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ACOUSTICAL REPORT

PROPOSED GYMNASIUM

2/2 WATTLE ROAD, BROOKVALE NSW

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ACOUSTICAL REPORT

PROPOSED GYMNASIUM

2/2 WATTLE ROAD, BROOKVALE NSW

CONTENTS

TABLE OF APPENDICES

1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was commissioned by Michael Battaglia to prepare a noise impact assessment for the proposed development at 2/2 Wattle Road, Brookvale seeking approval for the change of use of the premises to become a recreation facility, primarily focused on kickboxing, personal and group training.

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

This assessment aims to ascertain the type and extent of noise mitigation measures required to improve the acoustic performance of the flooring and any noise equipment/activities.

This assessment considers the following:

- Measurements of the operational noise levels from the proposed gymnasium to the adjoining residential and commercial units;
- Discussion of the noise criteria that applies to surrounding premises, and
- Provide recommended noise mitigation measures where necessary

so that the premises may operate in compliance with the nominated acoustic planning levels.

2.0 THE PROPOSED DEVELOPMENT

The development is proposed to occupy the site at 2/2 Wattle Road, Brookvale. This location is situated in a primarily urban residential area classified as IN1 'General Industrial' as per relevant land zoning maps included in the Warringah Council Local Environment Plan 2011. Surrounding properties are a mixture of commercial and residential in classification, also located within IN1 Zoning.

The subject site and surrounding properties are identified in the aerial photograph in Figure 1.

Figure 1. Aerial photo of the subject site and surrounding area – Image from SixMaps

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

This acoustic report and any associated recommendations are based solely on the architectural design and drawings by Michael Airey (dated October 2021). Any unapproved changes to the design may impact the findings of this report and associated noise control recommendations.

As per the architectural drawings prepared by Michael Airey and dated October 2021, the proposed development will include a change of use to the ground floor unit.

The gymnasium is proposed to operate between:

- 5:00 am – 8:00 pm Monday to Friday
- 7:00 am – 11:00 am Saturday to Sunday

The proposed gymnasium is to operate with hourly classes and individual sessions according to the following hours of operation:

- Monday to Friday;
  - 5:00 am – 8:00 am (group fitness classes)
  - 8:00 am – 6:00 pm (one-on-one and semi-private sessions)
  - 6:00 pm – 8:00 pm (group fitness classes)
- Saturday to Sunday
  - 7:00 am – 11:00 am (group fitness classes)

The operational activities consist of a mixture of one-on-one private training (1 person), semi-private training (4 people), and group fitness classes (10 people). These activities will involve the use of typical gym equipment such as:

- dumbbells,
- kettlebells,
- cardio, and
- boxing equipment.

The maximum number of people occupying the premises at any one time will be 12 people (10 patrons and 2 staff members).

Background music is expected to be played through the gymnasiums internal sound system.

3.0 NOISE MONITORING

3.1 AMBIENT NOISE SURVEY

An unattended noise logging survey was conducted between 12 November 2021 and 18 November 2021. The microphone was placed on the telegraph pole on the corner of Wattle Road and Harbord Road at approximately 4.0 - 4.5 metres above the natural ground level in 'free-field' conditions.

A Type 1 Convergence Instruments Noise Sentry RT-W noise logger was used for the survey. The instrument was set up to measure sound pressure levels as 'A' frequency weighting and 'Fast' time response. Noise levels were stored within the logger memory at recurring 1-second intervals.

A NATA calibrated and certified Larson Davis CAL200 precision acoustic calibrator was used to field calibrate the sound level meter before and after the noise survey. No system drift was observed for this sound level meter.

BOM weather records (**Appendix A**) for the nearest available weather station indicate that inclement weather conditions may have impacted the noise survey. Noise data from affected periods throughout the survey were removed following standard requirements of the NSW Environmental Protection Authority (EPA).

A summary of the noise survey data is presented below.

Table 2. Summary of noise logger results [dB]

Location	Period, T [1]	Ambient noise level L_{Aeq}	Rating background level L_{A90}	Traffic noise level[2] $L_{Aeq, Period}$
160 Harbord Road	Day	69	59	68
	Evening	66	48	
	Night	62	36	62

Notes

1. The **NSW EPA Noise Policy for Industry (NPfI)** refers to:
   Daytime: 7 am – 6 pm Monday to Saturday and 8 am to 6 pm Sunday and public holidays.
   Evening: 6 pm – 10 pm Monday to Sunday
   Night: 10 pm - 7 am Monday to Saturday and 10 pm to 8 am Sunday and public holidays.
2. The **EPA/RMS/NSW DoP** refers to:
   Daytime: 7 am – 10 pm seven days per week.
   Night: 10 pm - 7 am seven days per week

Daily logger graphs are attached in **Appendix B**.

3.2 ATTENDED NOISE MONITORING

Measurements were conducted inside the commercial lot directly adjoining the subject site within the premise at 2/2 Wattle Road, Brookvale to identify the proposed gymnasium activities impact on the adjoining premises. Measurements were taken inside the first floor commercial lot, which houses another recreational gym. Figure 2 identifies the subject premise and adjoining commercial premise upstairs, as taken from Wattle Road.

Figure 2. Façade of the subject site and adjoining premises

The noise surveys were conducted between 9:00 am and 10:00 am on Thursday 18th November 2021.

The noise survey was conducted with an NTi XL2 sound level meter set to A-frequency weighting and Fast-time response. Measurements were conducted for durations deemed sufficient to represent the underlying ambient and background noise environment without the influence of extraneous noise or noise from the subject development. The measured ambient noise levels were dominated by road traffic noise from Harbord Road. Inclement weather conditions did not adversely impact the noise survey.

A summary of the ambient noise levels excluding the proposed gymnasium activities is provided in Table 2. Background music is expected to be played through the commercial lots speaker system.

Table 1. Summary of criteria noise survey results [dB]

Location	L_{Aeq}	L_{A90}
2/2 Wattle Road, upstairs commercial premise fronting Wattle Road Attended Monitoring Location 1 – indoors, windows closed	53	44
2/2 Wattle Road, upstairs commercial premise middle room Attended Monitoring Location 2 – indoors, windows closed	57	45

Additionally, the ambient noise survey data suggests that the outdoor background noise level was 5-10 dB lower at 5:00 am than it was during the attended survey from 9:00 am to 10:00 am, as a result of reduced traffic volumes earlier in the morning. On account of ambient indoor noise within the upstairs commercial premise during business hours, and the reduced traffic volumes at 5:00 am, indoor background noise levels at the most sensitive period (5:00 am) are anticipated to be 3 dB lower than those recorded during the attended survey at 9:00 am to 10:00 am.

4.0 NOISE ASSESSMENT GUIDELINES

4.1 EPA NOISE POLICY FOR INDUSTRY

Noise emission design targets have been referenced from the NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI).

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 used as a reference tool for establishing suitable planning levels for noise generated by mechanical plant and equipment and noise emission from commercial operations.

For residential receivers, 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 (PNTL)**. To determine which of the intrusive and amenity noise criteria is more stringent, the underlying noise metrics must be the same. As the intrusive noise level is defined in terms of an $L_{Aeq,\ 15\ minutes}$ and the amenity noise level is defined in terms of an $L_{Aeq,\ Period}$, a correction +3 dB correction is applied to the project amenity noise level to equate the $L_{Aeq\ Period}$ to $L_{Aeq,\ 15\ minutes}$.

Non-residential receivers are assessed to project amenity noise levels relevant to the applicable receiver category (industrial/commercial).

Where noise is measured or predicted below the project noise trigger level, the noise outcome is deemed acceptable. Above the project noise trigger level, management responses such as applying reasonable and feasible noise mitigation measures are to be recommended, along with assessing any residual noise impacts once noise mitigation has been considered.

The policy is designed in such a way that the assessing authority would consider the project noise trigger levels, reasonable and feasible mitigation measures, and any residual noise impacts when deciding on acceptable noise outcomes.

The site-specific project noise trigger levels need only be considered for the hours under which the

noise or activity occurs, which is limited to daytime hours.

Table 1. NPfI planning levels – $L_{Aeq,\ 15\ min}$ [dB] – Residential premise – 160 Harbord Road, Brookvale								
Period,T (Note 1)	**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	59	64	Urban	60	No	55	58	58
Evening	48	53	Urban	50	No	45	48	48
Night	36	41	Urban	45	No	40	43	41
Early Morning[2]	49	52	Urban	45	No	40	43	43
Notes: 1. 2. 3.	**EPA** defines the following periods: **Day**: 7 am to 6 pm Mon to Sat and 8 am to 6 pm Sun and public holidays, **Evening**: 6 pm to 10 pm Mon to Sun, **Night**: 10 pm to 7 am Mon to Sat and 10 pm to 8 am Sun and public holidays. **Early morning:** 5 am to 7 am Mon to Sat and 5 am to 8 am Sun and public holidays. Project noise amenity level = recommended noise amenity level – 5 dB, except where specific circumstances are met, such as high traffic.							

