koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

Commercial 1 (Unit 27)
637-645 Forest Road
Bexley NSW 2207

+612 9587 9702
office@koikasacoustics.com
www.koikasacoustics.com

DELIVERING SOUND ADVICE

ABN: 12 058 524 771

ACOUSTICAL REPORT

PROPOSED TRAFFIC LIGHTS AND ROAD WIDENING

KURRAJONG ROAD AND MOWBRAY STREET INTERSECTION,

PRESTONS NSW

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Approved by	Mason Jenkins Acoustical Consultant Member of the Australian Acoustical Society - MAAS
Client	Liverpool City Council Attention: Mahavir Arya - AryaM@liverpool.nsw.gov.au

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KURRAJONG ROAD AND MOWBRAY STREET INTERSECTION, PRESTONS NSW

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TABLE OF APPENDICES

1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was commissioned to conduct a noise impact assessment of the proposed traffic lights and road widening at the Kurrajong Road and Mowbray Road Intersection, Prestons NSW.

The acoustical adequacy of the proposed design must be assessed in terms of standard planning guidelines issued by the EPA regarding traffic noise increases, and construction noise and vibration impacts.

Koikas Acoustics has been advised the following acoustical components require an assessment at this stage:

- Traffic noise increase associated with Kurrajong Road and its impact on existing residents of the area, and
- Construction noise and vibration management plan.

This report presents the results and findings of an acoustical assessment of the subject proposal. In-principle acoustic treatments and noise control measures detailed within this report are deemed necessary for the development to comply with the nominated acoustical planning levels/project noise objectives.

2.0 THE PROPOSAL

The proposal is to widen Kurrajong Road to include additional westbound lanes and introduce a set of traffic lights at the Mowbray Road intersection. This location is situated in a primarily industrial and residential area with sites on the northern side of Kurrajong Road classified as E4 'General Industrial' and sites on the southern side of Kurrajong Road classified as R2 'Low-Density Residential' as per relevant land zoning maps including in Liverpool City Council Local Environment Plan 2008. Surrounding properties are also predominantly industrial and residential in classification, also located within E4 'General Industrial' and R2 'Low-Density Residential' Zoning. The subject site and surrounding properties are identified in the aerial photograph in Figure 1.

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

This acoustic report and any associated recommendations are based solely on the design and drawings prepared by Liverpool City Council (their Project No. 2020_046, dated 23/11/2022) and the traffic report prepared by Transport and Traffic Planning Associates (their Ref No. 398/2020, dated August 2020). Any changes to the design may impact the findings of this report and associated noise control recommendations.

3.0 UNATTENDED AMBIENT NOISE SURVEY

Both noise monitoring surveys were conducted using Type 1 Svantek 949 noise loggers. The instruments were set up to measure sound pressure levels as 'A' frequency weighting and 'Fast' time response. Noise levels were saved on the quarter-hour within the logger memory.

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.

A review of the weather records from the Bureau of Meteorology shows that adverse weather conditions did not influence the noise environment during the measurement period. Observable short-duration extraneous noise events were removed from the survey data.

The loggers were installed in the locations as marked in Figure 1 in **Section 2.0**:

	Logger No.	Address	Location	Distance from Facade
•	Logger 1:	24 Bergalia Close, Prestons	(*Rear Yard*)	3 m
•	Logger 2:	33 Huskisson Street, Prestons	(*Rear Yard*)	0.8 m

The measurement microphones were set at a height of 1.5 metres above the ground.

Logger 1 was about 3 metres away from a sound-reflective building facade. This means that the equivalent continuous level for free-field conditions would therefore be 1 dB less compared to what was measured. Background noise levels during the nighttime would generally need no adjustments.

Logger 2 was about 0.8 metres away from a sound-reflective building facade. This means that the equivalent continuous level for free-field conditions would therefore be 3 dB less compared to what was measured. Background noise levels during the nighttime would generally need no adjustments.

The unattended noise survey data was obtained between Wednesday 6th September and Tuesday 12th September 2023.

A summary of the noise survey data is presented below.

Table 1. Summary of Adjusted Free Field Noise Logger Results [dB]					
Location	**Period, T [1]**	**Ambient noise level L_{Aeq}**	**Rating background level L_{A90}**	**Traffic noise level[2] $L_{Aeq, Period}$**	**Maximum Traffic noise level $L_{Aeq, 1\text{-}hour}$**
Site 1: **Noise Logger 1** *24 Bergalia Close*	Day	60	49	60	62
	Evening	60	46		
	Night	57	36	57	61
Site 2: **Noise Logger 2** *33 Huskisson Street*	Day	61	47	61	63
	Evening	60	46		
	Night	60	36	60	61

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

The results show that ambient noise levels during the daytime are marginally louder at Site 2, *33 Huskisson Street,* but, generally the same levels at both sites during the evening and nighttime.

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

Noise logger graphs are attached to this report as **Appendix A**.

4.0 ACOUSTIC REQUIREMENTS

4.1 NSW ROAD NOISE POLICY

The document entitled "NSW Road Noise Policy" has replaced the "Environmental Criteria for Road Traffic Noise" (ECRTN) for assessment procedures and criteria for traffic noise effective from the 1st of July 2011.

An extract of Table 3 and Table 6 of NSW Road Noise Policy from Environmental Climate Change & Water (ECCW) is provided below:

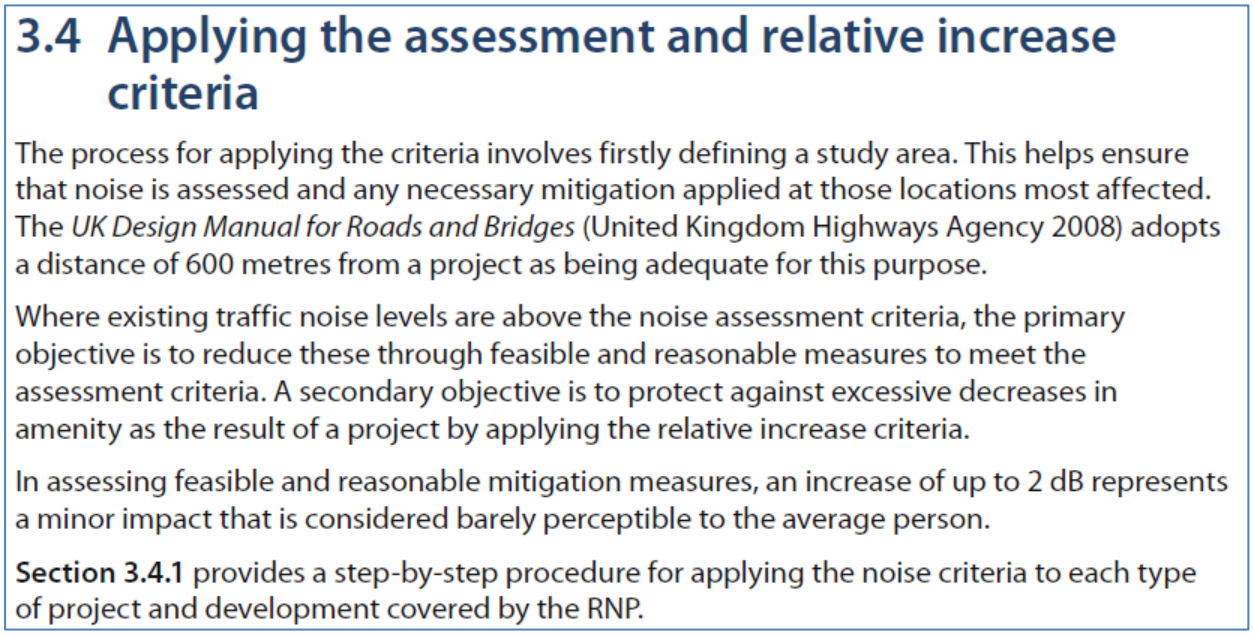
Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq, (15\ hour)}$ 55 (external)	$L_{Aeq, (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq, (15\ hour)}$ 60 (external)	$L_{Aeq, (9\ hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from **new** local road corridors 5. Existing residences affected by noise from **redevelopment** of existing local roads 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see **Appendix C10**).

