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This and the following 34 pages is the annexure marked " I " referred to in the Affidavit of Anthony Boskovitz sworn / ~~affirmed~~ at Edgecliff this 31st day of July 2020 before me

[redacted]

Solicitor / ~~Katherine Boskovitz~~ TIFFANY STOUAR

ACOUSTICAL REPORT – SECTION 34 CONCILIATION

BOARDING HOUSE DEVELOPMENT AT

6 EDITH STREET, KINGSWOOD NSW

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

LAND AND ENVIRONMENT COURT OF NSW FILED ON - 3 AUG 2020

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ACOUSTICAL REPORT – SECTION 34 CONCILIATION

BOARDING HOUSE DEVELOPMENT AT

6 EDITH STREET, KINGSWOOD

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TABLE OF APPENDICES

1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was engaged by Liquid Gold 888 Pty Ltd to prepare an acoustical report for the proposed boarding house development at 6 Edith Street, Kingswood NSW. The report will form part of the documentation required to submit to Penrith City Council and Land and Environment Court (L&EC) for Section 34 Conciliation conferences.

This revised report was prepared to reflect the updated architectural drawings (listed in Table 1 of this report) and address Item 5 a) and 5 d) of the letter from L&EC for Section 34 Conciliation. The following acoustical components are assessed:

1. Potential noise impact from future occupants and guests occupying the rear communal open space of the subject boarding house to neighbouring dwellings;
2. Assess the potential noise impact from vehicles entering the driveway to the neighbouring property;
3. Mechanical plant noise assessment (outdoor AC condensing units only), and
4. Inter-tenancy sound insulation requirements for partitions that separate units.

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 DEVELOPMENT

The development is proposed to occupy the site at 6 Edith Street, Kingswood NSW. The application is for one (1) indoor communal room and thirteen (13) boarding rooms with one basement level parking (8 car spaces). The current development design can be seen in architectural drawings as prepared by Designcorp Architects Pty Ltd, detailed in Table 1. All calculations conducted for this assessment are referenced to these architectural drawings.

Table 1. Design drawings used in the assessment

Drawing Title	Drawing No.	Ref.	Issue	Date
BASEMENT FLOOR PLAN	A2	2020-110	a	07/02/2020
GROUND FLOOR PLAN	A3	2020-110	a	07/02/2020
FIRST FLOOR PLAN	A4	2020-110	a	07/02/2020
3D PERSPECTIVES	A5	2020-110	a	07/02/2020
3D PERSPECTIVES	A6	2020-110	a	07/02/2020
3D PERSPECTIVES	A7	2020-110	a'	07/02/2020

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, our assessment results and conclusions published within this report may be incorrect.

The development location is situated in a primarily suburban residential area. The subject site is surrounded by residential premises in all directions.

Prevailing ambient noise conditions on-site and in the local area are generally the result of typical environmental noise such as wind, rustling leaves and sporadic distant traffic.

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

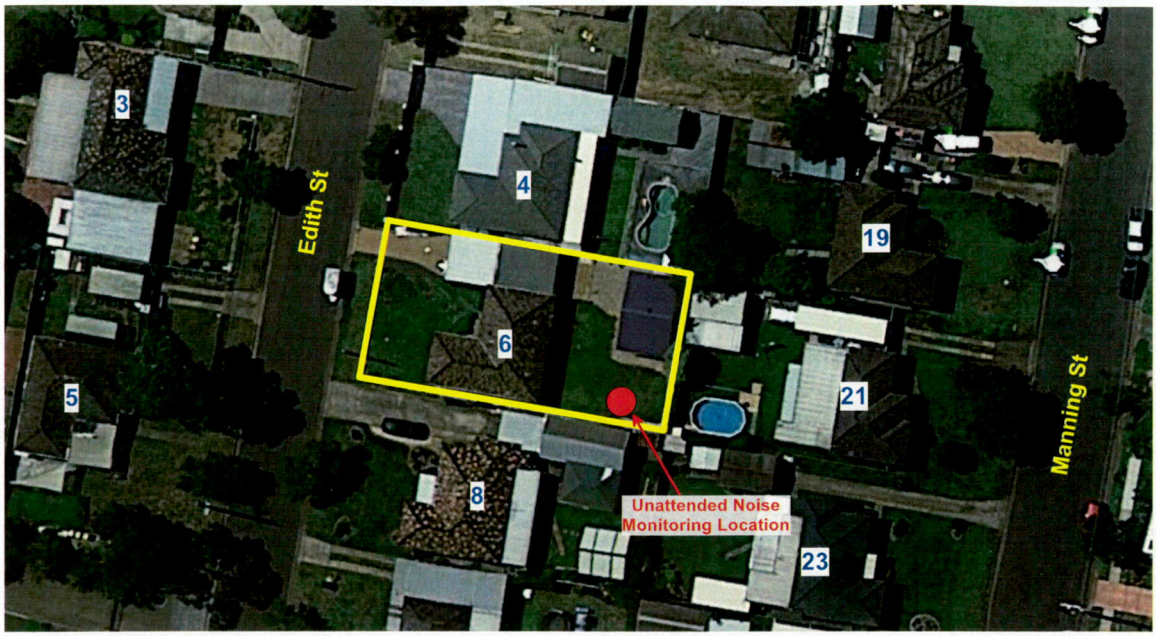


Figure 1. Aerial photo of the subject site and surrounding premises – Image is taken from Google Earth

3.0 UNATTENDED AMBIENT NOISE SURVEY

Existing external ambient noise levels were measured by installing a sound level meter data logger near the south-eastern boundary of the subject property. A Type 1 precision Svan 949 noise logger was used for the survey. The microphone was placed at approximately 1.5 metres above the natural ground level. This meter was placed to measure existing background and ambient noise levels in the area. Refer to Figure 1 of this report for noise monitoring location.

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 a period of one week between Saturday 10th and Friday 16th August 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 (Bureau of Meteorology) weather records for the nearest available weather station indicate that inclement weather conditions did not adversely impact on the noise survey.

A summary of the surveyed noise levels is included in Table 2.

Table 2. Summary of noise logger results [dB]

Location	Period, T [1]	Ambient noise level LAeq	Rating Background Level LA90
South-eastern boundary of the assessment site	Day	53	34
	Evening	45	36
	Night	44	30
Notes			
1:	The NSW EPA NPfI defines the day, evening, and night periods as follows: - Day: 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays - Evening: 6pm to 10pm Monday to Sunday - Night: 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 ACOUSTICAL REQUIREMENTS AND GUIDELINES/POLICIES

4.1 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 $L_{Aeq\ 15\ minutes}$.

4.2 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 10pm and 7am (Monday to Friday) or 10pm and 8am (Saturday, Sunday and public holidays).

4.3 INTER-TENANCY NOISE (BCA REQUIREMENTS)

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 or 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 3. 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.		

5.0 BUILDING USE (OCCUPANTS & GUESTS OCCUPYING THE REAR OUTDOOR COMMUNAL SPACE)

5.1 PROJECT NOISE TRIGGER LEVELS

Based on the unattended noise survey data and discussion in Section 3.0 and 4.0 of this report, the following NPfI planning levels apply for this project relating to boarding house noise (predominantly from occupants & guests occupying the outdoor communal area):

Table 4. Operational noise criterion levels [dB]

Period, T (Note 1)	Intrusive		Amenity					
	RBL	RBL + 5	Area classification	Recommended amenity noise level	High traffic area	Project amenity noise level[3]	+3dB correction	Project noise trigger level
Day	34[2] (35)	40	Suburban	55	No	50	53	40
Evening	36	41	Suburban	45	No	40	43	41
Night	30	35	Suburban	40	No	35	38	35
Night **(Inaudibility)**	25	-	Suburban	-	-	-	-	25[4]

Notes

1. EPA defines the following time periods, Day – 7am to 6pm Mon to Sat and 8am to 6pm Sun and public holidays, Evening – 6pm to 10pm Mon to Sun, Night – 10pm to 7am Mon to Sat and 10pm to 8am Sun and public holidays.
2. The measured RBL is lower than the minimum RBL of the NPfI, as such, the minimum RBL of L_{A90} 35 dB is adopted for the daytime period.
3. Project noise amenity level = recommended noise amenity level – 5dB, except where specific circumstances are met, such as high traffic.
4. The inaudibility criterion (applicable during the night-time period only and is normally achieved when the noise level is 5~8 dB lower than the ambient background noise level. The inaudibility criterion is applicable to AC units during the night-time period only.

