been assessed to comply with the BCA airborne and impact sound insulation requirements. **The 'for construction' floor systems should be re-assessed at the detailed design stage.**

Verification of installed acoustic performance should also be determined in accordance with the recommendations of Section 7.5 of this report.

7.5 SOIL, WASTE, WATER SUPPLY PIPES

Where a duct, soil, waste or water supply pipe is located within a wall or ceiling cavity and serves or passes through one or more SOU's, the following separation details may be used to comply with the required acoustic rating:

Table 13. Services in cavity wall or ceiling

Option	Rating	Documented source	System detail
1	Rw + Ctr 25	CSR Red Book, Koikas Acoustics opinion	2 layers of 10mm plasterboard
2	Rw + Ctr 25	CSR Red Book	Acoustilag 45 and 13mm plasterboard wall/ceiling lining
3	Rw + Ctr 25	CSR Red Book	Unlagged pipes and 13mm Soundchek wall/ceiling lining. Alternatively, 2 layers of 16mm Fychek may be used as wall/ceiling lining
4	Rw + Ctr 40	CSR Red Book	Acoustilag 45 and 13mm Soundchek wall/ceiling lining. Alternatively, 2 layers of 16mm Fychek may be used as wall/ceiling lining
5	Rw + Ctr 40	Pyrotech Soundlag 4525C brochure	Soundlag 4525C and minimum 10mm plasterboard wall/ceiling lining

Notes:

1. The acoustic lagging material may be excluded by using Rehau Raupiano Plus pipe system.
2. All installations are to be in accordance with relevant manufacturers' specifications and requirements.
3. Incorporating downlights into ceilings will impact on the acoustic rating of the partition system. Consultation should be made with an acoustic consultant in the event of downlights being proposed in the ceiling. The CSR Red Book provides some guidance on downlights being installed in a services partition system.

The BCA further qualifies the acoustic requirements of services partitions with the following:

- Services must not be chased into concrete or masonry elements,
- An access door or panel must be firmly fixed so as to overlap the frame or rebate the frame by not less than 10mm and be fitted with proper sealing gasket along all edges and constructed of:
- Wood, particle board or block board not less than 38mm thick; or
- Compressed fibre reinforced cement sheeting not less than 9mm thick; or
- Other suitable material with a mass per unit area not less than 24kg/m2.
- A water supply pipe must only be installed in the cavity of discontinuous construction, and in the case of a pipe that serves only one SOU, must not be fixed to the wall leaf on the side adjoining any other SOU and have a clearance not less than 10mm to the other wall leaf.

7.6 SOUND ISOLATION OF PUMPS

A flexible coupling must be used at the point of connection between the service's pipes in a building and any circulation or another pump.

7.7 VERIFICATION OF ACOUSTIC PERFORMANCE

It is common for comparable floor/ceiling systems designs to achieve varying acoustic insulation and isolation ratings between buildings. This can be due to the quality of workmanship, attention to detail in sealing any penetrations, and the emergence of flanking sound transmission paths within a building. For this reason, one cannot categorically state that any partition will achieve a specific acoustic rating without conducting in-situ testing.

Koikas Acoustics recommends that in-situ testing is conducted on a representative, and fully installed floor/ceiling assembly (for all types of floor coverings – timber, tiles, carpet) to ensure adequate acoustic insulation and isolation is achieved, prior to installing all floors on all floor levels of the building.

8.0 CONSTRUCTION NOISE AND VIBRATION PLAN OF MANAGEMENT

8.1 ACOUSTICAL REQUIREMENTS

Noise and vibration generated during excavation and construction works are assessed at surrounding residential receivers in accordance with the Interim Construction Noise Guidelines (NSW DECCW, 2009).

8.1.1 ICNG - Construction noise

The guideline recognises that construction and excavation works will at times generate noise that is clearly audible at neighbouring sites. The primary focus is to provide a means of determining the severity of noise impacts at surrounding affected receiver locations and a framework for managing construction noise, generally through implementing best practice noise minimisation principles and facilitating communication between construction workers and the local community.

Small-scale construction projects/works generally do not require detailed calculations of noise emission.

For ongoing projects where surrounding receivers may be exposed to construction noise for periods exceeding three weeks, a more detailed assessment approach is adopted. In this case, a receiver is categorised by the likely community reaction to the level of noise, where some community reaction is expected at 10dB above the background level and strong community reaction is expected at levels exceeding 75 dB(A).

For this assessment, 10 dB above the existing EPA minimum measured daytime background level is 51 dB(A). This is defined as the Noise Affected Level under the ICNG. Above 75 dB(A) is defined as the Highly Noise Affected Level.

8.1.2 ICNG - Construction vibration

Section 4.4 of the ICNG states that "Human comfort vibration from construction works, including continuous, intermittent or impulsive vibration from construction, but excluding blasting, is to be assessed in accordance with Section 2.5 'Short-term works' in *Assessing Vibration – a technical guideline (DEC 2006)*".

The DEC vibration standard has been sourced from *British Standard 6472-1992 Evaluation of human exposure to vibration in buildings (1Hz to 80Hz).* The referenced table nominates preferred and maximum vibration dose values (VDV) that correlate with human annoyance at receiver sites of different classifications such as residential, education facilities etc.

Table 14. Acceptable vibration dose value for intermittent vibration (m/s$^{1.75}$), BS6472:1992				
Location	**Daytime**		**Night-time**	
	Preferred values	**Maximum values**	**Preferred values**	**Maximum values**
Critical areas	0.1	0.2	0.1	0.2
Residences	**0.2**	**0.4**	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6

A more critical assessment of vibration impacts may be related to structural damage to surrounding buildings. It is expected that the geotechnical engineer will specify a peak particle velocity limit not to be exceeded at the site boundary. Where this is not available, a guide to applicable structural damage criteria can be taken from *British Standard 7385-2:1993* and/or *German Standard DIN4150-3.*

BS7385-2:1993 recommends a maximum peak component particle velocity when measured at the base of the building of:

- 50mm/s for reinforced or framed structures – Industrial and heavy commercial buildings.
- 15mm/s for unreinforced or light framed structures – Residential or light commercial type buildings.

German standard DIN4150-3 recommends a maximum peak particle velocity of:

Table 15. DIN4150-3 Guideline values for assessing short-term vibration effects					
Line	**Type of structure**	**Vibration velocity, v_i, in mm/s**			
		Foundation			**Plane of floor of uppermost full storey**
		At a frequency of			**Frequency mixture**
		Less than 10Hz	**10 to 50Hz**	**50 to 100Hz**	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

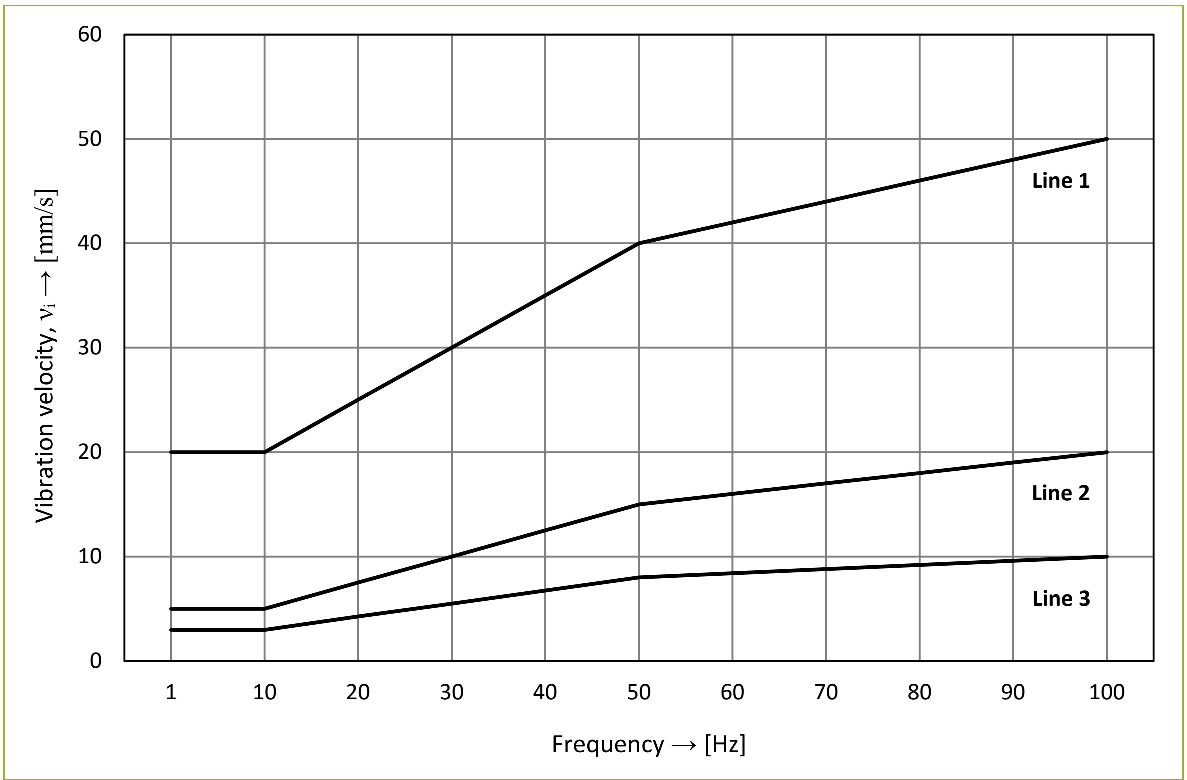

Figure 2. DIN4150-3 Curves representing guideline vibration velocity values at the building foundation

8.2 CONSTRUCTION NOISE

8.2.1 Construction noise sources and sound levels

In terms of noise emanating from typical construction activity, levels range depending on the process or sources involved. Typical construction noise levels are included in *Australian Standard 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites* and the *Department for Environment, Food and Rural Affairs (DEFRA – UK) Update of Noise Database for Prediction of Noise on Construction and Open Sites, December 2004.*

Table 16. Construction activity typical sound levels, [dB]

Equipment	Typical sound power level – Lw	Reference noise level – L_{Aeq} at 10m
Circular saw	112	84
Angle grinder	108	80
Hand tools (pneumatic)	116	88
Trucks (dump)	117	89
22-tonne excavator	99	71
Excavator loading truck	107	79
Concrete pump	103	75
Concrete truck and pump	95	67

8.2.2 Calculated construction noise levels

The level of noise predicted at a specific receiver location is governed by the source noise level, the distance between the source and receiver, and the presence of any screening objects along the propagation path. The location of plant and equipment on construction sites are not always at a fixed point and, therefore, the distance between a noise source and receiver location can vary.

Koikas Acoustics has assessed each of the identified construction noise sources at a central location on the development site. This results in the following distances to nearby residential properties:

- 35 metres to Tallawong Metro Station;
- 55 metres to the nearest boundary with 59-91 Amarco Circuit;
- 140 metres to the nearest boundary with 85 Schofields Road, and
- 220 metres to the nearest boundary with 34 Tallwong Road.

Construction noise levels were calculated at the residential boundary for each of the nearest residential receivers. Construction noise levels will vary at times from those predicted in this report on account of plant and equipment being located at varying locations within the development site.

Table 17. Estimated construction noise levels to surrounding receivers – LAeq 15 min [dB]

Equipment	Noise assessment receiver location			
	Tallawong Metro Station	59-91 Amarco Cct	85 Schofields Rd	34 Tallawong Rd
Circular saw	73	69	61	57
Angle grinder	69	65	57	53
Hand tools (pneumatic)	77	73	65	61
Trucks (dump)	78	74	66	62
22 tonne excavator	60	56	48	44
Excavator loading truck	68	64	56	52
Concrete pump	64	60	52	48
Concrete truck and pump	56	52	44	40

Notes

1. Predicted construction noise levels are estimates only due to the large variance in noise level generated by comparable plant performing similar tasks on different construction sites. Should complaints arise it may be necessary to survey noise being generated on-site to determine the actual working noise levels.

Estimated construction noise levels in Table 17 do not consider acoustic screening from any existing boundary fences. Receivers that are screened from construction equipment by a boundary fence of approximately 1.8 metres in height, noise levels may be up to 5dB below those predicted.

Noise from construction is predicted to, at times, exceed the Noise Affected level of the ICNG at nearby premises. This is due to the proximity of the adjoining residences in relation to the assessment site and the typical nature of noise associated with construction equipment.

It should be noted that the predicted levels consider construction noise levels being constant over a 15 minutes assessment period with the equipment operating at maximum capacity. Therefore, calculated noise levels above should be considered as conservative. Given typical respite periods, we could reasonably expect construction noise levels to be up to 3 to 5dB lower than predicted.

8.3 VIBRATION ASSESSMENT

The highest anticipated vibration levels will result from rock breaking or other impulsive-type excavation works (depending on the local geology).

Concrete sawing is an alternative to rock breaking that generates far less vibration and should be used for removal of the existing concrete structure along the affected boundaries.

A guide to safe work distances for typical vibration generating construction works is given in Table 2 of the *Construction Noise and Vibration Guideline (RMS, 2016)*.

Table 18. Reproduced in part from Table 2 of the RMS construction noise and vibration guide

Plant item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS7385)	Human response (Assessing vibration: A technical guideline)
Vibratory roller	< 50kN (Typically 1-2 tonnes)	5m	15m to 20m
	< 100kN (Typically 2-4 tonnes)	6m	20m
Small hydraulic hammer	300kg – 5 to 12t excavator	2m	7m
Medium Hydraulic Hammer	900kg – 12 to 18t excavator	7m	23m
Jackhammer	Handheld	1m (nominal)	2m

The vibration generated from an excavator removing site soil during earthworks for the basement is not expected to result in structural damage or human annoyance at nearby receivers.

8.4 NOISE & VIBRATION CONTROLS

The NSW Department of Environment, Climate Change and Water (DECCW) recognise that there is a need to balance the existing noise amenity of residents along with the necessity to continue growth within the region. The fundamental principle involved with the development and success of each noise policy is maintaining open and free channels of communications between developers and residents alike.

Construction noise policies are implemented to limit noise exposure for premises surrounding construction sites. Noise controls and mitigation strategies must be reasonable and feasible and applied on a case-by-case basis to ensure the best possible outcome for all parties involved.

In urban residential areas, it is often the case that a construction site will share a boundary with another residential property. Due to proximity, construction noise levels will generally exceed any adopted criterion. For this particular development, construction noise levels could potentially significantly exceed the Noise Affected Level of the ICNG at times.

Minimising the impact of noise from construction sites to surrounding land uses can be achieved through treatment of the noise sources themselves, treating noise along its propagation path and/or by consulting with the community and scheduling noise intensive works during less noise-sensitive times of the day. Consideration needs to be given to each source in identifying the most practical and efficient noise controls where treatment is necessary.

Table C3 in AS2436-2010 states the relevant effects of various types of noise control measures typically employed on construction sites.

Table 19. AS2436-2010 Table C3 – Relative effectiveness of various forms of noise control

Control by	Nominal noise reduction possible, in total A-weighted sound pressure level LpA [dB]
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum 15
Enclosure	Normally 15 to 25, maximum 50
Silencing	Normally 5 to 10, maximum 20

For this project, the following noise and vibration controls could be implemented to help maintain suitable noise and vibration amenity for surrounding land uses:

- The use of moveable screens for specific work practices could achieve the noise reductions of Table 19. The screens would have to be moveable where noise sources are not stationary within the construction site.
- Providing an acoustic type hoarding along the site boundary will also lower noise levels, however, the benefit would only be realised by residents on the ground floor level of adjoining buildings.
- Exhaust silencers could be considered to motorised plant and equipment such as the excavators. Silenced plant and equipment could lower noise emission from the exhaust system by 5 to 10dB.
- Undertake construction works during standard hours as defined in the ICNG.
- Use appropriately sized plant and equipment.
- Identify when high noise-generating activities are likely to take place and conducting this work during times of least noise sensitivity as agreed through community consultation. Having open lines of communication with residents and appropriate scheduling of works on construction sites are processes recommended in both the City's construction noise code and the NSW ICNG.
- To minimise vibration from rock breaking, it is recommended that a hydraulic hammer attachment with a pointed 'cone' type hammer is used in place of a flat 'block' type hammer.

- The minimum work distances as tabled within this report should be observed at all times, especially regarding structural damage guidelines.
- Continuous vibration monitoring surveys may be considered during excavation to ensure vibration levels do not reach a point where the structural integrity of surrounding buildings is compromised. Vibration monitors can be set to measure either the peak particle velocity or r.m.s. acceleration at the site boundary where a design vibration limit is specified by the Geotech engineer or as a Vibration Dose Value within adjoining residential buildings. Measuring vibration within the adjoining residential building will require significant cooperation from the tenants/occupants.
- Progress noise monitoring could also be conducted during construction works to provide feedback to site managers as to the level of noise being emitted from the site.
- Refer to Section 6 of the ICNG and Section 4 of AS2436-2010 for additional information regarding the design, selection, and implementation of suitable work practices for noise control on construction sites.

8.5 COMPLAINTS HANDLING

A site contact and phone number should be distributed to all surrounding premises and displayed on the site notice-board for any complaints arising due to noise and/or vibration generated during construction works. The site should have clear complaints handling procedure and staff who are well-versed in the complaints handling procedures.

A register of all complaints must be kept on-site and be readily available. Details within the complaints register should include, but not be limited to:

- Date and time of the complaint,
- The person receiving a complaint,
- Complainant phone number,
- Site contact who the complaint was referred to for action,
- Description of the complaint,
- Action to be taken,
- The time frame for action to be implemented.

All complaints should be given a fair hearing and adequately investigated. This may involve scheduling a relevant consultant to substantiate or refute any received complaint, and/or verifying any remedial action taken by the site manager by way of on-site testing.

9.0 LOADING DOCK NOISE ASSESSMENT

Koikas Acoustics Pty Ltd was requested to provide comments regarding the noise intrusion from the ground floor (street level) loading dock areas for the mixed-use development at 2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155.

The noisiest activity identified is the garbage truck entering the loading dock, unloading the recycling bins (includes glass bottles and other recyclables) into the truck and exiting the loading dock. Noise intrusion calculations have been conducted to determine the noise impact from the loading dock. The noise source considered is that of a front lift truck idling, lifting a bin and unloading materials into the truck.

Whilst there are no specified noise criteria for all habitable spaces from loading dock activities, Koikas Acoustics has adopted noise criteria of $\mathbf{L_{Aeq,T}}$ 35-45 dB during the daytime and evening period, as outlined in AS2107:2016 (for quasi-static and steady-state noise sources) and SEPP 2007 (for traffic noise intrusion). The noise in question would be similar to that of traffic noise. The parameter (,T) for the noise metric $\mathbf{L_{Aeq,T}}$ is the period of the activity that includes the truck driving in and out, the lifting, idling and reversing. This criterion is significantly more stringent compared to that of traffic noise intrusion whereby the period is over a longer period.

An analysis of the worst-case loading dock scenario has been conducted in Table 20. The worst-case loading dock was on Level 1 of Building 2D (seen in Figure 2). This loading dock shares one common wall with a study room and one common wall of a kitchen/dining/living, and both rooms are within proximity to the loading dock entry/exit (shown in Figure 3). This loading dock also shares a common ceiling/floor with residential units above on Level 3.

The most noise-sensitive habitable space is the study room with one common wall and located directly next to the loading dock entry/exit with a window on the northern façade to the balcony.

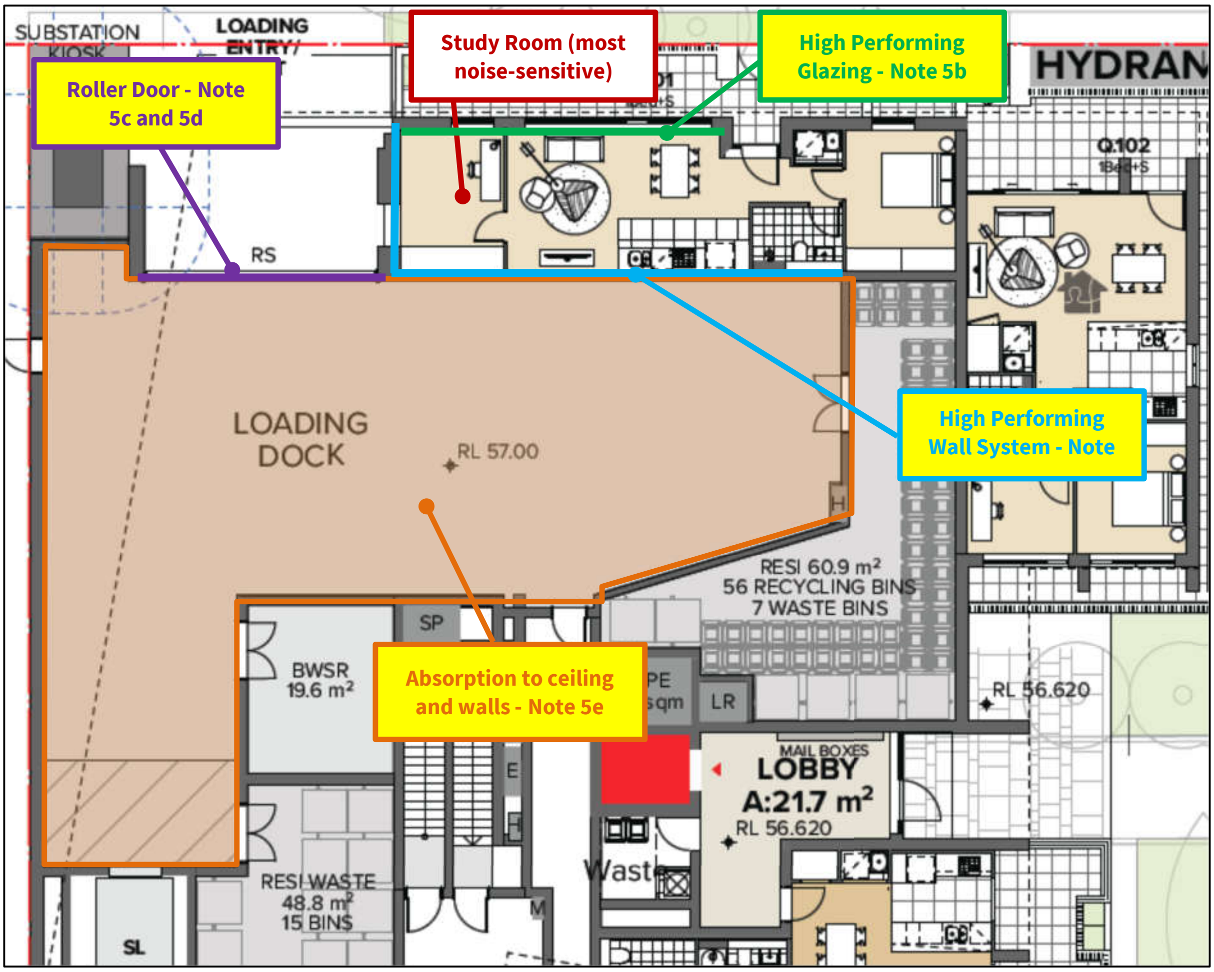

Figure 3: Loading dock was on Level 1 of Building 2D (image source – architectural drawings)

Table 20 is a summary of the calculated noise contributions through each building element and noise intrusion to the most noise-sensitive space of Building 2D.

Table 20. Noise impact within the bedroom on Level 1 adjoining the loading dock of Building 2D [dB]

Description	Octave Band Centre Frequency [Hz]									Total
	31.5	63	125	250	500	1k	2k	4k	8k	
Front lift truck idling/lifting (external) L_{Aeq}	71	86	93	94	91	95	95	90	82	**101**
Indoor correction	+6	+6	+6	+6	+6	+6	+6	+6	+6	-
Front lift truck idling/lifting (internal) L_{Aeq}	77	92	99	100	97	101	101	96	88	**107**
Noise transmission through the adjoining wall										
Distance attenuation (10meters)	-25	-25	-25	-25	-25	-25	-25	-25	-25	
STL of AFS 162 + 20 air gap + 64 steel stud with insulations + 2 x 16 Fyrchek	-40	-42	-61	-73	-93	-101	-102	-109	-111	-
Surface area radiation of the wall (8m²)	+ 9	+ 9	+ 9	+ 9	+ 9	+ 9	+ 9	+ 9	+ 9	-
Calculated noise level through adjoining wall L_{Aeq}	21	34	22	11	-12	-16	-17	-29	-39	**34**
Noise transmission through open roller door										

Distance attenuation (12meters)	-27	-27	-27	-27	-27	-27	-27	-27	-27	-
Surface area radiation (16m^2)	+12	+12	+12	+12	+12	+12	+12	+12	+12	-
Sound power level of open roller door L_{Aeq}	62	77	84	85	82	86	86	81	73	**93**
Noise transmission through the western external wall (breakout noise from open roller door)										
Calculated Cadna receiver at wall L_{Aeq}	46	61	68	69	66	70	70	65	57	**76**
STL of double brick with brick-ties and no insulation	-36	-38	-46	-43	-49	-59	-69	-78	-80	-
Surface area radiation of the wall (10m^2)	+ 10	+ 10	+ 10	+ 10	+ 10	+ 10	+ 10	+ 10	+ 10	-
Calculated indoor noise levels through external northern wall L_{Aeq}	20	33	32	36	27	21	11	-3	-13	**39**
Noise transmission through the window on the northern facade (breakout noise from open roller door)										
Calculated Cadna receiver at window L_{Aeq}	32	46	51	51	45	47	45	37	26	**56**
STL of 10.38mm laminated glass	-18	-21	-25	-30	-33	-32	-34	-39	-45	-
Surface area radiation of the window(5m^2)	+7	+7	+7	+7	+7	+7	+7	+7	+7	-
Calculated indoor noise levels through window on eastern facade L_{Aeq}	21	32	33	28	19	22	18	5	-12	**37**
Total calculated resultant indoor noise levels within the study room L_{Aeq}	25	38	36	37	28	25	19	6	-9	**42**
Indoor noise criterion Level L_{Aeq}	-	-	-	-	-	-	-	-	-	**35~45**

As observed in Table 20, the noise intrusion into the study room is predominately from the external façade, as such, the use of an acoustic roller door will significantly improve the noise impact to the most noise-sensitive habitable space of the loading dock in Building 2D.

A review of the loading dock of Building 2C (seen in Figure 4), shows habitable spaces on Level 1 are significantly shielded and unlikely to be adversely affected by the noise within the loading dock.

The most noise-sensitive habitable space is the bedroom (directly above the loading dock) on Level 3 fronting Conferta Avenue with noise intrusion through the common ceiling/floor system and breakout noise through the loading dock and the northern window/façade.