4.2 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.*

The noise criterion adopted by Koikas Acoustics to addresses "offensive noise" to an adjoining commercial space(s) (indoors) is:

$$\text{Ave } L_{Amax} \leq L_{A90} + 15 \text{ dB}, \quad \text{i.e. Ave } L_{Amax} \leq 56 - 57 \text{ dB}$$

For the commercial premises (assuming indoor L_{A90} at 5:00 am is approximately 3 dB below the measured levels during the attended survey, as per previous discussions). The selection of L_{A90} + 10

dB is informed by reference to Australian Standards AS2107-2016, wherein the recommended indoor noise levels for fitness rooms is 10 – 20 dB higher than the recommended indoor noise levels for rooms within residences, and a criteria of L_{A90} + 5 dB is typically used for "offensive noise" criterion where fitness rooms directly adjoin residences.

The noise criterion adopted by Koikas Acoustics to addresses "offensive noise" to a residential premises (indoors):

Ave L_{Amax} ≤ 45 dB for residential premises

4.3 OFFENSIVE NOISE CHECKLIST (EPA NOISE GUIDE FOR LOCAL GOVERNMENT, 2013)

The EPA NGLG provides a checklist that is used to assist with establishing if a particular noise is offensive. The checklist is summarised below:

- Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?
- Does the noise include characteristics that make it particularly irritating?
- Does the noise occur at times when people expect to enjoy peace & quiet?
- Is the noise atypical for the area?
- Does the noise occur often?
- Are several people affected by the noise?

4.4 SLEEP DISTURBANCE/AROUSAL – RESIDENTIAL PREMISES

The NPfI also guides on assessing potential sleep disturbance for residents affected by maximum noise levels from a particular development or assessment site. Although the current literature is yet to define a quantifiable noise level above which sleep disturbance is experienced, guidelines are provided by the EPA for assessing the potential for sleep disturbance as follows:

- $L_{Aeq,\ 15\ minutes}$ 40 dB or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB, whichever is the greater.

The DECCW Road Noise Policy (RNP) also provides some guidance for assessing noise that may result in sleep disturbance. This document suggests that a low probability for sleep disturbance can be achieved where L_{Amax} noise levels within a bedroom are kept below 50-55 dB, and $L_{A1,\ 1\text{-minute}}$

noise levels do not exceed the background level by more than 15 dB. A summary of the existing sleep disturbance guidelines are as follows:

Table 3. Sleep disturbance assessment guidelines

Location	Period, T	Noise Policy for Industry		Road Noise Policy	
		$L_{Aeq,\ 15\ mins}$	L_{Amax}	L_{Amax}	$L_{A1,\ 1\ min}$
Residential	0600-0700	40 Outdoors	52 Outdoors	50-55 indoors Indoors	51 Outdoors
Notes 1.	Night: 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday and public holidays				

5.0 ANALYSIS

5.1 MEASURED NOISE LEVELS

All noise activity events were identified with a software program called XL2 Data Explorer which allows for the analysis and playback of recorded sound files.

Noise level measurements of the following activities were undertaken to the first floor commercial premises in the main room fronting Wattle Road (Location 1), and also in the centre room (Location 2). Layout of locations are shown below.

All dumbbell drop tests considered noise impact from dumbbells dropped from approximately 0.4 metres (knee height), except for Test 00.

- **Test 00**:

  30 kg dumbbell, controlled drop (lowered quickly from knee height) on bare concrete sub-base
- **Test 01**:

  30 kg dumbbell dropped from knee height on 15mm impact tile

- **Test 02**:

  30 kg dumbbell dropped from knee height on 15mm impact tile over 30 mm Olympact
- **Test 03**:

  30 kg dumbbell dropped from knee height on 15mm impact tile over 2 x 30 mm Olympact
- **Test 04**:

  30 kg dumbbell dropped from knee height on 15mm impact tile over 3 x 30 mm Olympact
- **Test 05**:

  Music played off a portable speaker (Spatial L_{Aeq} 81 dB, spatial L_{Amax} 89 dB).

Table 3. Summary of Attended Noise Survey Results – Watermark Services

Descriptions of Flooring Samples and Activities	Location 1		Location 2		Compliance Achieved?
	Measured Noise Levels L_{Amax} [dB]	Noise Criterion L_{Amax} [dB]	Measured Noise Levels L_{Amax} [dB]	Noise Criterion L_{Amax} [dB]	
Test 00: 30 kg dumbbell, controlled drop (lowered quickly from knee height) on bare concrete sub-base	51	**56**	58	**57**	**No – Exceeded by 1 dB**
Test 01: 30 kg dumbbell dropped from knee height on 15mm impact tile	55		59		**No – Exceeded by 2 dB**
Test 02: 30 kg dumbbell dropped from knee height on 15mm impact tile over 30 mm Olympact	47		49		**Yes**
Test 03: 30 kg dumbbell dropped from knee height on 15mm impact tile over 2 x 30 mm Olympact	Barely audible		Barely audible		**Yes**
Test 04: 30 kg dumbbell dropped from knee height on 15mm impact tile over 3 x 30 mm Olympact	Barely audible		Barely audible		**Yes**
Test 05: Music played off a portable speaker (Spatial LAeq 81 dB, spatial LAmax 89 dB)	Barely audible		Barely audible		**Yes**

Tests 03-05 were barely audible to inaudible in the upstairs commercial premises. This is primarily due to the relatively high ambient noise in these spaces as a result of music being played through speakers and conversations associated with the upstairs gym classes. The measured L_{Aeq} in Location 1 was 53 dB and in Location 2 was 57 dB.

It is also noted that the impact testing results represent a worst-case scenario. Dropping weights is quite unlikely in the proposed gym, and the weights are anticipated to be smaller than 30 kg.

5.2 CALCULATED NOISE LEVELS TO NEIGHBOURING RESIDENTIAL PROPERTIES

Noise emissions from the proposed gymnasium have also been assessed to neighbouring

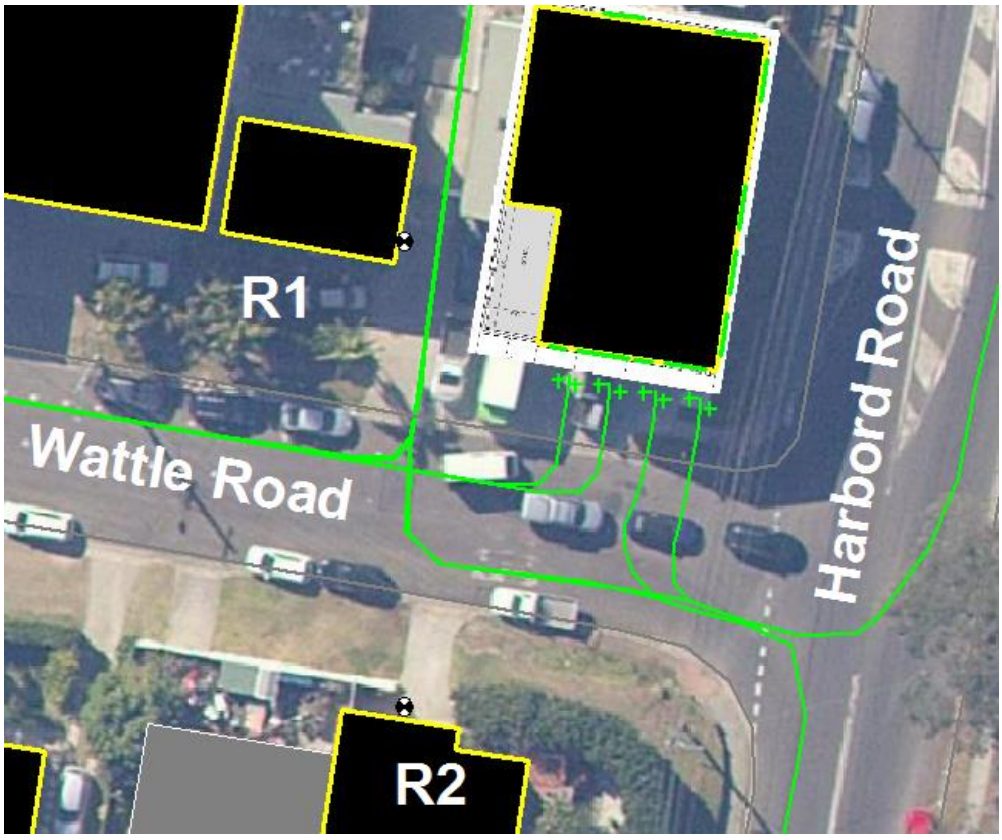
residential receivers by way of preparing an acoustic model and conducting point-to-point calculations based on standard sound propagation algorithms. All calculations consider music played off the portable speaker emanating from the roller door and as breakout noise from the glazed windows and doors. Calculations also consider a worst-case scenario for vehicle parking movements, assuming 8 vehicles arriving/leaving in one 15-minute period. Associated noise sources such as car doors closing and engines starting are included.