Therefore, the operational noise criteria adopted for this assessment become:

- $L_{Aeq,\ 15\ min}$ **≤ 40~41 dB** during the daytime and evening period, and
- $L_{Aeq,\ 15\ min}$ **≤ 35 dB** during the night-time period.

5.2 ASSOCIATED SOUND LEVELS

The primary focus of the noise emission assessment in this section is attributed to persons talking in the rear outdoor communal open space on the ground floor level at rear. It is unlikely that more than 14 people would occupy the outdoor area at the same time. As a worst case scenario, this acoustic assessment considers a maximum of 14 people occupying this area at any one time. For

the purpose of predicting noise emission, 50% of people are conservatively assumed to be speaking at the same time with normal conversational vocal effort. Sound power level attributed to normal conversational voice is L_{Aeq} 64 dB for one person (i.e. equivalent to L_{Aeq} 72 dB for 7 people talking at the same time).

5.3 RESULTANT NOISE LEVELS FROM THE REAR OUTDOOR COMMUNAL OPEN SPACE TO SURROUNDING RESIDENTIAL PREMISES

Noise levels resulting from the use of the outdoor communal open space were determined for the proposed boarding house utilising computer software package CadnaA.

The calculated maximum noise level from the rear outdoor communal open space was found to be $L_{Aeq,15mins}$ 40 dB in the rear yard of No. 4 Edith Street, Kingswood and expected to comply with daytime/evening noise criterion levels.

Cadna/A noise level map showing noise impact from the proposed outdoor communal open space is attached as **Appendix B**.

5.4 RECOMMENDATIONS AND BOARDING HOUSE OPERATING RESTRICTIONS

In order to achieve compliance during all periods, the following is restricted to the proposed boarding house:

Daytime/Evening Period (Between 0700 and 2200 hours)

- A maximum of 14 people occupying the rear outdoor communal areas at any time during the daytime/evening period.
- Video cameras and signage are to be installed to ensure that boisterous activities are minimised.
- A 1.8 m noise barrier is to be included for the outdoor communal open space along the rear boundaries (Refer to Figure 2 below). The following construction materials will be adequate for the proposed noise barrier:
    - Double lapped 15mm thick timber fence palings offset so that there are no air gaps. This equates to a total barrier thickness of 30 mm;

      OR
    - 15mm compressed fibre cement panels with no air gaps at the joins;

      OR

- 6mm compressed fibre cement panels either side of a 50mm steel frame with fibreglass insulation batts (18kg/m³) to the cavity;

It is to be noted that gaps between the panels and the posts or the ground will significantly reduce the effectiveness of the noise barrier and may lead to non-compliant noise levels at the adjoining premises.

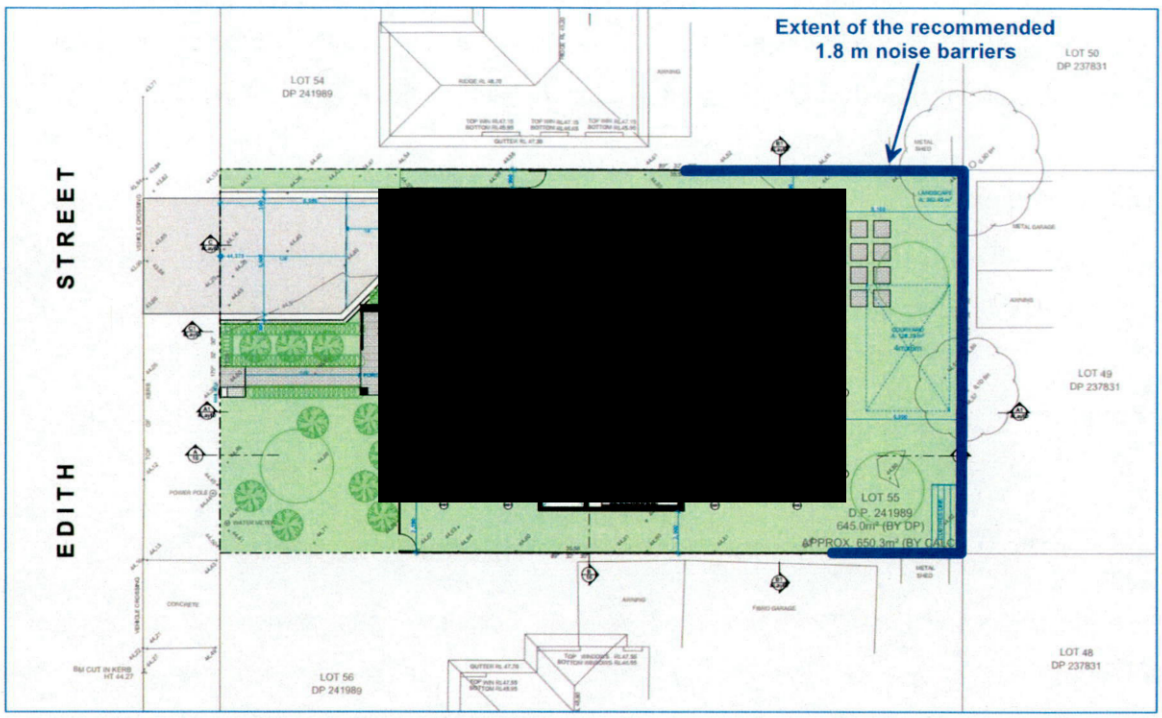


Figure 2. The extent of the recommended 1.8 m noise barriers

Night-time Period (Between 2200 and 0700 hours)

- For the benefit of occupants of the subject boarding house units, it is recommended that all music cease playing or is played at low levels after 10 pm to minimise the potential of adverse comment. House rules could be enforced by building management.
- No one is to occupy the indoor and outdoor communal areas for recreational purposes.

Furthermore,

- Signage needs to be erected to remind occupants to keep their noise down and to respect the quiet enjoyment of other occupants and surrounding neighbours.
- Signage of owner's/operator's details can also be erected at appropriate locations internally and externally so that the owners/operators can be contacted immediately in the event that the noise rules in the plan of management are not complied with.

6.0 VEHICULAR NOISE IMPACT TO ADJOINING RESIDENTIAL PREMISES

6.1 NOISE REQUIREMENTS

Similarly (refer to Section 5.1 of this report), the vehicular noise criteria adopted are:

- **$L_{Aeq,\ 15\ min}$ ≤ 40~41 dB** during the daytime and evening period, and
- **$L_{Aeq,\ 15\ min}$ ≤ 35 dB** during the night-time period.

6.2 SOURCE NOISE LEVELS

The vehicular sound source levels used in this acoustical assessment are listed in Table 5 below.

Table 5. Vehicular source sound levels [dB]

Description	Noise Metric	L_{Aw} Sound Power Level
Car travelling 5 – 8 km/hr (Moving point source)	L_{Aweq}	77
Car engine idling	L_{Aweq}	50

It is noted that the above sound source levels were based on noise level measurements previously conducted by Koikas Acoustics for other similar projects.

6.3 ANALYSIS & CALCULATION

The predicted vehicular noise impact in the driveway area of the proposed boarding house to the nearest neighbouring residential property (i.e. No. 4 Edith Street, Kingswood) is summarised in Table 6 below.