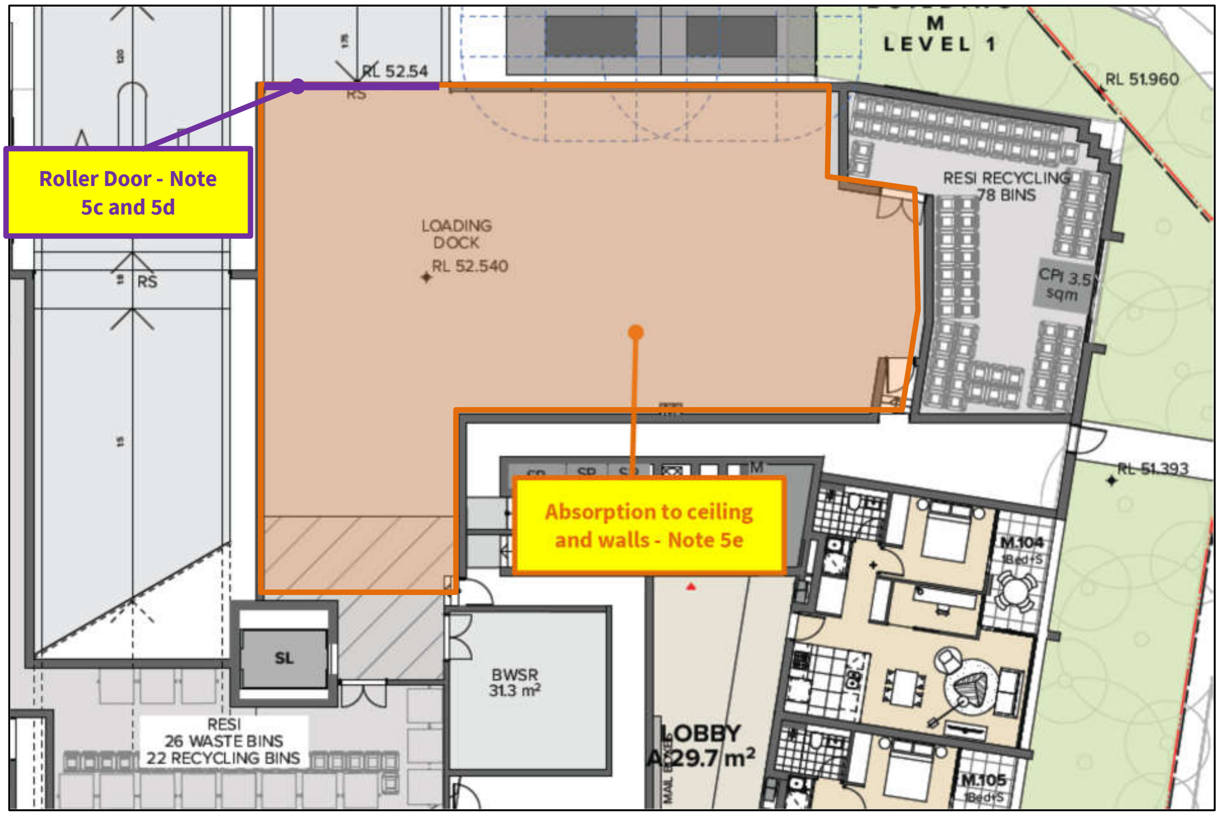

Figure 4: Loading dock was on Level 1 of Building 2C (image source – architectural drawings)

Table 21 is a summary of the calculated noise contributions through each building element and noise intrusion to the most noise-sensitive space of Building 2C.

Table 21. Noise impact within the bedroom on Level 3 adjoining the loading dock of Building 2C [dB]

Description	Octave Band Centre Frequency [Hz]									Total
	31.5	63	125	250	500	1k	2k	4k	8k	
Front lift truck idling/lifting (external) L_{Aeq}	71	86	93	94	91	95	95	90	82	**101**
Indoor correction	+6	+6	+6	+6	+6	+6	+6	+6	+6	-
Front lift truck idling/lifting (internal) L_{Aeq}	77	92	99	100	97	101	101	96	88	**107**
Noise transmission through the adjoining ceiling/floor										
Distance attenuation (10meters)	-25	-25	-25	-25	-25	-25	-25	-25	-25	
STL of 300mm concrete	-44	-48	-47	-54	-61	-67	-71	-76	-80	-
Surface area radiation of the ceiling (12m^2)	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	-
Calculated noise level through adjoining wall L_{Aeq}	19	30	38	32	22	20	16	6	-6	**39**
Noise transmission through open roller door										
Distance attenuation (12meters)	-27	-27	-27	-27	-27	-27	-27	-27	-27	-
Surface area radiation (16m^2)	+12	+12	+12	+12	+12	+12	+12	+12	+12	-

Sound power level of open roller door L_{Aeq}	62	77	84	85	82	86	86	81	73	**93**
Noise transmission through the window on the northern facade (breakout noise from open roller door)										
Calculated Cadna receiver at window L_{Aeq}	34	49	56	57	54	58	57	51	42	**64**
STL of 10.38mm laminated glass	-18	-21	-25	-30	-33	-32	-34	-39	-45	**-**
Surface area radiation of the window(5m^2)	+7	+7	+7	+7	+7	+7	+7	+7	+7	**-**
Calculated indoor noise levels through window on eastern facade L_{Aeq}	23	35	38	34	28	33	30	19	4	**42**
Total calculated resultant indoor noise levels within the bedroom L_{Aeq}	24	36	41	36	29	33	30	19	4	**44**
Indoor noise criterion Level L_{Aeq}	-	-	-	-	-	-	-	-	-	**35~45**

As observed in Table 20, similarly to the loading dock in Building 2D, the noise intrusion into the study room is predominately from the external façade, as such, the use of an acoustic roller door will significantly improve the noise impact to the most noise-sensitive habitable space of the loading dock in Building 2C.

A review of the loading dock of Building 2A (seen in Figure 5), shows habitable spaces on Level 1 are significantly shielded and unlikely to be adversely affected by the noise within the loading dock.

The most noise-sensitive habitable space is the bedroom with one common wall and located directly next to the loading dock entry/exit with a window on the western façade.

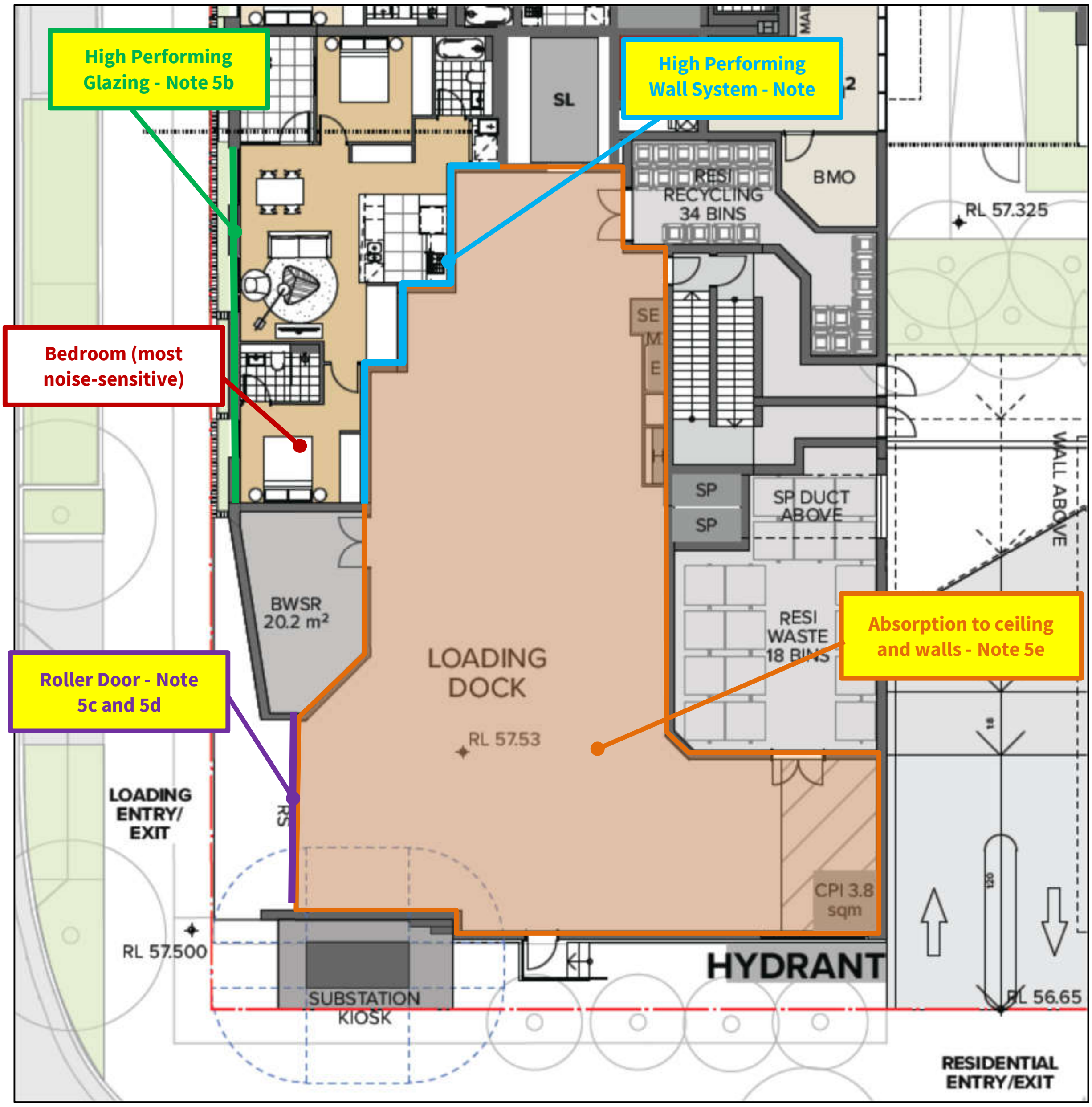

Figure 5: Loading dock was on Level 1 of Building 2A (image source – architectural drawings)

Table 22 is a summary of the calculated noise contributions through each building element and noise intrusion to the most noise-sensitive space of Building 2A.

Table 22. Noise impact within the bedroom on Level 1 adjoining the loading dock of Building 2A [dB]

Description	Octave Band Centre Frequency [Hz]									Total
	31.5	63	125	250	500	1k	2k	4k	8k	
Front lift truck idling/lifting (external) L_{Aeq}	71	86	93	94	91	95	95	90	82	**101**
Indoor correction	+6	+6	+6	+6	+6	+6	+6	+6	+6	-
Front lift truck idling/lifting (internal) L_{Aeq}	77	92	99	100	97	101	101	96	88	**107**
Noise transmission through the adjoining wall										

Distance attenuation (8meters)	-23	-23	-23	-23	-23	-23	-23	-23	-23	
STL of AFS 162 + 20 air gap + 64 steel stud with insulations + 2 x 16 Fyrchek	-40	-42	-61	-73	-93	-101	-102	-109	-111	-
Surface area radiation of the wall ($12m^2$)	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	-
Calculated noise level through adjoining wall L_{Aeq}	25	38	26	15	-8	-12	-13	-25	-35	**38**
Noise transmission through open roller door										
Distance attenuation (12meters)	-27	-27	-27	-27	-27	-27	-27	-27	-27	-
Surface area radiation ($16m^2$)	+12	+12	+12	+12	+12	+12	+12	+12	+12	-
Sound power level of open roller door L_{Aeq}	62	77	84	85	82	86	86	81	73	**93**
Noise transmission through the western external wall (breakout noise from open roller door)										
Calculated Cadna receiver at wall L_{Aeq}	32	47	54	58	55	59	59	53	44	**65**
STL of double brick with brick-ties and no insulation	-36	-38	-46	-43	-49	-59	-69	-78	-80	-
Surface area radiation of the wall ($5.5m^2$)	+ 7	+ 7	+ 7	+ 7	+ 7	+ 7	+ 7	+ 7	+ 7	-
Calculated indoor noise levels through external northern wall L_{Aeq}	3	16	15	22	13	7	-3	-18	-29	**25**
Noise transmission through the window on the western facade (breakout noise from open roller door)										
Calculated Cadna receiver at window L_{Aeq}	32	47	54	58	55	59	59	53	44	**65**
STL of 10.38mm laminated glass	-18	-21	-25	-30	-33	-32	-34	-39	-45	-
Surface area radiation of the window($2.5m^2$)	+4	+4	+4	+4	+4	+4	+4	+4	+4	-
Calculated indoor noise levels through window on eastern facade L_{Aeq}	18	30	33	32	26	31	29	18	3	**39**
Total calculated resultant indoor noise levels within the bedroom L_{Aeq}	26	38	34	33	26	31	29	18	3	**41**
Indoor noise criterion Level L_{Aeq}	-	-	-	-	-	-	-	-	-	**35~45**

The noise intrusion into the bedroom is predominately through the window and adjoining wall, as such, acoustic roller doors and surface treatment to the loading dock will further minimise noise intrusion.

Notes:

1. A calibrated Cadna/A noise model was used to predict the external noise levels from the open roller door of the loading dock.
2. The sound transmission loss of building materials were based on Insul V9.0.22 and previous measurements/test reports.
3. Conservative assumptions have been made regarding the trucks noise sources, building materials and distances. No sound absorption was considered for the indoor spaces. A more detailed assessment will be conducted at the CC stage once more details are available.

4. Acceptable noise levels were achieved with readily available and reasonable building materials, i.e. double brick wall, AFS 162 with a stud wall and 10.38mm laminated glazing.
5. The following noise mitigation can be implemented to further reduce the noise:
    a. Higher acoustically performing wall systems within a total of 300mm wall thickness;
    b. installing higher acoustically performing glazing;
    c. closing the roller door;
    d. installing an acoustic roller door;
    e. installing absorption in the loading dock, and
    f. amend the architectural design/layout shielding glazing from the loading dock.
6. Garbage trucks should not be entering the loading dock during the night-time period (2200 to 0700 hours, or 2200-0800 hours on Sundays).
7. Koikas Acoustics has conducted noise measurements of various types of garbage trucks and found them to vary in noise level by up to 15 dB due to the type of vehicle and type of garbage. Koikas Acoustics has utilised one of the noisier garbage truck measurements within these calculations, however, the actual noise levels are likely significantly lower.

It is in Koikas Acoustics opinion that the loading dock areas on the street level can be acoustically treated and a management plan adopted to ensure adequate noise levels to the adjoining residential premises at 75-81 Schofields Road & 38 Cudgegong Road, Rouse Hill NSW 2155. A more detailed assessment should be undertaken before construction to determine the required acoustic treatment.

10.0 TRAFFIC NOISE IMPACT ARISING FROM THE PROPOSED DEVELOPMENT

10.1 ACOUSTICAL REQUIREMENTS

According to the NSW Road Noise Policy, the following noise criteria apply:

Noise Mode Scenario	Space	Noise Criteria	Period
Scenario 2.1	Residential	$L_{Aeq,(1hr)}$ = **55 dB -** External	Daytime (0700-2200)
Scenario 2.2	Residential	$L_{Aeq,(1hr)}$ = **55 dB -** External	Daytime (0700-2200)

Furthermore, the relative increases in traffic noise levels arise from the proposed development are not to exceed 2 dB is also applicable for residential premises.

10.2 TRAFFIC VOLUMES

The sound power level of the road traffic noise source was determined based on traffic volume data stated in the Traffic & Parking Impact Assessment Report provided by Barker Ryan Stewart (Project No.: SY190226, Dated: 11/03/2020) in conjunction with the use of Cadna/A, a software package developed by DataKustik.

Traffic noise source levels are dependent on several input factors such as the road surface, road gradient/slope, vehicular speed, percentage of heavy vehicles and traffic volumes along each road carriageway. As a worst-case scenario, the PM peak hours traffic volumes illustrated in the figures extracted from the traffic report shown above have been considered in this acoustic assessment.

The future hourly traffic volumes during PM peak hours along surrounding roads are illustrated in the figures below (extracted from the report prepared by Barker Ryan Stewart):

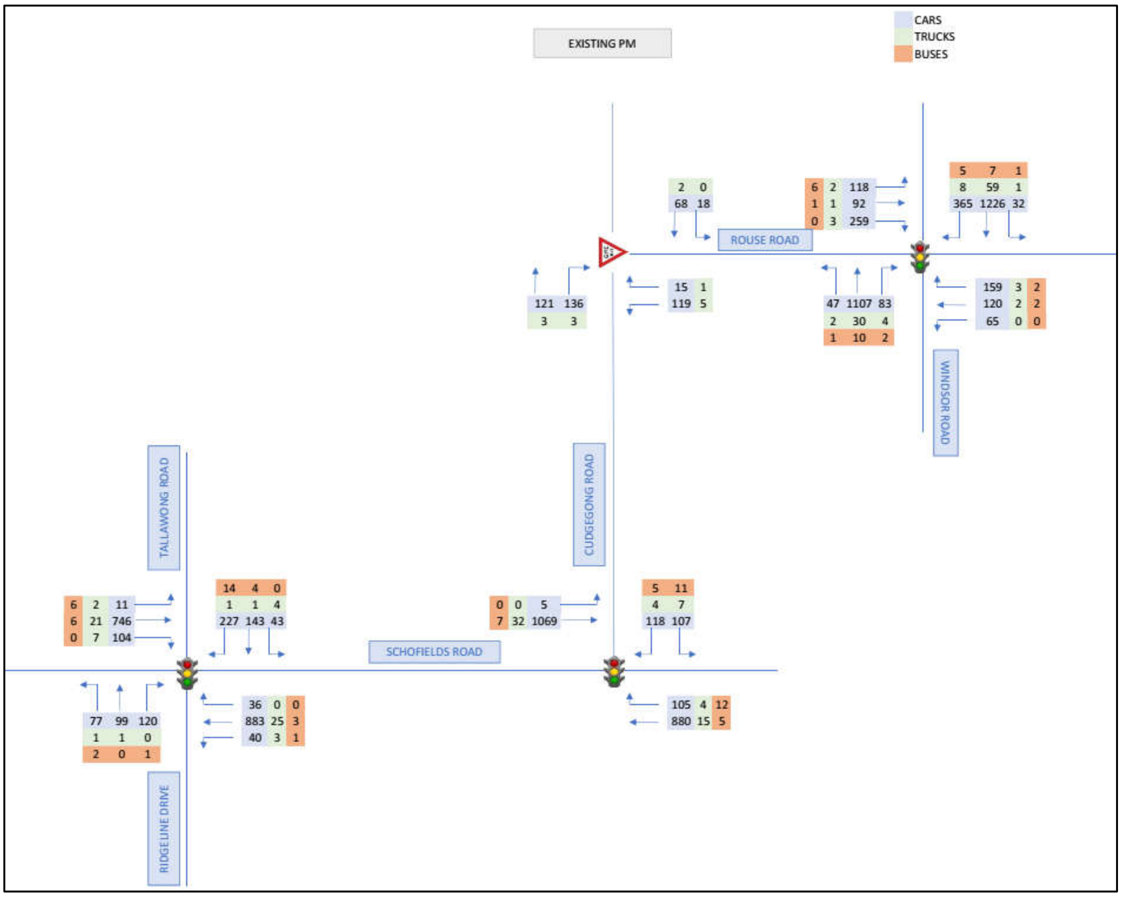

Figure 6. Existing PM peak traffic volumes (extracted from traffic report prepared by Barker Ryan Stewart)

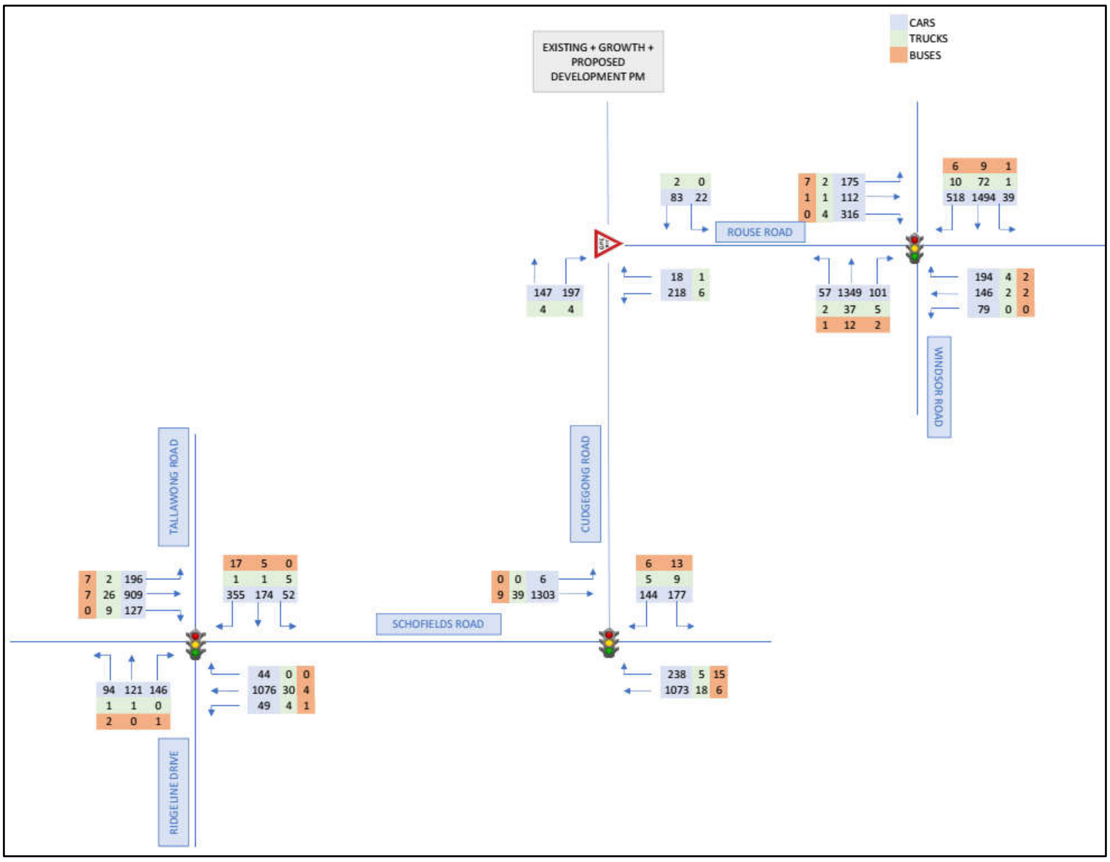

Figure 7. Projected PM peak traffic volumes (extracted from traffic report prepared by Barker Ryan Stewart)

10.3 CADNA (A) NOISE MODEL

A calibrated Cadna/A noise model was used to predict traffic noise levels, as described in Section 5.2. Refer to **Appendix B** for Cadna noise contour maps

Scenario 2.1 (Existing Traffic Noise Impact to Surrounding Premises)

External Noise Criterion: $L_{Aeq, 1\,hr} \leq$ 55 dB or ≤ 2 dB Increase

As a worst-case scenario, the existing morning peak hour traffic volumes for local and future roads illustrated in Figure 5 of the traffic report (prepared by Barker Ryan Stewart) have been included in this noise model scenario.

The maximum calculated road traffic noise level based on the existing (no-build option) to the surrounding residential premise is found to be $L_{Aeq,1hour}$ 71 dB and exceeds the traffic noise criterion by 16 dB. As such, the limiting criterion is less than or equal to 2 dB increase for the proposed build option in Scenario 2.2.

Scenario 2.2 (Proposed Traffic Noise Impact to Surrounding Premises)

External Noise Criterion: $L_{Aeq, 1\,hr} \leq$ 55 dB or ≤ 2 dB Increase

As a worst-case scenario, the PM peak hour traffic volumes for local and future roads illustrated in Figure 6 of the traffic report (prepared by Barker Ryan Stewart) have been included in this noise model scenario.

The maximum calculated road traffic noise level to the surrounding residential premise is found to be $L_{Aeq,1hour}$ 72 dB and is equivalent to a 1 dB increase compared to the corresponding no-build option in Scenario 2.1. The additional road traffic noise due to the development is therefore expected to achieve the acoustic requirement of the NSW Road Noise Policy.

11.0 CAR PARK SERVICING THE TALLAWONG METRO STATION NOISE IMPACT ASSESSMENT

Noise impact assessment from the existing car park servicing the Tallawong Metro Station to the proposed development has been conducted.

11.1 ACOUSTICAL REQUIREMENTS

Any new car park constructed near residential premises would be expected to comply with the EPA's Noise Policy for Industry. Whilst there are no specific guidelines or recommended noise levels from an existing car park area, Koikas Acoustics has considered the EPA's Noise Policy for Industry. As per Section 6.2 (Table 9), the EPA's Noise Policy for Industry planning levels are summarised in Table 23.

Table 23. NPfI planning levels

Period, T (Note 1)	Project Noise Trigger Levels		
	Monitoring Location A – Schofields Road	Monitoring Location B & C – Cudgegong Road	Monitoring Location D – Themeda Avenue
Day	55	48	46
Evening	57	49	48
Night	43	40	39
Notes 1.	The NSW EPA Industrial Noise Policy refers to the following time periods, Day – 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sunday and public holidays, Evening – 6 pm to 10 pm Monday to Sunday, Night – 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday and public holidays.		

11.2 TRAFFIC VOLUMES

The traffic volumes and noise sources utilised for this assessment was the parking lot module in the calibrated Cadna/A noise model. This considers the size, capacity and type of car park to determine the relevant sound power level. The car park is divided into 3 areas:

- North-east – approximately 4360m^2 with 170 parking lots.
- North-west – approximately 12,800m^2 with 460 parking lots
- South – approximately 11,900m^2 with 395 parking lots

11.3 CADNA (A) NOISE MODEL

A calibrated Cadna/A noise model was used to predict car park noise levels, as described in Section 5.2. Refer to **Appendix B** for Cadna noise contour maps

Scenario 3 (Tallawong Station Car park impact to the subject site)

The predicted operational noise levels are presented in Table 23.

Table 24. Calculated receiver noise levels [dB]			
Receiver location	**Project noise criteria $L_{Aeq\ 15\ minutes}$**		**Predicted receiver noise $L_{Aeq\ 15\ mins}$**
	Residential Daytime	**Residential Evening**	
R1 – Residential	46	48	**46**
R2 – Residential	48	49	**47**
R3 – Residential	48	49	**45**
R4 – Residential	48	49	**46**
R5 – Residential	55	57	**50**

Predicted noise levels during the daytime and evening period are expected to comply with the adopted project noise trigger levels. Night-time noise levels from the car park are significantly lower and expected to be below $L_{Aeq,15min}$ 35 dB, therefore compliance with the night-time i project noise trigger levels. As the car park is expected to achieved compliance in accordance with the EPA's Noise Policy for Industry to the subject residential site, no further acoustic treatments are required.

12.0 CONCLUSION

Koikas Acoustics was requested to prepare an acoustical report for the proposed mixed-use development at 2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155 seeking approval for the construction of sixteen buildings over eight-storeys with associated basement level parking.

The assessment considers potential noise impacts to future occupants of the development, and to surrounding residents such that acceptable acoustic amenity for the area is maintained.

Acoustic planning levels have been referenced from current ISEPP, NSW DoP, EPA, BCA, and other relevant acoustic planning guidelines and requirements.

The included recommendations are based on designs prepared by Turner Studio.

The conclusions reached in this report should assist Council in making their determination of the proposal in terms of compliance with the necessary acoustic design requirements. A further detailed acoustic report may be required for the CC submission should the building design be amended, or as required by Council.

Of the assessed components of noise, the following conclusions have been reached:

1. The building can be sufficiently insulated against existing external sources of noise in the area such as road and rail traffic through the use of acoustic glazing. Recommended glazing systems are provided in this report. These recommendations should be verified before construction.
2. Rail vibration was not measurable at the nearest boundary, as such, Koikas Acoustics expects a low probability of adverse comment and no further mitigation measures are required to mitigate rail vibrations.
3. A detailed assessment of mechanical plant noise should be prepared for the subject development before construction.
4. Acoustic treatment options for the common floors and services partitions included within this report would be adequate for satisfying the sound insulation provisions of the BCA.
5. A quantitative construction noise impact assessment has been conducted and construction noise and vibration plan of management have been prepared to outline reasonable and feasible noise and vibration mitigation measures. Not all mitigation measures apply to this development.
6. Noise impact from the loading dock areas has been calculated and found that the loading dock can be acoustically treated and a management plan adopted to ensure adequate noise levels to the adjoining residential premises. A more detailed assessment should be undertaken before construction to determine the required acoustic treatment.