Figure 2. Road traffic noise assessment criteria – Image from NSW Road Noise Policy

In this case, type 5 of the above for local roads will be applicable. Furthermore, Section 3.4 of the NSW Road Noise Policy states the following:



3.4 Applying the assessment and relative increase criteria

The process for applying the criteria involves firstly defining a study area. This helps ensure that noise is assessed and any necessary mitigation applied at those locations most affected. The *UK Design Manual for Roads and Bridges* (United Kingdom Highways Agency 2008) adopts a distance of 600 metres from a project as being adequate for this purpose.

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

Section 3.4.1 provides a step-by-step procedure for applying the noise criteria to each type of project and development covered by the RNP.

Figure 3. Applying the assessment and relative increase criteria– Image from NSW Road Noise Policy

Where the existing traffic noise levels are above the NSW Road Noise Policy (ECCW) assessment criteria, the increase in traffic noise levels due to the proposed development is not to exceed **2 dB**.

4.2 CONSTRUCTION NOISE AND VIBRATION – INTERIM CONSTRUCTION NOISE GUIDELINES

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

4.2.1 Construction noise

The guideline recognises that construction and excavation works will at times generate noise that is 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 set 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.

Some community reaction is expected at 10 dB above the background level and strong community reaction is expected at levels exceeding $L_{Aeq,\ 15\ minutes}$ 75 dB.

For this assessment, 10 dB above the daytime RBL (47-49 dBA) is $L_{Aeq,\ 15\ minutes}$ 57-59 dB(A). This is defined as the *Daytime Noise Affected Level*. Additionally, 5 dB above the nighttime RBL (36 dBA) is $L_{Aeq,\ 15\ minutes}$ 41 dB(A). This is defined as the *Nighttime Noise Affected Level*. Above these noise levels, it is required that all feasible and reasonable work practices are implemented to minimise impacts.

$L_{Aeq,\ 15\ minutes}$ 75 dB is defined as the *Highly Noise Affected Level*. At and above this level, additional feasible and reasonable mitigation strategies are implemented such as adopting time restrictions for work activities or providing respite periods throughout the workday that have been agreed upon via a community consultation process.

4.2.2 Sleep Disturbance/Arousal

The potential for noise-induced sleep disturbance should be considered where a noise source or activity from a particular development occurs before 7 am (Monday to Saturday) or 8 am (Sundays or public holidays) and/or after 10 pm (Monday to Sunday). The process followed by Koikas Acoustics when determining the potential for sleep disturbance is:

1. Conduct a screening assessment that identifies the potential for sleep disturbance impacts as per:
    a. Section 2.5 of the NSW EPA Noise Policy for Industry (NPfI) 'Maximum noise level event assessment' and/or
    b. Section 2.2.4 of the NSW EPA Noise Guide for Local Government (NGLG) 'Assessment of Sleep Disturbance'
2. Where the screening assessment identifies a potential for sleep disturbance, a further and more rigorous analysis of the maximum noise levels attributed to the noise source or activity under assessment is prepared. This detailed assessment would:
    a. Compare the maximum noise levels and the number of maximum noise events from the subject source or activity to that of typical ambient maximum noise events in the local area such as from passing traffic etc.
    b. Assess the maximum event noise level inside an affected residence and compare this to further guidance on sleep disturbance impacts presented in the NSW EPA Road Noise Policy (RNP).

3. Present a final opinion on the potential for sleep disturbance and/or the need for any specific noise mitigation and/or management.

For reference, the NPfI and NGLG screening levels and RNP internal maximum noise levels are presented below.

Table 2. Sleep disturbance assessment levels

Description	Assessment period	L_{Aeq} noise level	L_{Amax} noise level
Screening assessment 'a' NSW EPA Noise Policy for Industry (2017)	**Night only** 10 pm to 7 am (Mon-Sat) 10 pm to 8 am (Sun & pub hols)	$L_{Aeq\ 15\ mins}$ ≤ 40 dB or the RBL + 5, whichever is the greater	$L_{Amax\ outdoors}$ ≤ 52 dB or the RBL + 15, whichever is the greater
Screening assessment 'b' NSW EPA Noise Guide for Local Government (2013)	**Night only** 10 pm to 7 am (Mon-Sat) 10 pm to 8 am (Sun & pub hols)	n/a	$L_{Amax\ outdoors}$ ≤ RBL + 15 ($L_{A1,\ 1\ minute}$ may also be used where appropriate)
Internal L_{Amax} assessment NSW EPA Road Noise Policy (2013)	**Night only** 10 pm to 7 am (Mon-Sat) 10 pm to 8 am (Sun & pub hols)	n/a	$L_{Amax\ indoors}$ ≤ 50-55 dB is "unlikely to cause awakenings"

It is also important to recognise that the point at which noise causes sleep disturbance is currently not well known and that the EPA advises that "more research is needed to better understand this relationship". Therefore, the above should be used as a guide only and applied with caution on a case-by-case basis.

4.2.3 Construction vibration – human annoyance

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 as per 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 3. 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

4.2.4 Construction vibration – structural damage

The geotechnical engineer will typically 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-Part 3.*

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

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

The German standard DIN 4150-3 recommends a maximum peak particle velocity of:

Table 4. DIN4150-3 guideline values for assessing short-term vibration effects					
Line	**Type of structure**	**Vibration velocity, v_i, in mm/s**			
		Foundation			**Plane of the floor of the 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