Table 6. Vehicular noise calculation summary (assessed to one 15 minute period)

Descriptions	Noise Level
One vehicular entering/leaving the car park area (approximately 5 seconds)	L_{AWeq} 77
Noise reduction of masonry barrier and distance attenuation	-25 dB
Correction for noise exposure duration	-23 dB
Noise contribution of one vehicle movement (arithmetic addition/subtraction)	L_{Aeq} 29 dB
One vehicular engine idling (15 seconds) – waiting for the gate to open	L_{AWeq} 50
Noise reduction of masonry barrier and distance attenuation	-25 dB
Correction for noise exposure duration	-18 dB
Noise contribution of one vehicle engine idling (arithmetic addition/subtraction)	L_{Aeq} 7 dB
Total noise level of one vehicle in front of No. 4 Edith St. (logarithmic addition)	L_{Aeq} 29 dB
Correction for 8 vehicle movements	+9 dB
Total resultant noise level of 8 vehicles in front of No. 4 Edith St. (arithmetic addition)	L_{Aeq} 38 dB
Daytime/evening noise criterion level	**L_{Aeq} 40~41 dB**
Compliance Achieved?	**YES**

The following are also noted:

- The calculation summary demonstrated in Table 6 above was based on a worst-case scenario such that all 8 cars were entering or leaving the car park area within one 15 minute period. This is unlikely to occur, and typical noise levels are expected to be lower.
- It is expected that only 1~2 vehicles would enter or leave the car park area during the night-time period. Therefore, the subsequent resultant noise level calculated at the front of No. 4 Edith Street is $L_{Aeq,15minutes\ (night\text{-}time)}$ 29~32 dB and will also comply with the night-time noise criterion of $L_{Aeq,15minutes}$ 35 dB.
- It is unlikely that anyone would occupy the front lawn area of No. 4 Edith Street during night-time period and therefore the noise impact from the vehicles entering/leaving the car park area during night-time period is expected to be negligible, nevertheless, compliance with the EPA's Noise Policy for Industry is achieved for all periods of the day.

6.4 RECOMMENDATIONS FOR CAR PARK NOISE (MOTORISED GARAGE DOOR)

The most common noise-related issue in the car park area is the automated/motorised roller door. The design and details of the garage roller door are not available at the time of preparing this report.

In order to minimise the potential structural-borne noise from the garage roller door, vibration isolation rubber/spring mounts are recommended to be installed to all metal brackets (or contacting point) associated with the garage door including the electrical motor/gearbox such that there is no mechanical linkage with the concrete slab above, walls or columns.

Appropriate rubber isolation mounts can be purchased from numerous suppliers of which two are provided below:

- Mackay Consolidated Industries Pty Ltd (03 9555 6500 / 03 9838 9273)
- G P Embelton and Co Pty Ltd (02 9748 3188)

The railing and tracks of the motorised garage door also need to be serviced and lubricated on a regular basis to minimise noise due to friction or grinding of the mechanical parts.

7.0 MECHANICAL PLANT (AC UNITS ONLY)

Mechanical plant and equipment on this project could include air conditioning condenser units. Koikas Acoustics has been advised that all outdoor AC condensers are to be located within the basement level.

7.1 PROJECT NOISE TARGETS

The following noise criterion levels apply for outdoor AC condensers (refer to Table 4 of this report for the derivation of noise criteria as per the NPfI assessment procedures and POEO Act):

- $L_{Aeq,\ 15\ min}$ **≤ 40~41 dB** during the daytime and evening period, and
- $L_{Aeq,\ 15\ min}$ **≤ 25 dB** during the night-time period (inaudibility).

At this stage, the mechanical design is yet to be completed. A detailed mechanical plant noise impact assessment is to be provided once the final mechanical design and specification have been completed.

7.2 DISCUSSION & RECOMMENDATIONS

As all AC units are to be located within the basement level, the noise impact from AC units is therefore expected to be negligible on account of masonry wall construction. The following recommendations provided in this section will further reduce the noise level:

- The recommended model for the outdoor AC condenser unit is Daikin FTXM46QVMA or similar. An alternative outdoor AC unit with a maximum sound power level of no more than 60 dB(A) could also be considered.
- All outdoor AC condenser units are to be vibration isolated from the building structure to minimise structure-borne vibrations transmitting into floor slabs/walls which will manifest as airborne noise in adjoining spaces. Embleton rubber mounts (Refer to Figure 3 below) could be considered.

Figure 3. Embelton Rubber Mount NR/NRD

Expert advice regarding vibration isolation details is to be sought from Embelton or other similar suppliers/manufacturers based on the detailed design specifications available at a later stage.

8.0 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.

8.1 RECOMMENDED PARTITION WALLS

Table 7 recommends a number of partition wall systems that are capable of achieving the required acoustic performance.

Table 7. Recommended 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. Laboratory tests of the AFS 162 Logicwall on its own showed non-compliance with the BCA requirement of Rw + Ctr 50.
2. 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.

In addition to the above, Item 5 d) of the letter from L&EC for Section 34 Conciliation refers to the acoustic amenity of the boarding room (Room 5) which shares an adjoining wall with the communal indoor room and communal open space. As per the updated architectural design, Room 5 is no longer adjacent to the communal spaces. The rooms that require additional consideration under this item are (refer to Figure 4):

- Room 3 and Room 4 (adjacent to indoor communal room), and
- Room 4 only (adjacent to outdoor communal space).

The recommendations for the **inter-tenancy wall** included in Table 7 above can apply for walls between boarding rooms (Room 3 or Room 4) and indoor communal room. It is the professional opinion of Koikas Acoustics that by achieving the acoustic rating of $R_w + C_{tr}$ 50 for common walls separating boarding rooms and indoor communal room, reasonable acoustic amenity will be maintained.

Similarly, the same wall system could be considered for the external walls of Room 4 adjacent to outdoor communal space to provide adequate acoustic attenuation. Further, the overall acoustic performance can be compromised if the weakest building component is not providing a comparable acoustic attenuation, i.e. window glazing. In this regard, a minimum thickness of 10.38 mm laminated glazing is recommended for Room 04, Room 10, Room 11, Room 12 and Room 13 (facing rear only). Refer to Figure 4 for illustration.

Figure 4. Illustration for recommended partition systems adjacent to communal areas

8.2 RECOMMENDED PARTITION FLOOR/CEILING

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

Table 8. 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 sole occupancy unit (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 8.5 of this report.

8.3 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 9. 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.

8.4 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.

8.5 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.

9.0 CONCLUSION

Koikas Acoustics was requested to prepare a revised acoustic report for the proposed boarding house development at 6 Edith Street, Kingswood NSW. The acoustical report is to be submitted to Penrith City Council and L&EC for Section 34 Conciliation.

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 EPA and BCA acoustic planning guidelines and requirements.

The included recommendations are based on designs prepared by Designcorp Architects Pty Ltd, detailed in Table 1.

The conclusions reached in this report should assist Council and L&EC 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. Based on the preliminary assessment conducted in this report, there are sufficient means to attenuate the proposed boarding house operation noise (predominantly people occupying the outdoor communal space) to the surrounding premises provided that the recommendations and operating restrictions stated in Section 5.4 of this report are implemented in design and construction.

2. The building can be sufficiently insulated/treated against noise associated with the car park ramp area. Recommendations are provided in Section 6.4 of this report.

3. A detailed assessment of mechanical plant noise should be prepared for the subject development prior to construction. Based on the preliminary assessment conducted in this report, there are sufficient means to attenuate the mechanical plant (i.e. outdoor AC condensers). Recommendations are provided in Section 7.2 of this report.

4. Acoustic treatment options for the common walls, floors and services partitions included within this report would be adequate for satisfying the sound insulation provisions of the BCA and Item 5 d) of the letter from L&EC.