Reference should also be made to additional noise control recommendations included within Section 6.0 of this report, which also govern the calculated receiver noise levels.

Due to the size of the development, several potentially affected receiver locations must be assessed in terms of their respective noise exposure from mechanical plant and equipment associated with the development. The most noise-sensitive receiver locations are summarised below.

Table 4. Assessment locations

ID	Receiver type and address	Assessment location
R1	Residential / 4 Wattle Road	Upper floor level, bedroom window
R2	Residential / 160 Harbord Road	Upper floor level, bedroom window



Predicted operational noise levels are as follows:

Table 5. Calculated Noise Levels, $L_{Aeq, 15\text{-}minutes}$ [dB]		
ID	**Calculated Noise Levels**	**Night Noise Criteria**
R1	38	**43**
R2	38	

Compliance with the most stringent night-time noise criteria implies compliance during all other periods of the day with less stringent noise criteria.

A Cadna/A noise model is attached as **Appendix C**.

5.3 OFFENSIVE NOISE CHECKLIST (EPA NOISE GUIDE FOR LOCAL GOVERNMENT, 2013)

The EPA NGLG provides a checklist that is proposed to assist with establishing if a particular noise is offensive. The checklist is covered based on the above recommendations being properly implemented. The checklist is summarised as follows with respect to the recommendations being implemented:

- *Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?*

  Provided the recommendations have been implemented, measured noise levels are expected to be barely audible at both the adjoining commercial premises and nearby residential receivers.
- *Does the noise include characteristics that make it particularly irritating?*

  The impulsive nature of the thumps may be considered irritating, however, expected to be barely audible to inaudible.
- *Does the noise occur at times when people expect to enjoy peace & quiet?*

  Although the gymnasium is proposed to operate during some hours that the EPA classes as the night period, a compliant noise level is expected at the most sensitive residences pending the implementation of recommendations discussed in this report. Therefore, the noise should not occur at times when people expect peace and quiet.
- *Is the noise atypical for the area?*

  Occasional thumps could be heard from other commercial and industrial units nearby, however, provided the recommendations have been implemented, measured noise levels emanating from the proposed exercise zone to the most sensitive receivers are expected to

be barely audible to inaudible. Ambient noise from road traffic along Harbord is also high, and will provide some masking of noise-producing activities.

- *Does the noise occur often?*

  The noise may occur often. However, provided the recommendations have been implemented, measured noise levels are expected to be barely audible to inaudible.

6.0 RECOMMENDATIONS

It is the opinion of Koikas Acoustics that compliance with the nominated acoustic criteria will be achieved, provided the following recommendations are implemented in the gymnasium.

6.1 FLOOR COVERINGS

All lifting zones and light exercise class zones where the use of weights is expected should be constructed with one layer of 15 mm impact tile (A1 Rubber), over one layer of 30 mm Olympact (A1 Rubber).

Signs should be posted advising clients not to use free-weights outside of their allocated area. Alternatively, one layer of 15 mm impact tile over one layer of 30 mm Olympact could be installed in the entire exercise zone.

6.2 MUSIC

Music is expected to be played at a range of levels depending on the type of activity and the need for conversation between trainers and patrons. Koikas Acoustics measured internal music levels within the proposed gymnasium of up to L_{Aeq} 81 dB (spatial average) and found this to be barely audible in the upstairs commercial premise, and hence is compliant in this location.

To ensure compliance at neighbouring residences during the night-time period (5:00 am to 7:00 am), spatially averaged noise levels from speakers are required to be a maximum of L_{Aeq} 70 dB within the inside of the proposed gymnasium (assuming that the roller door is open). Alternatively, the roller door may be closed, in which case the original music levels of L_{Aeq} 81 dB (spatial average) are acceptable.

A spatial average of L_{Aeq} 70 dB for music within the proposed exercise zone is judged to be conservative, and internal music levels are expected to be lower.

6.3 ADDITIONAL RECOMMENDATIONS

Also, the following is noted:

- It is also recommended that signs advising gym patrons to “not drop weights” are posted around the gymnasium. This should be strictly adhered to and all trainers should be vigilantly enforcing the proper placement of weights on the flooring.
- The information provided in this report relates to acoustic matters only. Supplementary advice should be sought for other matters relating to flooring installation, construction, design, structural, fire-rating, waterproofing, and the likes.
- Product installation details, methodologies and bonding or adhesive product (if any) must be sought from the product supplier, installer or other experts. Koikas Acoustics is not liable for any product defects. In this case, the installation guideline and details from A1 Rubber must be strictly followed.
- All hard floor surface finishes should be vibration isolated off the structural walls and columns.

6.4 COMPLAINTS HANDLING

A site contact and phone number should be distributed to all surrounding premises and displayed on the site noticeboard for any complaints arising due to noise and/or vibration generated during the proposed gymnasium operation. The site should have clear complaints handling procedures 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.

7.0 CONCLUSION

Koikas Acoustics was requested to prepare a noise impact assessment for the proposed gymnasium at 2/2 Wattle Road, Brookvale NSW.

Approval of the development is subject to conditions of consent imposed by the Council to ensure the development complies with all relevant statutory requirements and is consistent with the development standards required in the respective Local Government Area.

Noise level measurements of the activities were undertaken to the first floor commercial premises in the main room fronting Wattle Road, and also in the centre room, to identify the proposed gymnasium activities impact to the adjoining premises. The noise surveys were conducted between 9:00 am and 10:00 am on Thursday 18th November 2021.

When the recommendations provided in Section 6.0 of this report are implemented, it is in Koikas Acoustics opinion that “offensive noise” from the proposed gymnasium is minimised and unlikely to occur within the adjoining commercial premises or neighbouring residences.

APPENDIX A

APPENDIX A

APPENDIX A

Daily Rainfall (millimetres)

COLLAROY (LONG REEF GOLF CLUB)

Station Number: 066126 · State: NSW · Opened: 1965 · Status: Open · Latitude: 33.74°S · Longitude: 151.31°E · Elevation: 2 m