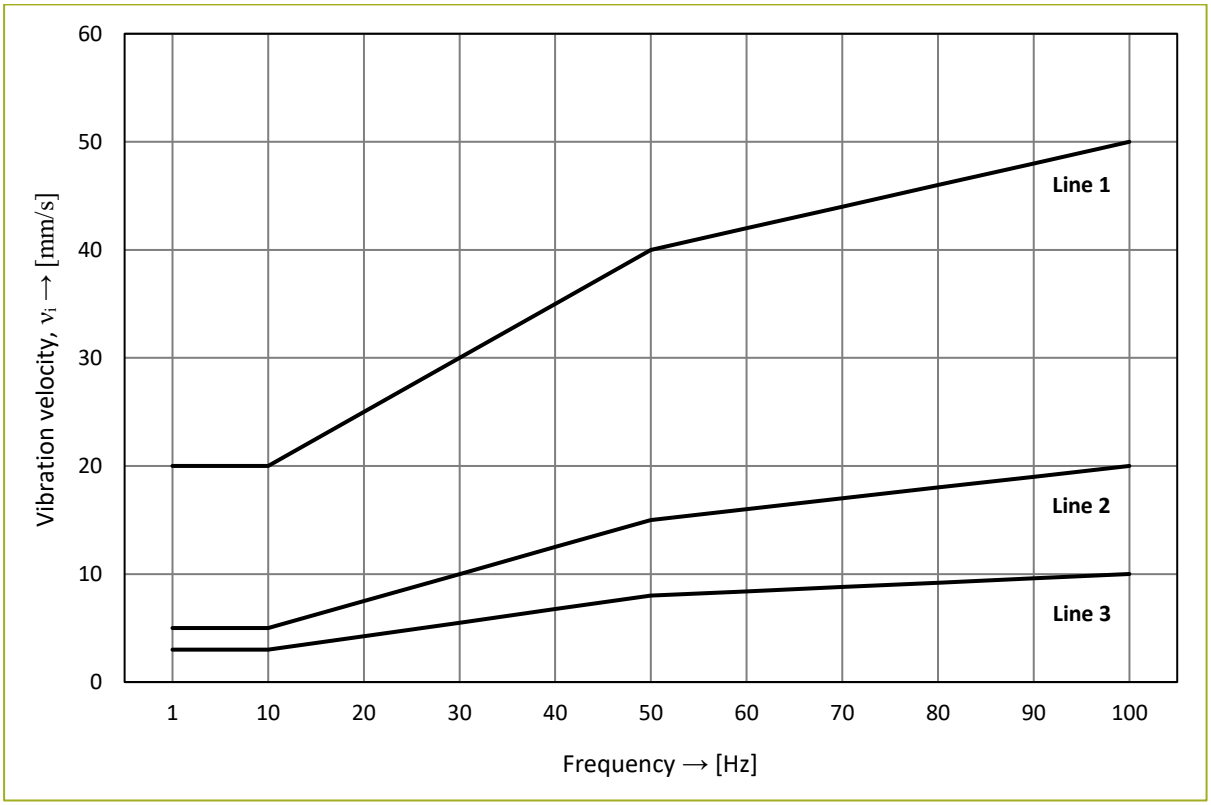


Figure 4. DIN 4150-3 Curves representing guideline vibration velocity values at the building foundation

5.0 TRAFFIC NOISE INCREASE ASSESSMENT

The proposed Kurrajong Road widening and traffic control signal installation will result in additional traffic noise levels using the local road network. The assessment has been based on the detailed design drawings prepared by Liverpool City Council (their Project No. 2020_046, dated 23/11/2022) and the traffic report prepared by Transport and Traffic Planning Associates (their Ref No. 398/2020, dated August 2020).

The extent of the proposed intersection upgrades is outlined below:

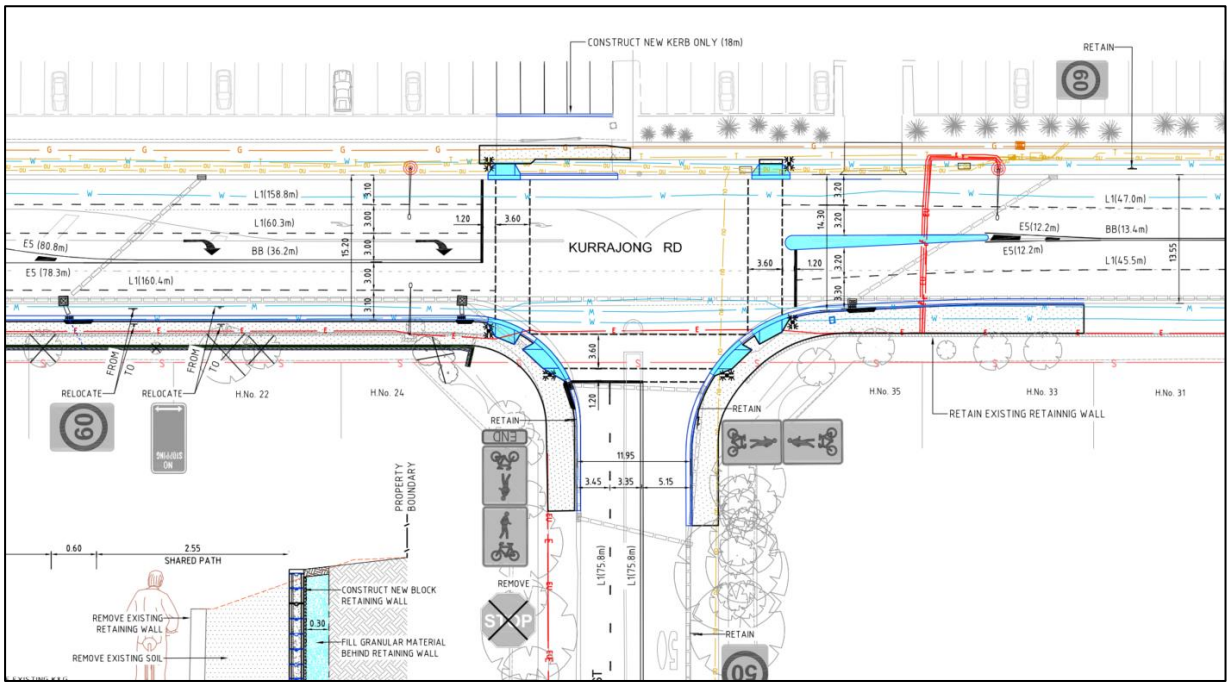


Figure 5. Extent of road widening and traffic signal installation – Image from Liverpool City Council

As per Appendix B of the traffic report, the peak traffic period was measured to occur between 7:45 a.m. and 8:45 a.m., with a total of 2,192 vehicles using the existing road network. This corresponds to the trends observed in the noise logger graphs during the daytime period, where a steady increase in noise levels is observed from, approximately 3 a.m. to 8:30 a.m., and noise levels thereafter reduce slightly and plateau.

Koikas Acoustics has been advised by the Liverpool City Council to assume a 2 % increase in annual traffic growth. It is standard assessment procedure to conduct the assessment to ensure continued compliance over an appropriate planning period, taken as 10 years from the date of the assessment to accord with *AS3671-1989 Acoustics – Road traffic noise intrusion building siting and construction*.

The following table outlines the expected noise level increase based on a 2 % traffic growth increase as a result of road widening and traffic signal installation over the next 10 years.

Table 5. Traffic Noise Increase Results

Year in Future	Calculated Peak Hour Traffic Volume (7:45 a.m. – 8:45 a.m.)	Calculated dB Increase in Traffic Noise Level [dB]
1	2236	0.1
2	2281	0.2
3	2326	0.3
4	2373	0.3
5	2420	0.4
6	2469	0.5
7	2518	0.6
8	2568	0.7
9	2620	0.8
10	2672	0.9

As shown above, where the existing peak hour traffic volume is extrapolated out to account for 2 % annual traffic growth over 10 years, traffic noise levels are expected to rise by 0.9 dB in 10 years and are therefore compliant with the 2 dB increase as per the NSW Road Noise Policy, outlined in Section 4.1 of this report. A 0.9 dB increase in traffic noise level is expected to not be perceptible to most humans with normal hearing.

Nighttime traffic volumes have not been provided in the traffic report, and therefore minimal impact is expected as a result of the proposed road widening and installation of traffic signals. Based on a standard 2 % annual traffic growth, traffic noise levels at residential properties fronting the Kurrajong Road and Mowbray Street intersection are expected to be minimal, and compliant with the NSW Road Noise Policy.

6.0 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

6.1 CONSTRUCTION NOISE

Koikas Acoustics has been advised that the works along Kurrajong Road and Mowbray Street are to be split into four stages:

1. Night Work – 29/01/2024-16/02/2024
   Install Sydney Water Mains
2. Day Work – 19/02/2024-10/05/2024
   Widen existing retaining wall, gutter, kerb and footpath along the southern side of Kurrajong Road
3. Night Work – 19/04/2024-31/05/2024
   Kerb, gutter and footpath works and traffic control device installation at Kurrajong Road/Mowbray Street intersection:
4. Night Work – 28/05/2024-15/06/2024
   Mill and re-sheet asphalt along all road sections:

6.1.1 Construction noise sources and sound levels

The range of typical construction noise levels depends on the process or sources involved. Construction noise levels are included in:

- British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise;
- 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.