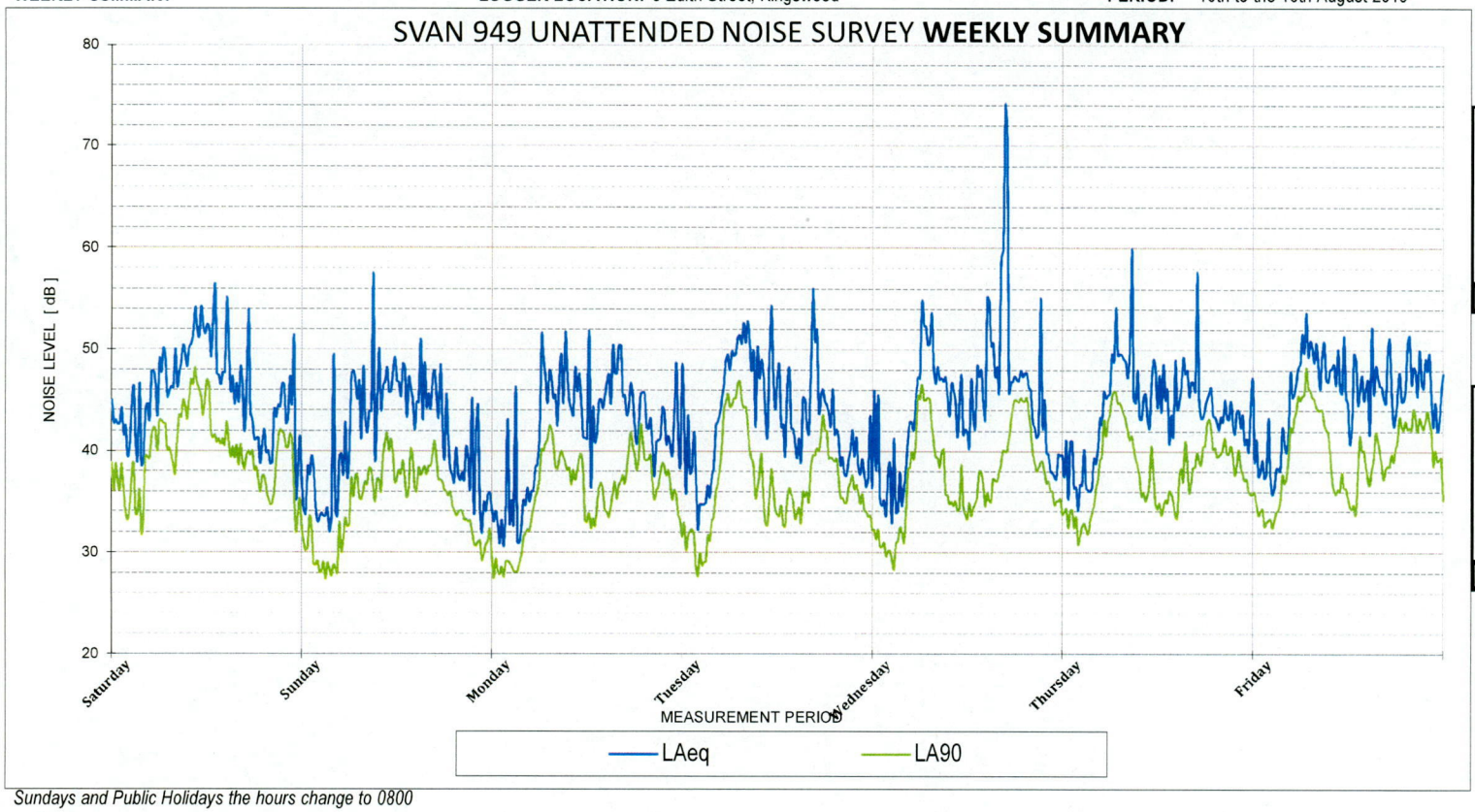
In our professional opinion, there is sufficient scope within the proposed building design to achieve the applied acoustic planning guidelines. Item 5 a) and 5 d) of the letter from L&EC for Section 34 Conciliation have also been adequately addressed in this revised report.

APPENDIX A

APPENDIX A

APPENDIX A

WEEKLY SUMMARY **LOGGER LOCATION:** 6 Edith Street, Kingswood **PERIOD:** 10th to the 16th August 2019



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	39	35	34
Day 2	36	33	28
Day 3	33	36	28
Day 4	33	35	29
Day 5	34	38	30
Day 6	34	39	32
Day 7	35	41	33
RBL	**34**	**36**	**30**

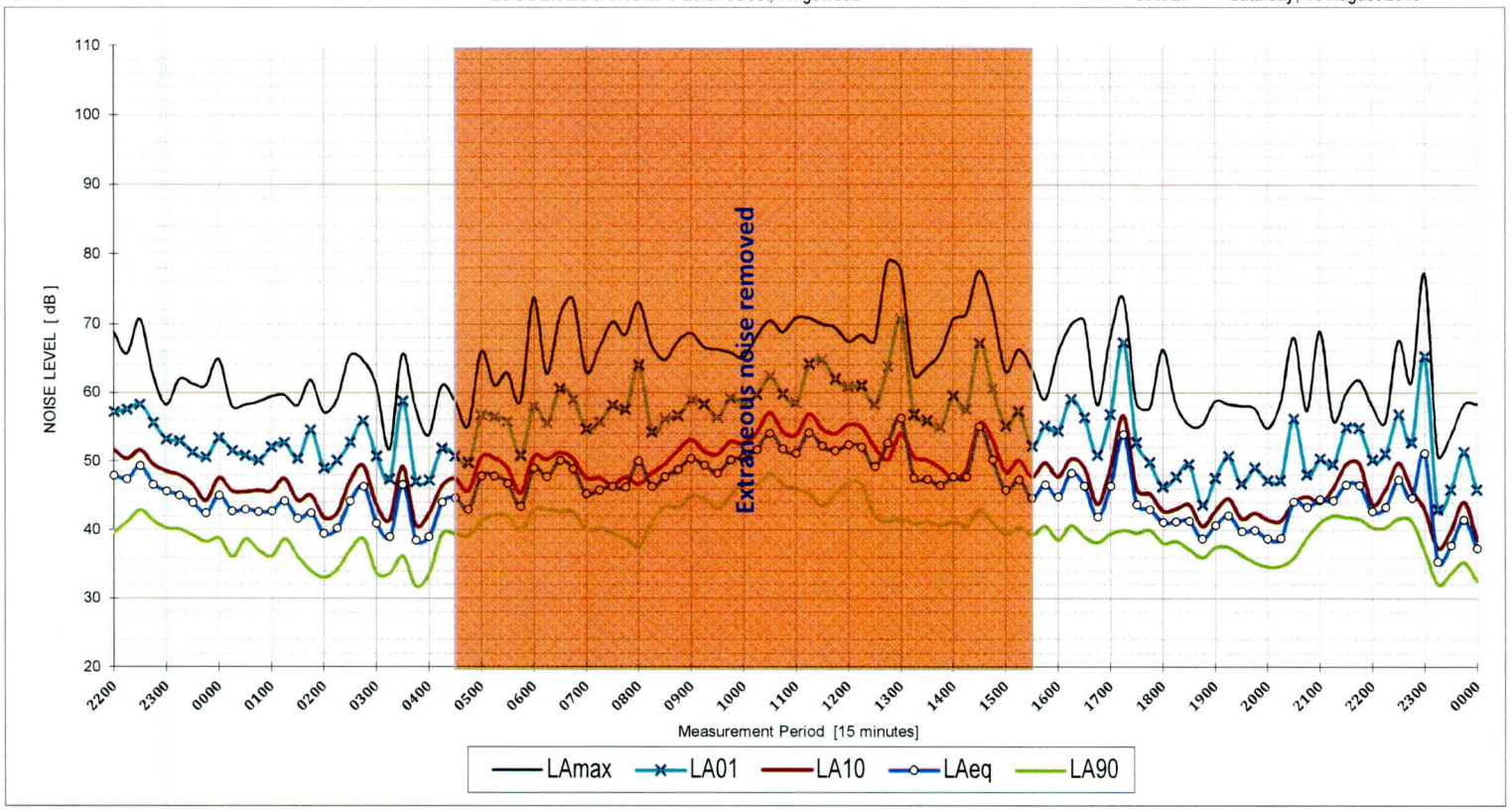
	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	50	43	45
Day 2	48	40	43
Day 3	47	43	41
Day 4	49	42	44
Day 5	60	48	45
Day 6	49	44	44
Day 7	48	48	45
Average	**53**	**45**	**44**

SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	52	dB
LAeq 9 hrs	2200-0700	44	dB
Max LAeq 1 hr	0700-2200	51	dB
Max LAeq 1 hr	2200-0700	46	dB
Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]			20

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 1 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Saturday, 10 August 2019



AMBIENT NOISE METRICS

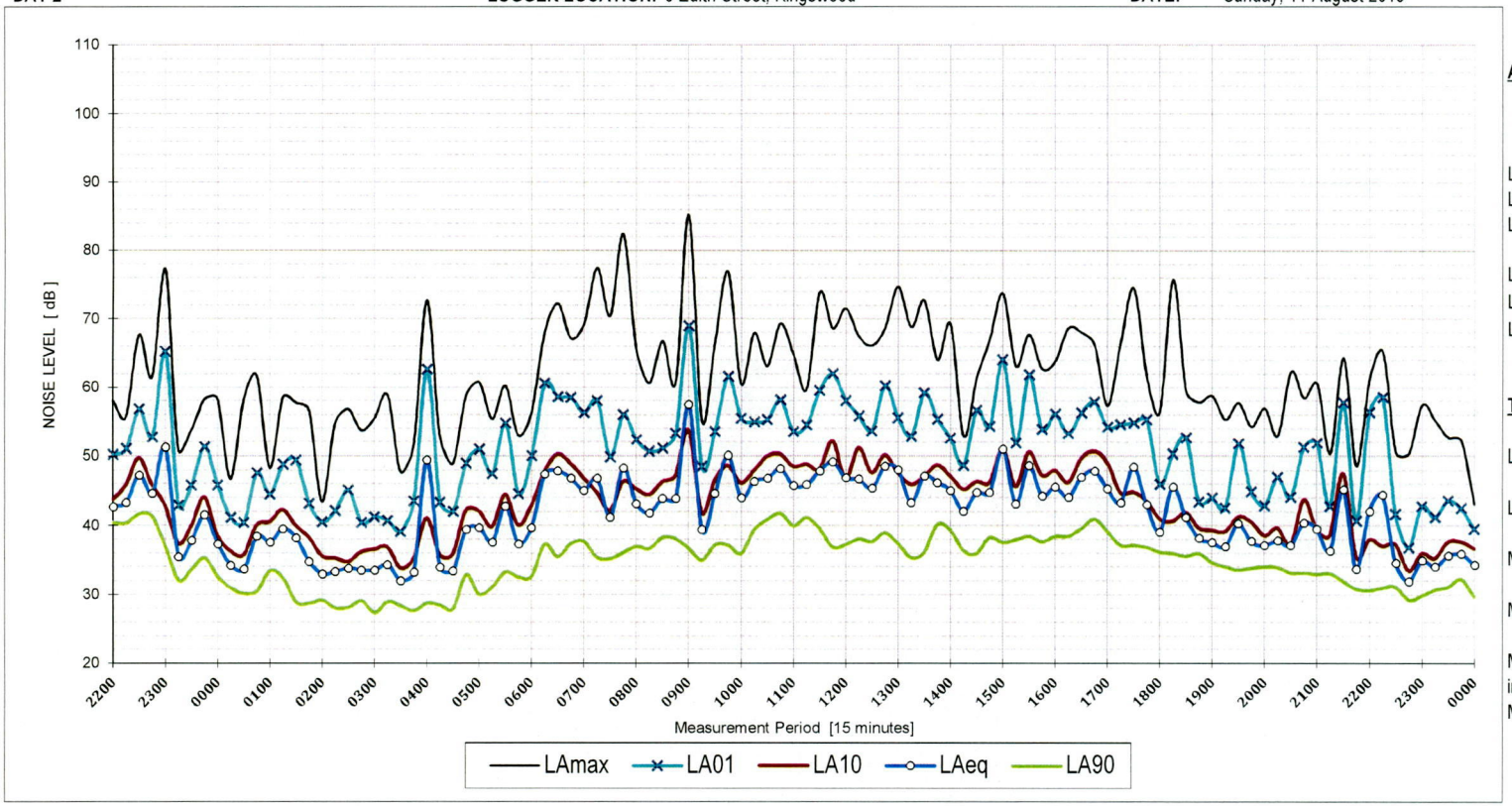
Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	39	dB
LA90 Evening	1800-2200	35	dB
LA90 Night-time	2200-0700	34	dB
LAeq Daytime	0700-1800	50	dB
LAeq Evening	1800-2200	43	dB
LAeq Night-time	2200-0700	45	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	49	dB
LAeq 9 hours	2200-0700	45	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]			30

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 2 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Sunday, 11 August 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	36	dB
LA90 Evening	1800-2200	33	dB
LA90 Night-time	2200-0800	28	dB
LAeq Daytime	0800-1800	48	dB
LAeq Evening	1800-2200	40	dB
LAeq Night-time	2200-0800	43	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	46	dB
LAeq 9 hours	2200-0700	43	dB
Max LAeq 1 hour	0700-2200	48	dB
Max LAeq 1 hour	2200-0700	46	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]			32

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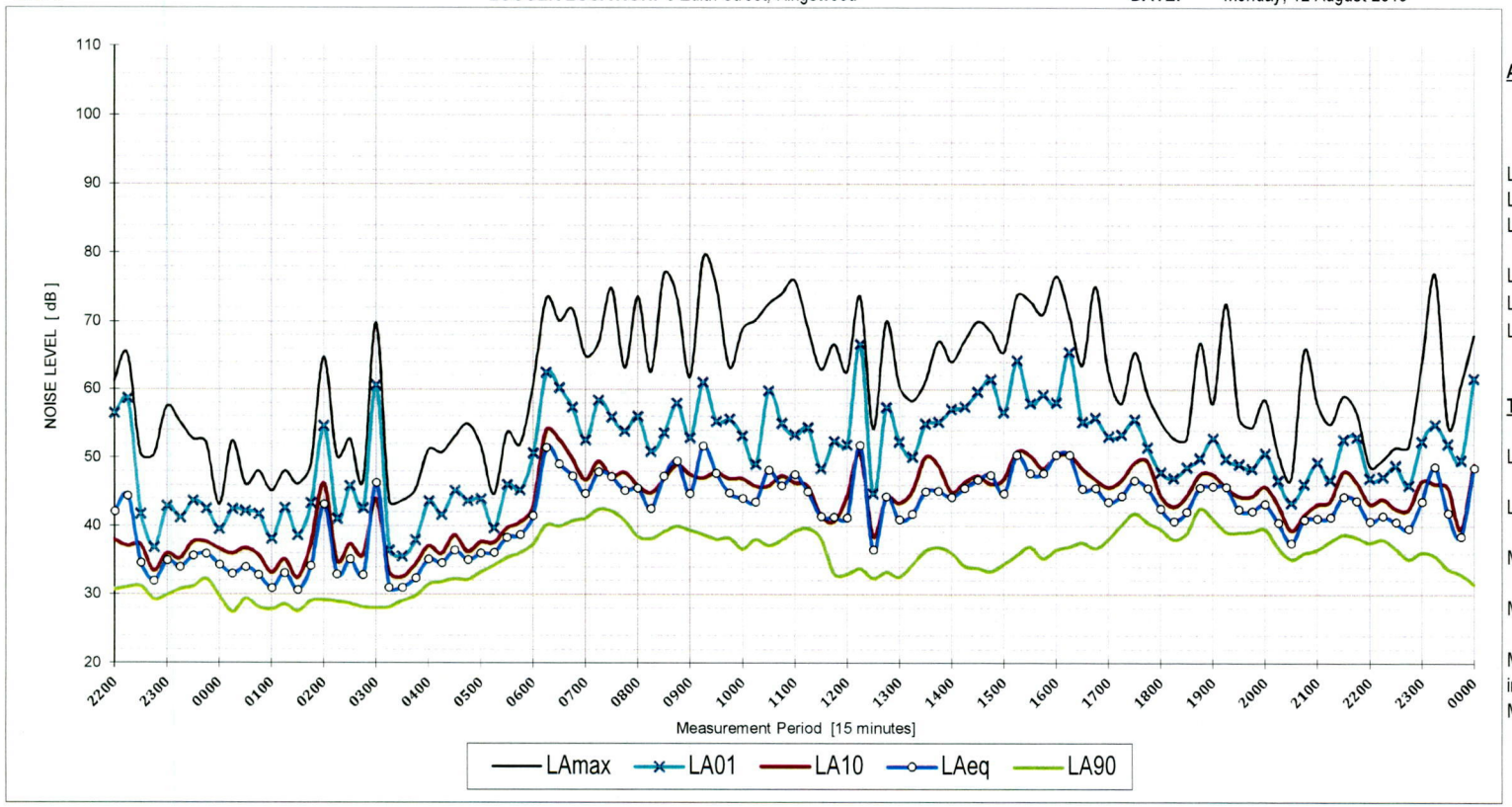
CONSULTANTS IN NOISE & VIBRATION