2021	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	*0*	*0.8*	*0*	*4.4*	*0*	*0*	*4.0*	*0*	*0*	*0*	*0*	
2nd	*0.8*	*8.4*	*0*	*0*	*0*	*0*	*2.2*	*0*	*0*	*0*	*0*	
3rd	*5.8*	*4.2*	*15.2*	*0*	*0*	*0*	*0*	*3.2*	*0*	*7.0*	*0*	
4th	*1.2*	*0*	*0*	*0*	*0*	*8.4*	*0*	*0*	*0*	*0*	*0*	
5th	*8.2*	*0*	*0*	*0*	*12.6*	*5.4*	*0*	*0*	*10.0*	*0*	*11.2*	
6th	*42.6*	↓	*0*	*1.2*	*11.6*	*0*	*0*	*0*	*1.6*	*0*	*0*	
7th	*0*	*2.2*	*0*	*7.0*	*6.2*	*0*	*0*	*0*	*0*	*0*	*0*	
8th	*0*	*0*	*0*	*13.6*	*0*	*0*	*0*	*0*	*0*	*0*	*7.6*	
9th	*0*	*0*	*0*	*0*	*0*	*8.8*	*0*	*3.0*	*0*	*0*	*1.2*	
10th	*0*	*5.2*	*1.8*	*1.0*	*0*	*0*	*2.8*	*0*	*0*	*0*	*0*	
11th	*0*	*0*	*13.6*	*0*	*0*	*6.6*	*15.2*	*0*	*0*	*5.6*	*24.8*	
12th	*0*	*0*	*0.8*	*0*	*0*	*0*	*4.8*	*0*	*0*	*2.2*	*10.2*	
13th	*0*	*9.8*	*5.2*	*0*	*1.8*	*0*	*0*	*0*	*0*	*4.4*	*0*	
14th	*0*	*13.6*	*4.2*	*0*	*0*	*0*	*0*	*0*	*20.8*	*10.8*	*1.0*	
15th	*2.0*	*0*	*26.8*	*0*	*0*	*0*	*1.2*	*0*	*3.2*	*0*	*1.8*	
16th	*0*	*4.8*	*0*	*0*	*0*	*0*	*0*	*0*	*1.6*	*0.4*	*0*	
17th	*0*	*0*	*5.8*	*0*	*0*	*4.8*	*2.0*	*0*	*0*	*0*	*0*	
18th	*0*	*4.8*	*6.8*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
19th	*0*	*14.6*	*51.0*	*0*	*0*	*2.2*	*0*	*0*	*0*	*0*	*0*	
20th	*2.0*	*0.8*	*32.0*	*0*	*0*	*8.6*	*0*	*0*	*0*	*0*	*0*	
21st	*0*	*0.4*	*152.2*	*0*	*8.6*	*22.4*	*0*	*0.4*	*0*	*0*	*9.4*	
22nd	*0*	*0*	*31.4*	*0*	*1.4*	*3.8*	*0*	*0*	*0.6*	*0*	*12.6*	
23rd	*0*	*0.4*	*41.8*	*0*	*0.2*	*0*	*0*	*0*	*0*	*0*	*2.4*	
24th	*0*	*34.0*	*12.6*	*0*	*9.8*	*0.2*	*0*	*25.2*	*0*	*0*	*2.6*	
25th	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*22.8*	*0*	*0*		
26th	*0*	*0.6*	*1.0*	*0*	*0*	↓	*0*	*0*	*1.8*	*0*		
27th	*0*	*0*	*0*	*0*	*0*	↓	*0*	*0*	*8.4*	*0*		
28th	*8.4*	*0.8*	*0*	*0*	*0*	*3.6*	*0*	*0*	*0*	*0*		
29th	*8.6*		*0*	*0*	*0*	*7.4*	*0*	*0*	*0*	*0*		
30th	*19.4*		*1.2*	*0*	*0*	*16.2*	*0*	*0*	*3.4*	*0*		
31st	*0.6*		*7.6*		*0*		*0*	*0*		*0*		
Highest daily	*42.6*	*34.0*	*152.2*	*13.6*	*12.6*	*22.4*	*15.2*	*25.2*	*20.8*	*10.8*	*24.8*	
Monthly Total	*99.6*	105.4	*411.0*	*27.2*	*52.2*	*98.4*	*32.2*	*54.6*	*51.4*	*30.4*		

↓ This day is part of an accumulated total
Quality control: 12.3 Done & acceptable, *12.3* Not completed or unknown

Product code: IDCJAC0009 reference: 80423756

Australian Government
Bureau of Meteorology

Daily Rainfall (millimetres)

COLLAROY (LONG REEF GOLF CLUB)

Station Number: 066126 · State: NSW · Opened: 1965 · Status: Open · Latitude: 33.74°S · Longitude: 151.31°E · Elevation: 2 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	116.4	132.6	140.1	103.6	103.5	141.9	67.8	61.9	68.2	63.3	85.8	69.7
Median	92.5	124.4	107.9	70.1	82.9	121.8	47.2	48.0	57.2	54.8	76.0	66.1
Highest daily	206.0	*138.2*	*152.2*	119.6	88.0	*114.4*	86.0	149.0	99.1	83.0	151.4	100.6
Date of highest daily	8th 1973	10th 2020	21st 2021	13th 1971	3rd 2009	5th 2010	1st 2005	7th 1998	2nd 1970	2nd 2004	14th 1969	10th 1970

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

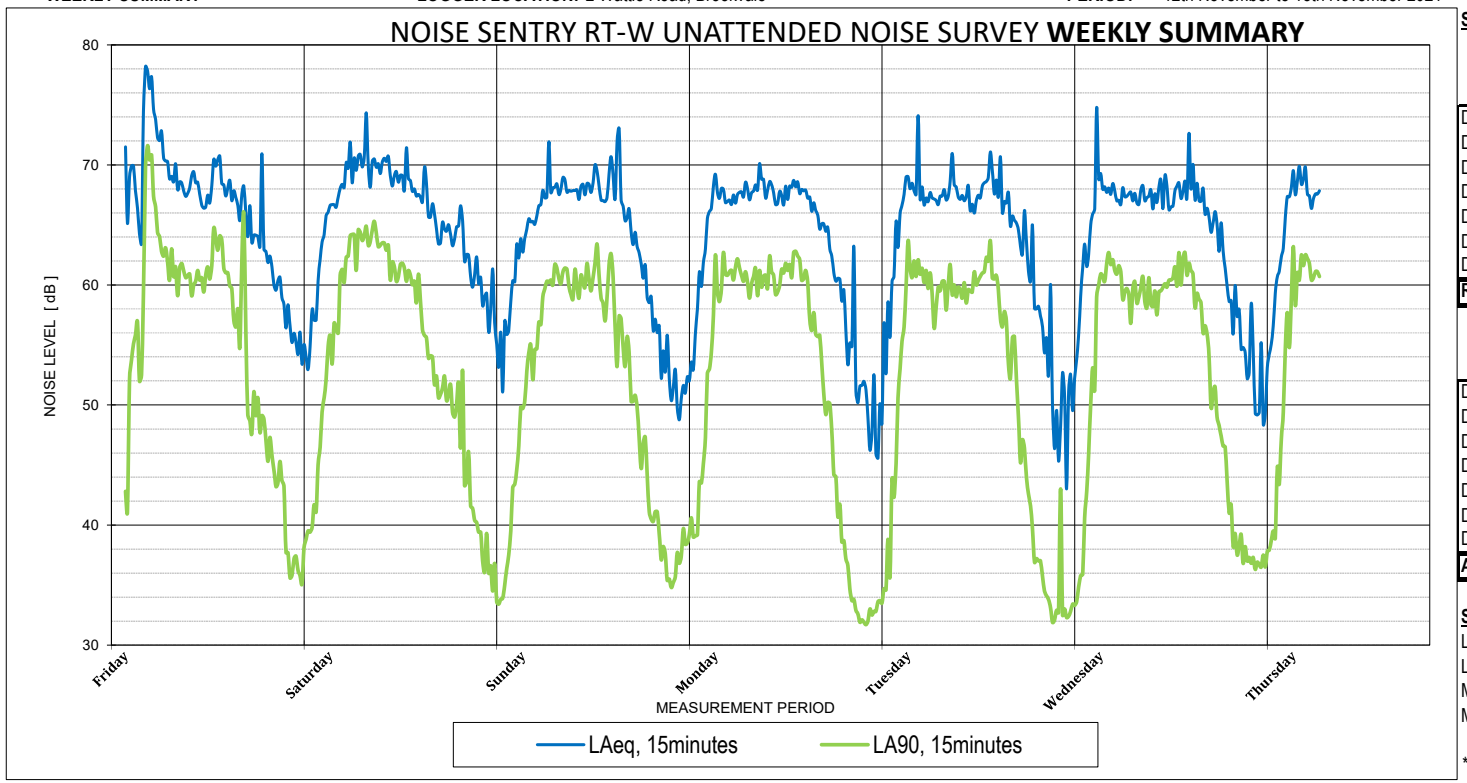
http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml.

APPENDIX B

APPENDIX B

APPENDIX B

WEEKLY SUMMARY **LOGGER LOCATION:** 2 Wattle Road, Brookvale **PERIOD:** 12th November to 18th November 2021



SUMMARY OF AMBIENT NOISE LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	59	49	38
Day 2	59	51	36
Day 3	57	47	34
Day 4	59	46	36
Day 5	59	45	32
Day 6	58	49	32
Day 7	N/A	N/A	37
RBL	**59**	**48**	**36**