Koikas Acoustics have assumed that the works may require the following equipment:

- Excavator with a rock saw and hammer attachments
- Trucks for removing spoil
- Trucks
- Concrete pumps/trucks

- Various powered hand tools
- Road/vibratory rollers
- Asphalt compactors
- Dozers

Table 6. Construction activity typical sound levels, [dB]

Equipment	Typical sound power level – L_w	Reference noise level – L_{Aeq} at 10 m
Excavator breaking and spreading rubble	114	86
Truck	109	81
Excavator loading a truck (brick rubble)	117	89
Rock breaker	112	94
Rock saw	109	91
Excavator (ground removal)	103	75
Truck	111	83
Concrete pump truck	112	84
Circular saw	112	84
Angle grinder	108	80
Hand tools (pneumatic)	116	88
Concrete pump	103	75
Concrete truck and pump	95	67
Road planer	110	82
Road planer (idling)	90	62
Mini planer	96	68
Mini planner (idling)	82	54
Wheeled excavator	101	76
Dozer	110	82
8.9t Vibratory roller	103	75
Vibratory compactor (asphalt)	110	82
18t Asphalt paver	105	77
Tracker excavator	102	74
Hand-held circular saw (petrol)	102	74
Electric water pump	96	68

6.1.2 Calculated construction noise levels

The level of noise predicted at a specific receiver location is governed by:

- The source noise level,
- The duration of the noise source,
- The distance between the source and receiver. As the location of plant and equipment on construction sites is not always at a fixed point, the distance between the noise source and receiver location can vary, and
- The screening between the source and receiver sound propagation path.

The following calculation parameters are assumed:

- Omni-directional point source radiating over hard ground.
- 1.8 m boundary fence screening attenuation.
- Source-receiver distances are calculated from the nearest point where construction activities could occur in front of the adjacent property boundary, resulting in a minimum source-receiver distance of 6 m.
- Duration corrections presuming:
    - All noise sources are assumed to be constant over 15 minutes, expected where noted below
    - Truck noise was apparent for 2 of 15 minutes
    - Truck loading occurs for 10 of 15 minutes
    - Rock breaking/sawing occurs for 10 of 15 minutes

Construction noise levels were calculated at the nearest residential property boundaries. The calculated construction noise levels can vary on account of the duration of use, the method of use, and the location of the plant and equipment at any moment throughout the construction site.

Table 7. Estimated construction noise levels to surrounding receivers – L_{Aeq} [dB]			
Equipment	**Day Criteria**	**Night Criteria**	**Calculated Noise Level at 6 m From Noise Source**
Excavator breaking and spreading rubble	*NSW DECCW, 2009* *Noise Affected Level: 57-59* *Highly Noise Affected Level: 75*	*NSW DECCW, 2009* *Noise Affected Level: 41* *Highly Noise Affected Level: 75*	89
Truck			84
Excavator loading a truck (brick rubble)			92
Rock breaker			97
Rock saw			94
Excavator (ground removal)			78
Truck			86
Concrete pump truck			87
Circular saw			87
Angle grinder			83
Hand tools (pneumatic)			91
Concrete pump			78
Concrete truck and pump			70
Road planer			85
Road planer (idling)			65
Mini planer			71
Mini planner (idling)			57
Wheeled excavator			76
Dozer			85
8.9t Vibratory roller			78
Vibratory compactor (asphalt)			85
18t Asphalt paver			80
Tracker excavator			77
Hand-held circular saw (petrol)			77
Electric water pump			71
Notes 1.	Predicted construction noise levels are estimated only due to the large variance in noise levels generated by comparable construction-type plants 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.		

Table 8. Estimated construction noise levels to surrounding receivers – $L_{A, max}$ [dB]		
Equipment	**Night Criteria**	**Calculated Noise Level at 6 m From Noise Source**
Dozer	***Sleep Disturbance*** *Screening Assessment 'A'* *51 – Outdoors* *Screening Assessment 'B'* *52 – Outdoors* *Screening Assessment 'C'* *50-55 – Indoors*	86
22t Road roller		80
12t Vibratory roller		84
18t Asphalt paver		84
Notes 1.	Predicted construction noise levels are estimated only due to the large variance in noise levels generated by comparable construction-type plants 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.	

NSW DECCW, 2009 outlines that strong justification is usually required for construction works outside of daytime hours. Due to the need to keep the existing road network open, construction works will need to take place during night hours to ensure traffic congestion is minimised. Most of the surrounding receivers are expected to be exposed to high noise emanating from the construction site. This is not surprising as all construction sites produce high levels of noise, and often cannot be effectively reduced at the source, at the boundary and the receiver. It is therefore necessary to consider all practical, feasible and reasonable noise control measures.

6.2 VIBRATION ASSESSMENT

Ground vibration during excavation and earthworks for the road may impact adjoining buildings and occupants depending on the local geology. Of particular sensitivity are the residential buildings to the south of Kurrajong Road as they share a site boundary with the works zone.

Excavating loose soil, sand and clays with an excavator and standard bucket and grab attachments is not expected to generate any significant vibration impacts on adjoining residents or structures. Excavation of sandstone bedrock or asphalt/existing road sections will, however, typically require the use of excavators with hydraulic breaker attachments. This equipment can generate significant levels of vibration.

The proximate location of adjoining buildings may require alternative work practices to impact-driven excavations along site boundaries if the minimum safe working distances as detailed cannot be achieved. Rock sawing and/or rock grinding are alternatives to impact-driven rock breaking that

generate far less vibration and should be used for the removal of hard rock in areas where the minimum safe working distances cannot be achieved.

If rock breakers are proposed to be used, it is recommended that vibration monitoring is conducted to ensure that safe vibration levels are not exceeded. At the point where excavation with rock breakers results in vibration levels exceeding the nominated threshold levels at the site boundary, alternative excavation methodologies must be implemented such as rock grinding and/or sawing.

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 9. 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)	5 m	15 m to 20 m
	< 100kN (Typically 2-4 tonnes)	6 m	20 m
Small hydraulic hammer	300kg – 5 to 12t excavator	2 m	7 m
Medium Hydraulic Hammer	900kg – 12 to 18t excavator	7 m	23 m
Jackhammer	Handheld	1 m (nominal)	2 m

6.3 NOISE AND 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 in the development and success of each noise policy is to maintain open and free channels of communication 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 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-Guide to noise and vibration control on construction, demolition and maintenance sites* states the relevant effects of various types of noise control measures typically employed on construction sites.

Table 10. 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 L_{pA} [dB]
Distance	Approximately 6 for each doubling of distance
Screening	Typically 5 to 10, maximum 15
Enclosure	Typically 15 to 25, maximum 30
Silencing	Typically 5 to 10, maximum 15

6.3.1 General control measures

The following general noise and vibration control measures are recommended:

- Neighbouring residents are to be notified of the anticipated duration, equipment, and work processes involved during each stage of work (demolition - excavation - construction). Notification in the form of a letterbox drop is generally found to best reach the majority of surrounding residents. The notification letter must include a contact phone number for appropriate site management personnel.
- Use appropriately sized plant and equipment and ensure that the equipment is operated in a manner that reduces noise emissions such as turning off equipment when not in use.
- Trucks removing material from the site should not be left idling at any time whilst on-site and as being filled, especially at night.
- Plant & equipment with broadband reversing alarms should be used instead of tonal reversing alarms.
- Motorised plant and equipment such as excavators shall be fitted with appropriate exhaust silencers to minimise noise emission during their use.

- Ensure that all plant and equipment are appropriately maintained such that it remains in good working order.
- Avoid 'clustering' of plant & equipment in localised areas.
- The minimum work distances as tabled within this report should be observed at all times, especially regarding vibration damage guidelines.
- Rock sawing or grinding is recommended along the southern site boundary where the advised minimum safe working distances cannot be achieved.
- Rock breaking must be conducted outside of the safe working distances and should use a hydraulic pointed 'cone' type hammer attachment in place of a flat 'block' type hammer.
- Extended periods of continuous vibration-generating work should be avoided to limit the potential for dynamic magnification due to resonance in neighbouring buildings/structures.
- Respite periods for high-noise-generating equipment could be considered.