DAY 3 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Monday, 12 August 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	33	dB
LA90 Evening	1800-2200	36	dB
LA90 Night-time	2200-0700	28	dB
LAeq Daytime	0700-1800	47	dB
LAeq Evening	1800-2200	43	dB
LAeq Night-time	2200-0700	41	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	46	dB
LAeq 9 hours	2200-0700	41	dB
Max LAeq 1 hour	0700-2200	48	dB
Max LAeq 1 hour	2200-0700	41	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]			25

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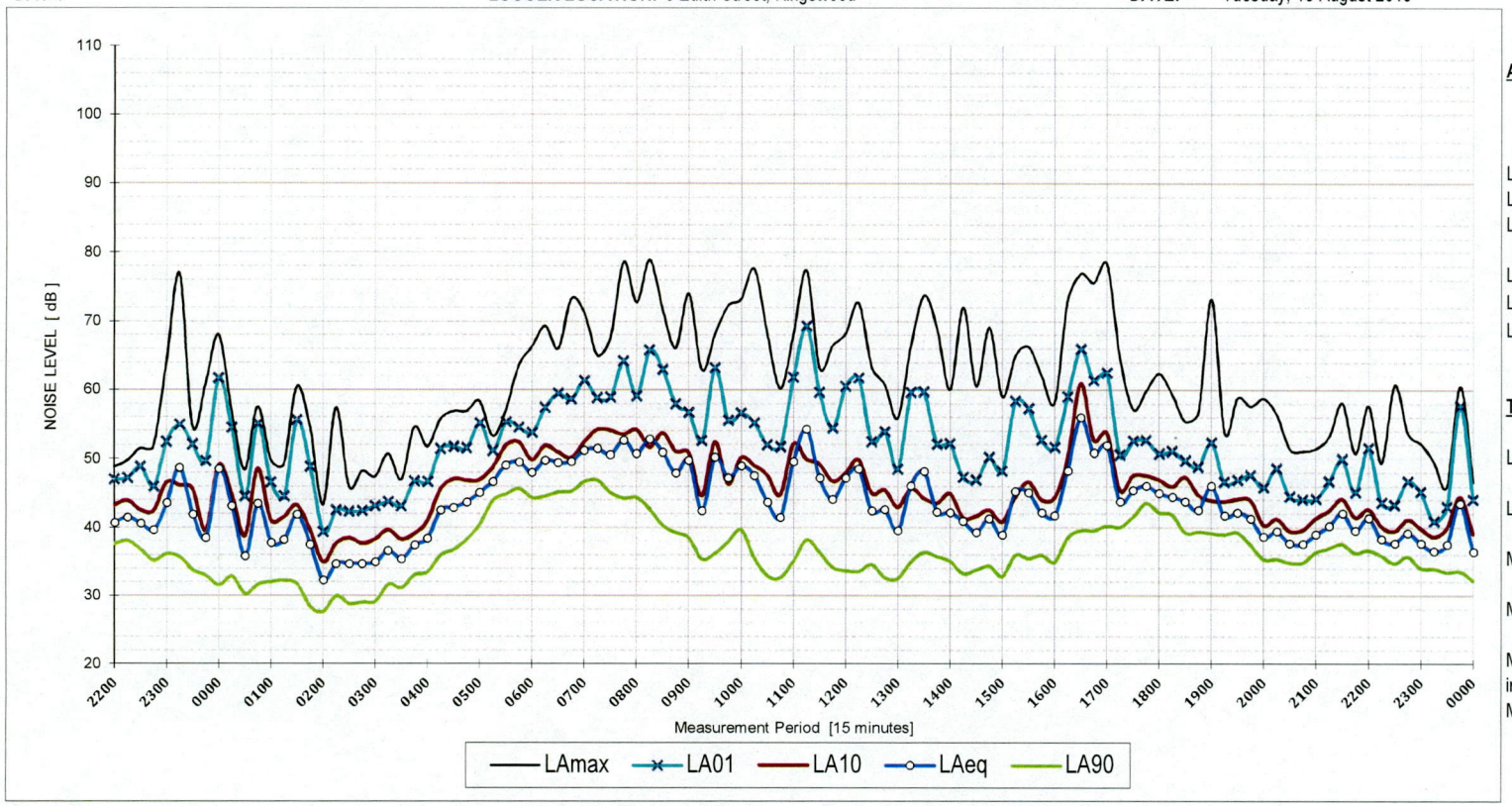
CONSULTANTS IN NOISE & VIBRATION

DAY 4 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Tuesday, 13 August 2019



AMBIENT NOISE METRICS

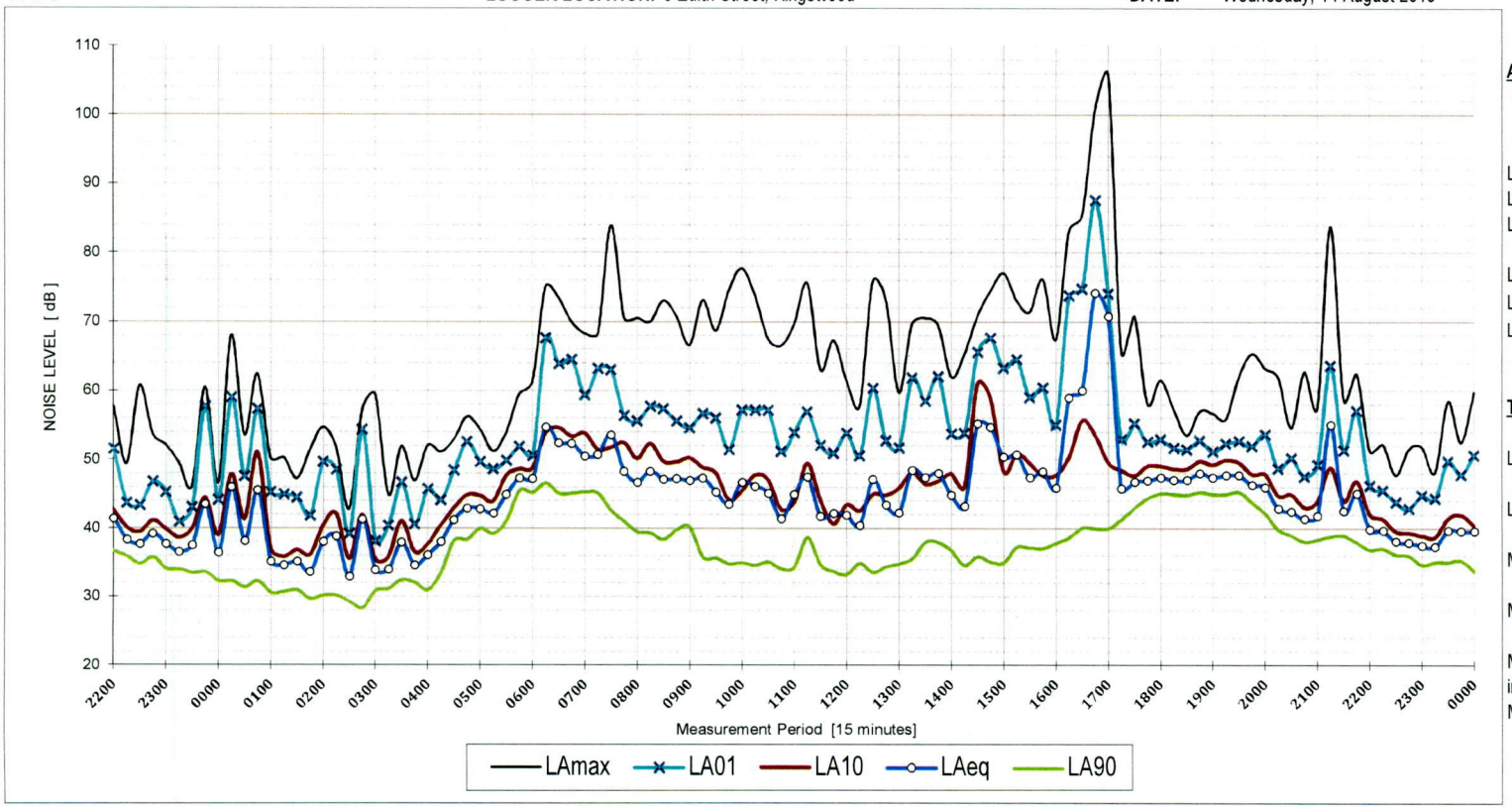
Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	33	dB
LA90 Evening	1800-2200	35	dB
LA90 Night-time	2200-0700	29	dB
LAeq Daytime	0700-1800	49	dB
LAeq Evening	1800-2200	42	dB
LAeq Night-time	2200-0700	44	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	48	dB
LAeq 9 hours	2200-0700	44	dB
Max LAeq 1 hour	0700-2200	51	dB
Max LAeq 1 hour	2200-0700	48	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]			12