7. Based on the results of the analysis in noise model Scenarios 2.1 and 2.2, the future project road traffic noise level is expected to achieve less than 2 dB increase in noise levels to surrounding residential premises. The additional road traffic noise due to the development is therefore expected to achieve the acoustic requirement of the NSW Road Noise Policy.
8. Predicted noise levels from the existing car park servicing Tallawong Station are expected to achieved compliance in accordance with the EPA's Noise Policy for Industry to the subject residential site. No further acoustic treatments are required.

In our professional opinion, there is sufficient scope within the proposed building design to achieve the applied acoustic planning guidelines.

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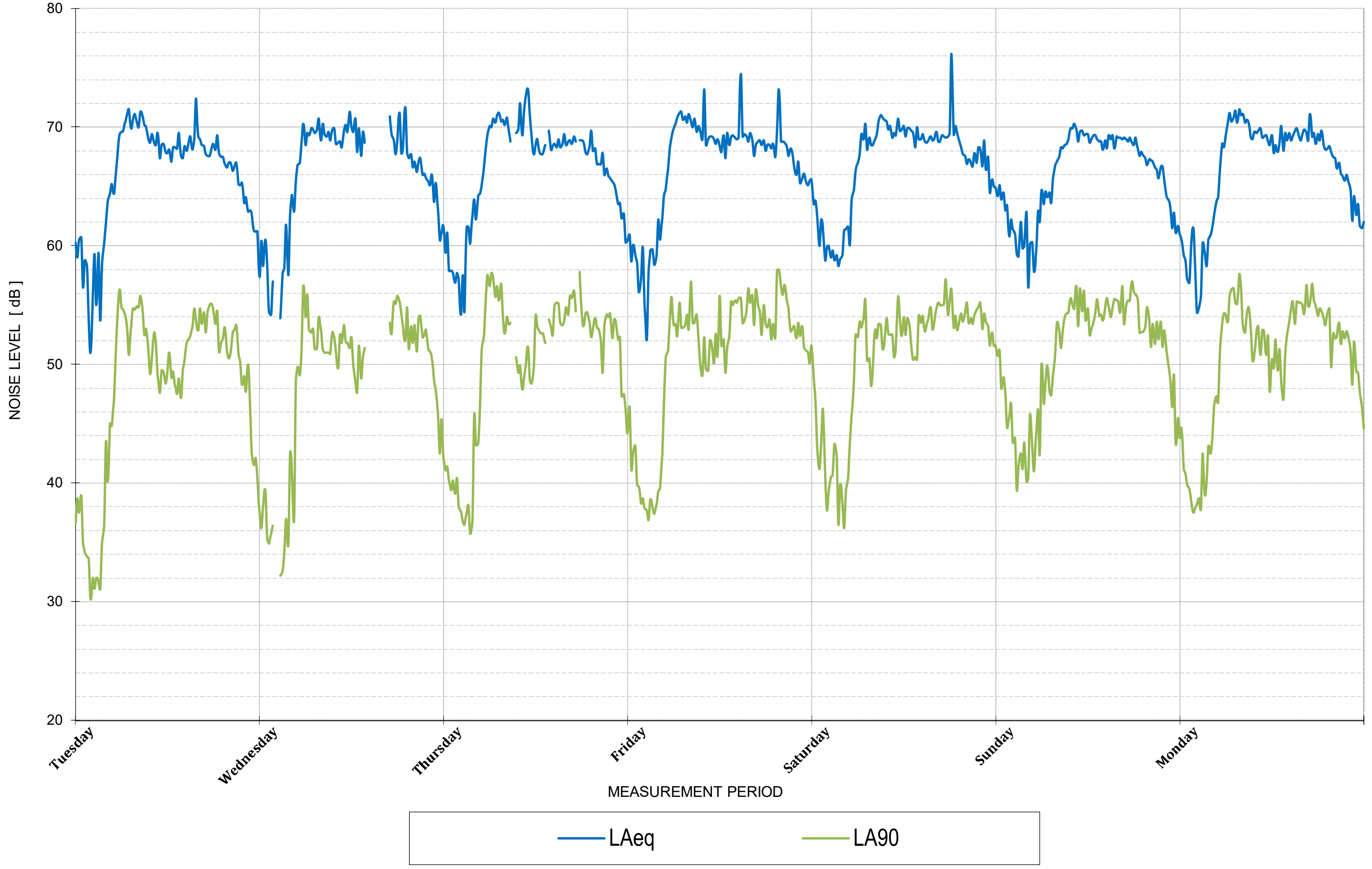
APPENDIX A

WEEKLY SUMMARY | LOGGER LOCATION: Schofields Road | PERIOD: 3rd to the 9th December 2019

SVAN 977 UNATTENDED NOISE SURVEY **WEEKLY SUMMARY**



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	49	50	32
Day 2	50	52	35
Day 3	49	52	37
Day 4	50	53	38
Day 5	50	53	39
Day 6	53	52	41
Day 7	50	52	38
RBL	50	52	38

	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	69	67	65
Day 2	70	68	65
Day 3	70	68	65
Day 4	70	69	65
Day 5	70	69	64
Day 6	69	67	64
Day 7	70	68	64
Average	69	68	65

SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	69	dB
LAeq 9 hrs	2200-0700	64	dB
Max LAeq 1 hr	0700-2200	71	dB
Max LAeq 1 hr	2200-0700	68	dB

Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]	25

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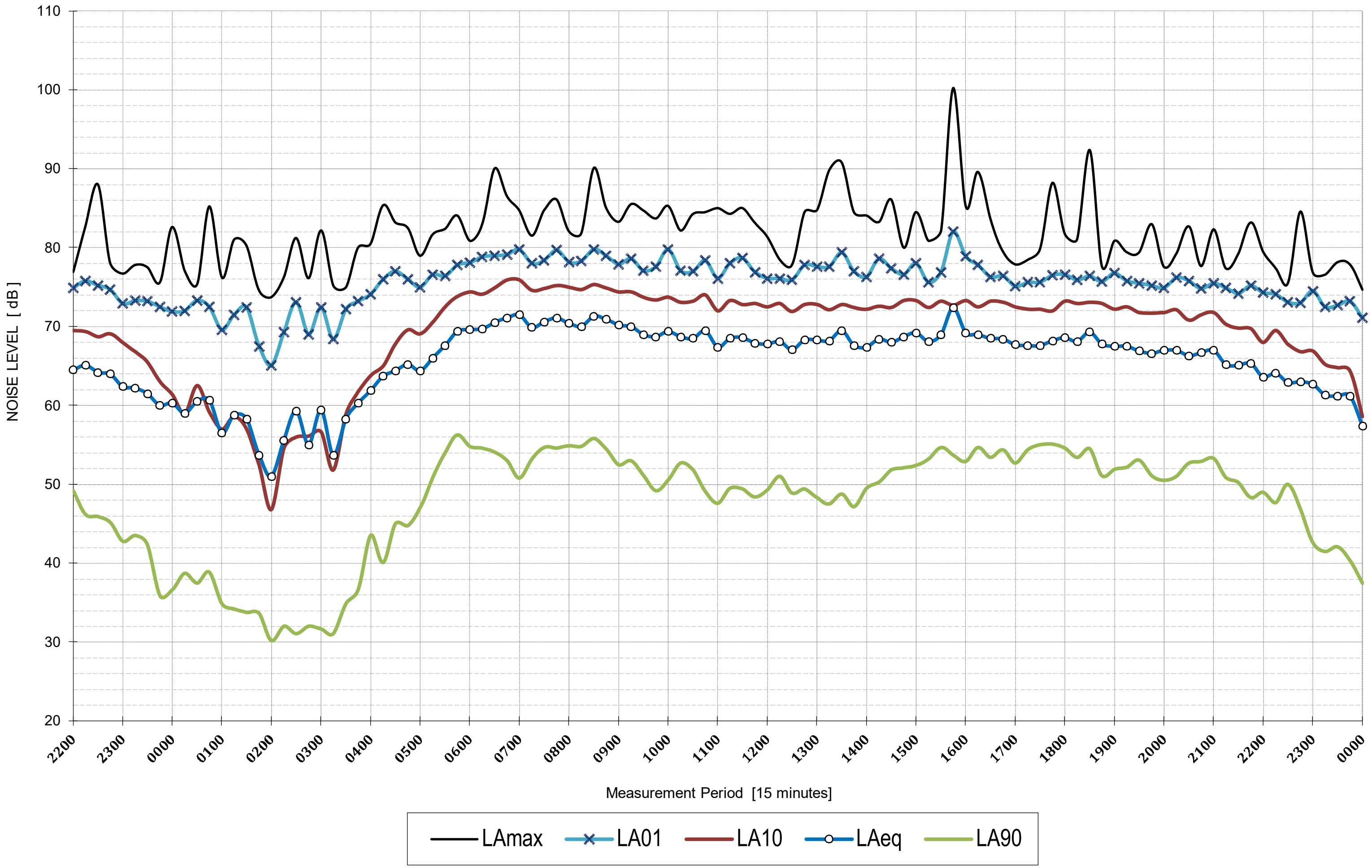
CONSULTANTS IN NOISE & VIBRATION

DAY 1 LOGGER LOCATION: Schofields Road DATE: Tuesday, 3 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	49	dB
LA90 Evening	1800-2200	50	dB
LA90 Night-time	2200-0700	32	dB
LAeq Daytime	0700-1800	69	dB
LAeq Evening	1800-2200	67	dB
LAeq Night-time	2200-0700	65	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	65	dB
Max LAeq 1 hour	0700-2200	71	dB
Max LAeq 1 hour	2200-0700	68	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	27

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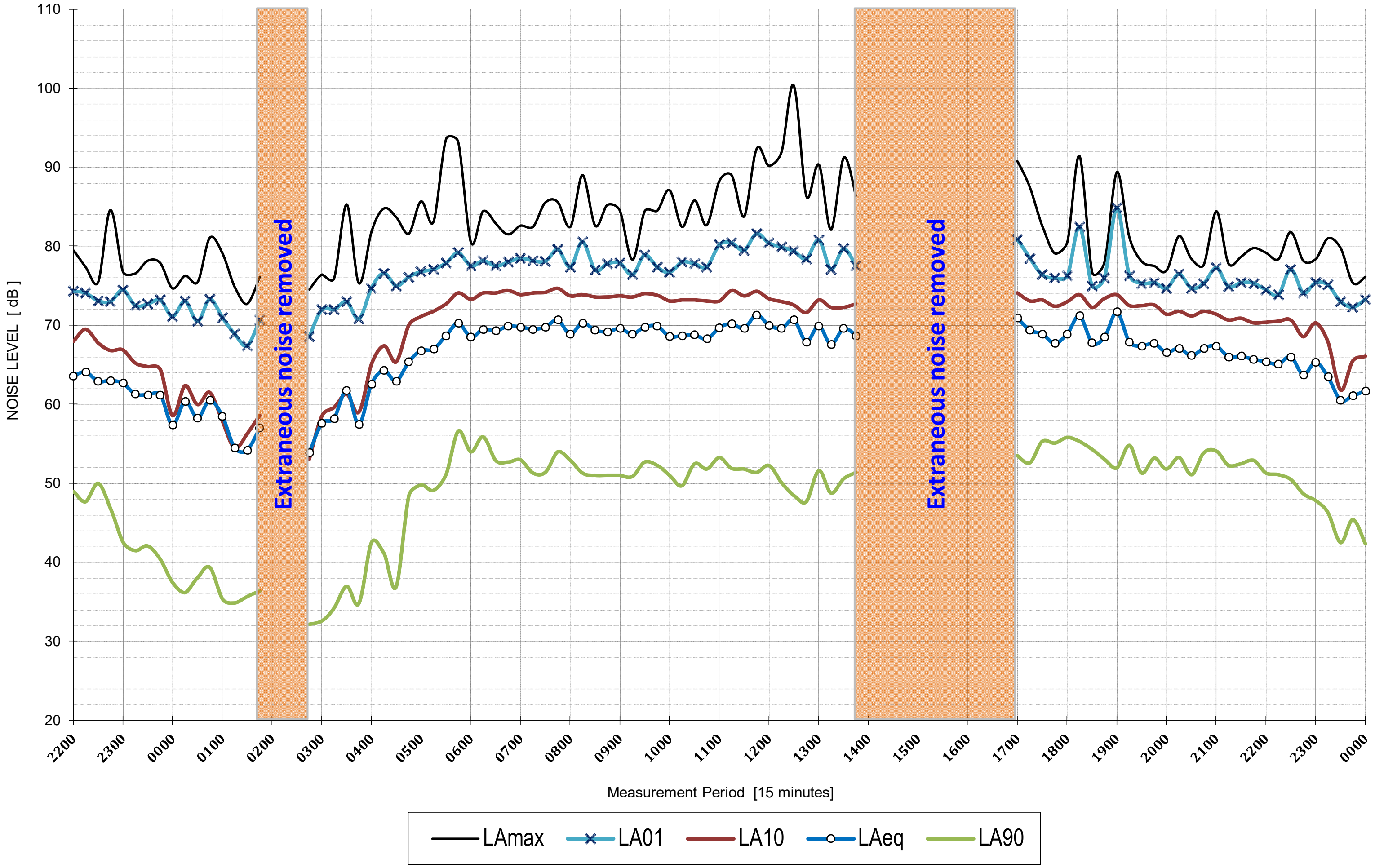
CONSULTANTS IN NOISE & VIBRATION

DAY 2 LOGGER LOCATION: Schofields Road DATE: Wednesday, 4 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	52	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	70	dB
LAeq Evening	1800-2200	68	dB
LAeq Night-time	2200-0700	65	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	65	dB
Max LAeq 1 hour	0700-2200	70	dB
Max LAeq 1 hour	2200-0700	69	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	26

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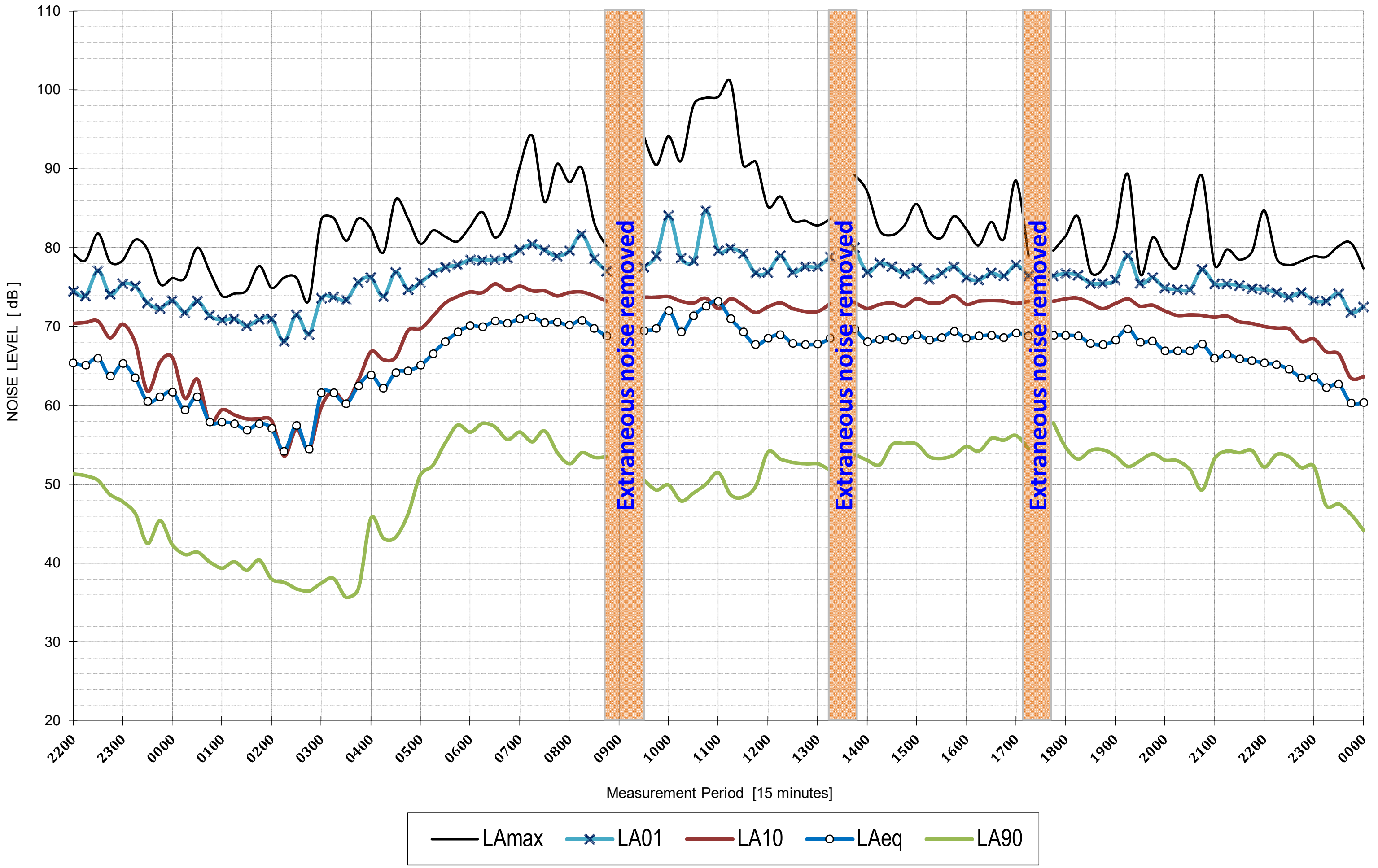
CONSULTANTS IN NOISE & VIBRATION

DAY 3 LOGGER LOCATION: Schofields Road DATE: Thursday, 5 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	49	dB
LA90 Evening	1800-2200	52	dB
LA90 Night-time	2200-0700	37	dB
LAeq Daytime	0700-1800	70	dB
LAeq Evening	1800-2200	68	dB
LAeq Night-time	2200-0700	65	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	65	dB
Max LAeq 1 hour	0700-2200	71	dB
Max LAeq 1 hour	2200-0700	68	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	24

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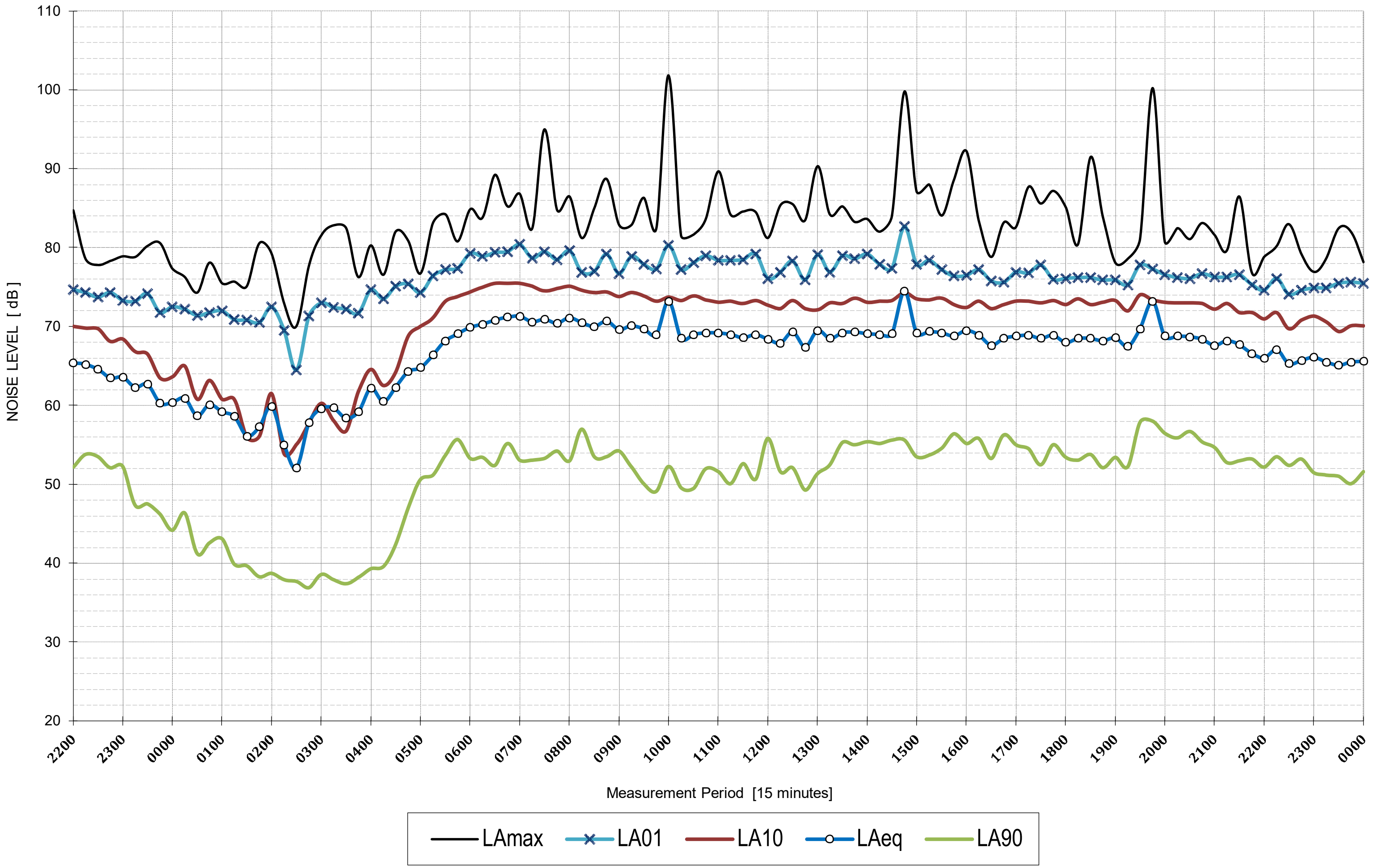
CONSULTANTS IN NOISE & VIBRATION

DAY 4 LOGGER LOCATION: Schofields Road DATE: Friday, 6 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	53	dB
LA90 Night-time	2200-0700	38	dB
LAeq Daytime	0700-1800	70	dB
LAeq Evening	1800-2200	69	dB
LAeq Night-time	2200-0700	65	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	65	dB
Max LAeq 1 hour	0700-2200	71	dB
Max LAeq 1 hour	2200-0700	68	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	29

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CONSULTANTS IN NOISE & VIBRATION

DAY 5 LOGGER LOCATION: Schofields Road DATE: Saturday, 7 December 2019

AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	53	dB
LA90 Night-time	2200-0700	39	dB
LAeq Daytime	0700-1800	70	dB
LAeq Evening	1800-2200	69	dB
LAeq Night-time	2200-0700	64	dB

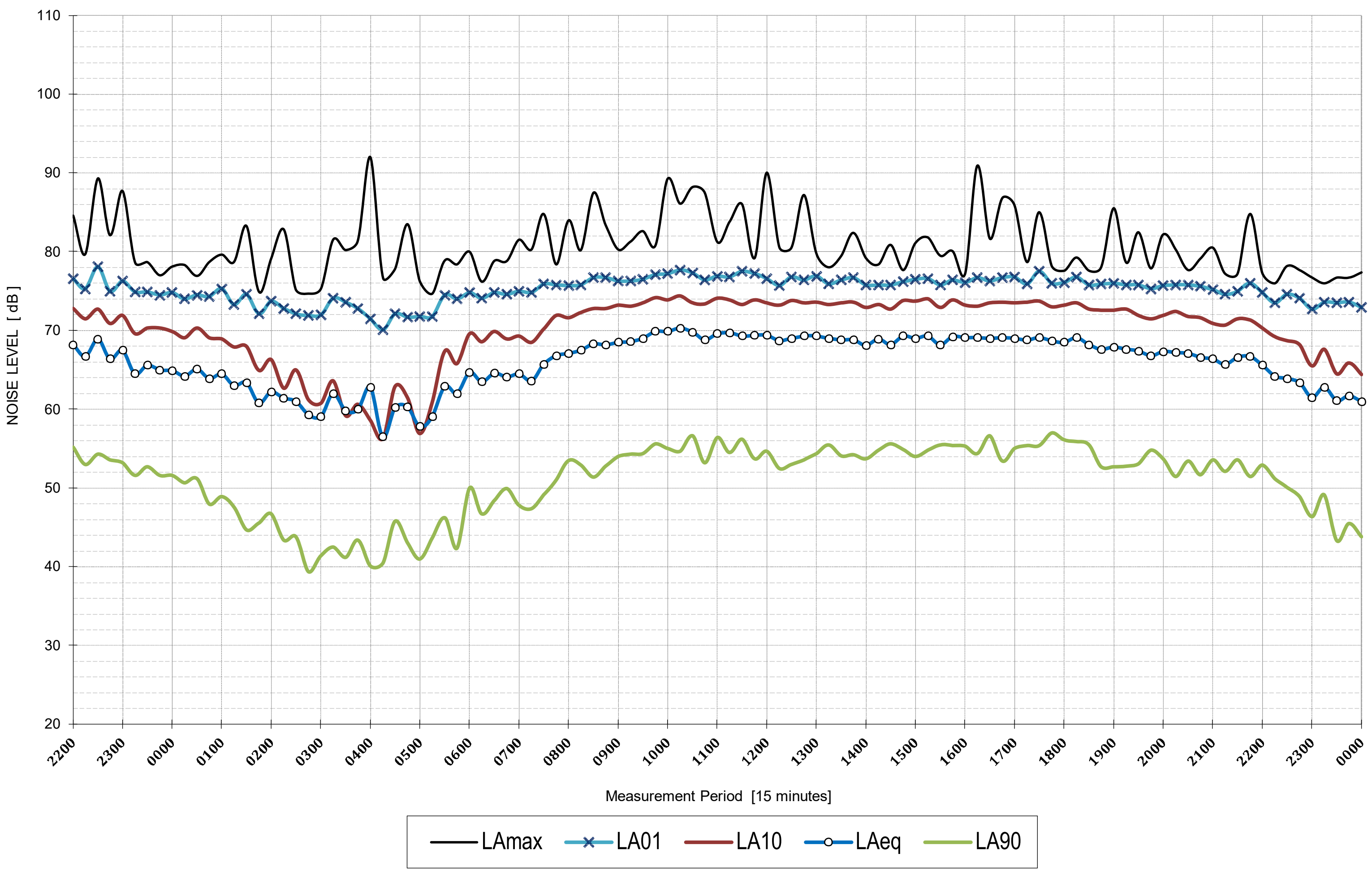
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	70	dB
LAeq 9 hours	2200-0700	64	dB
Max LAeq 1 hour	0700-2200	71	dB
Max LAeq 1 hour	2200-0700	66	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	24

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 6 LOGGER LOCATION: Schofields Road DATE: Sunday, 8 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	53	dB
LA90 Evening	1800-2200	52	dB
LA90 Night-time	2200-0800	41	dB
LAeq Daytime	0800-1800	69	dB
LAeq Evening	1800-2200	67	dB
LAeq Night-time	2200-0800	64	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	68	dB
LAeq 9 hours	2200-0700	64	dB
Max LAeq 1 hour	0700-2200	69	dB
Max LAeq 1 hour	2200-0700	66	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	23

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 7 LOGGER LOCATION: Schofields Road DATE: Monday, 9 December 2019

AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	52	dB
LA90 Night-time	2200-0700	38	dB
LAeq Daytime	0700-1800	70	dB
LAeq Evening	1800-2200	68	dB
LAeq Night-time	2200-0700	64	dB