  For example, a 1-hour respite period is adhered to after every two hours of major construction work.

6.3.2 Additional control measures

Where complaints arise during construction works that cannot be managed through work schedules, the following noise controls may be considered:

- Providing respite periods that are agreed upon through consultation with site management and the community.
- Exhaust silencers could be considered for motorised excavation-type plants & equipment.
- Attended noise monitoring of construction activities could be undertaken surrounding residential receivers at the start of each new construction phase. Attended noise monitoring should be undertaken for at least 15 minutes of major construction work at each surrounding residence.
- Continuous vibration monitoring may need to be considered during piling/excavation to ensure vibration levels do not reach a point where the structural integrity of surrounding buildings is compromised. A Geotechnical engineer would need to consider whether vibration monitoring is warranted.

If a vibration survey is required, the monitors installed should provide real-time visual and audible feedback to site management and equipment operators. This will provide feedback to the personnel on vibration levels generated by construction activities.

Vibration monitors with a two-stage alarm system should be used and provisionally set as per the below guidelines, being the limiting structural damage guidelines within *DIN4150 Vibrations in buildings - Part 3: Effects on structures.* It is noted, that the recommended vibration levels nominated in DIN4150-Part 3 are safe vibration level limits relating to cosmetic cracks for different types of buildings. These are not threshold levels that if exceeded would compromise the structural integrity of the building. Site-specific threshold levels may be determined by conducting a series of attended vibration surveys to derive a suitable transfer function for vibration propagation.

Stage 1: Provisional vibration alarm – vibration threshold level set at 4 mm/s Peak Particle Velocity (PPV)

Stage 2: Stop-work alarm level - vibration threshold level set at 5 mm/s Peak Particle Velocity (PPV)

If construction activities trigger the Stage 1 alarm, the equipment operators are to proceed with caution, ensuring that all care is taken to minimise unnecessary vibration during the construction works.

If construction activities trigger the Stage 2 alarm, the offending plant/equipment and site activity must cease immediately and not recommence until further investigation is carried out by an acoustical or geotechnical engineer. Any recommendations made by the consulting engineer concerning vibration control must be implemented before work recommences.

6.4 COMPLAINTS HANDLING

A site-specific complaint-handling procedure must be established, implemented, and managed on the construction site by a suitable complaint-handling representative (representative to be determined by Project/Site Management). As a guide, the following procedure should be followed and actioned:

Contact information

1. Distribute via letterbox drops and publish on the site notice board the contact information (Name/24-hour contact phone number/Email) for the Complaint Handling Representative.

Receiving complaints

2. Establish a Complaint Register that is to be managed by the Complaint Handling Representative. The register should include as a minimum:
    a. Date and time of the complaint,
    b. The person receiving a complaint,
    c. Complainant's contact information,
    d. Site contact to whom the complaint was referred for action,
    e. Description of the complaint,
    f. Action to be taken,
    g. The proposed time frame for action to be implemented.

Responding to a complaint

3. Receipt of a complaint should be acknowledged by the Complaint Handling Representative with the complainant as soon as practicable upon receiving the complaint, preferably within the first hour of receiving the complaint and no later than 24 hours after receiving the complaint.
4. The response must include a follow-up to discuss in detail the nature of the complaint so that a suitable investigation of the complaint may be undertaken. During the follow-up consultation with the complainant, the verification process and scheduled completion of the verification process are to be advised.

Verifying a complaint

5. In the event of receiving a noise or vibration complaint, action must be taken to verify the complaint as to its merit concerning the associated development approval conditions. For

a noise and/or vibration complaint, this will involve commissioning a noise and/or vibration audit of the offending work/s. The process of engaging a suitable noise/vibration consultant to investigate site works must occur after responding to the complainant.

Remediation

6. Where a complaint is verified by the consultant, the recommended rectification measures must be implemented and re-evaluated to ensure that the issue is effectively resolved such that the works are conducted under the development approval conditions.

Periodic review of the complaints handling procedure

7. The complaints handling procedure is to be periodically reviewed to maintain its effective delivery. Where the complaints handling procedure is amended/updated, the local community must be notified via letterbox drops and notifications posted on the site notice board.

7.0 CONCLUSION

Koikas Acoustics was requested to conduct an acoustical assessment and prepare a report for the proposed road widening and traffic signal installation at the Kurrajong Road and Mowbray Street intersection.

The assessment considers potential noise impacts on surrounding residents such that acceptable acoustic amenity is maintained.

Acoustic planning levels have been referenced from current EPA acoustic planning guidelines and requirements.

The included recommendations are based on designs prepared by Liverpool City Council and the traffic report prepared by Transport and Traffic Planning Associates.

The conclusions reached in this acoustical report should assist the Council in making their determination of the proposal.

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

- Increased traffic volumes on the existing roads as a result of the proposed work are expected to have a minimal impact on existing residents surrounding the work site.
- Where the recommendations outlined in Section 5.0 of this report are implemented where appropriate, noise and vibration impacts from construction noise are expected to be minimised.

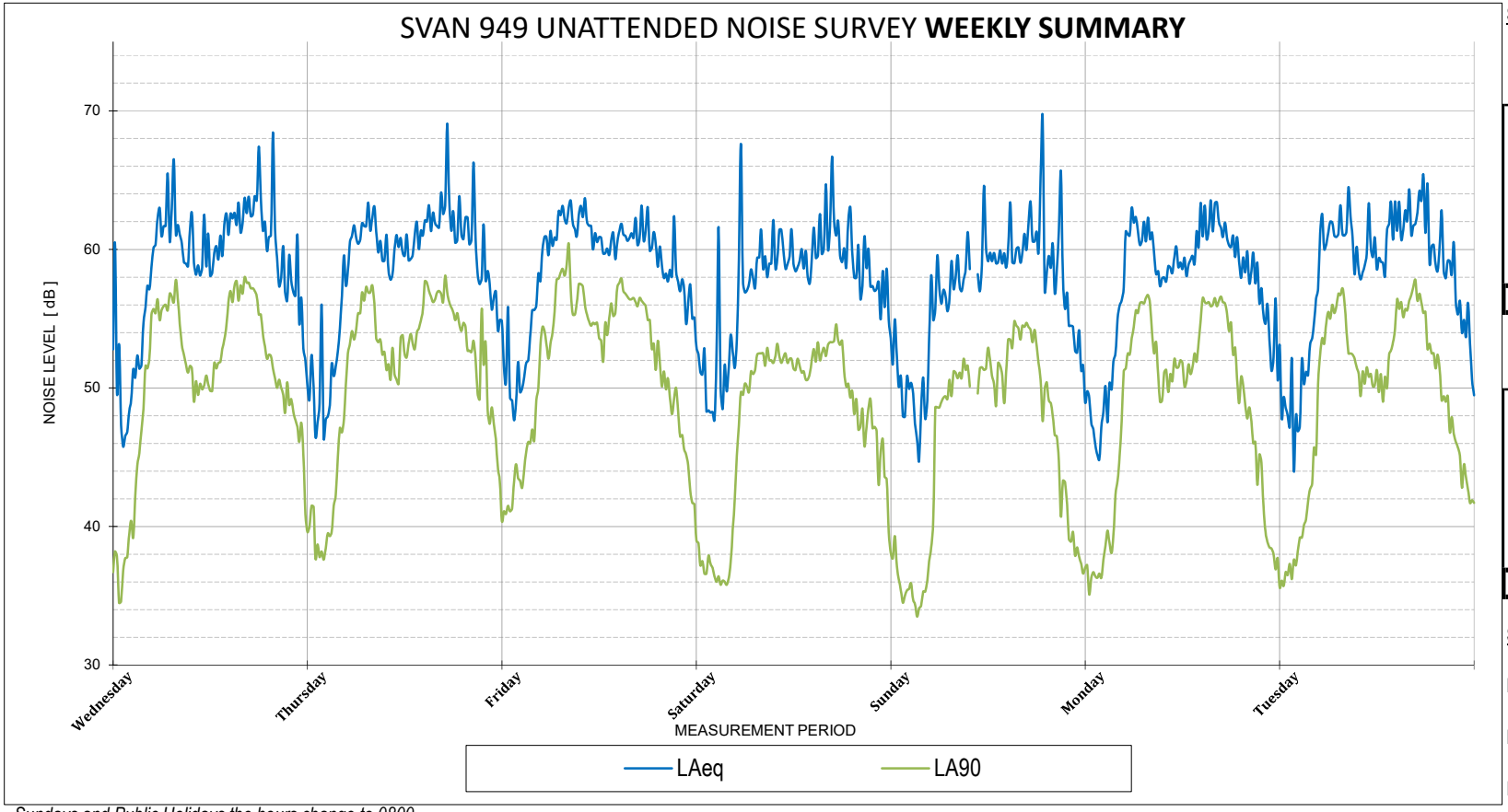
In our professional opinion, there is sufficient scope within the proposed design to achieve the applied acoustic planning guidelines.