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 5 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Wednesday, 14 August 2019



AMBIENT NOISE METRICS

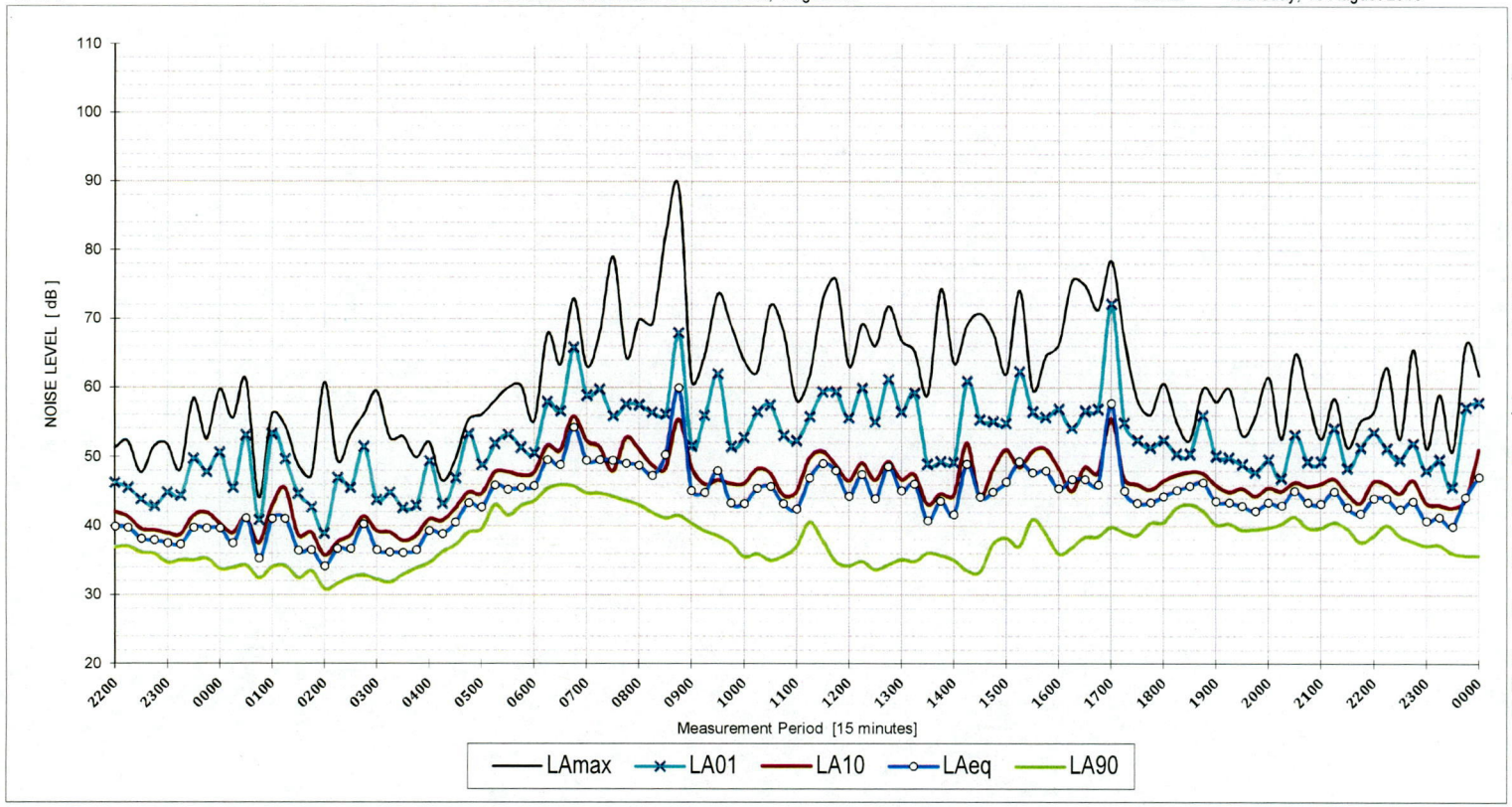
Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	34	dB
LA90 Evening	1800-2200	38	dB
LA90 Night-time	2200-0700	30	dB
LAeq Daytime	0700-1800	60	dB
LAeq Evening	1800-2200	48	dB
LAeq Night-time	2200-0700	45	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	59	dB
LAeq 9 hours	2200-0700	45	dB
Max LAeq 1 hour	0700-2200	55	dB
Max LAeq 1 hour	2200-0700	46	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]			16

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 6 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Thursday, 15 August 2019