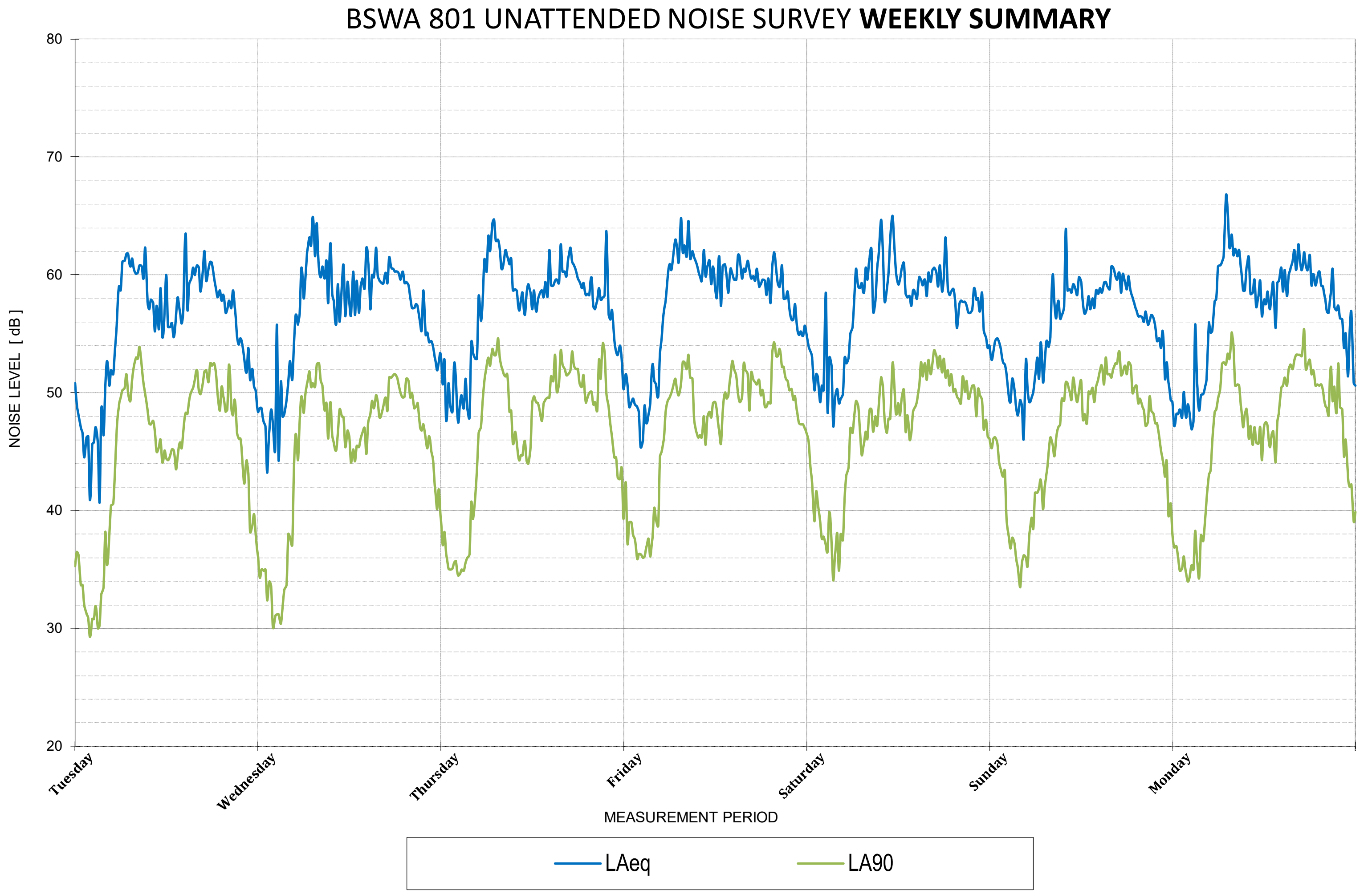
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	64	dB
Max LAeq 1 hour	0700-2200	70	dB
Max LAeq 1 hour	2200-0700	68	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	25

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

WEEKLY SUMMARY LOGGER LOCATION: Cudgegong Road (near Schofields Road) PERIOD: 3rd to the 9th December 2019



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	45	46	31
Day 2	45	47	31
Day 3	45	49	35
Day 4	46	49	36
Day 5	47	49	37
Day 6	47	47	36
Day 7	46	48	34
RBL	46	48	35

	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	59	58	55
Day 2	60	59	55
Day 3	60	59	56
Day 4	61	59	55
Day 5	60	58	55
Day 6	59	57	54
Day 7	61	59	55
Average	60	59	55

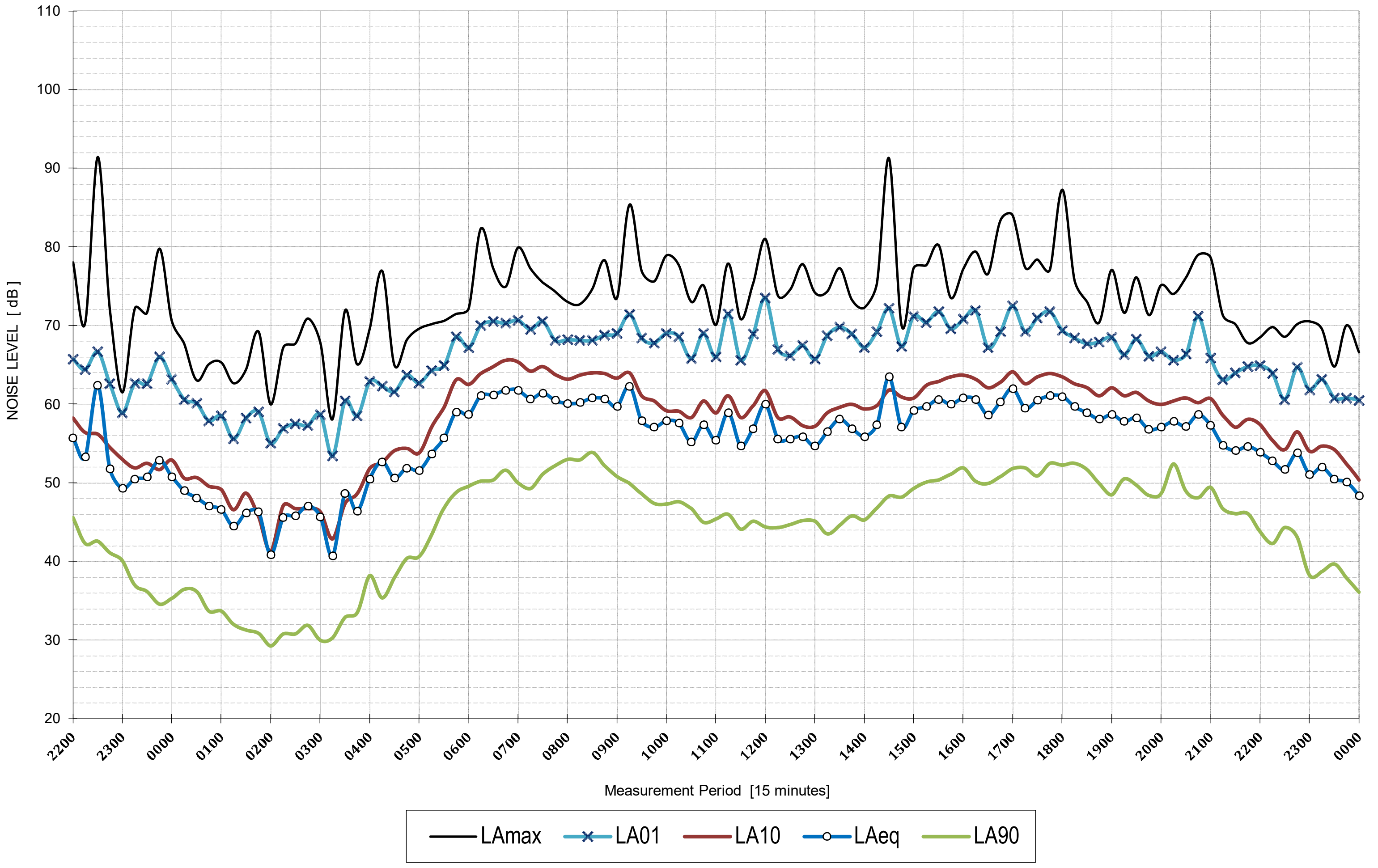
SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	60	dB
LAeq 9 hrs	2200-0700	55	dB
Max LAeq 1 hr	0700-2200	61	dB
Max LAeq 1 hr	2200-0700	58	dB

Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]	25

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 1 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Tuesday, 3 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	45	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0700	31	dB
LAeq Daytime	0700-1800	59	dB
LAeq Evening	1800-2200	58	dB
LAeq Night-time	2200-0700	55	dB

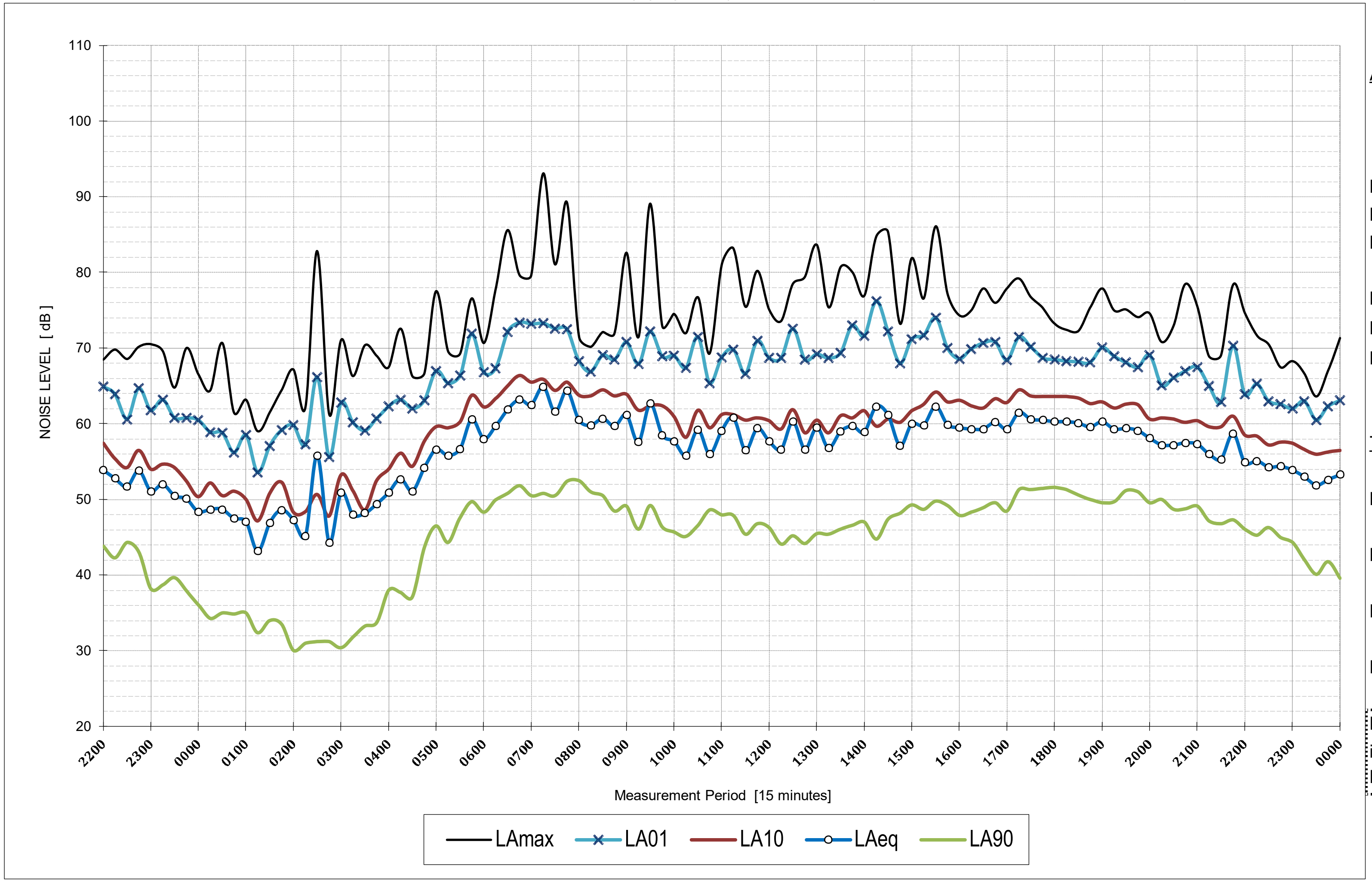
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	59	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	61	dB
Max LAeq 1 hour	2200-0700	58	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	29

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 2 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Wednesday, 4 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	45	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0700	31	dB
LAeq Daytime	0700-1800	60	dB
LAeq Evening	1800-2200	59	dB
LAeq Night-time	2200-0700	55	dB

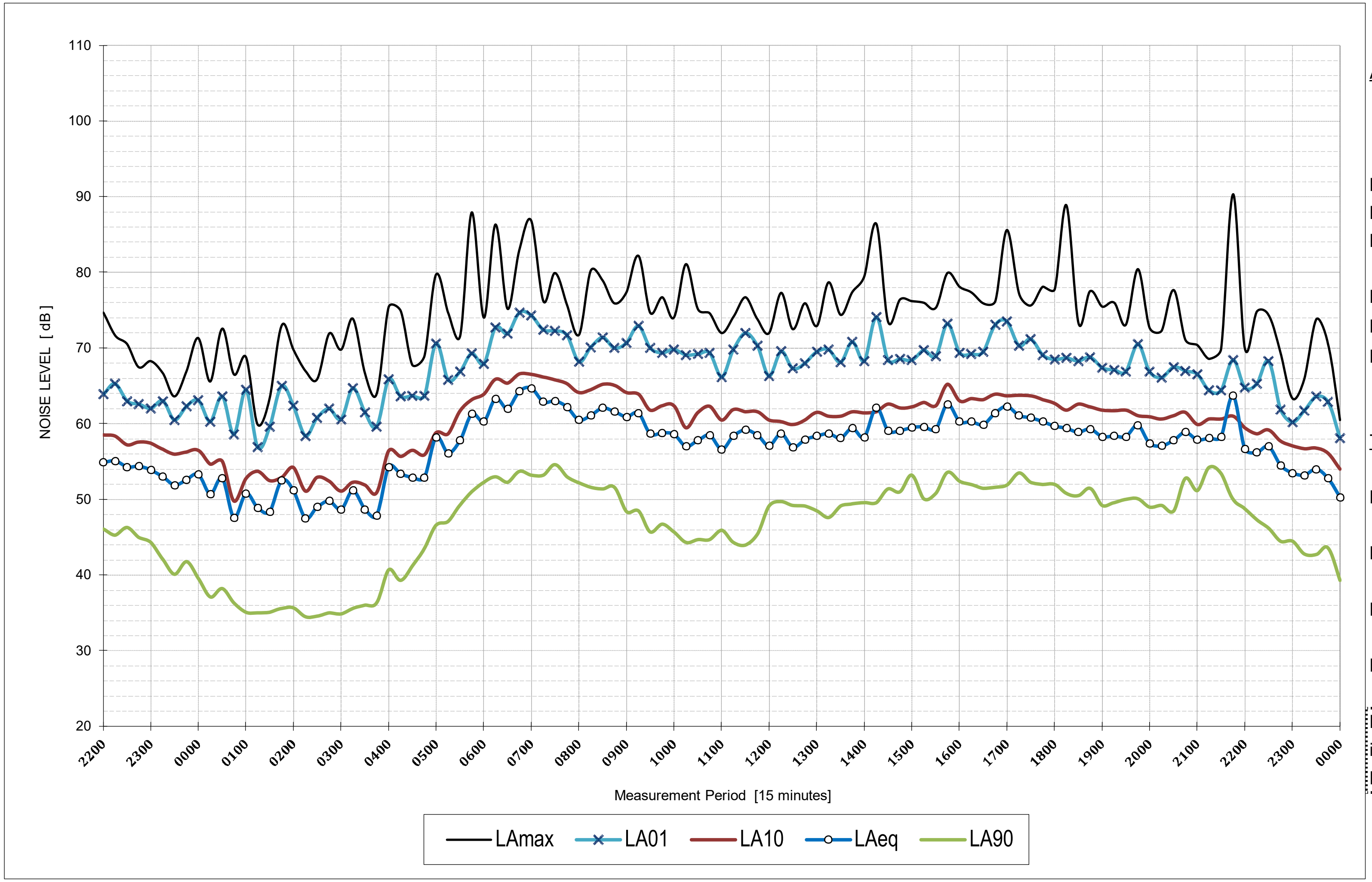
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	60	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	61	dB
Max LAeq 1 hour	2200-0700	58	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	28

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 3 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Thursday, 5 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	45	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	60	dB
LAeq Evening	1800-2200	59	dB
LAeq Night-time	2200-0700	56	dB

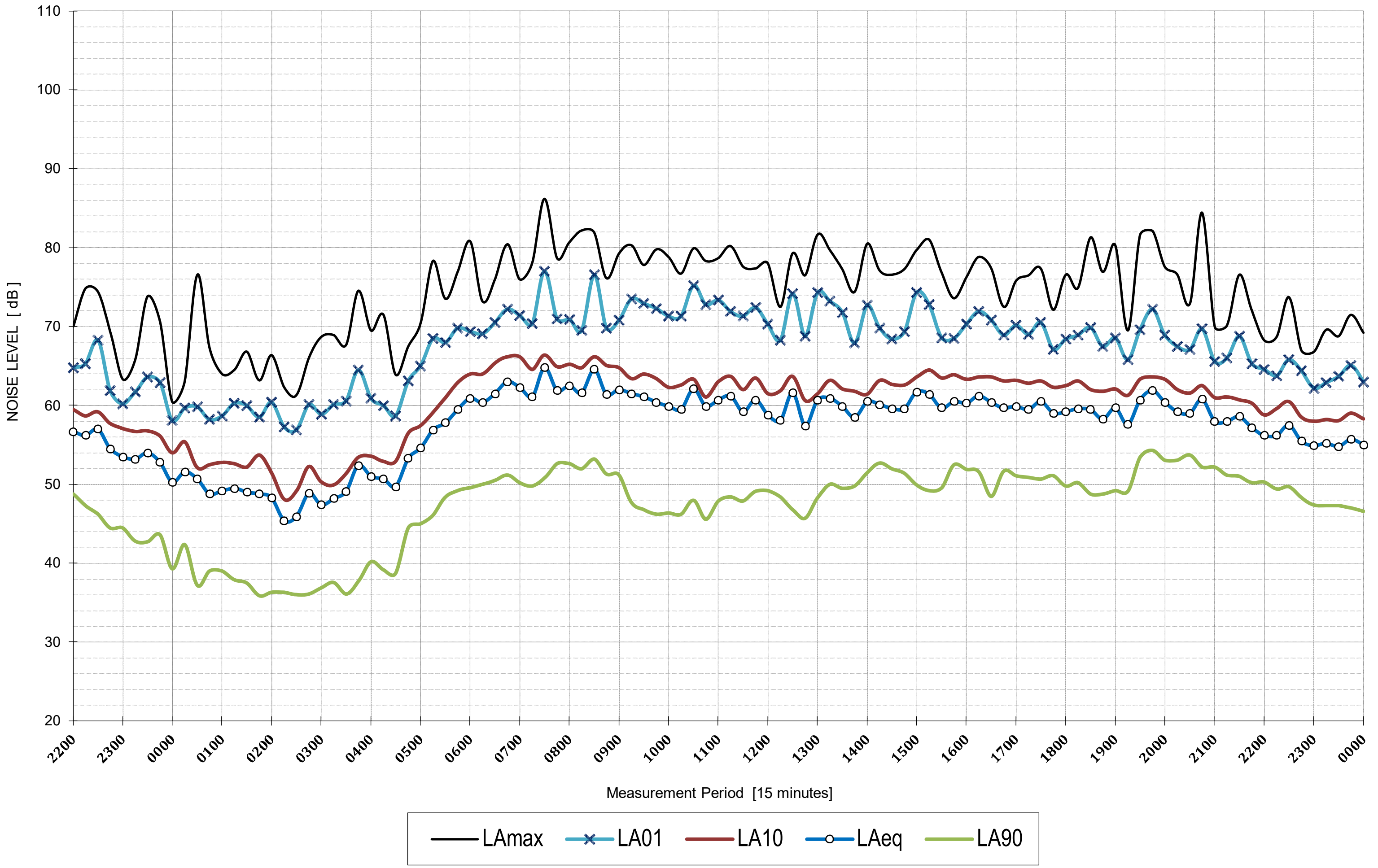
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	60	dB
LAeq 9 hours	2200-0700	56	dB
Max LAeq 1 hour	0700-2200	61	dB
Max LAeq 1 hour	2200-0700	59	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	25

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 4 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Friday, 6 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	46	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	61	dB
LAeq Evening	1800-2200	59	dB
LAeq Night-time	2200-0700	55	dB

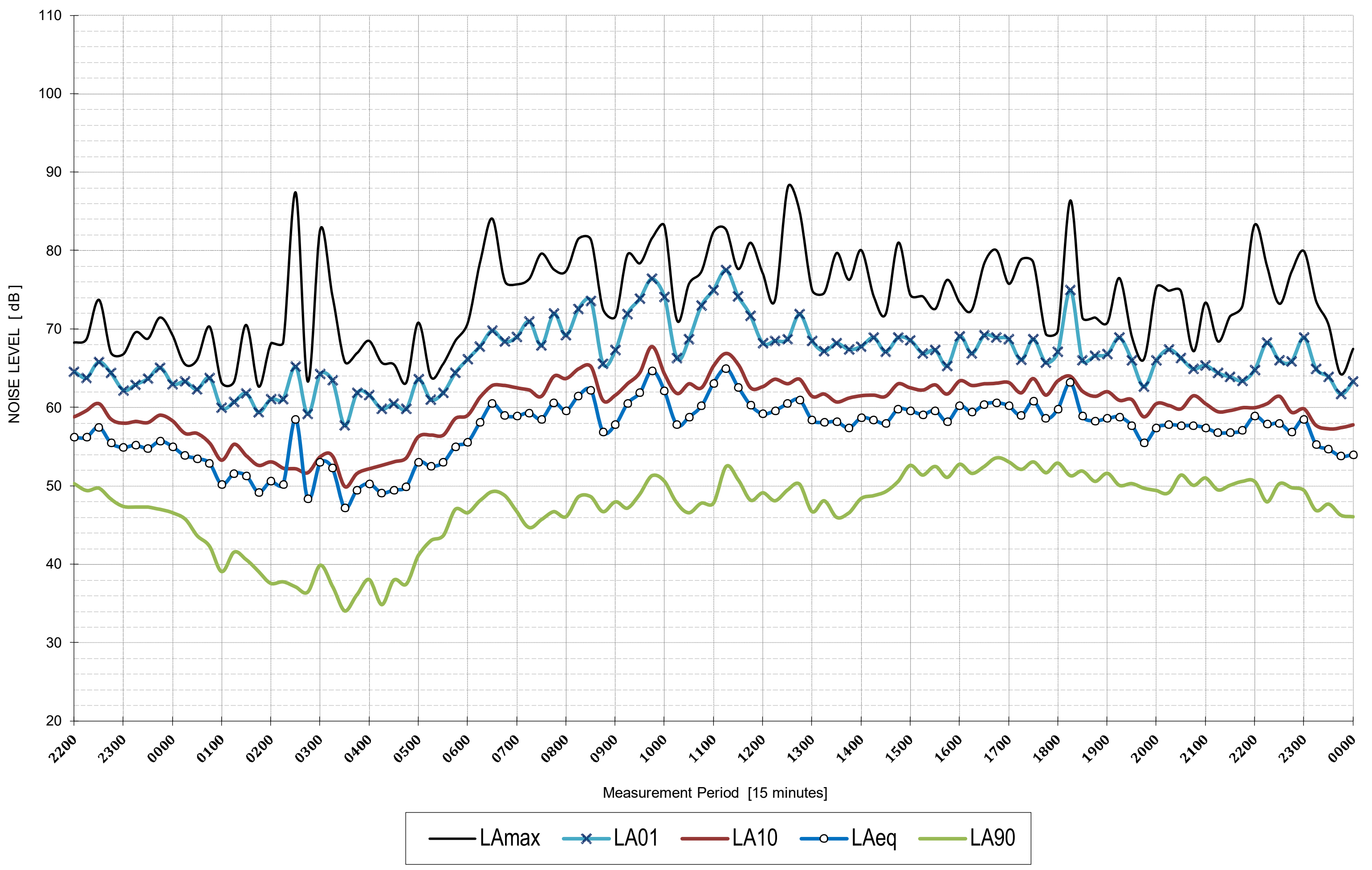
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	61	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	63	dB
Max LAeq 1 hour	2200-0700	59	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	24

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 5 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Saturday, 7 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	47	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	37	dB
LAeq Daytime	0700-1800	60	dB
LAeq Evening	1800-2200	58	dB
LAeq Night-time	2200-0700	55	dB

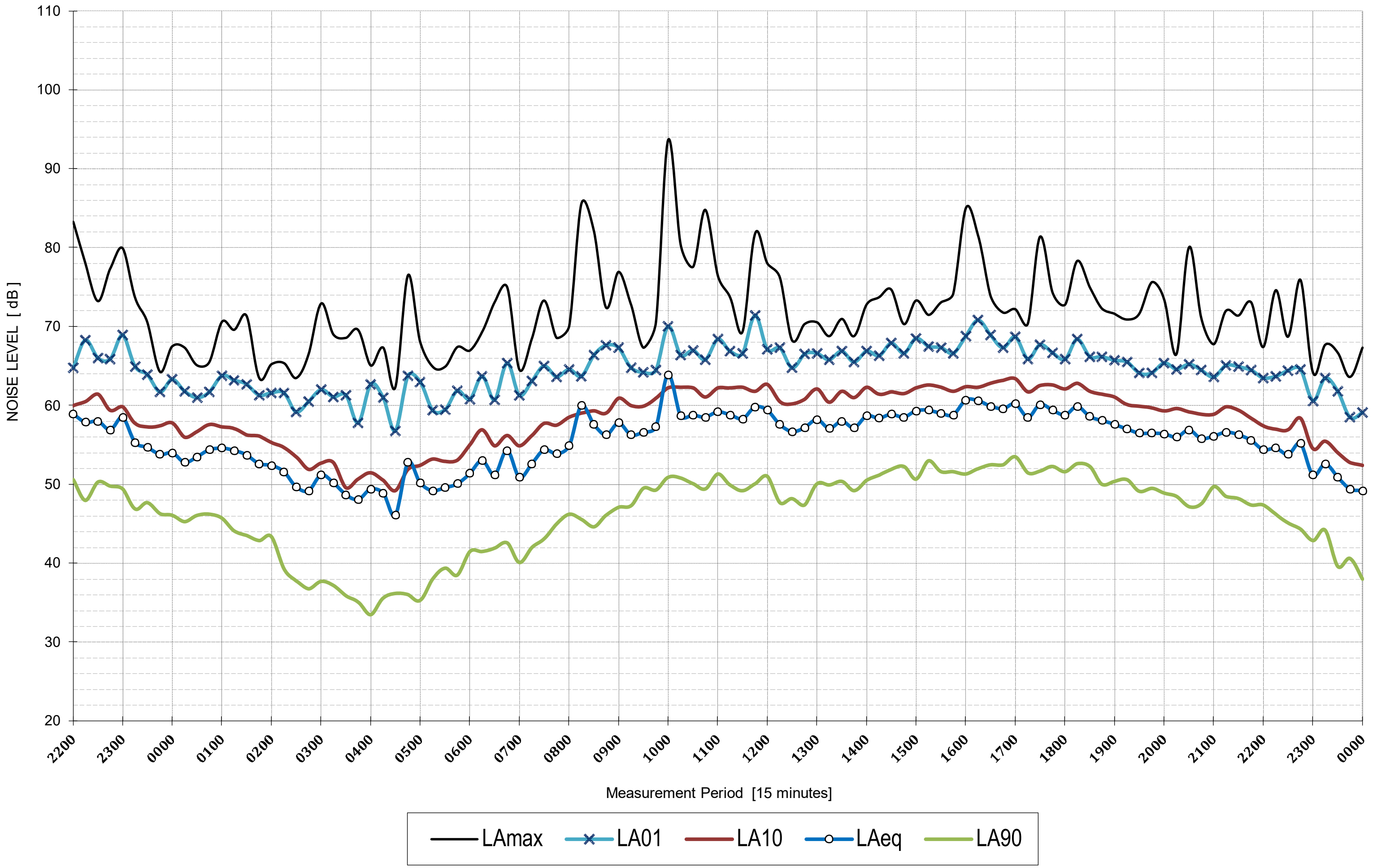
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	60	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	62	dB
Max LAeq 1 hour	2200-0700	56	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	19