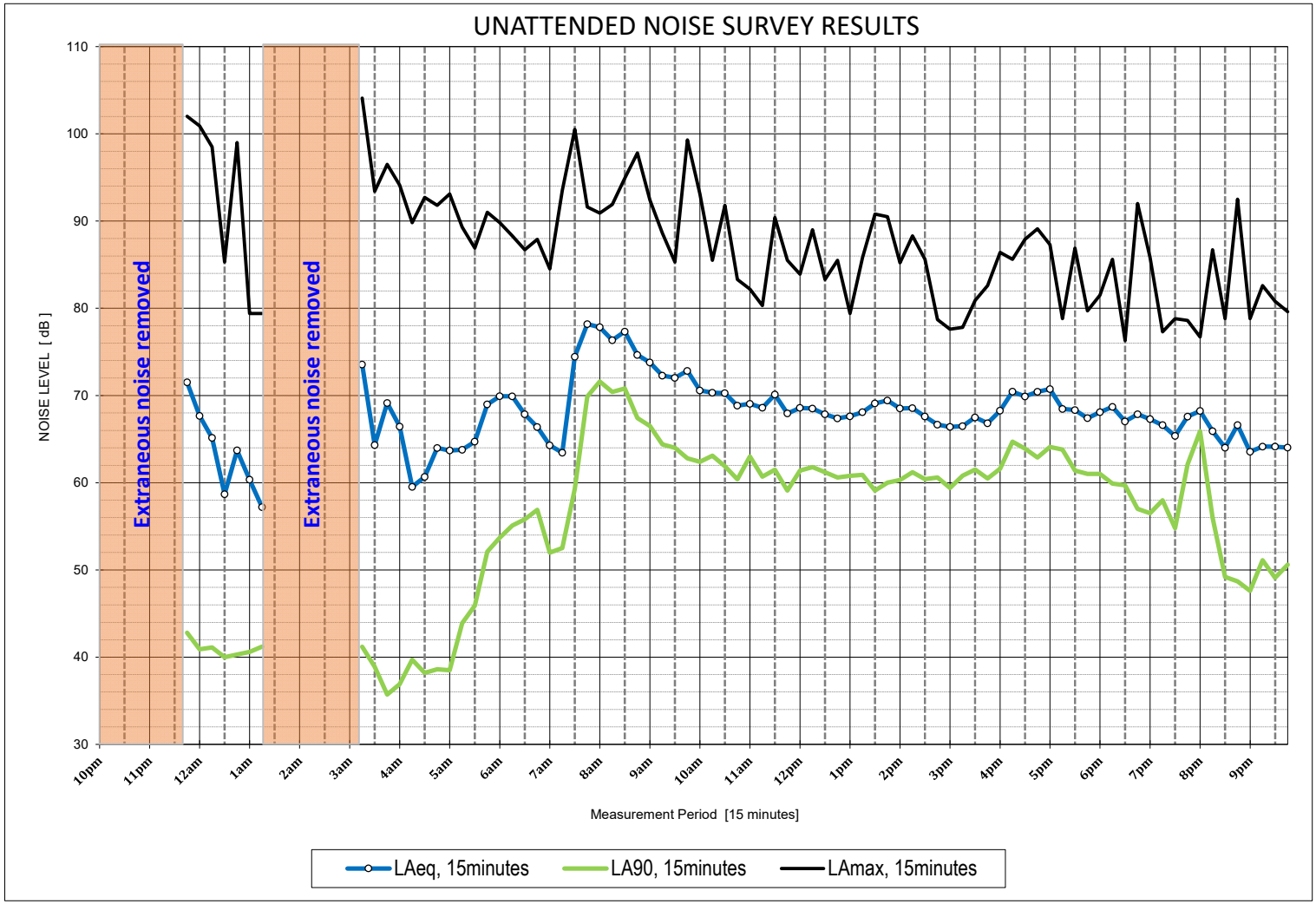
	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	71	67	65
Day 2	70	66	62
Day 3	68	67	62
Day 4	68	65	61
Day 5	68	66	61
Day 6	68	67	63
Day 7	63	0	61
Average	**69**	**66**	**62**

SUMMARY OF TRAFFIC & MISC. NOISE LEVELS

LAeq 15 hrs	0700-2200	68	dB
LAeq 9 hrs	2200-0700	62	dB
Max LAeq 1 hr	0700-2200	69	dB
Max LAeq 1 hr	2200-0700	65	dB

* *Sundays and Public Holidays the hours change to 0800*

DAY 1 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Friday, 12 November 2021



AMBIENT BACKGROUND NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	59	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	38	dB

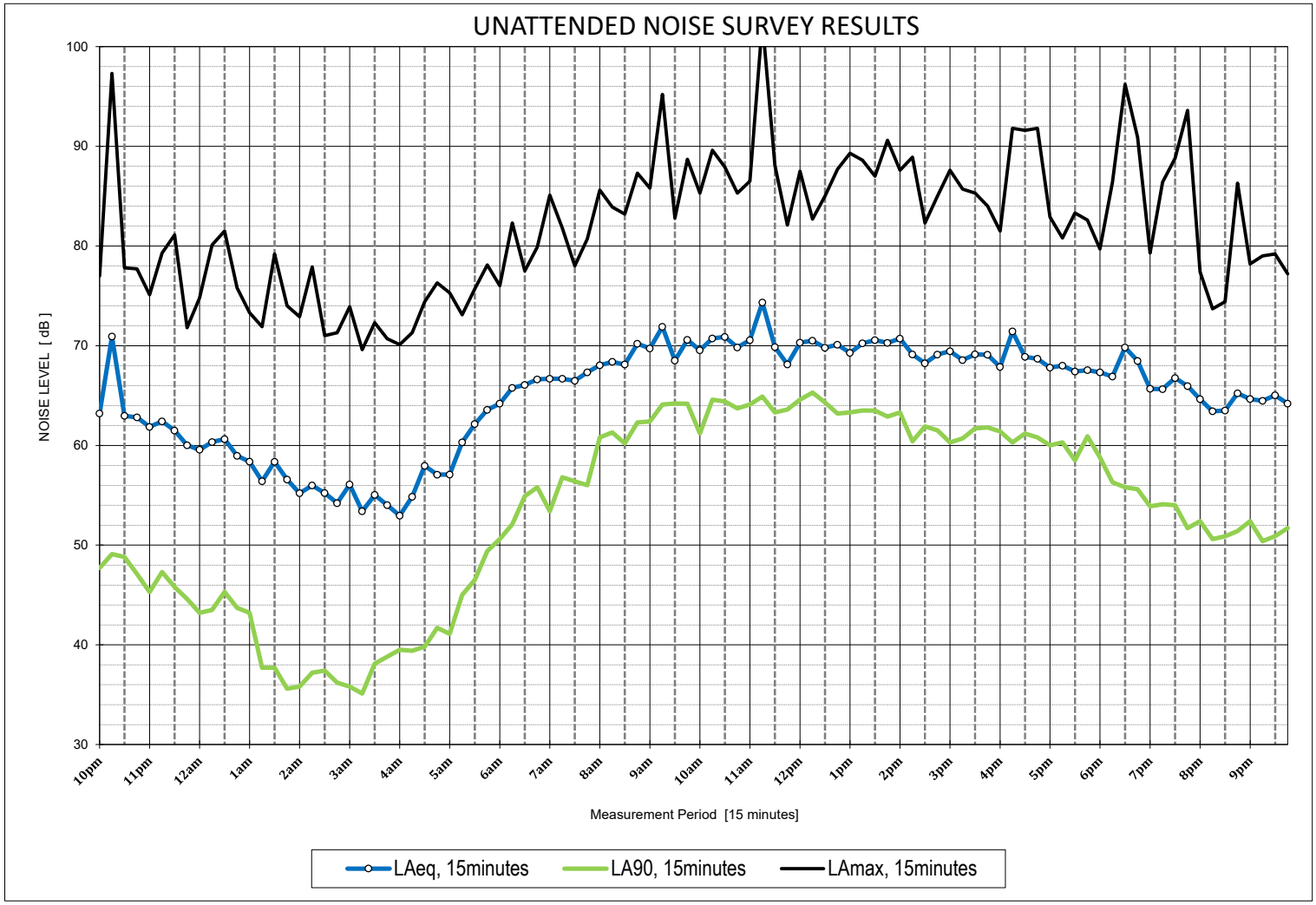
AMBIENT NOISE METRICS

LAeq Daytime	0700-1800	71	dB
LAeq Evening	1800-2200	67	dB
LAeq Night-time	2200-0700	65	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	71	dB
LAeq 9 hours	2200-0700	65	dB
Max LAeq 1 hour	0700-2200	74	dB
Max LAeq 1 hour	2200-0700	69	dB

DAY 2 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Saturday, 13 November 2021



AMBIENT BACKGROUND NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	59	dB
LA90 Evening	1800-2200	51	dB
LA90 Night-time	2200-0700	36	dB