AMBIENT NOISE METRICS

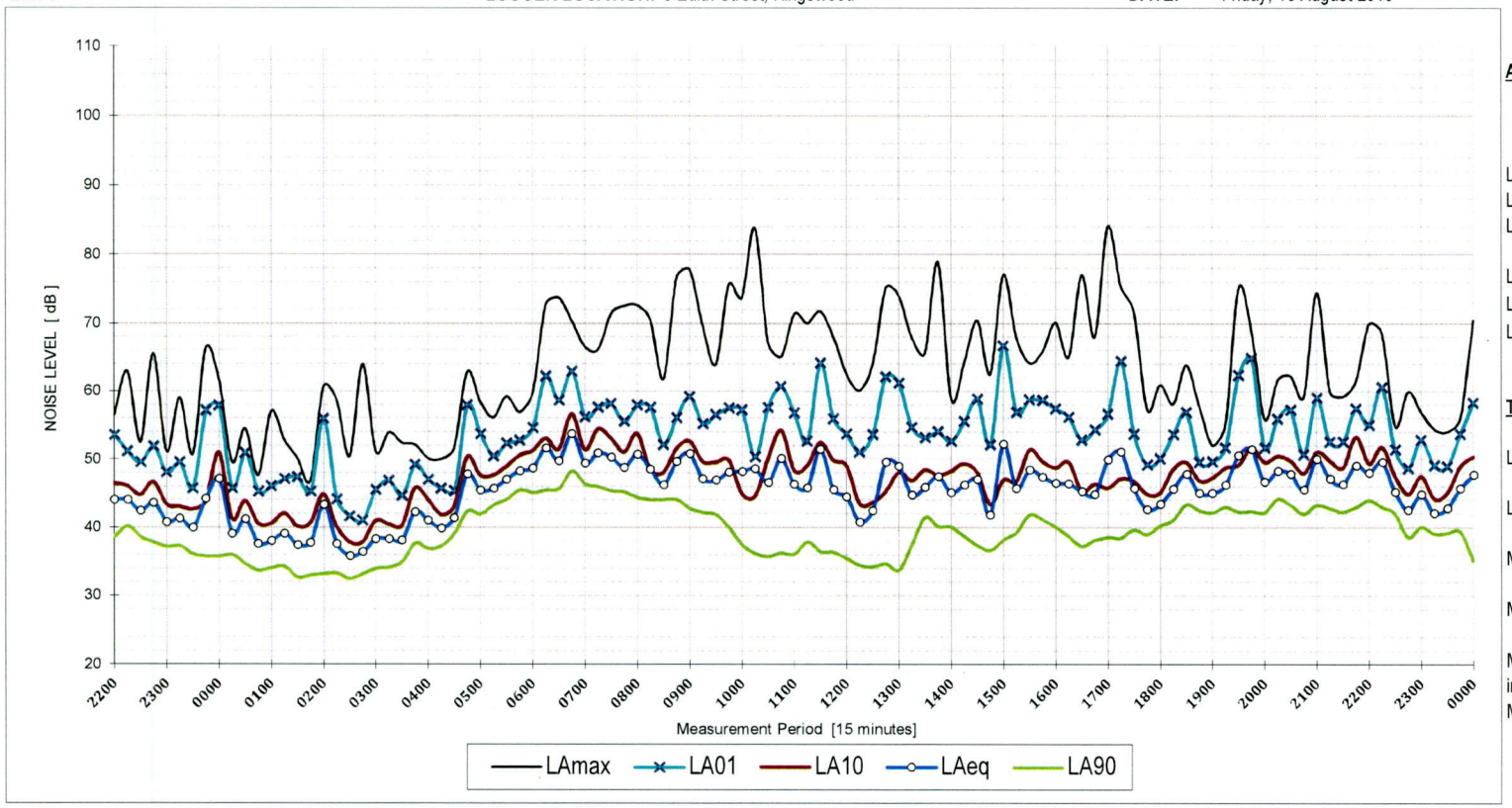
Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	34	dB
LA90 Evening	1800-2200	39	dB
LA90 Night-time	2200-0700	32	dB
LAeq Daytime	0700-1800	49	dB
LAeq Evening	1800-2200	44	dB
LAeq Night-time	2200-0700	44	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	48	dB
LAeq 9 hours	2200-0700	44	dB
Max LAeq 1 hour	0700-2200	52	dB
Max LAeq 1 hour	2200-0700	46	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]			13

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 7 **LOGGER LOCATION:** 6 Edith Street, Kingswood **DATE:** Friday, 16 August 2019



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	35	dB
LA90 Evening	1800-2200	41	dB
LA90 Night-time	2200-0700	33	dB
LAeq Daytime	0700-1800	48	dB
LAeq Evening	1800-2200	48	dB
LAeq Night-time	2200-0700	45	dB

TRAFFIC & MISC. NOISE METRICS

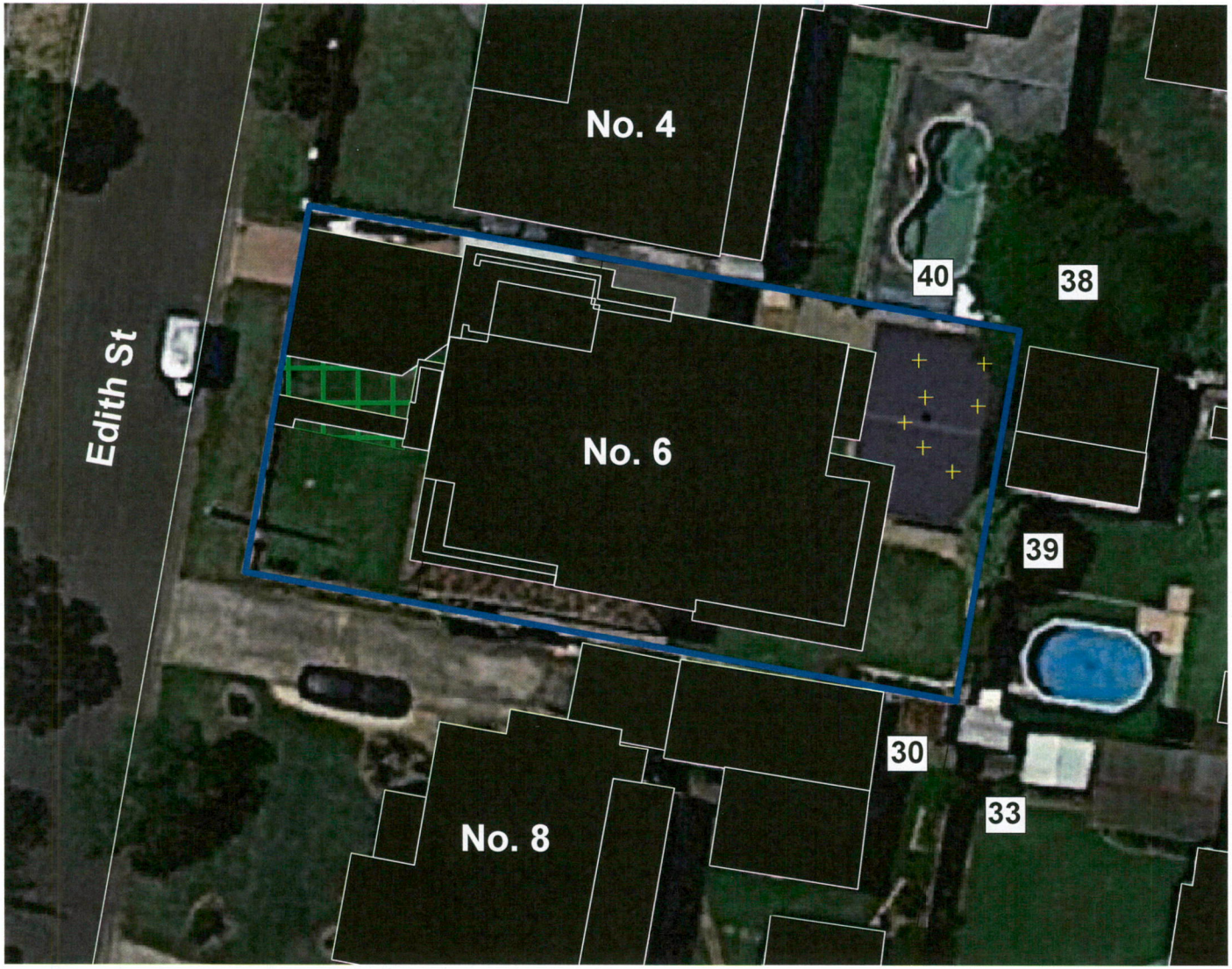
LAeq 15 hours	0700-2200	48	dB
LAeq 9 hours	2200-0700	45	dB
Max LAeq 1 hour	0700-2200	49	dB
Max LAeq 1 hour	2200-0700	47	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]			13

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

APPENDIX B

APPENDIX B

APPENDIX B



NOISE MODEL OF PEOPLE OCCUPYINGTHE OUTDOOR AREA

NOISE SOURCES

~ 14 people occupying the rear outdoor area (50% of people talking at normal vocal effort).

Note:

- LAeq,15mins noise level shown are at 1.5 m above natural ground level.

- The maximum reading at the surrounding residential dewlling is LAeq,15mins 40 dB.

PRINT DATE: 19/02/20

Point Source
Building
Barrier
3D-Reflector
Foliage
Ground Absorption
Contour Line
Receiver

> -99.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB
> 90.0 dB
> 95.0 dB
> 100.0 dB

NOISE MODEL OF PEOPLE OCCUPYING THE OUTDOOR AREA

JOB NUMBER: 3823
SITE LOCATION: 6 EDITH STREET, KINGSWOOD
ASSESSED TO: EPA's NPfI
LIMITING CRITERIA: 40-41 dB(A) - EXTERNAL

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