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 6 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Sunday, 8 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	47	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0800	36	dB
LAeq Daytime	0800-1800	59	dB
LAeq Evening	1800-2200	57	dB
LAeq Night-time	2200-0800	54	dB

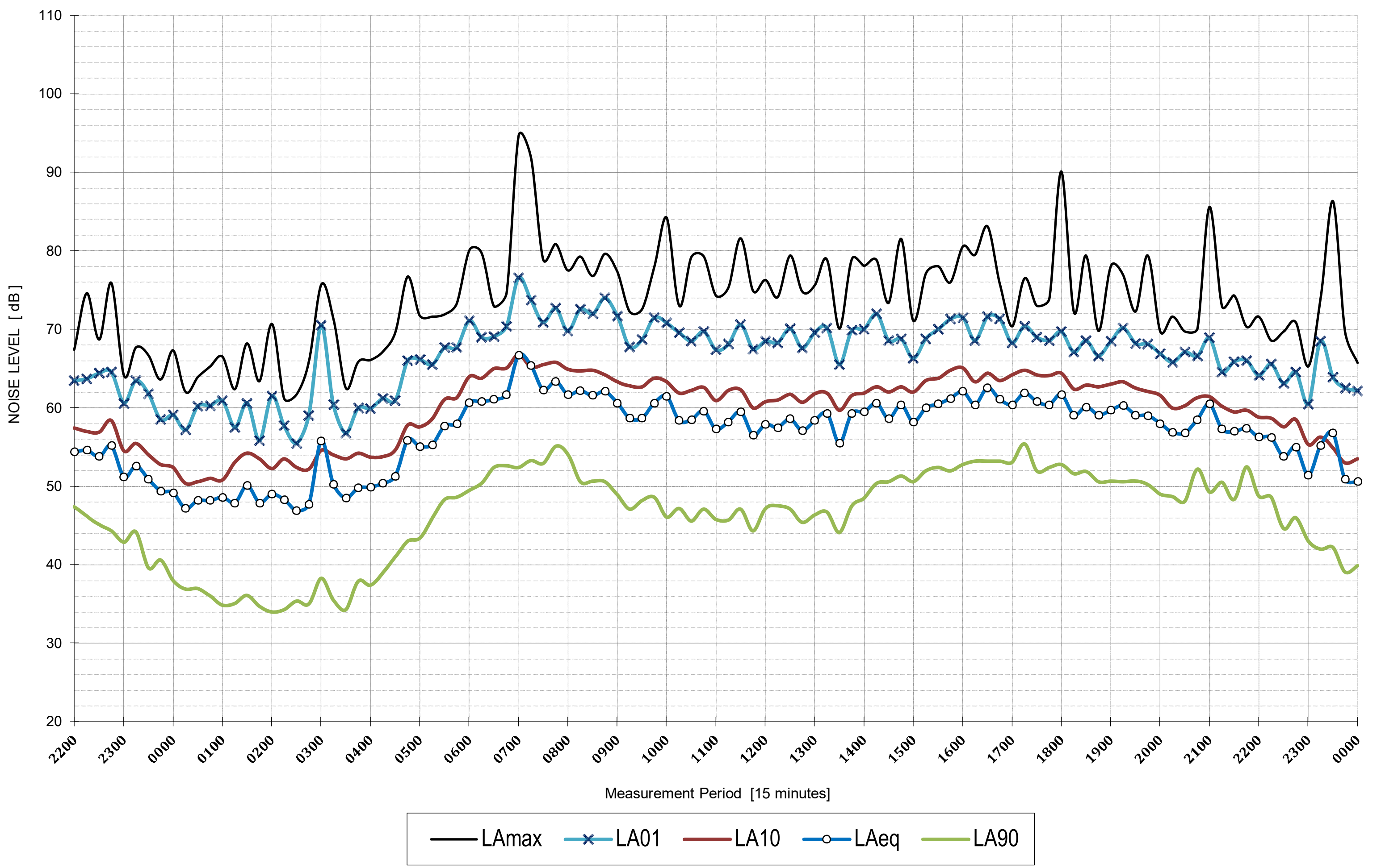
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	58	dB
LAeq 9 hours	2200-0700	54	dB
Max LAeq 1 hour	0700-2200	60	dB
Max LAeq 1 hour	2200-0700	56	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	27

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 7 LOGGER LOCATION: Cudgegong Road (near Schofields Road) DATE: Monday, 9 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	46	dB
LA90 Evening	1800-2200	48	dB
LA90 Night-time	2200-0700	34	dB
LAeq Daytime	0700-1800	61	dB
LAeq Evening	1800-2200	59	dB
LAeq Night-time	2200-0700	55	dB

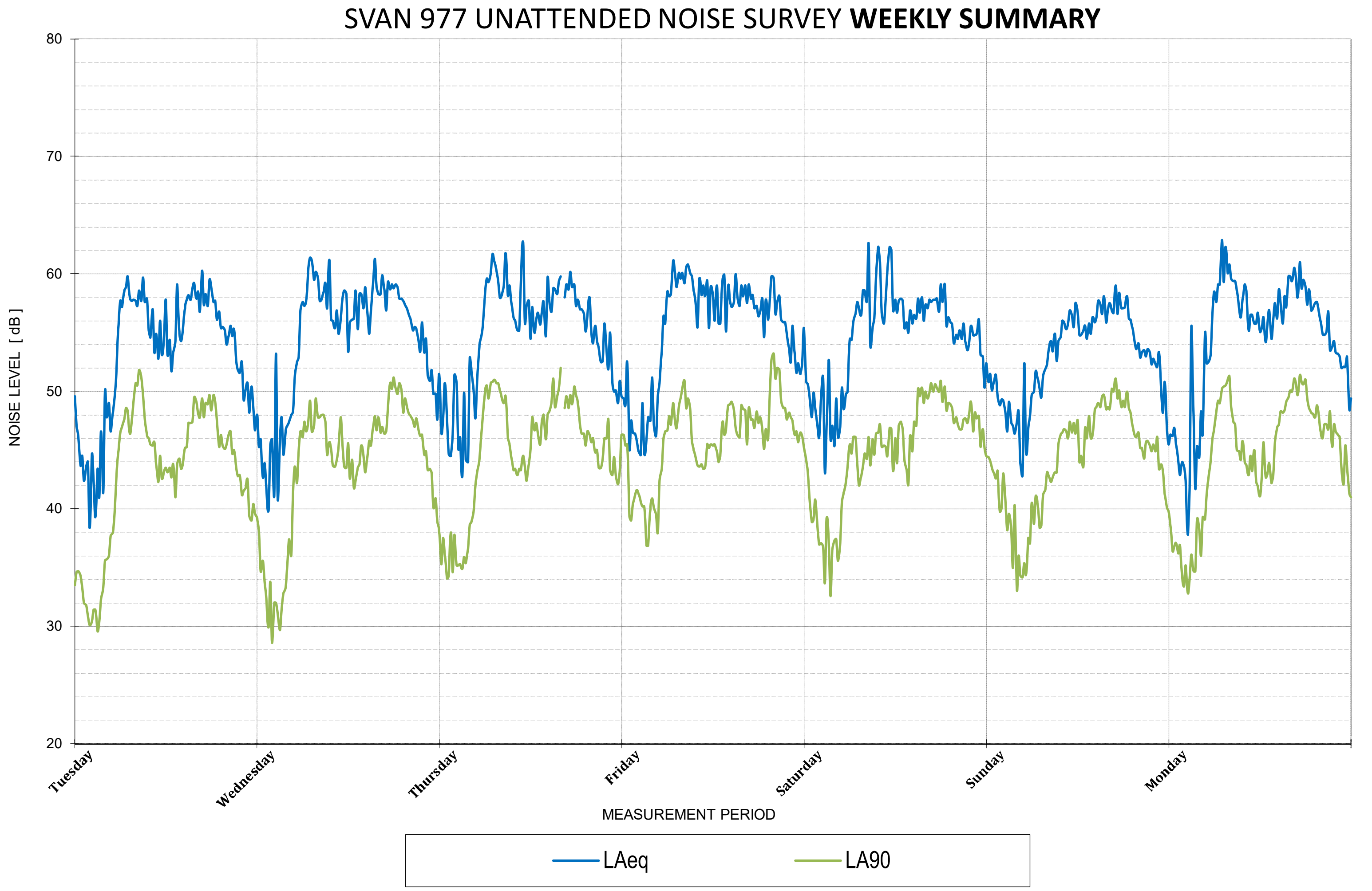
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	60	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	62	dB
Max LAeq 1 hour	2200-0700	58	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	24

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

WEEKLY SUMMARY LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) PERIOD: 3rd to the 9th December 2019



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	43	43	31
Day 2	44	47	31
Day 3	43	44	35
Day 4	44	46	39
Day 5	43	47	37
Day 6	43	45	35
Day 7	43	46	35
RBL	43	46	35

	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	57	56	51
Day 2	58	57	52
Day 3	59	56	53
Day 4	59	57	53
Day 5	58	56	52
Day 6	56	55	51
Day 7	58	57	52
Average	58	56	52

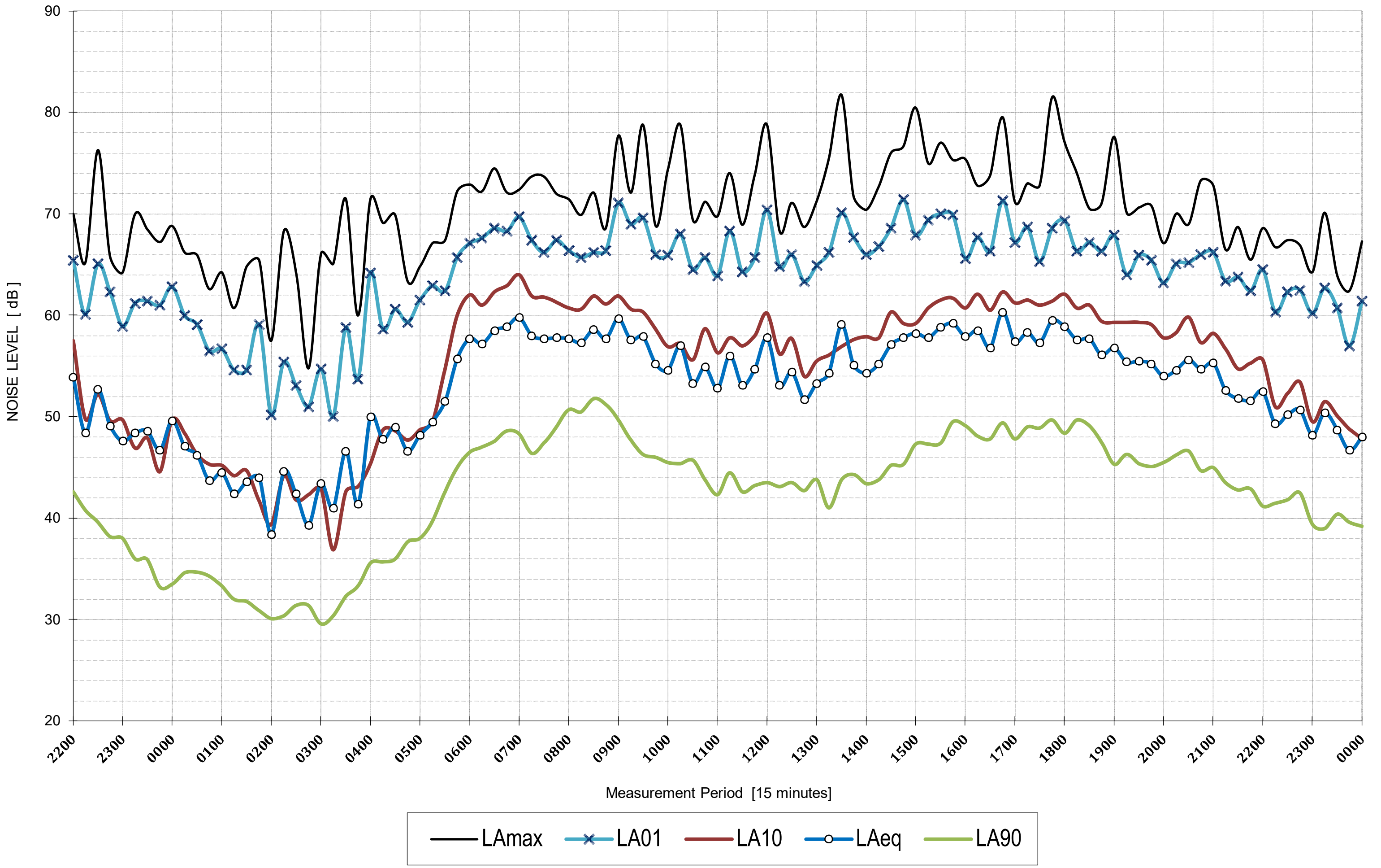
SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	58	dB
LAeq 9 hrs	2200-0700	52	dB
Max LAeq 1 hr	0700-2200	60	dB
Max LAeq 1 hr	2200-0700	55	dB

Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]	29

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 1 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Tuesday, 3 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	43	dB
LA90 Evening	1800-2200	43	dB
LA90 Night-time	2200-0700	31	dB
LAeq Daytime	0700-1800	57	dB
LAeq Evening	1800-2200	56	dB
LAeq Night-time	2200-0700	51	dB

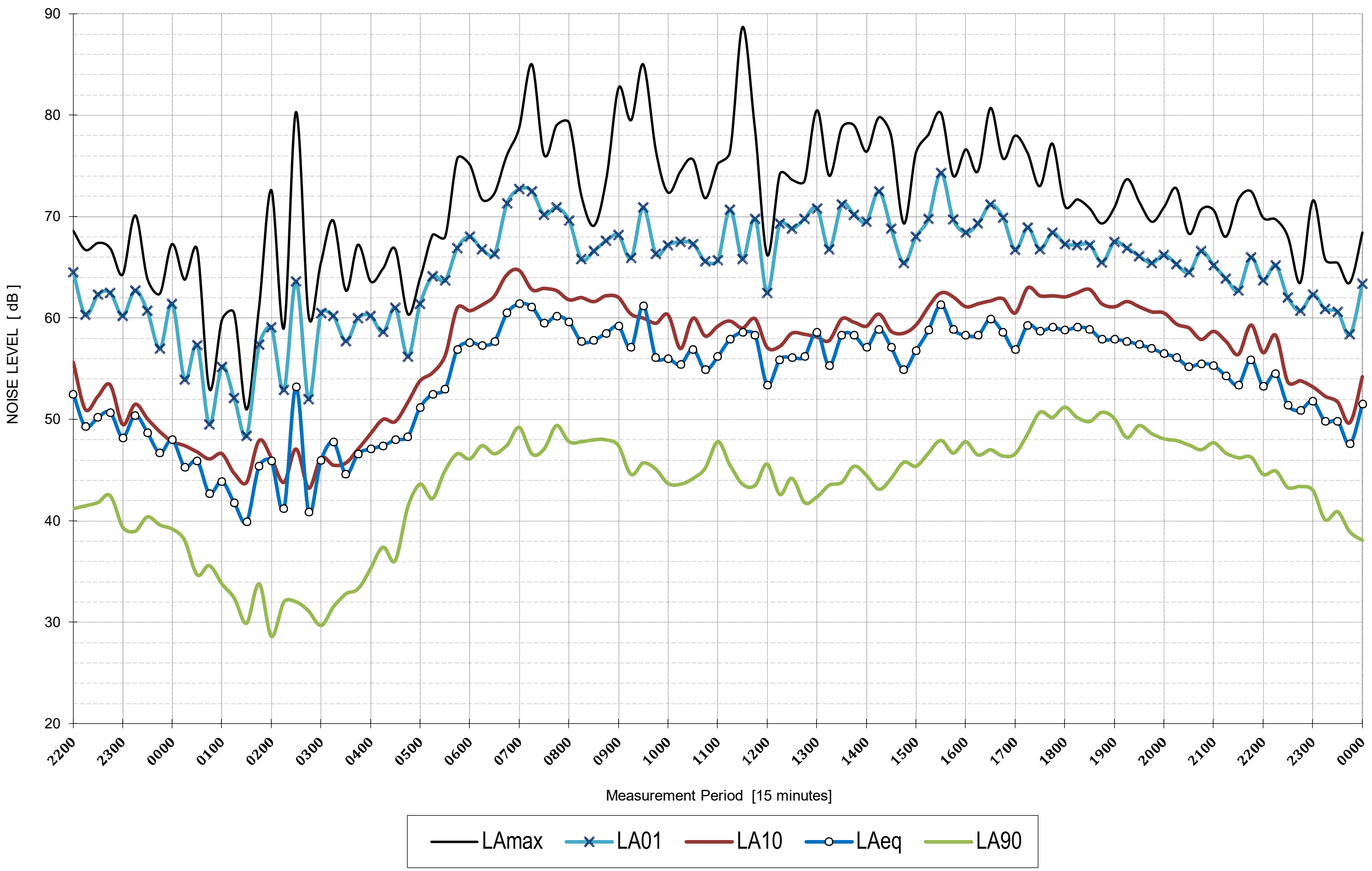
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	57	dB
LAeq 9 hours	2200-0700	51	dB
Max LAeq 1 hour	0700-2200	58	dB
Max LAeq 1 hour	2200-0700	54	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	35

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 2 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Wednesday, 4 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	44	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0700	31	dB
LAeq Daytime	0700-1800	58	dB
LAeq Evening	1800-2200	57	dB
LAeq Night-time	2200-0700	52	dB

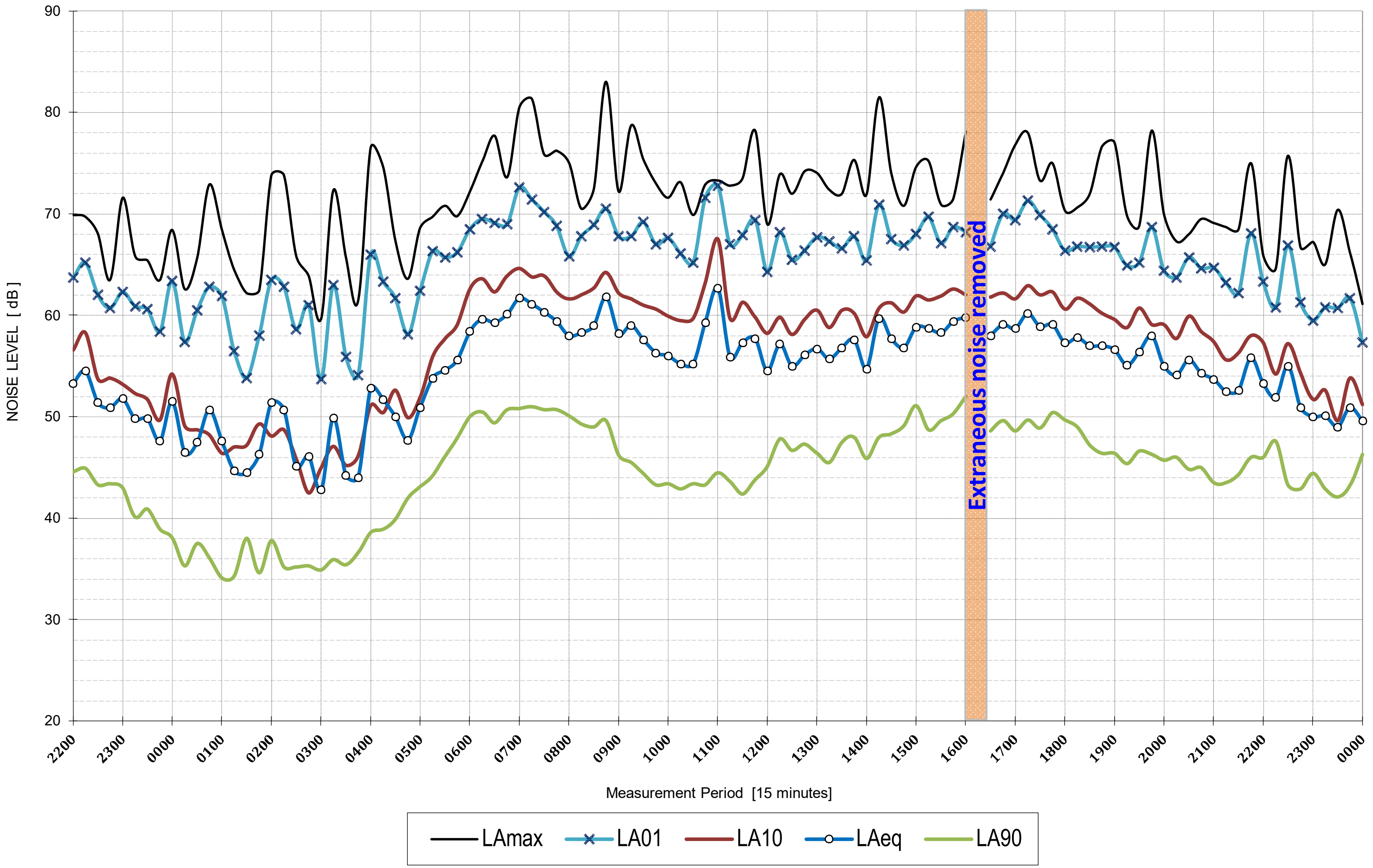
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	58	dB
LAeq 9 hours	2200-0700	52	dB
Max LAeq 1 hour	0700-2200	59	dB
Max LAeq 1 hour	2200-0700	55	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	30

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 3 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Thursday, 5 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	43	dB
LA90 Evening	1800-2200	44	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	59	dB
LAeq Evening	1800-2200	56	dB
LAeq Night-time	2200-0700	53	dB

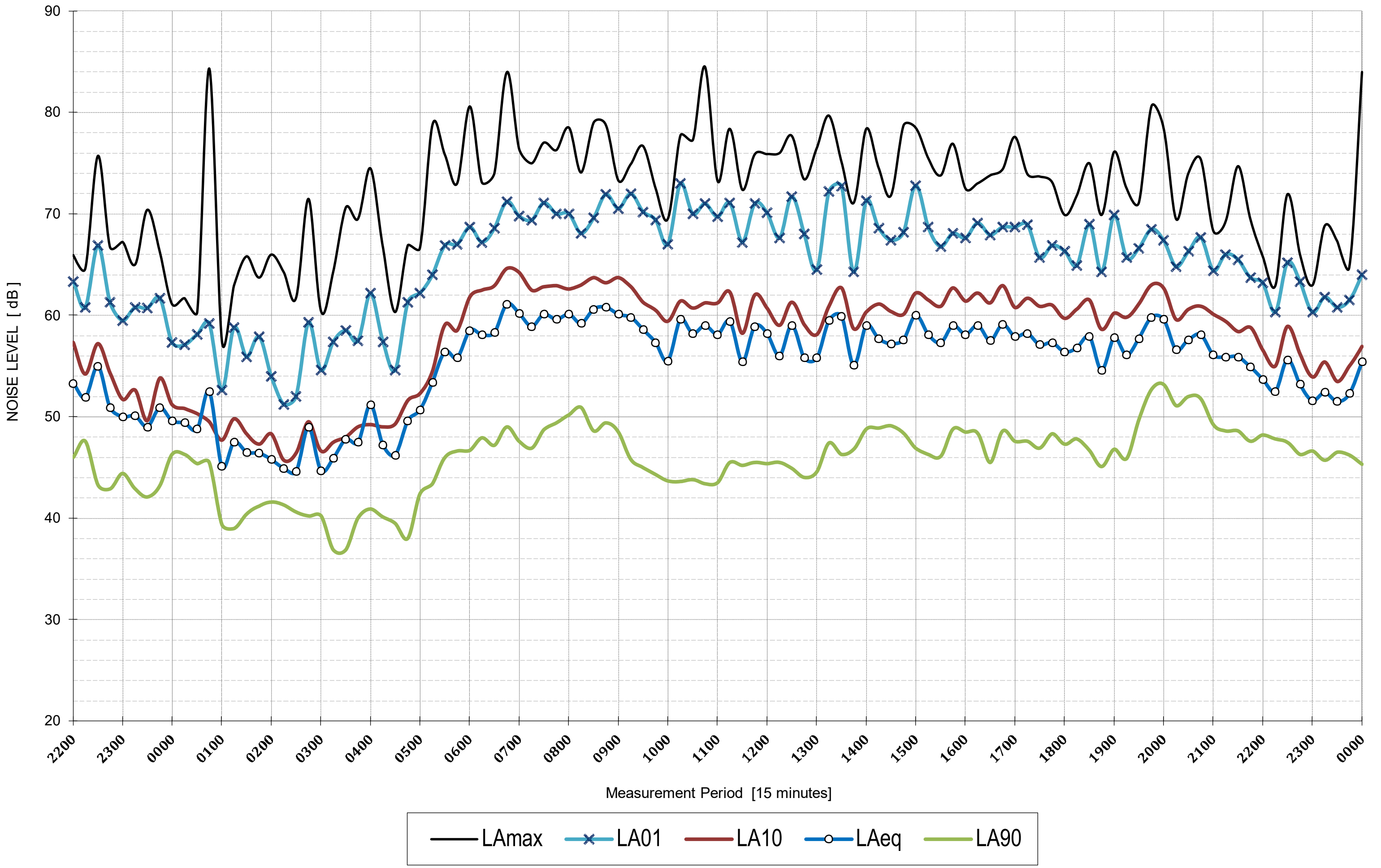
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	58	dB
LAeq 9 hours	2200-0700	53	dB
Max LAeq 1 hour	0700-2200	60	dB
Max LAeq 1 hour	2200-0700	56	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	32

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 4 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Friday, 6 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	44	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0700	39	dB
LAeq Daytime	0700-1800	59	dB
LAeq Evening	1800-2200	57	dB
LAeq Night-time	2200-0700	53	dB