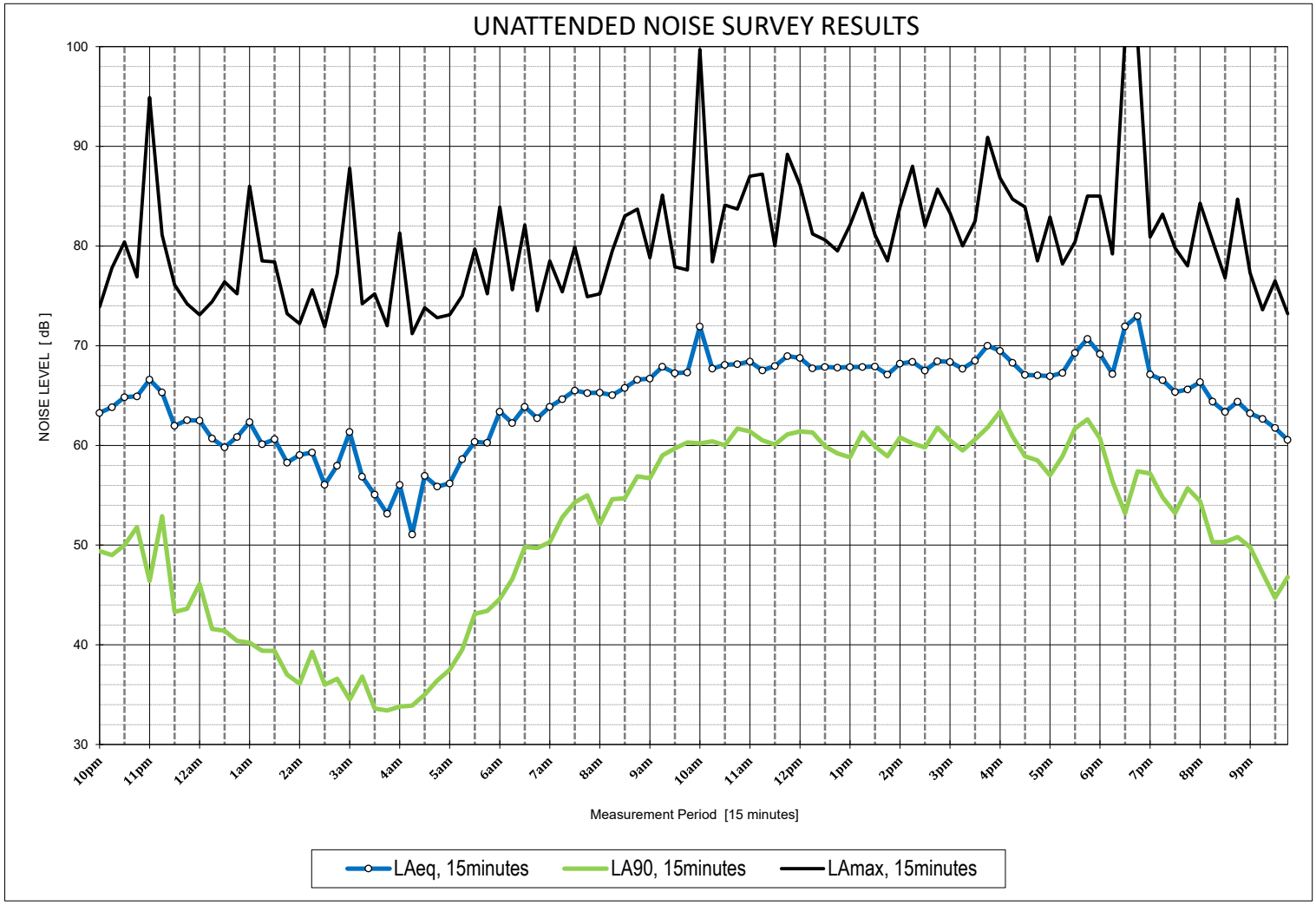
AMBIENT NOISE METRICS

LAeq Daytime	0700-1800	70	dB
LAeq Evening	1800-2200	66	dB
LAeq Night-time	2200-0700	62	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	62	dB
Max LAeq 1 hour	0700-2200	70	dB
Max LAeq 1 hour	2200-0700	65	dB

DAY 3 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Sunday, 14 November 2021



AMBIENT BACKGROUND NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	57	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0800	34	dB

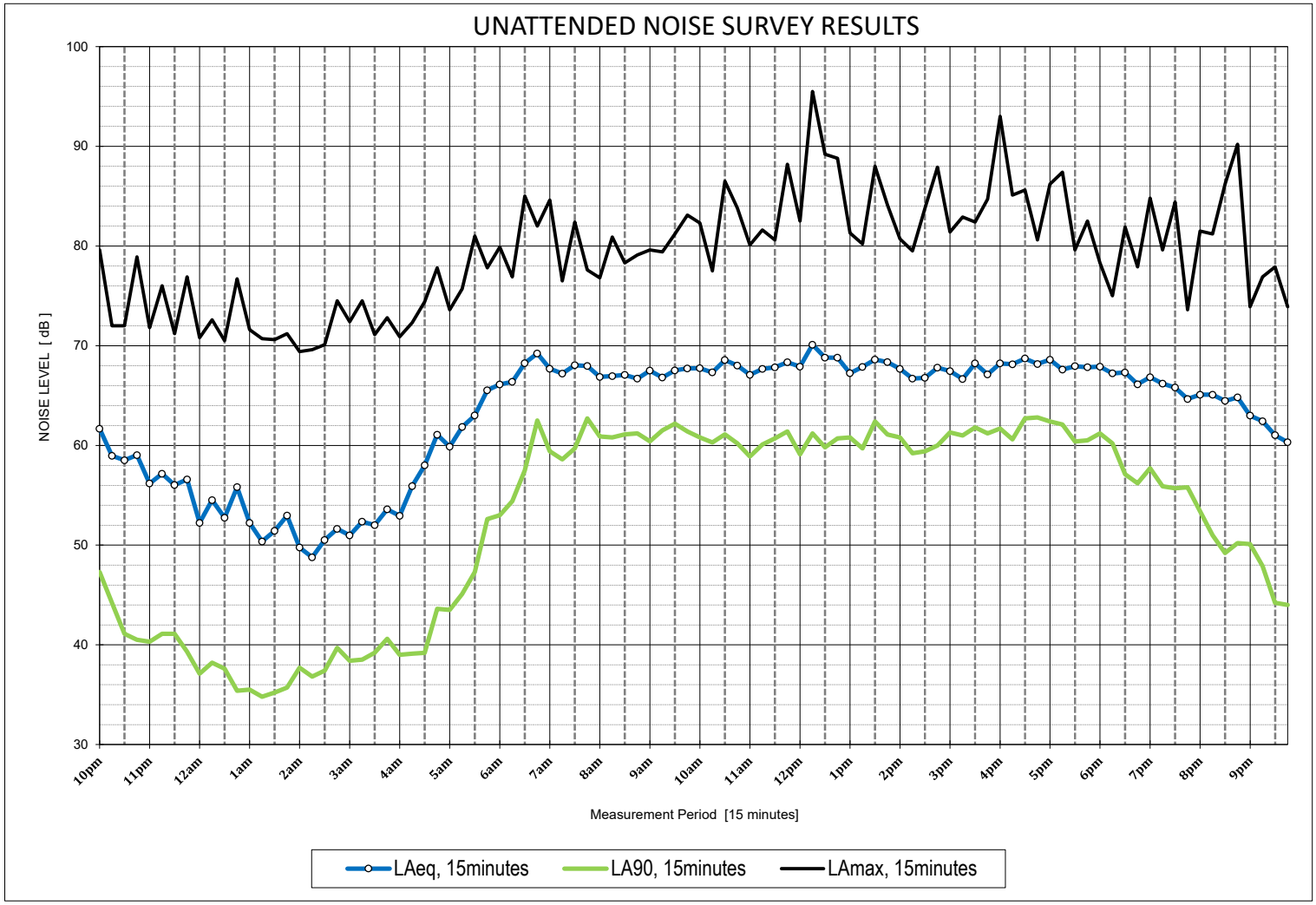
AMBIENT NOISE METRICS

LAeq Daytime	0800-1800	68	dB
LAeq Evening	1800-2200	67	dB
LAeq Night-time	2200-0800	62	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	68	dB
LAeq 9 hours	2200-0700	61	dB
Max LAeq 1 hour	0700-2200	69	dB
Max LAeq 1 hour	2200-0700	64	dB

DAY 4 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Monday, 15 November 2021