APPENDIX A

APPENDIX A

APPENDIX A

WEEKLY SUMMARY **LOGGER LOCATION:** 24 Bergalia Close, Prestons **PERIOD:** 6th to the 12th September 2023



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	***LA90*** Evening	***LA90*** Night-time
Day 1	50	49	37
Day 2	51	51	38
Day 3	54	49	41
Day 4	51	47	36
Day 5	50	42	34
Day 6	50	45	36
Day 7	50	47	36
RBL	**50**	**47**	**36**

	LAeq Daytime	***LAeq*** Evening	***LAeq*** Night-time
Day 1	62	62	58
Day 2	62	62	57
Day 3	62	60	57
Day 4	60	60	57
Day 5	60	62	55
Day 6	61	59	57
Day 7	62	60	57
Average	**61**	**61**	**57**

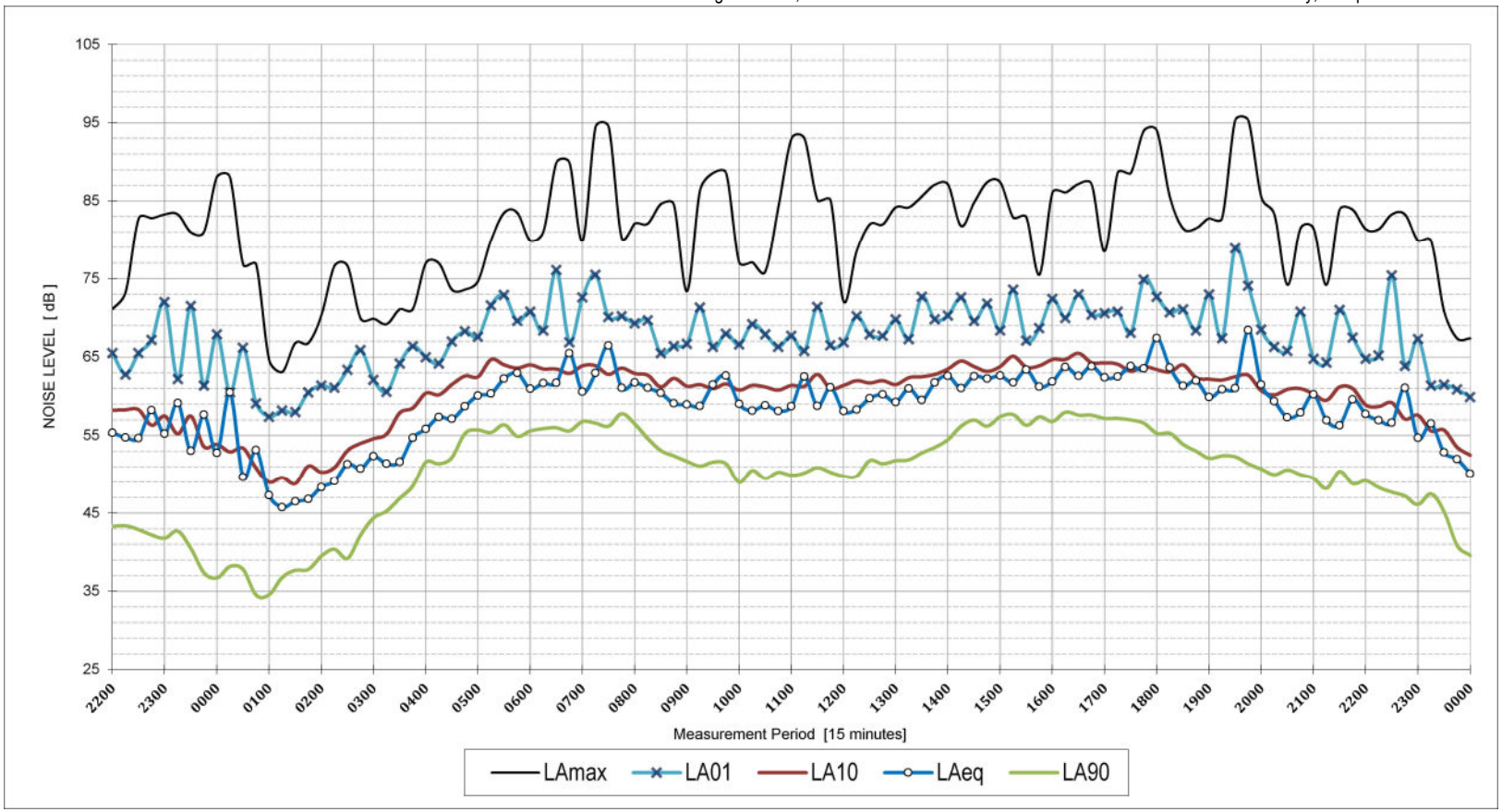
SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	61	dB
LAeq 9 hrs	2200-0700	57	dB
Max LAeq 1 hr	0700-2200	63	dB
Max LAeq 1 hr	2200-0700	61	dB

Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 1 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Wednesday, 6 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	37	dB
LAeq Daytime	0700-1800	62	dB
LAeq Evening	1800-2200	62	dB
LAeq Night-time	2200-0700	58	dB