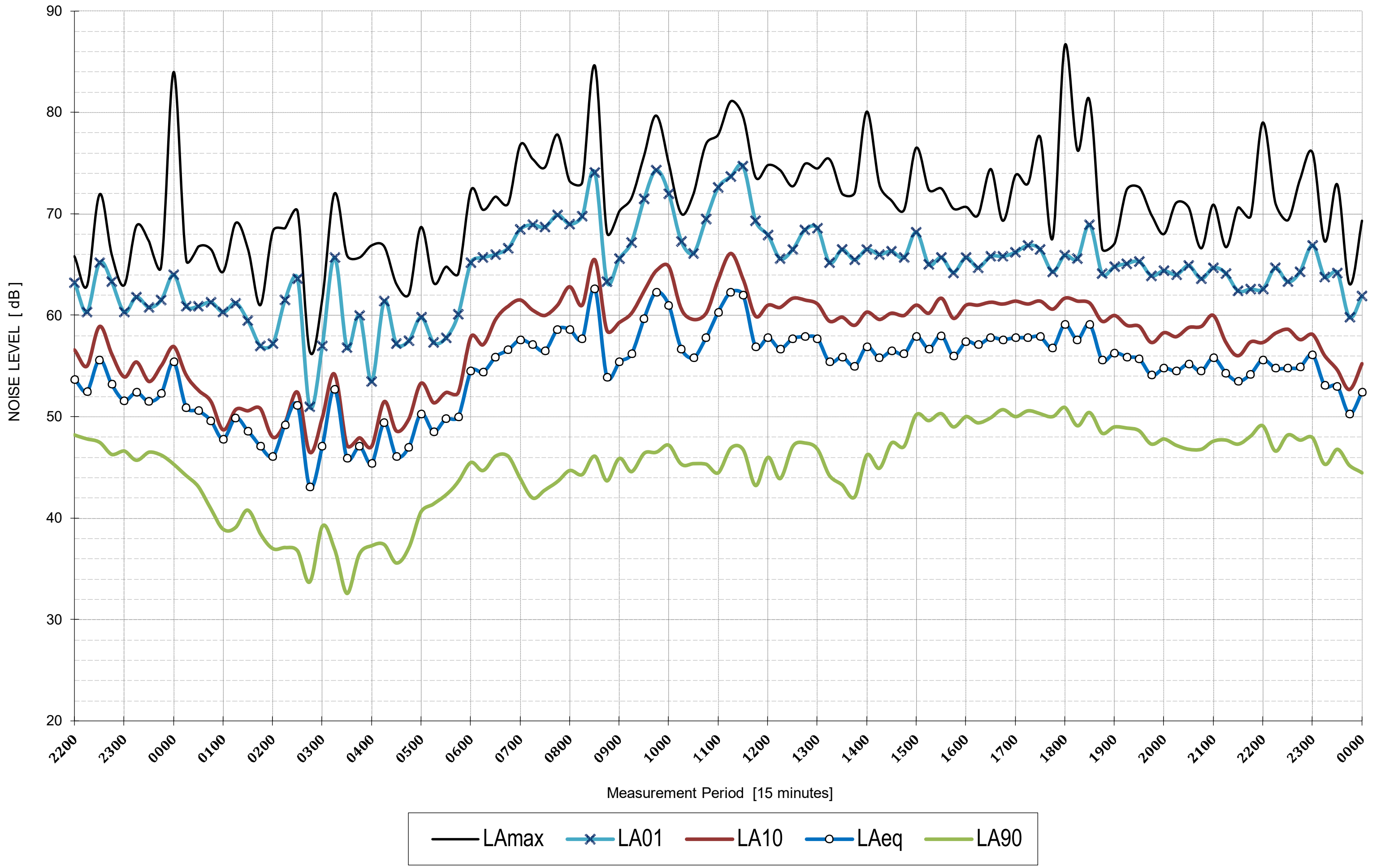
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	58	dB
LAeq 9 hours	2200-0700	53	dB
Max LAeq 1 hour	0700-2200	60	dB
Max LAeq 1 hour	2200-0700	56	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	28

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 5 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Saturday, 7 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	43	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0700	37	dB
LAeq Daytime	0700-1800	58	dB
LAeq Evening	1800-2200	56	dB
LAeq Night-time	2200-0700	52	dB

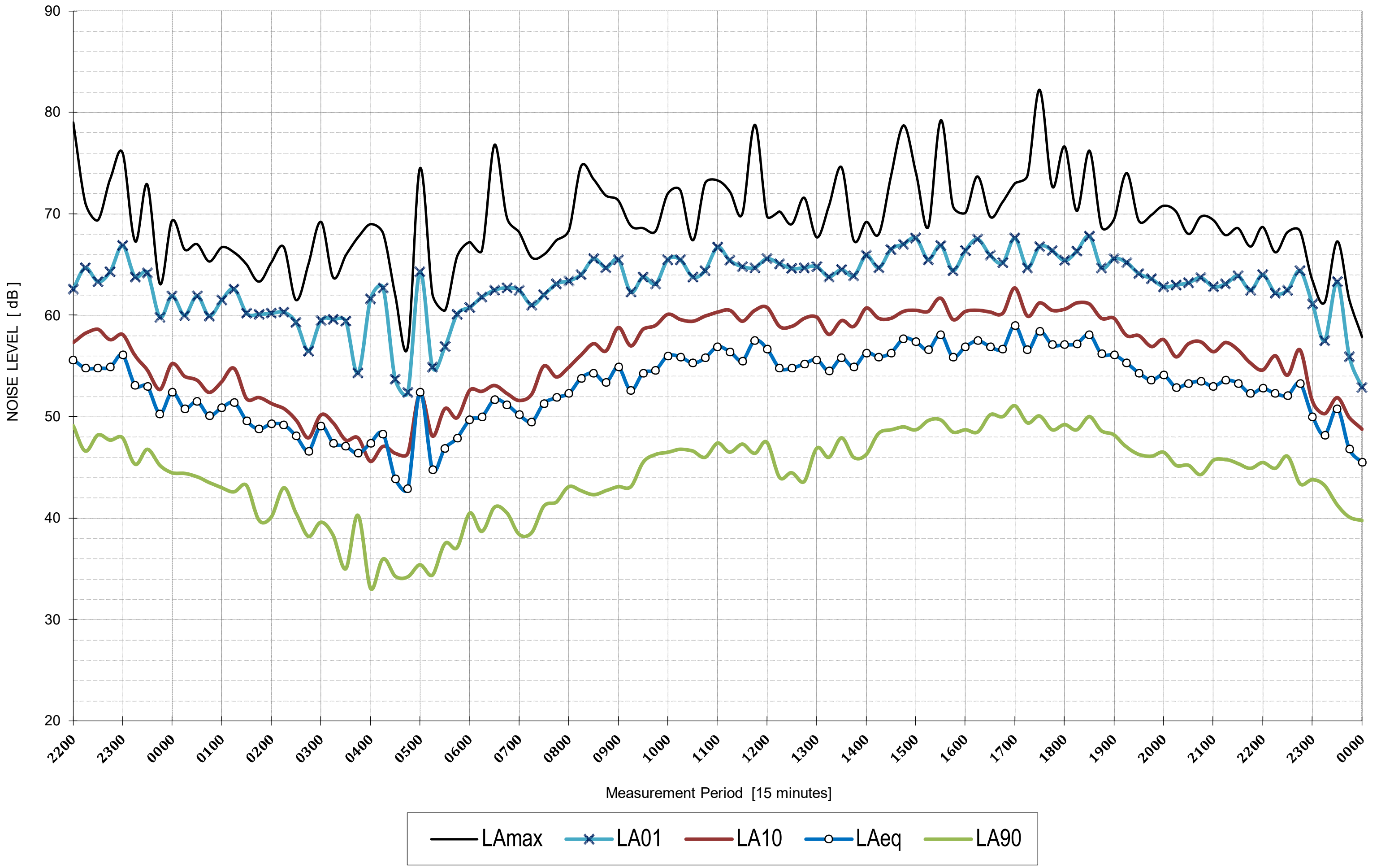
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	58	dB
LAeq 9 hours	2200-0700	52	dB
Max LAeq 1 hour	0700-2200	60	dB
Max LAeq 1 hour	2200-0700	53	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	24

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 6 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Sunday, 8 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	43	dB
LA90 Evening	1800-2200	45	dB
LA90 Night-time	2200-0800	35	dB
LAeq Daytime	0800-1800	56	dB
LAeq Evening	1800-2200	55	dB
LAeq Night-time	2200-0800	51	dB

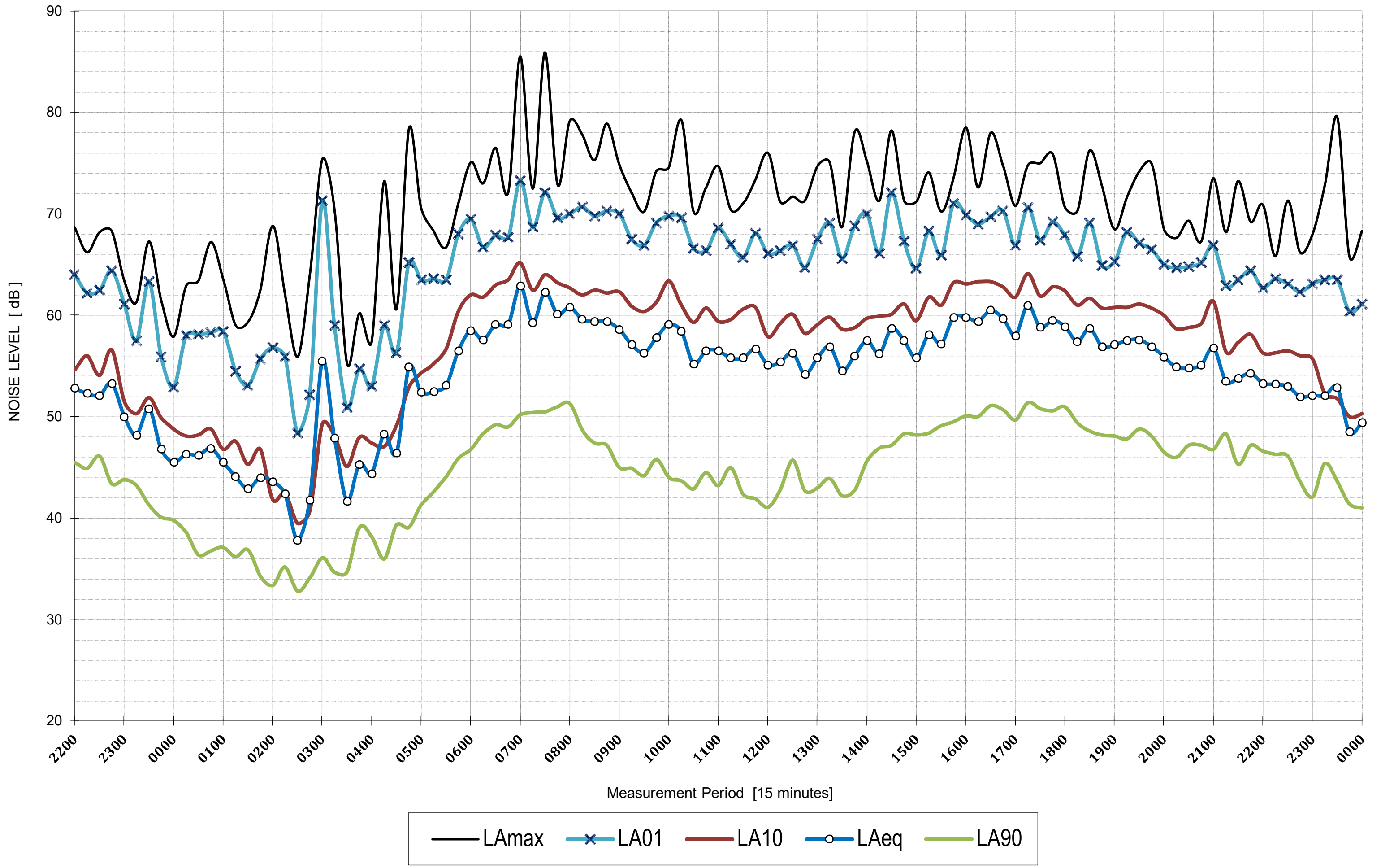
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	56	dB
LAeq 9 hours	2200-0700	51	dB
Max LAeq 1 hour	0700-2200	57	dB
Max LAeq 1 hour	2200-0700	54	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	28

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 7 LOGGER LOCATION: Cudgegong Road (near Themeda Avenue) DATE: Monday, 9 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	43	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	58	dB
LAeq Evening	1800-2200	57	dB
LAeq Night-time	2200-0700	52	dB

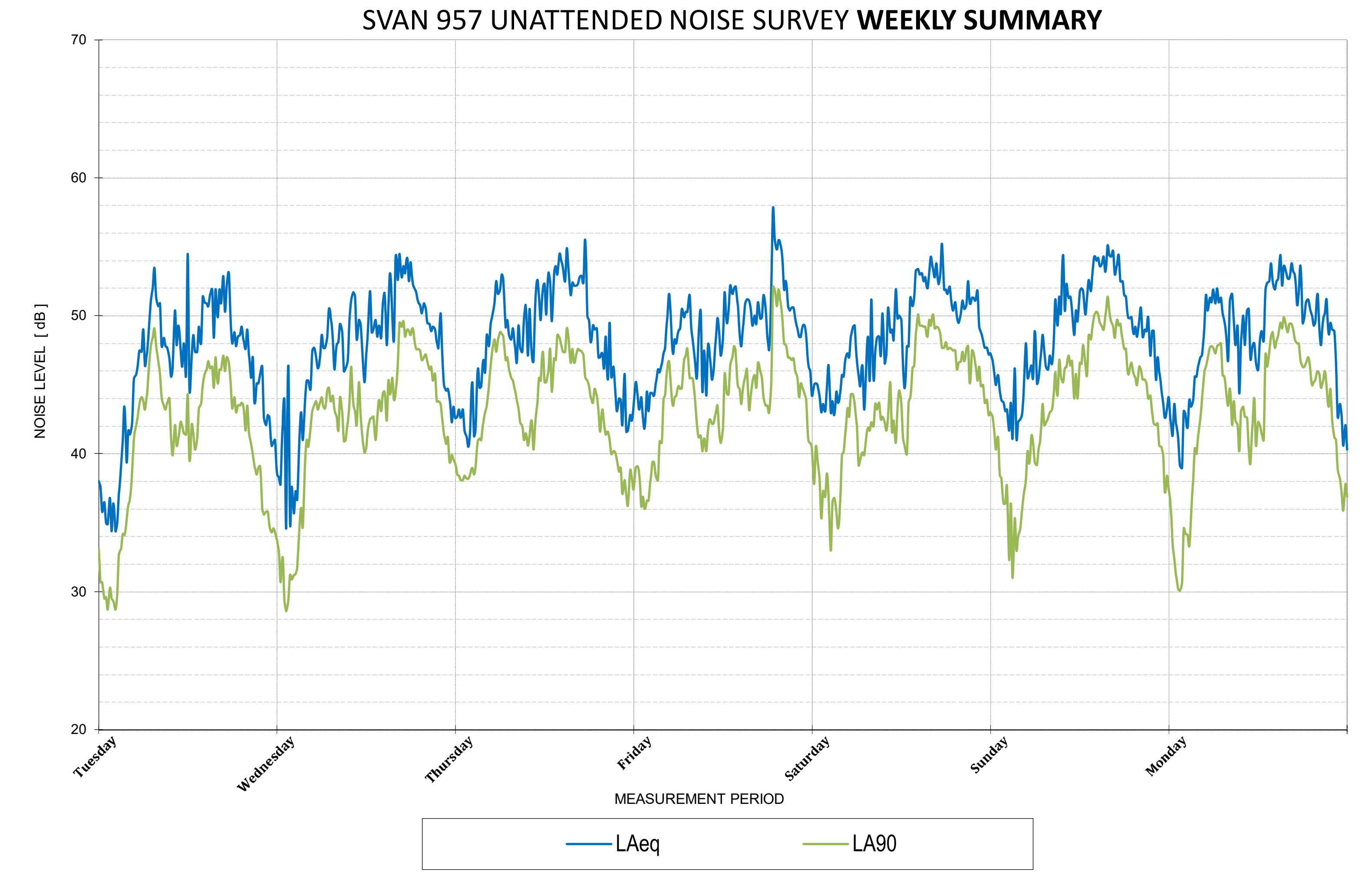
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	58	dB
LAeq 9 hours	2200-0700	52	dB
Max LAeq 1 hour	0700-2200	60	dB
Max LAeq 1 hour	2200-0700	55	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	23

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

WEEKLY SUMMARY   LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station)   PERIOD: 3rd to the 9th December 2019



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	41	39	29
Day 2	41	45	31
Day 3	41	40	38
Day 4	41	44	36
Day 5	41	46	36
Day 6	44	44	34
Day 7	41	44	31
RBL	41	44	34

	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	50	47	43
Day 2	51	51	44
Day 3	52	48	48
Day 4	50	53	47
Day 5	51	51	47
Day 6	52	50	47
Day 7	51	50	47
Average	51	50	46

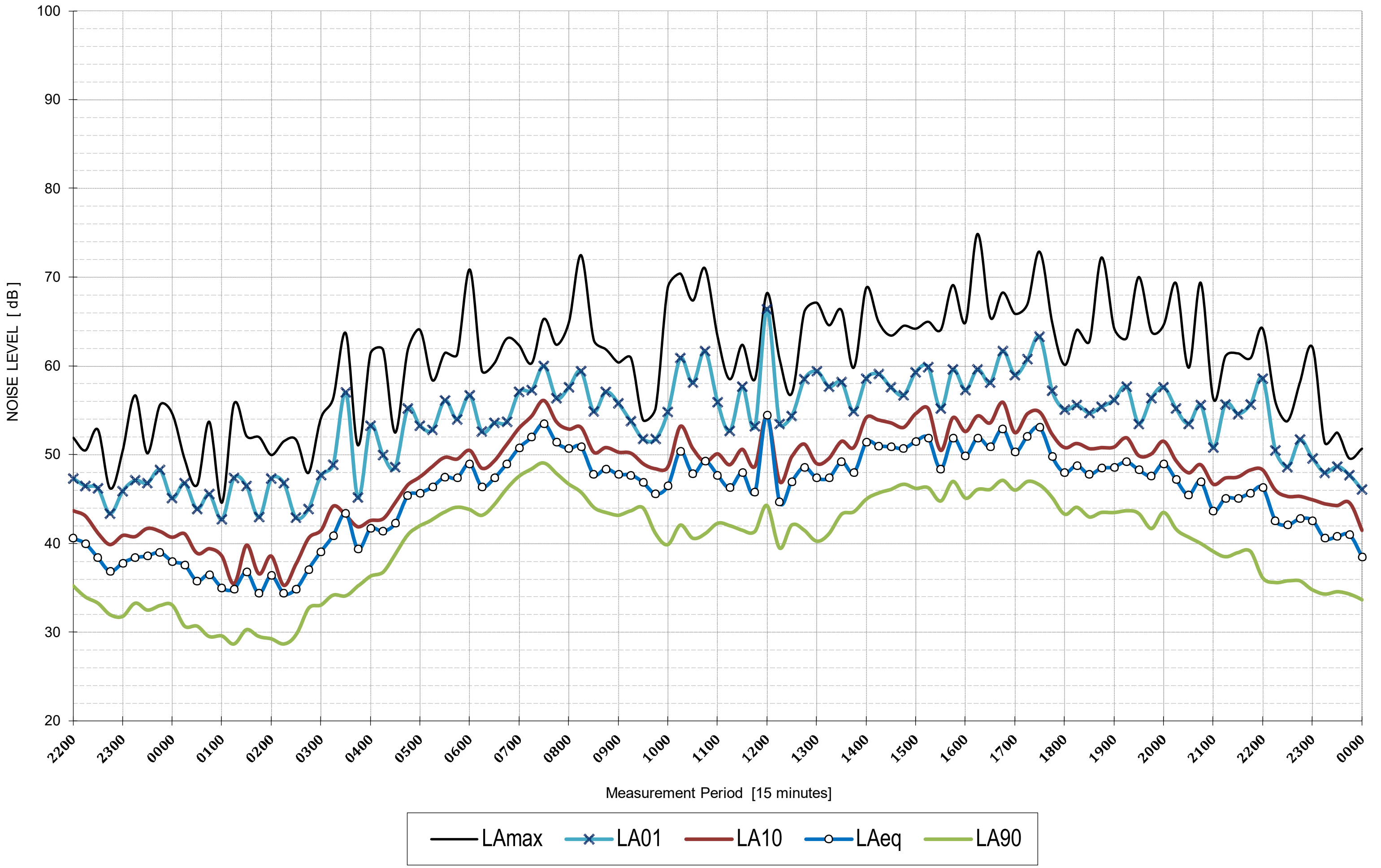
SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	51	dB
LAeq 9 hrs	2200-0700	46	dB
Max LAeq 1 hr	0700-2200	53	dB
Max LAeq 1 hr	2200-0700	49	dB

Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]	14

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 1 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Tuesday, 3 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	41	dB
LA90 Evening	1800-2200	39	dB
LA90 Night-time	2200-0700	29	dB
LAeq Daytime	0700-1800	50	dB
LAeq Evening	1800-2200	47	dB
LAeq Night-time	2200-0700	43	dB

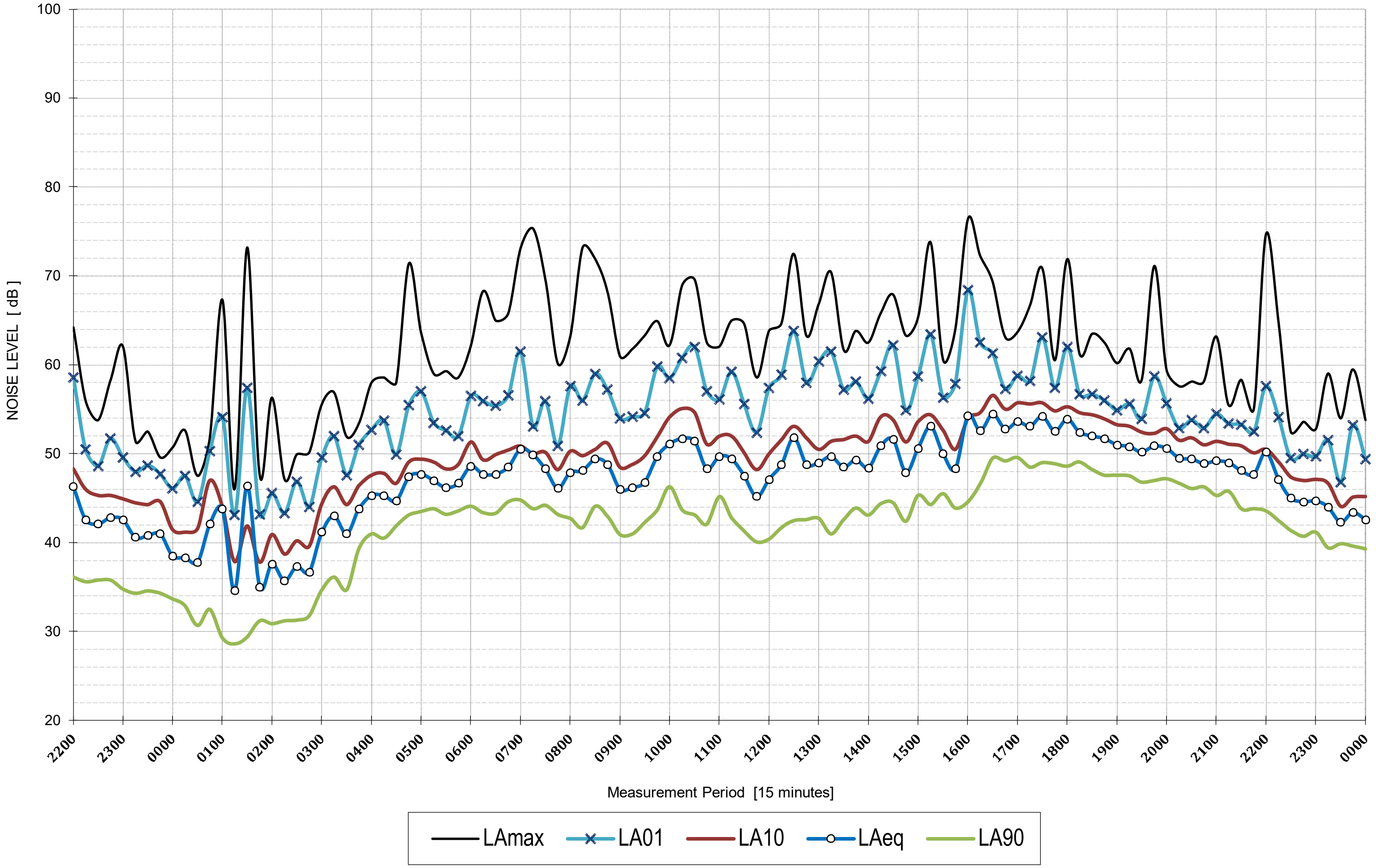
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	50	dB
LAeq 9 hours	2200-0700	43	dB
Max LAeq 1 hour	0700-2200	52	dB
Max LAeq 1 hour	2200-0700	47	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	17

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 2 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Wednesday, 4 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	41	dB
LA90 Evening	1800-2200	45	dB
LA90 Night-time	2200-0700	31	dB
LAeq Daytime	0700-1800	51	dB
LAeq Evening	1800-2200	51	dB
LAeq Night-time	2200-0700	44	dB

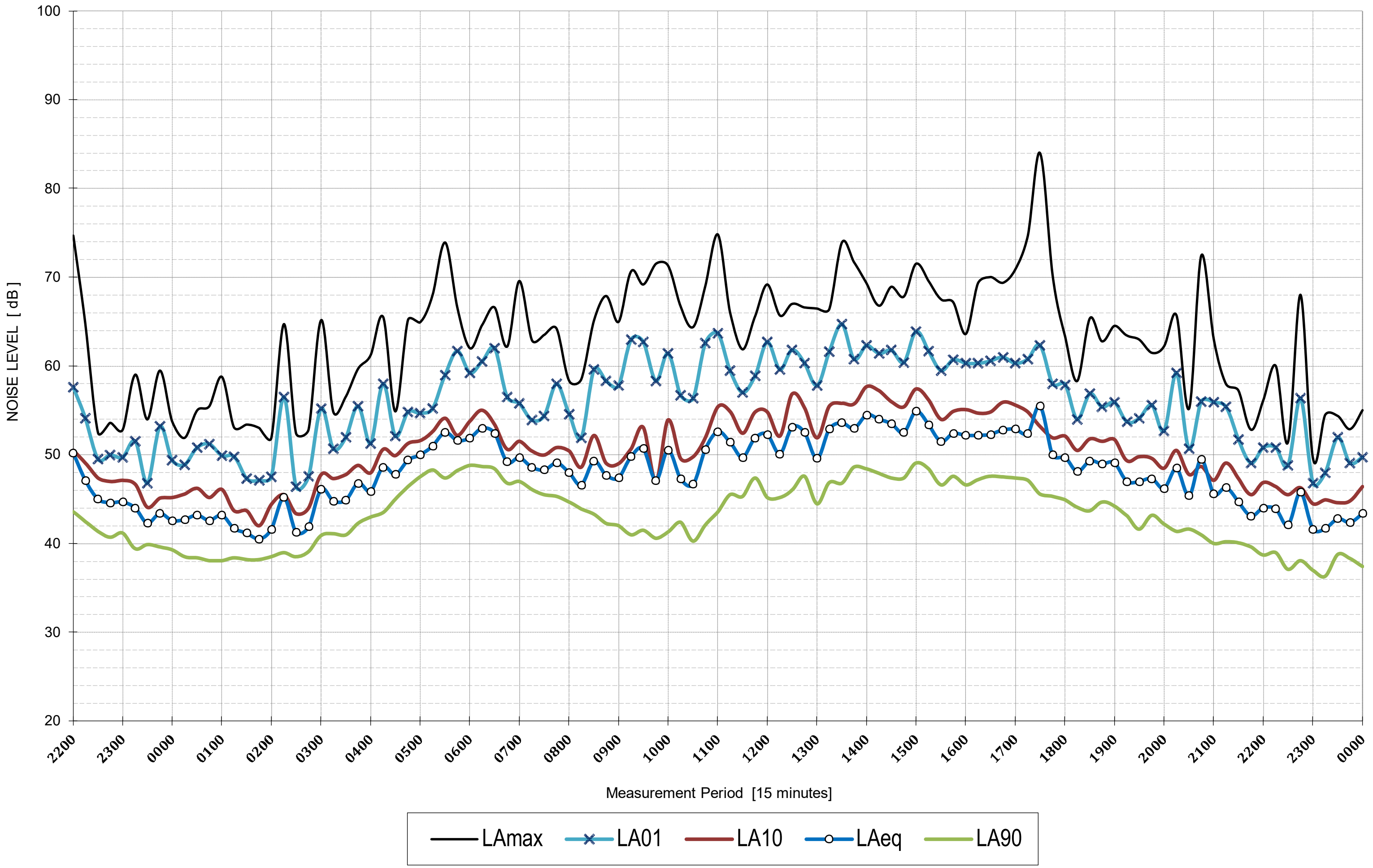
TRAFFIC & MISC. NOISE METRICS

Descriptor	Period	Level	Units
LAeq 15 hours	0700-2200	51	dB
LAeq 9 hours	2200-0700	44	dB
Max LAeq 1 hour	0700-2200	53	dB
Max LAeq 1 hour	2200-0700	47	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	11