AMBIENT BACKGROUND NOISE METRICS

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

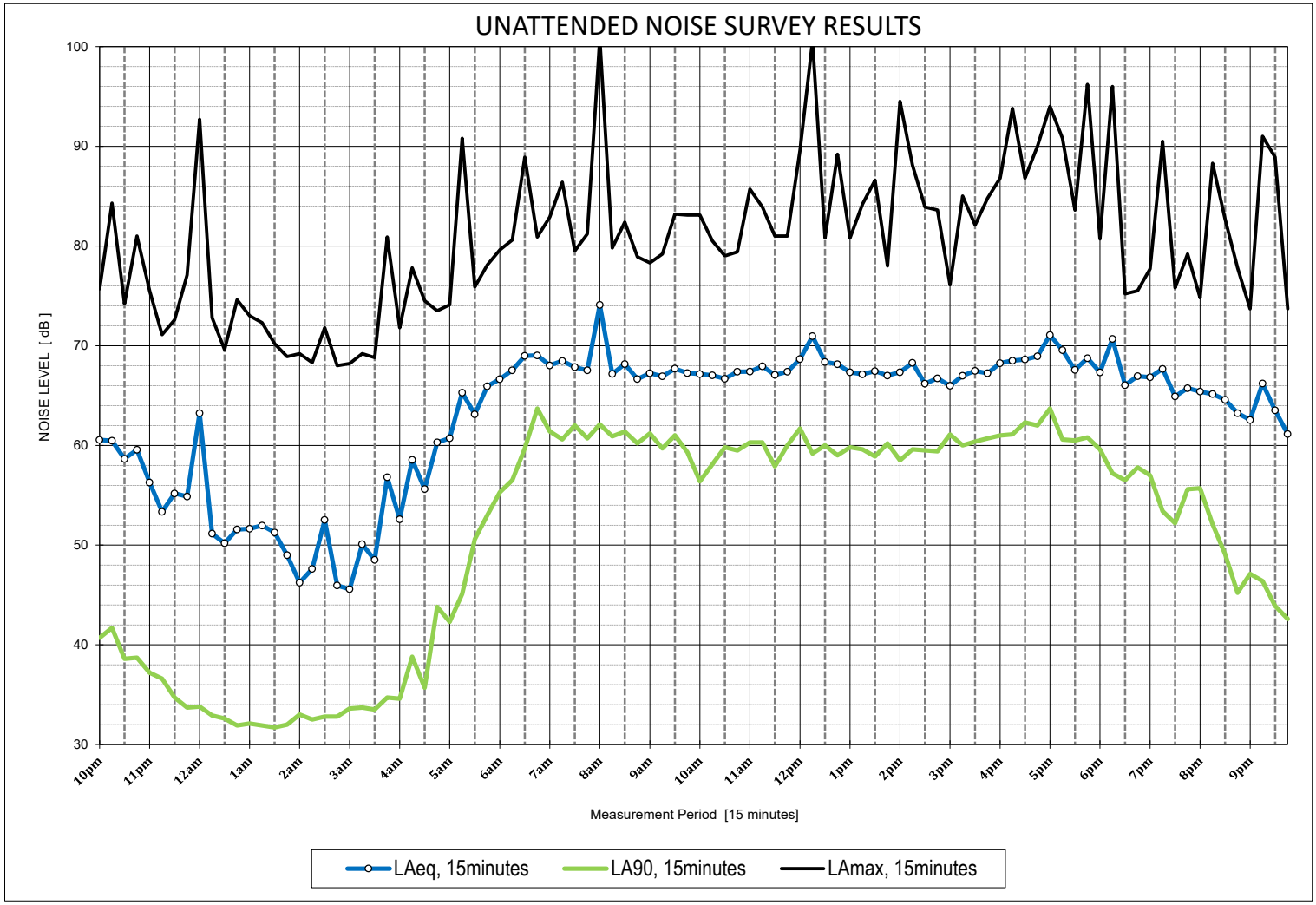
AMBIENT NOISE METRICS

LAeq Daytime	0700-1800	68	dB
LAeq Evening	1800-2200	65	dB
LAeq Night-time	2200-0700	61	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	67	dB
LAeq 9 hours	2200-0700	61	dB
Max LAeq 1 hour	0700-2200	68	dB
Max LAeq 1 hour	2200-0700	64	dB

DAY 5 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Tuesday, 16 November 2021



AMBIENT BACKGROUND NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	59	dB
LA90 Evening	1800-2200	45	dB
LA90 Night-time	2200-0700	32	dB

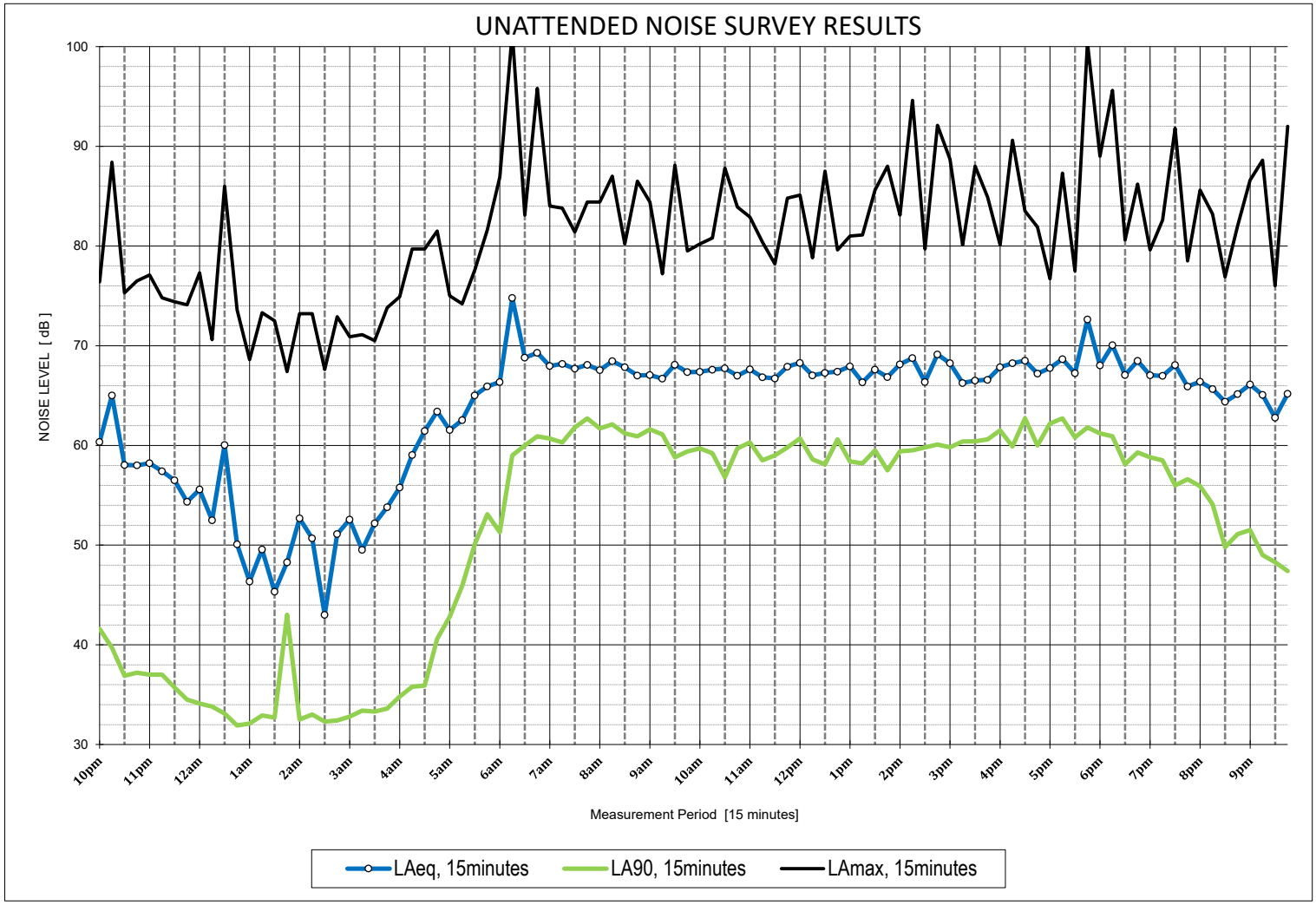
AMBIENT NOISE METRICS

LAeq Daytime	0700-1800	68	dB
LAeq Evening	1800-2200	66	dB
LAeq Night-time	2200-0700	61	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	68	dB
LAeq 9 hours	2200-0700	61	dB
Max LAeq 1 hour	0700-2200	69	dB
Max LAeq 1 hour	2200-0700	65	dB

DAY 6 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Wednesday, 17 November 2021



AMBIENT BACKGROUND NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	58	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	32	dB