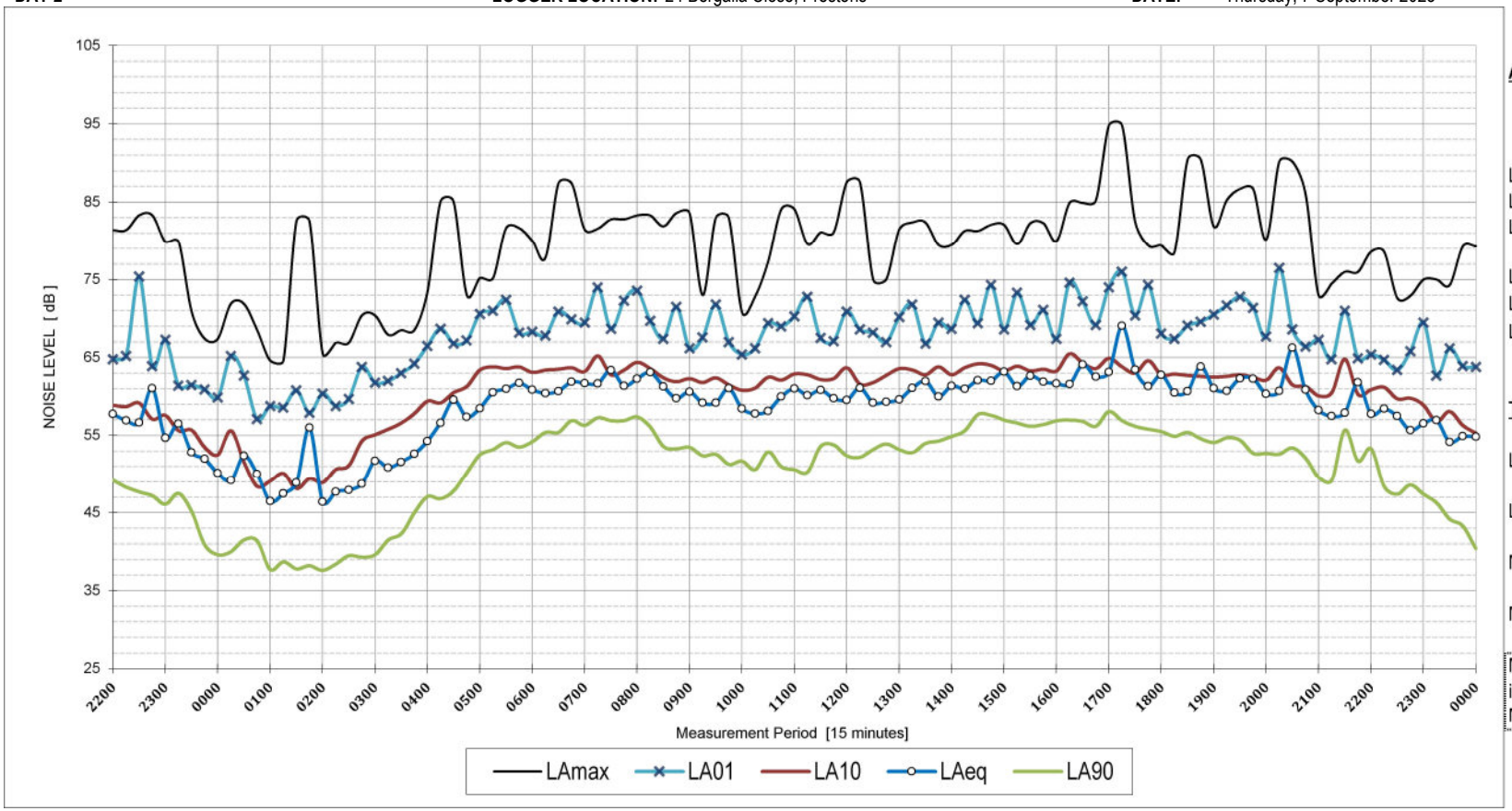
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	62	dB
LAeq 9 hours	2200-0700	58	dB
Max LAeq 1 hour	0700-2200	64	dB
Max LAeq 1 hour	2200-0700	62	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 2 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Thursday, 7 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	51	dB
LA90 Evening	1800-2200	51	dB
LA90 Night-time	2200-0700	38	dB
LAeq Daytime	0700-1800	62	dB
LAeq Evening	1800-2200	62	dB
LAeq Night-time	2200-0700	57	dB

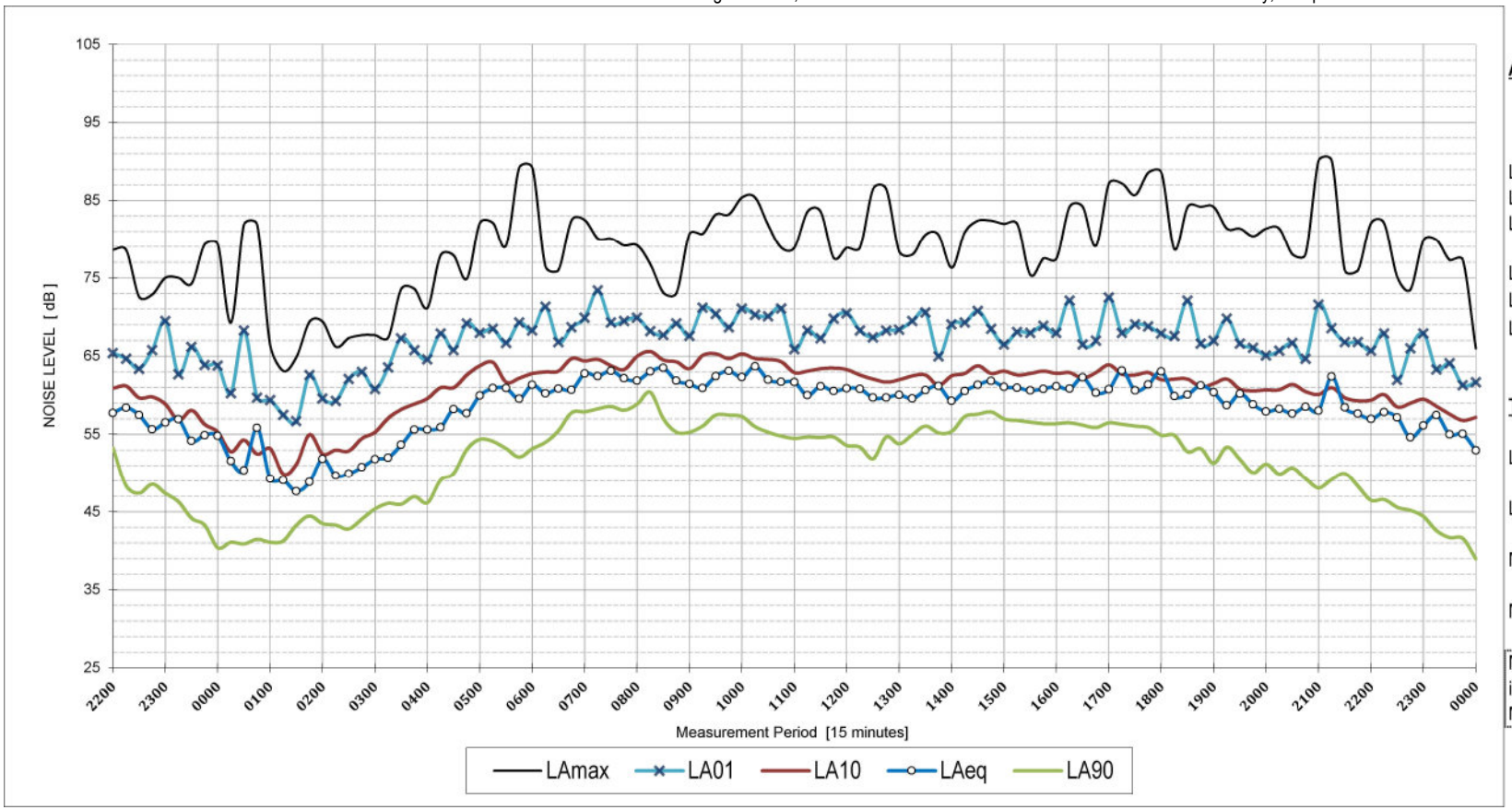
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	62	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	63	dB
Max LAeq 1 hour	2200-0700	61	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 3 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Friday, 8 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	54	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	41	dB
LAeq Daytime	0700-1800	62	dB
LAeq Evening	1800-2200	60	dB
LAeq Night-time	2200-0700	57	dB