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 3 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Thursday, 5 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	41	dB
LA90 Evening	1800-2200	40	dB
LA90 Night-time	2200-0700	38	dB
LAeq Daytime	0700-1800	52	dB
LAeq Evening	1800-2200	48	dB
LAeq Night-time	2200-0700	48	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	51	dB
LAeq 9 hours	2200-0700	48	dB
Max LAeq 1 hour	0700-2200	54	dB
Max LAeq 1 hour	2200-0700	52	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	13

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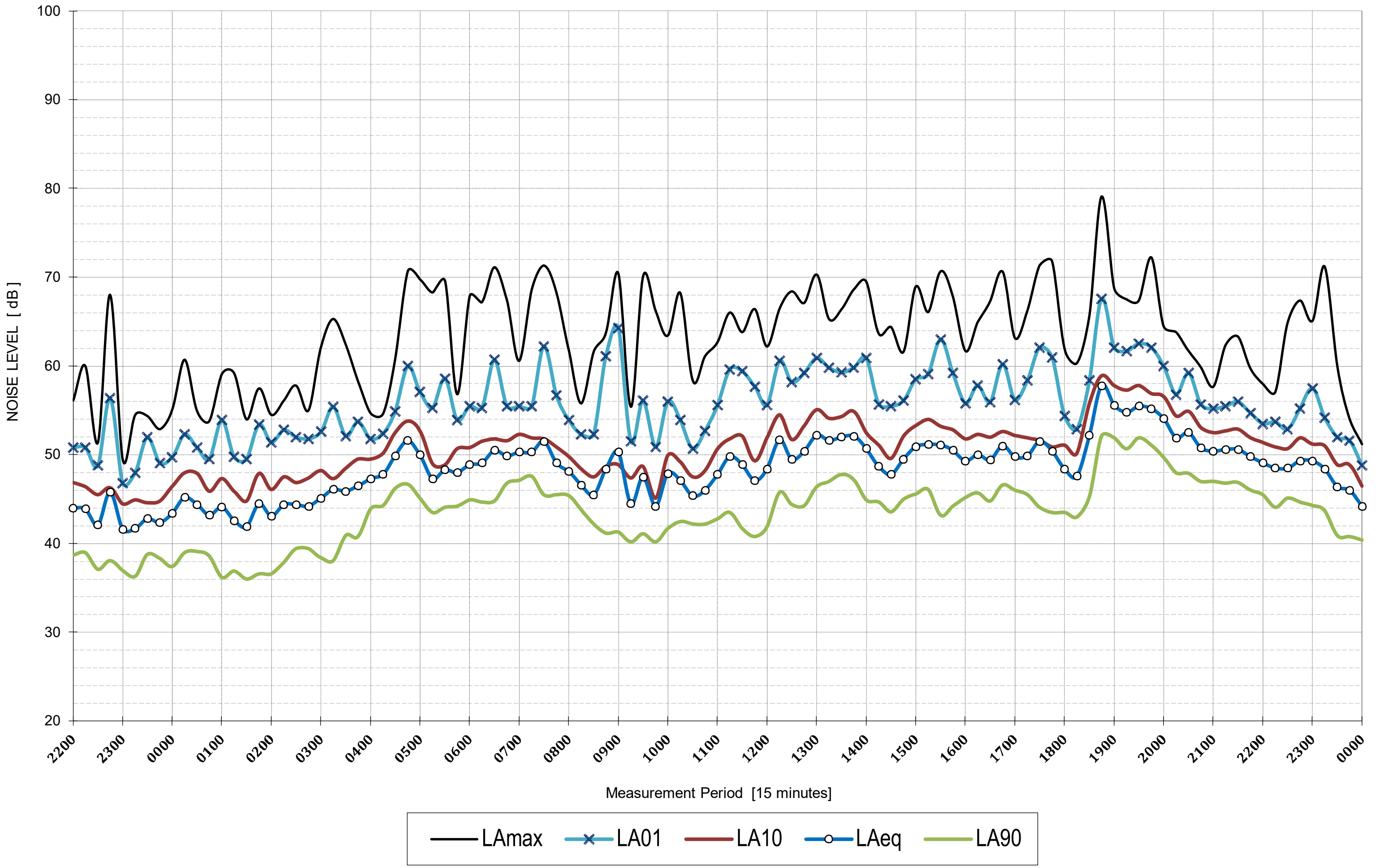
CONSULTANTS IN NOISE & VIBRATION

DAY 4 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Friday, 6 December 2019



AMBIENT NOISE METRICS

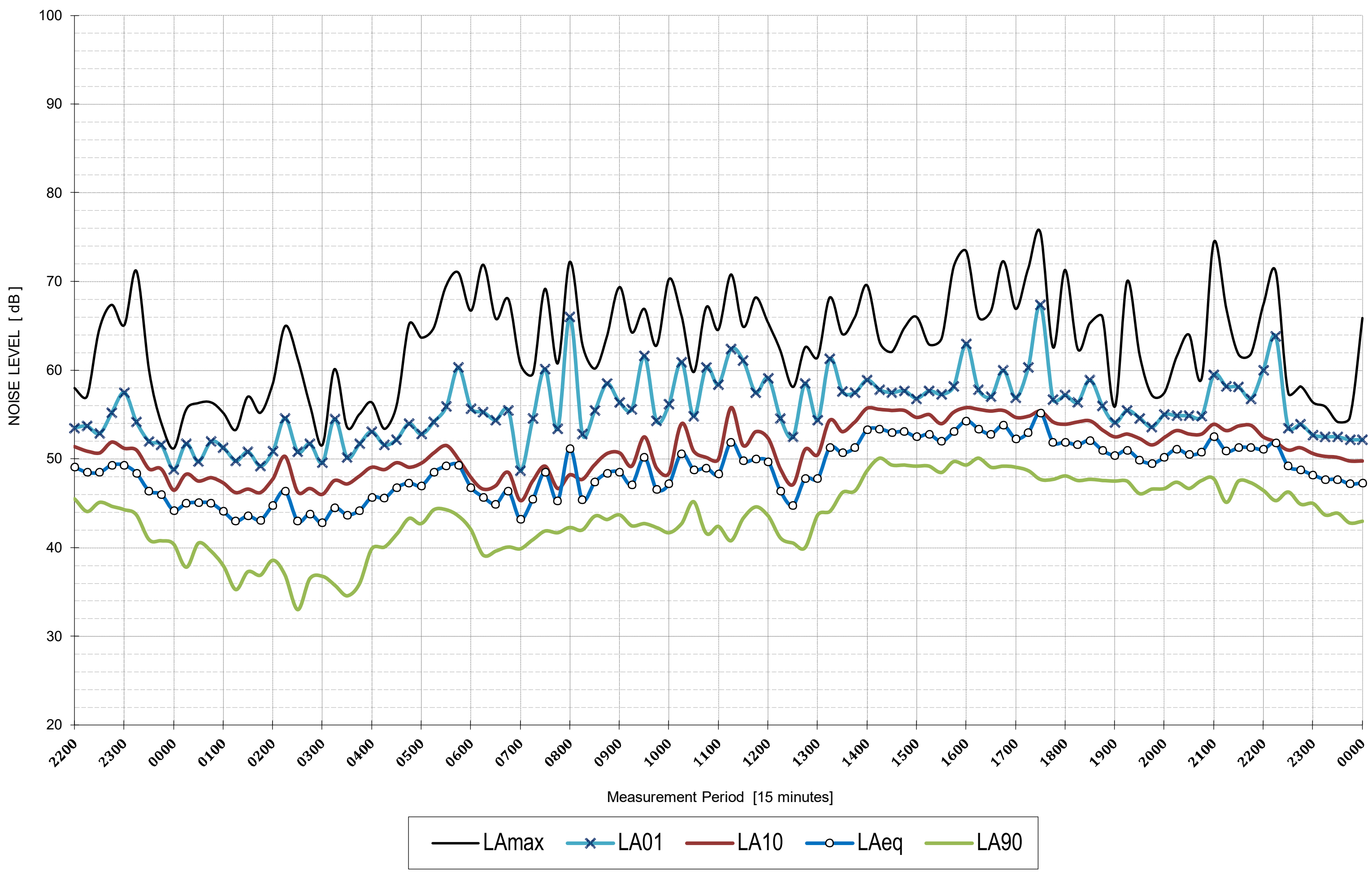
Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	41	dB
LA90 Evening	1800-2200	44	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	50	dB
LAeq Evening	1800-2200	53	dB
LAeq Night-time	2200-0700	47	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	51	dB
LAeq 9 hours	2200-0700	47	dB
Max LAeq 1 hour	0700-2200	54	dB
Max LAeq 1 hour	2200-0700	50	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	16

DAY 5 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Saturday, 7 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	41	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	51	dB
LAeq Evening	1800-2200	51	dB
LAeq Night-time	2200-0700	47	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	51	dB
LAeq 9 hours	2200-0700	47	dB
Max LAeq 1 hour	0700-2200	53	dB
Max LAeq 1 hour	2200-0700	49	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	16

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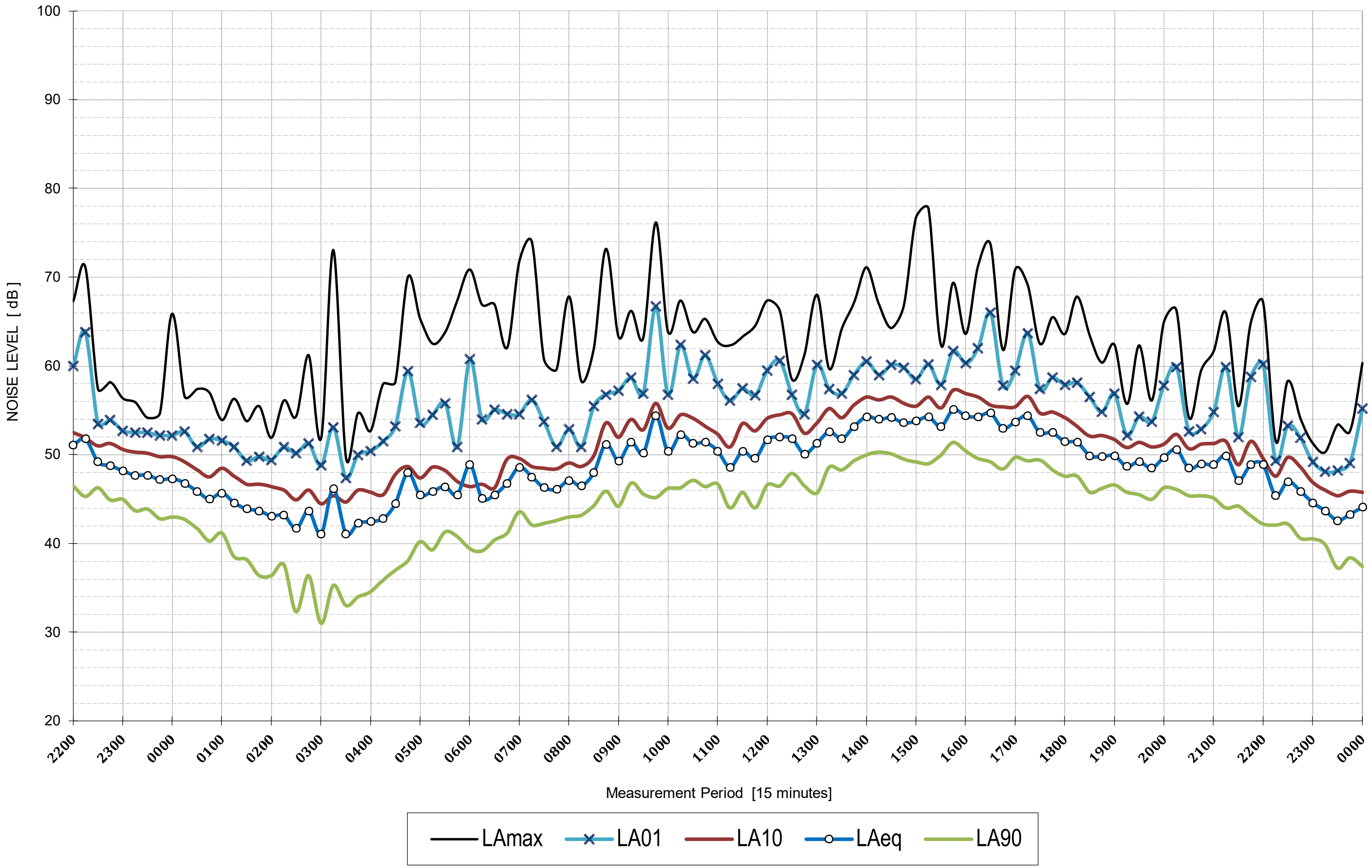
CONSULTANTS IN NOISE & VIBRATION

DAY 6 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Sunday, 8 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	44	dB
LA90 Evening	1800-2200	44	dB
LA90 Night-time	2200-0800	34	dB
LAeq Daytime	0800-1800	52	dB
LAeq Evening	1800-2200	50	dB
LAeq Night-time	2200-0800	47	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	52	dB
LAeq 9 hours	2200-0700	46	dB
Max LAeq 1 hour	0700-2200	54	dB
Max LAeq 1 hour	2200-0700	48	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	15

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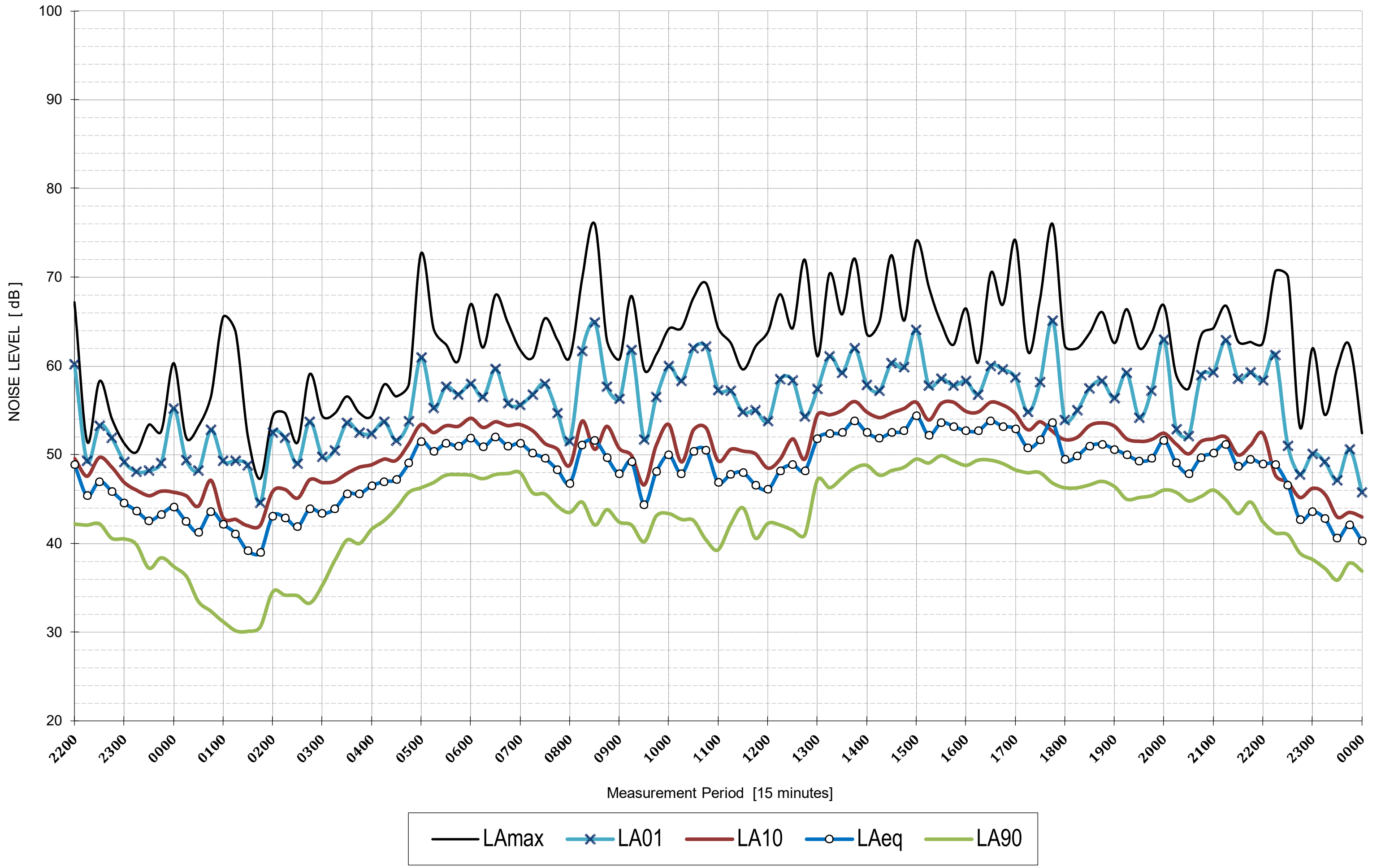
CONSULTANTS IN NOISE & VIBRATION

DAY 7 LOGGER LOCATION: Themeda Avenue (near Tallawong Metro Station) DATE: Monday, 9 December 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	41	dB
LA90 Evening	1800-2200	44	dB
LA90 Night-time	2200-0700	31	dB
LAeq Daytime	0700-1800	51	dB
LAeq Evening	1800-2200	50	dB
LAeq Night-time	2200-0700	47	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	51	dB
LAeq 9 hours	2200-0700	47	dB
Max LAeq 1 hour	0700-2200	53	dB
Max LAeq 1 hour	2200-0700	51	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	8

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

APPENDIX B

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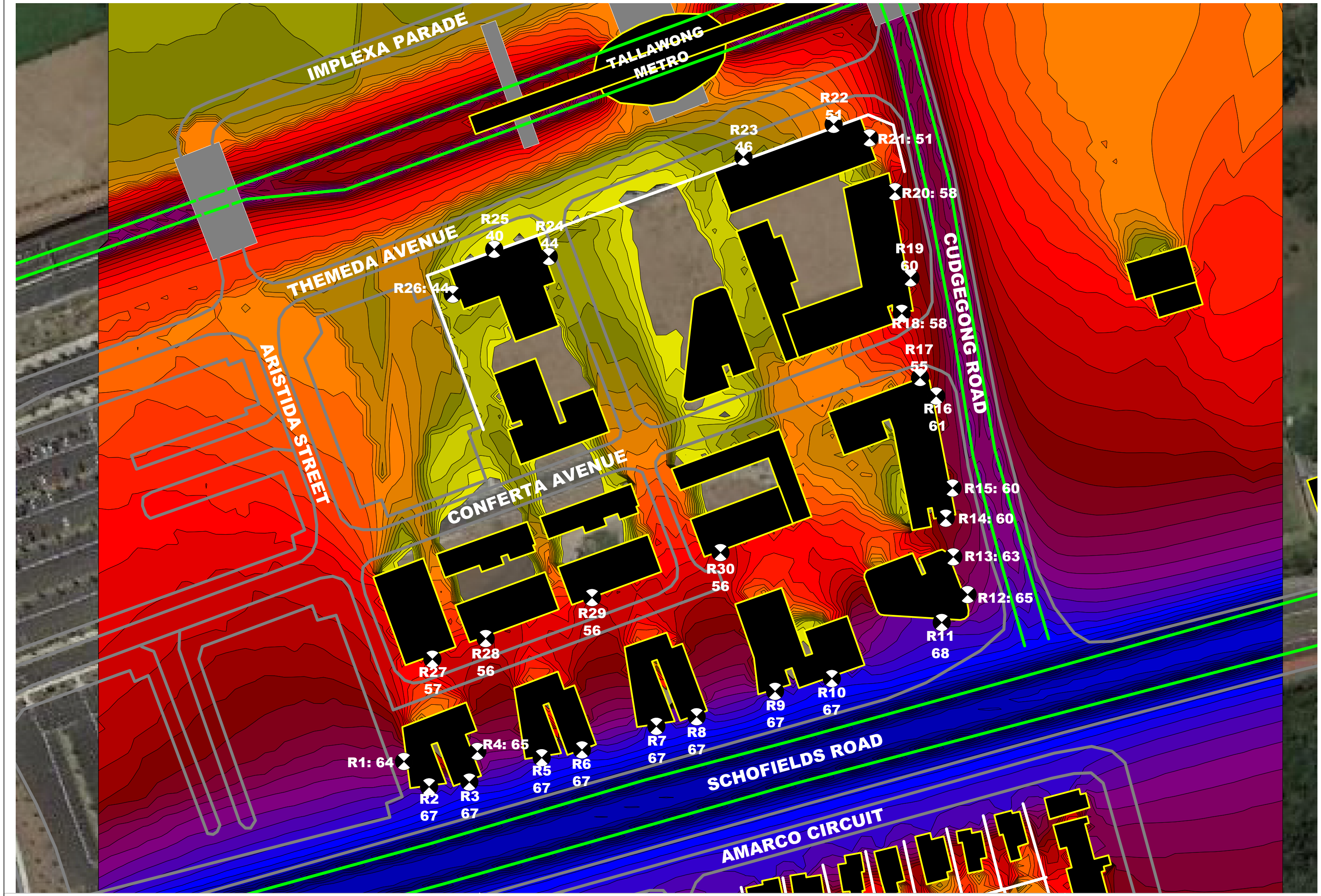
APPENDIX B



Scenario 1.1
(Ground Floor)
**** NOISE SOURCES ****

~ Schofield Road
~ Cudgegong Road
~ Tallawong Metro Line

Note:
- LAeq,15hrs noise level contours shown and receiver points are at a height of 1.5 m above the ground floor.
- The maximum reading at the nearest resident is 68 dB(A).

PRINT DATE: 15/04/20

Line Source
Building
Barrier
3D-Reflector
Ground Absorption
Contour Line
Receiver
Calculation Area

> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3947
CLIENT: Deicorp Project (Tallawong Station) Pty Ltd
SITE ADDRESS: 2-12 and 1-15 Conferta Ave, Rouse Hill
ASSESSED TO: ISEPP/DOP
LIMITING CRITERIA: 35 dB(A) - Bedrooms (2200-0700)
40 dB(A) - Other (0700-2200)

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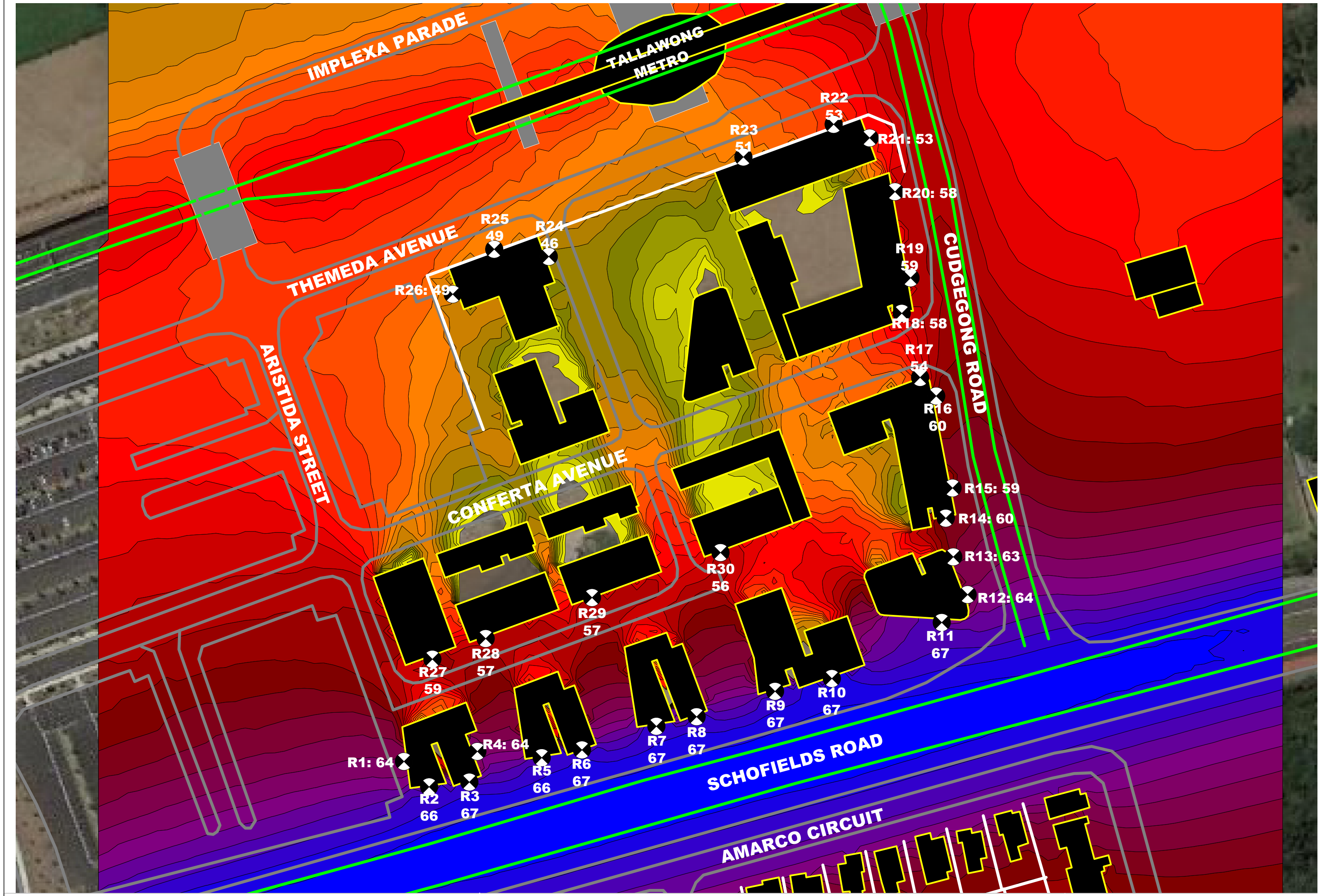

Scenario 1.2
(Fourth Floor)
**** NOISE SOURCES ****

~ Schofield Road
~ Cudgegong Road
~ Tallawong Metro Line

Note:
- LAeq,15hrs noise level contours shown and receiver points are at a height of 13.5 m above the ground floor.
- The maximum reading at the nearest resident is 67 dB(A).