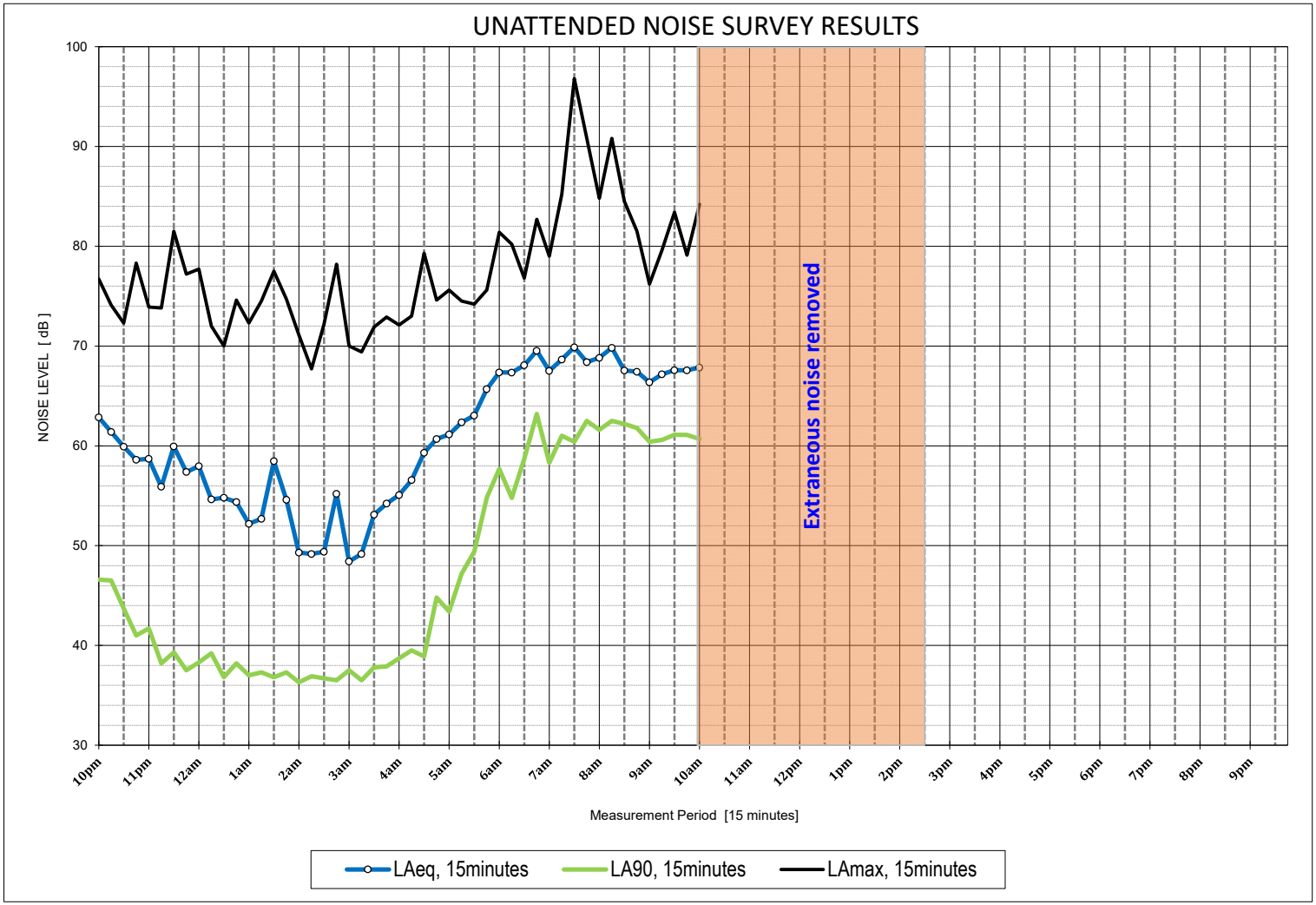
AMBIENT NOISE METRICS

LAeq Daytime	0700-1800	68	dB
LAeq Evening	1800-2200	67	dB
LAeq Night-time	2200-0700	63	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	68	dB
LAeq 9 hours	2200-0700	63	dB
Max LAeq 1 hour	0700-2200	69	dB
Max LAeq 1 hour	2200-0700	65	dB

DAY 7 **LOGGER LOCATION:** 2 Wattle Road, Brookvale **DATE:** Thursday, 18 November 2021



AMBIENT BACKGROUND NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	N/A	dB
LA90 Evening	1800-2200	N/A	dB
LA90 Night-time	2200-0700	37	dB

AMBIENT NOISE METRICS

LAeq Daytime	0700-1800	63	dB
LAeq Evening	1800-2200	0	dB
LAeq Night-time	2200-0700	61	dB

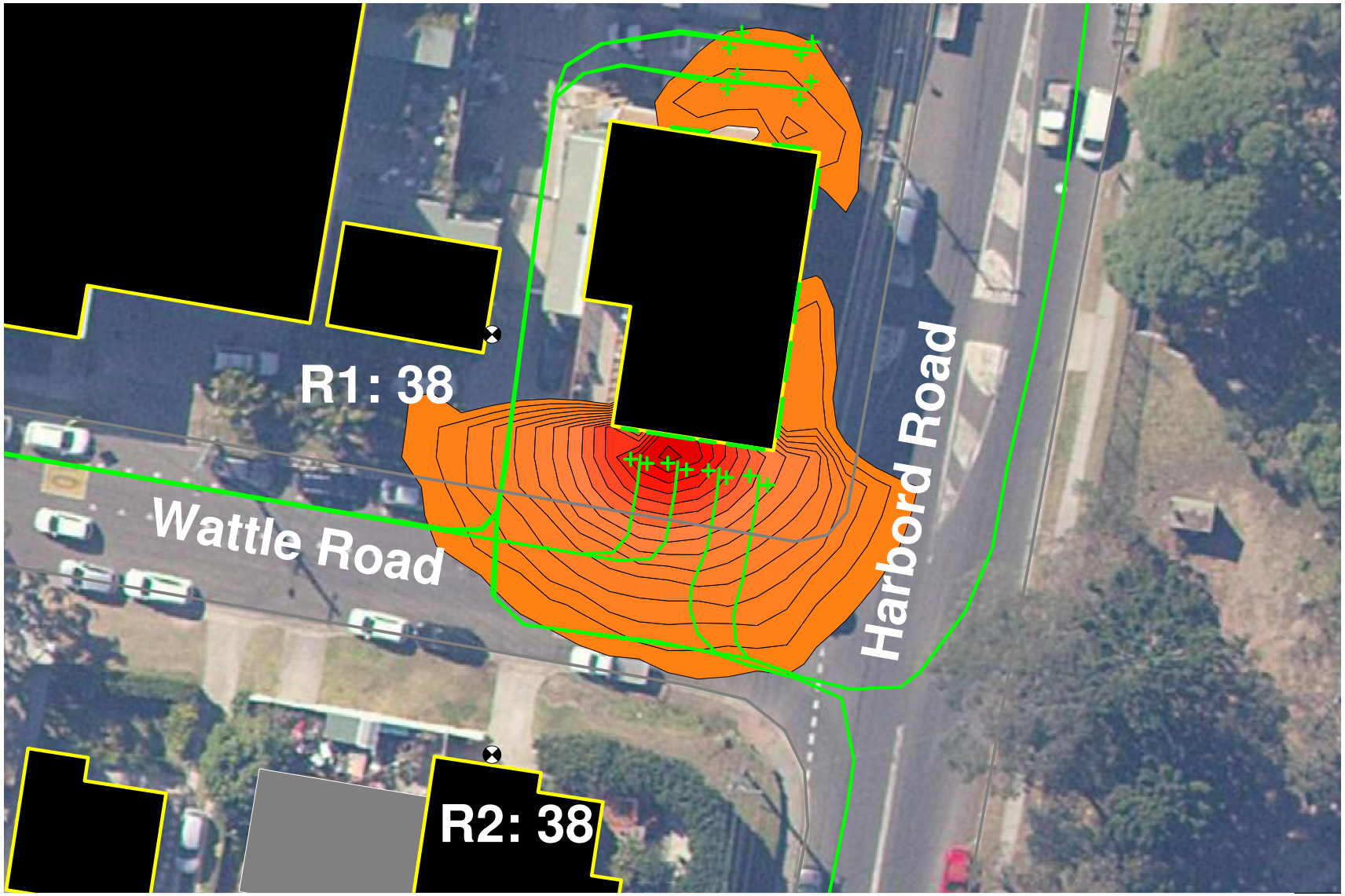
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	62	dB
LAeq 9 hours	2200-0700	61	dB
Max LAeq 1 hour	0700-2200	69	dB
Max LAeq 1 hour	2200-0700	65	dB

APPENDIX C

APPENDIX C

APPENDIX C



Scenario 1
(Early Morning)
**** NOISE SOURCES ****

~8 x vehicles moving at 5 km/h
~Breakout noise from music
~Car doors closing
~Car engines starting

Note:
- LAeq,15mins noise contours are at a height of 1.5 m above the natural ground level

- All receiver points are located 4.5 m above the ground.

PRINT DATE: 29/11/21

Point Source
Line Source
vert. Area Source
Building
3D-Reflector
Contour Line
Receiver
Calculation Area
Vertical Grid

> 40.0 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: 5133
CLIENT: Michael Battaglia
SITE ADDRESS: 2/2 Wattle Road, Brookvale
ASSESSED TO: NSW EPA NPfI
LIMITING CRITERIA: 43 dB(A) - residential boundary