PRINT DATE: 15/04/20

Line Source
Building
Barrier
3D-Reflector
Ground Absorption
Contour Line
Receiver
Calculation Area

> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3947
CLIENT: Deicorp Project (Tallawong Station) Pty Ltd
SITE ADDRESS: 2-12 and 1-15 Conferta Ave, Rouse Hill
ASSESSED TO: ISEPP/DOP
LIMITING CRITERIA: 35 dB(A) - Bedrooms (2200-0700)
40 dB(A) - Other (0700-2200)

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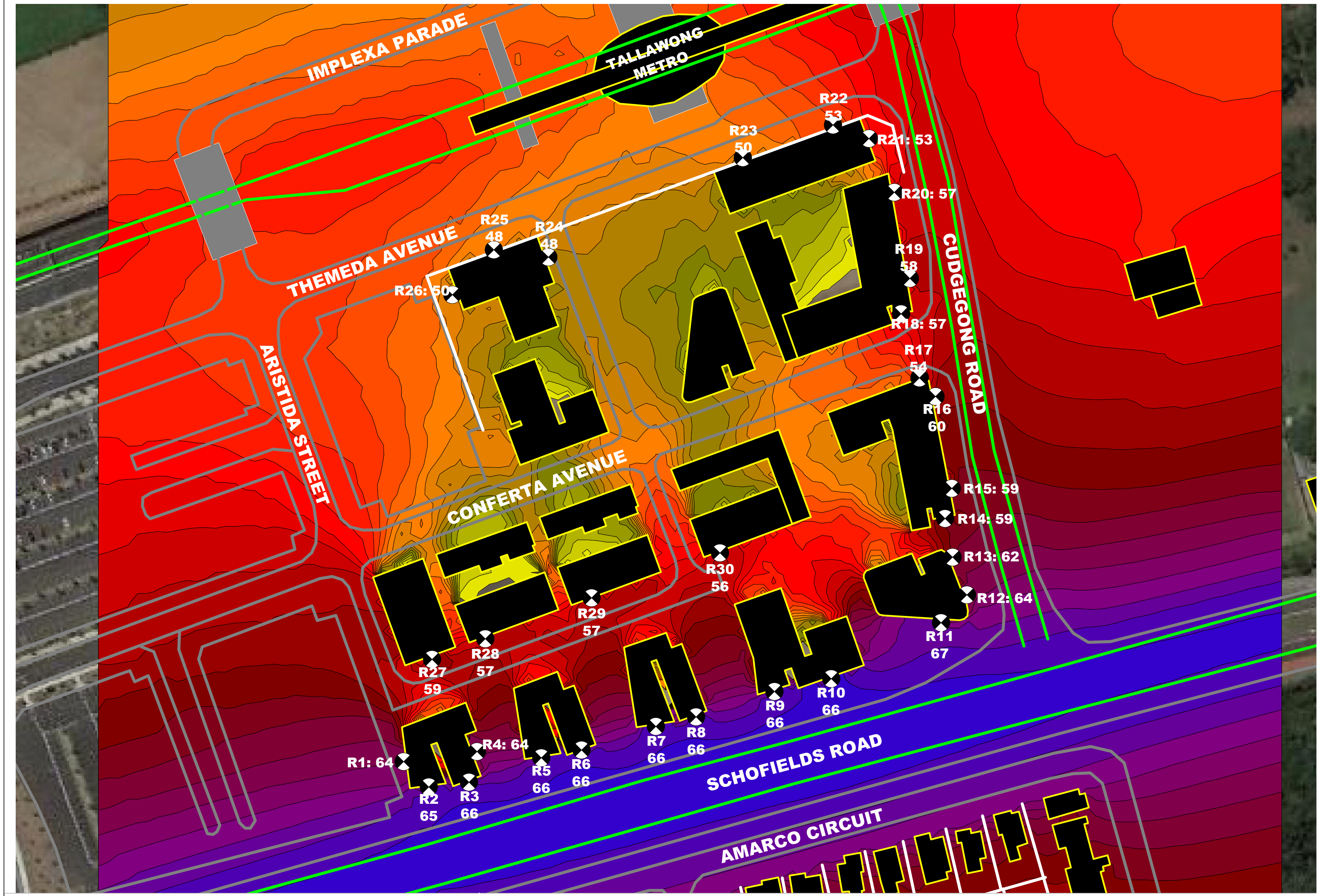

Scenario 1.3
(Seventh Floor)
**** NOISE SOURCES ****

~ Schofield Road
~ Cudgegong Road
~ Tallawong Metro Line

Note:
- LAeq,15hrs noise level contours shown and receiver points are at a height of 22.5 m above the ground floor.
- The maximum reading at the nearest resident is 67 dB(A).

PRINT DATE: 15/04/20

Line Source
Building
Barrier
3D-Reflector
Ground Absorption
Contour Line
Receiver
Calculation Area

> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB

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CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3947
CLIENT: Deicorp Project (Tallawong Station) Pty Ltd
SITE ADDRESS: 2-12 and 1-15 Conferta Ave, Rouse Hill
ASSESSED TO: ISEPP/DOP
LIMITING CRITERIA: 35 dB(A) - Bedrooms (2200-0700)
40 dB(A) - Other (0700-2200)

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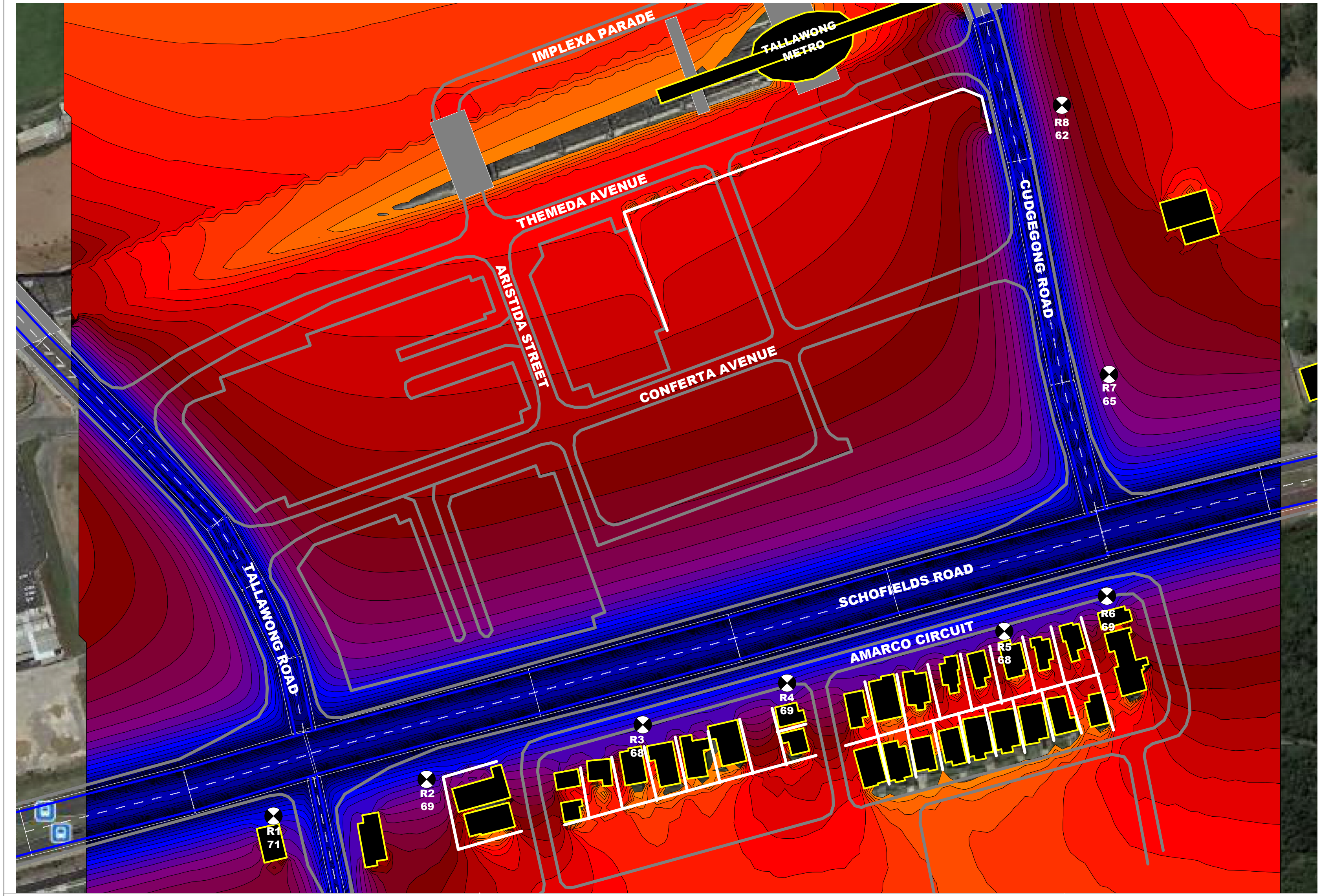

Scenario 2.1
(existing)
**** NOISE SOURCES ****

~ Schofield Road
~ Cudgegong Road
~ Tallawong Road
~ Ridgeline Drive

Note:
- Max LAeq,1hr noise level contours shown and receiver points are at a height of 1.5 m above the ground floor.
- The maximum reading at the nearest resident is 71 dB(A).

PRINT DATE: 15/04/20

Road
Building
Barrier
3D-Reflector
Ground Absorption
Contour Line
Receiver
Calculation Area

> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB

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CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3947
CLIENT: Deicorp Project (Tallawong Station) Pty Ltd
SITE ADDRESS: 2-12 and 1-15 Conferta Ave, Rouse Hill
ASSESSED TO: NSW Road Noise Policy
LIMITING CRITERIA: 2 dB - relative increase

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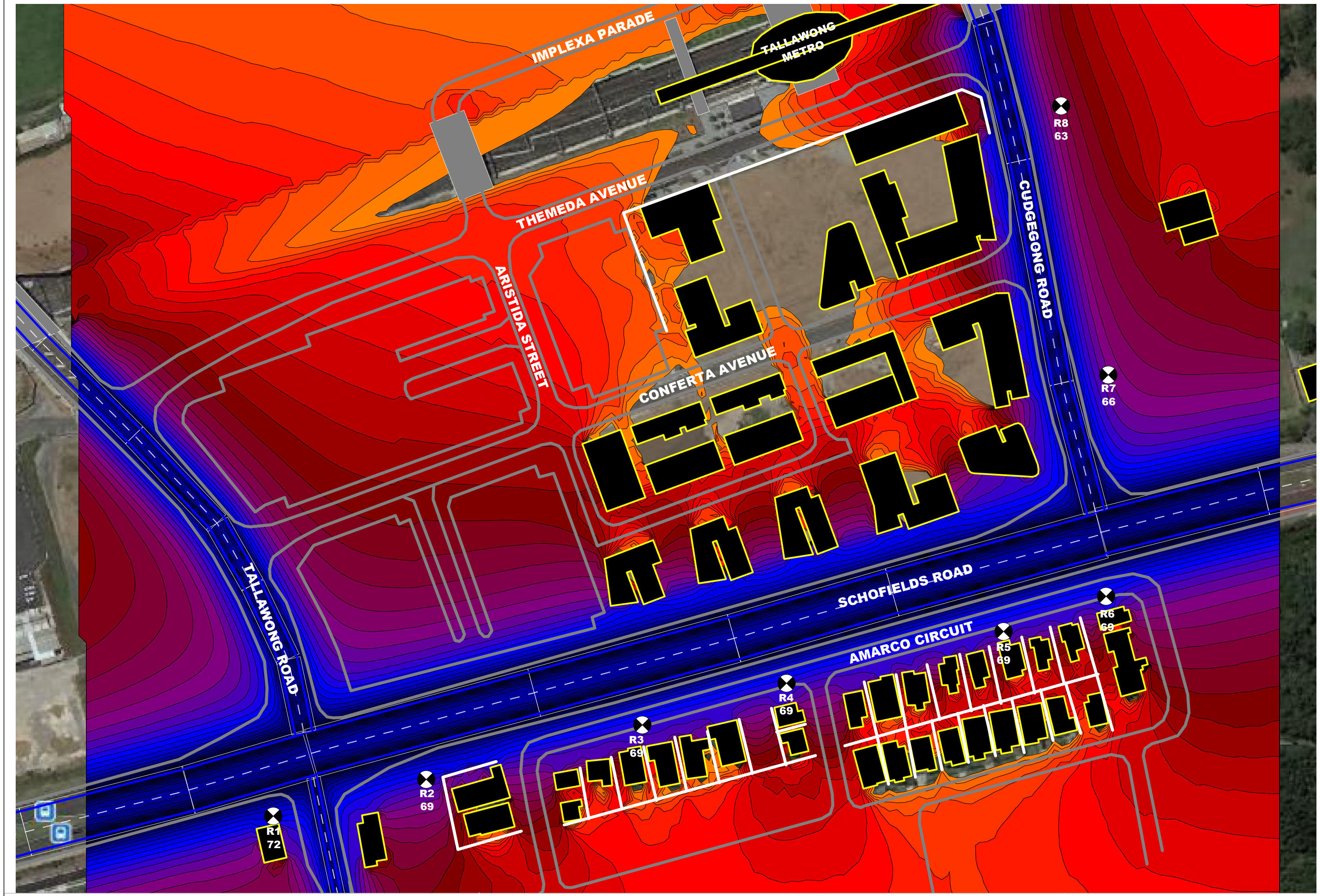

Scenario 2.2
(Proposed)
**** NOISE SOURCES ****

~ Schofield Road
~ Cudgegong Road
~ Tallawong Road
~ Ridgeline Drive

Note:
- Max LAeq,1hr noise level contours shown and receiver points are at a height of 1.5 m above the ground floor.
- The maximum reading at the nearest resident is 72 dB(A).

PRINT DATE: 15/04/20

Road
Building
Barrier
3D-Reflector
Ground Absorption
Contour Line
Receiver
Calculation Area

> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB

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CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3947
CLIENT: Deicorp Project (Tallawong Station) Pty Ltd
SITE ADDRESS: 2-12 and 1-15 Conferta Ave, Rouse Hill
ASSESSED TO: NSW Road Noise Policy
LIMITING CRITERIA: 2 dB - relative increase

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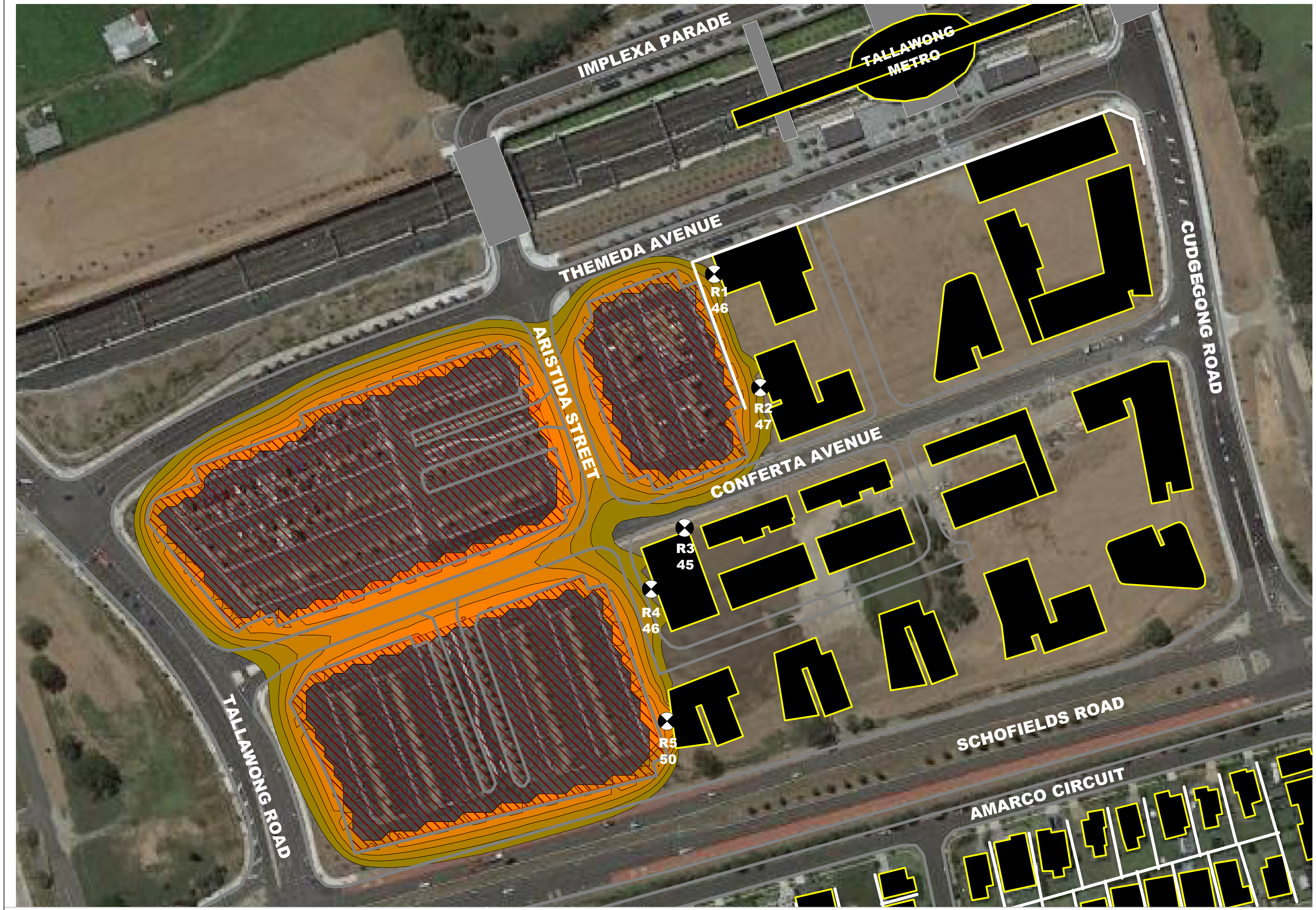

Scenario 3
(Car park)
**** NOISE SOURCES ****

~ Car parks servicing Tallawong Station

Note:

- Max LAeq,15min noise level contours shown and receiver points are at a height of 4.5 m above the ground floor.

- The maximum reading at the nearest resident is 50 dB(A).

PRINT DATE: 15/04/20

Parking Lot
Building
Barrier
3D-Reflector
Ground Absorption
Contour Line
Receiver
Calculation Area

> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3947
CLIENT: Deicorp Project (Tallawong Station) Pty Ltd
SITE ADDRESS: 2-12 and 1-15 Conferta Ave, Rouse Hill
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 46-57 dB - Residential (0700-2200)

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APPENDIX C

TRAFFIC NOISE INTRUSION CALCULATIONS

Job	*3947*		ROOM DATA			
Client	*Deicorp Projects (Tallawong Station) Pty Ltd*	H	2.6 m	D	4 m	
Site	*2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155*	W	3 m	V	31.2 m3	
Room	*Bedroom fronting Schofields Road (without balcony)*					

		63	125	250	500	1k	2k	4k	8k	Area
	Bedroom, timber floor, furnished (RT60, sec)	*0.5*	*0.5*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*	*0.3*	*0.38*
	EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB]	44	48	51	57	64	61	55	48	67
STL 1	*Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	1.0
STL 2	*10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	9.4
STL 3										
STL 4										
	Noise through Component 1	3	-1	3	3	-1	-14	-28	-38	9
	Noise through Component 2	29	29	26	29	35	31	21	7	39
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 1	**29**	**29**	**26**	**29**	**35**	**31**	**21**	**8**	**39**
	EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS

	Noise Transmission Through Each Façade LAeq,Period [dB]								
Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	29	29	26	29	35	31	21	8	39
Façade 2	0	0	0	0	0	0	0	0	0
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**29**	**29**	**26**	**29**	**35**	**31**	**21**	**10**	**39**

TRAFFIC NOISE INTRUSION CALCULATIONS

Job *3947*
Client *Deicorp Projects (Tallawong Station) Pty Ltd*
Site *2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155*
Room *Bedroom fronting Schofields Road (with balcony)*

ROOM DATA

H	2.6 m	D	4 m
W	3 m	V	31.2 m3

	63	125	250	500	1k	2k	4k	8k	Area
Bedroom, timber floor, furnished (RT60, sec)	*0.5*	*0.5*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*	*0.3*	*0.38*
EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB]	46	50	53	59	66	63	57	50	69
STL 1 *Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	4.2
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	6.2
STL 3									
STL 4									
Noise through Component 1	11	7	11	11	7	-6	-20	-30	17
Noise through Component 2	29	29	26	29	36	31	21	7	39
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 1	**29**	**29**	**26**	**29**	**36**	**31**	**21**	**9**	**39**
EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS

Noise Transmission Through Each Façade LAeq,Period [dB]

Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	29	29	26	29	36	31	21	9	39
Façade 2	0	0	0	0	0	0	0	0	0
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**29**	**29**	**26**	**29**	**36**	**31**	**21**	**10**	**39**

TRAFFIC NOISE INTRUSION CALCULATIONS

Job *3947*
Client *Deicorp Projects (Tallawong Station) Pty Ltd*
Site *2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155*
Room *Bedroom fronting Schofields Road (without balcony)*

ROOM DATA

H	2.6 m	D	4 m
W	3 m	V	31.2 m3

	63	125	250	500	1k	2k	4k	8k	Area
Bedroom, timber floor, furnished (RT60, sec)	*0.5*	*0.5*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*	*0.3*	*0.38*
EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB]	44	48	51	57	64	61	55	48	67
STL 1 *Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	4.2
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	6.2
STL 3									
STL 4									
Noise through Component 1	9	5	9	9	5	-8	-22	-32	15
Noise through Component 2	27	27	24	27	34	29	19	5	37
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 1	**27**	**27**	**24**	**27**	**34**	**29**	**19**	**7**	**37**
EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB]	44	48	51	57	64	61	55	48	67
STL 1 *Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	3.1
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	4.7
STL 3									
STL 4									
Noise through Component 1	8	4	8	7	4	-9	-24	-33	14
Noise through Component 2	26	26	23	26	32	28	18	4	36
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 2	**26**	**26**	**23**	**26**	**32**	**28**	**18**	**7**	**36**
EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
SUMMARY OF RESULTS	**Noise Transmission Through Each Façade LAeq,Period [dB]**								
Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	27	27	24	27	34	29	19	7	37
Façade 2	26	26	23	26	32	28	18	7	36
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**30**	**30**	**27**	**29**	**36**	**32**	**21**	**11**	**39**

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CONSULTANTS IN NOISE & VIBRATION

TRAFFIC NOISE INTRUSION CALCULATIONS

Job *3947*
Client *Deicorp Projects (Tallawong Station) Pty Ltd*
Site *2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155*
Room *Bedroom fronting Schofields Road (with balcony)*

ROOM DATA

H	2.6 m	D	4 m
W	3 m	V	31.2 m3

	63	125	250	500	1k	2k	4k	8k	Area
Bedroom, timber floor, furnished (RT60, sec)	*0.5*	*0.5*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*	*0.3*	*0.38*
EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB]	46	50	53	59	66	63	57	50	69
STL 1 *Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	6.2
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	4.2
STL 3									
STL 4									
Noise through Component 1	13	9	13	13	9	-4	-19	-28	19
Noise through Component 2	27	27	24	27	34	29	19	5	37
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 1	**28**	**27**	**25**	**27**	**34**	**29**	**19**	**7**	**37**
EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB]	44	48	51	57	64	61	55	48	67
STL 1 *Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	4.7
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	3.1
STL 3									
STL 4									
Noise through Component 1	10	6	10	9	6	-7	-22	-31	15
Noise through Component 2	24	24	21	24	31	26	16	2	34
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 2	**24**	**24**	**21**	**24**	**31**	**26**	**16**	**6**	**34**
EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS

Noise Transmission Through Each Façade LAeq,Period [dB]

Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	28	27	25	27	34	29	19	7	37
Façade 2	24	24	21	24	31	26	16	6	34
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**29**	**29**	**26**	**29**	**36**	**31**	**21**	**10**	**39**

TRAFFIC NOISE INTRUSION CALCULATIONS

Job	*3947*
Client	*Deicorp Projects (Tallawong Station) Pty Ltd*
Site	*2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155*
Room	*Kitchen/Dining/Living area fronting Schofields Road*

ROOM DATA

H	2.6 m	D	5 m
W	4 m	V	52.0 m3

	63	125	250	500	1k	2k	4k	8k	Area
KLD, timber and tile floor, furnished (RT60, sec)	*0.6*	*0.6*	*0.6*	*0.7*	*0.7*	*0.7*	*0.6*	*0.6*	*0.64*
EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB]	46	50	53	59	66	63	57	50	69
STL 1 *Double brick with brick ties (no insulation)*	*37*	*45*	*43*	*49*	*59*	*69*	*78*	*80*	7.8
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	*21*	*25*	*30*	*33*	*32*	*34*	*39*	*45*	5.2
STL 3									
STL 4									
Noise through Component 1	12	9	14	14	11	-2	-18	-27	19
Noise through Component 2	27	27	25	29	36	31	20	7	39
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 1	**27**	**27**	**25**	**29**	**36**	**31**	**20**	**8**	**39**
EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS	**Noise Transmission Through Each Façade LAeq,Period [dB]**								
Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	27	27	25	29	36	31	20	8	39
Façade 2	0	0	0	0	0	0	0	0	0
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**27**	**27**	**25**	**29**	**36**	**31**	**20**	**10**	**39**

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TRAFFIC NOISE INTRUSION CALCULATIONS

Job 3947
Client *Deicorp Projects (Tallawong Station) Pty Ltd*
Site *2-12 & 1-15 Conferta Avenue, Rouse Hill NSW 2155*
Room *Kitchen/Dining/Living area fronting Schofields Road*

ROOM DATA

H	2.6 m	D	5 m
W	4 m	V	52.0 m3

	63	125	250	500	1k	2k	4k	8k	Area
KLD, timber and tile floor, furnished (RT60, sec)	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.64
EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB]	46	50	53	59	66	63	57	50	69
STL 1 *Double brick with brick ties (no insulation)*	37	45	43	49	59	69	78	80	9.1
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	21	25	30	33	32	34	39	45	3.9
STL 3									
STL 4									
Noise through Component 1	13	9	14	15	12	-1	-17	-26	20
Noise through Component 2	25	26	24	27	35	30	19	6	38
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 1	**26**	**26**	**24**	**28**	**35**	**30**	**19**	**8**	**38**
EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB]	44	48	51	57	64	61	55	48	67
STL 1 *Double brick with brick ties (no insulation)*	37	45	43	49	59	69	78	80	7.3
STL 2 *10.38mm laminated glass with qlon + fin/mohair seals*	21	25	30	33	32	34	39	45	3.1
STL 3									
STL 4									
Noise through Component 1	10	6	11	12	9	-4	-20	-29	17
Noise through Component 2	22	23	21	25	32	27	16	3	35
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 2	**23**	**23**	**21**	**25**	**32**	**27**	**16**	**6**	**35**
EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1									
STL 2									
STL 3									
STL 4									
Noise through Component 1	0	0	0	0	0	0	0	0	0
Noise through Component 2	0	0	0	0	0	0	0	0	0
Noise through Component 3	0	0	0	0	0	0	0	0	0
Noise through Component 4	0	0	0	0	0	0	0	0	0
NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS

Noise Transmission Through Each Façade LAeq,Period [dB]

Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	26	26	24	28	35	30	19	8	38
Façade 2	23	23	21	25	32	27	16	6	35
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**27**	**28**	**26**	**30**	**37**	**32**	**21**	**11**	**40**

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