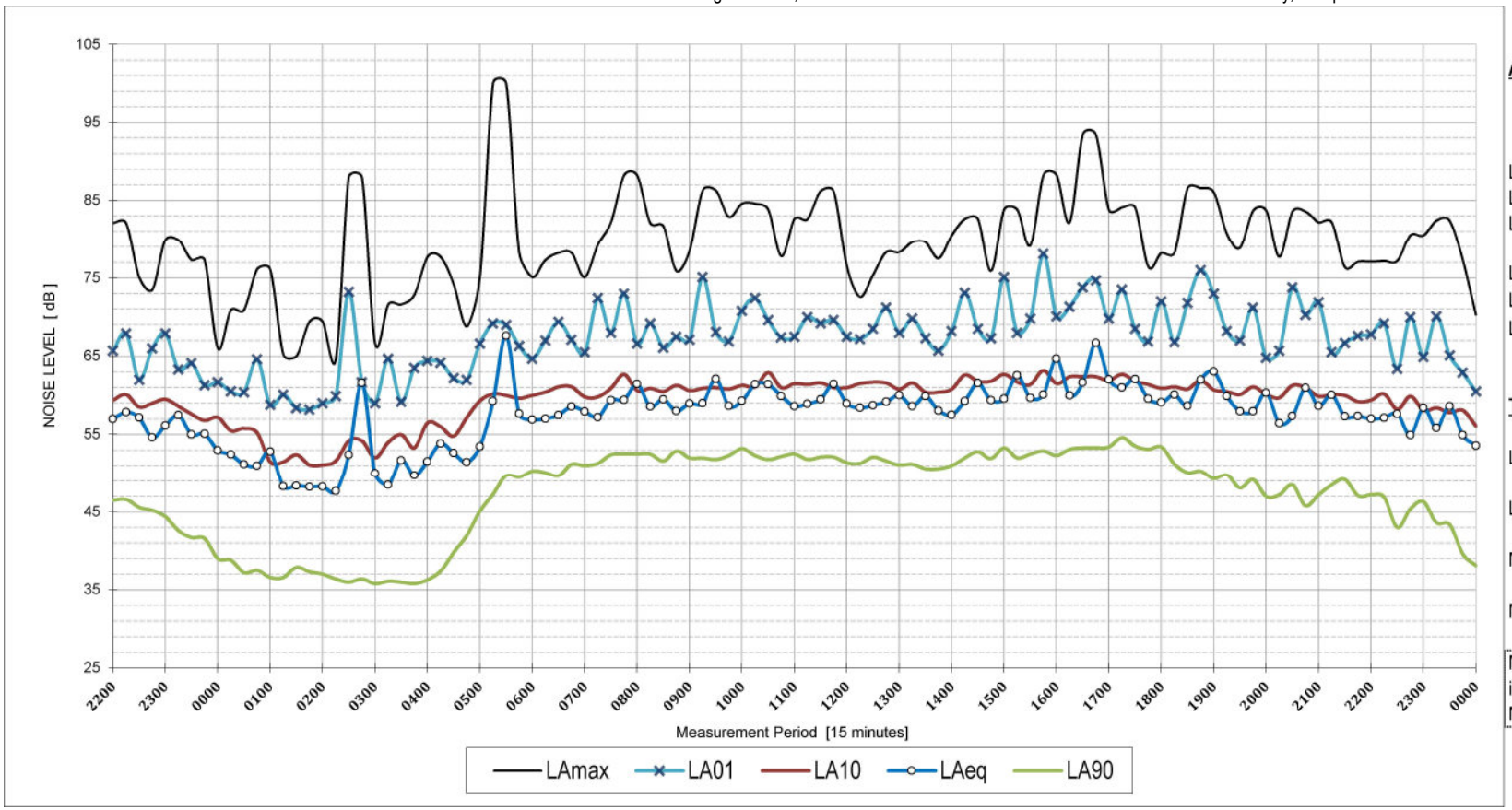
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	61	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	63	dB
Max LAeq 1 hour	2200-0700	61	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 4 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Saturday, 9 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	51	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	60	dB
LAeq Evening	1800-2200	60	dB
LAeq Night-time	2200-0700	57	dB

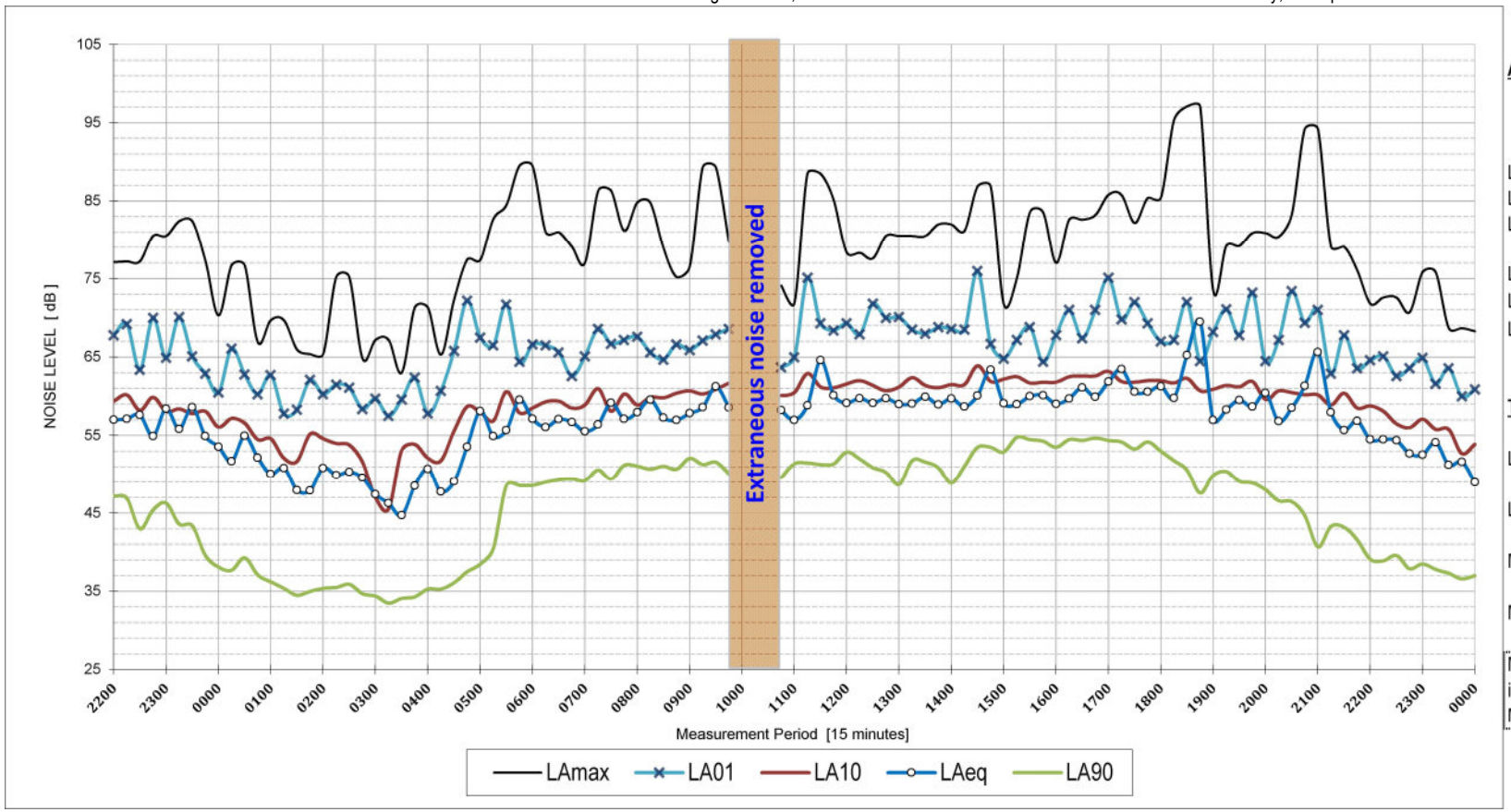
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	60	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	62	dB
Max LAeq 1 hour	2200-0700	61	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 5 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Sunday, 10 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	50	dB
LA90 Evening	1800-2200	42	dB
LA90 Night-time	2200-0800	34	dB
LAeq Daytime	0800-1800	60	dB
LAeq Evening	1800-2200	62	dB
LAeq Night-time	2200-0800	55	dB

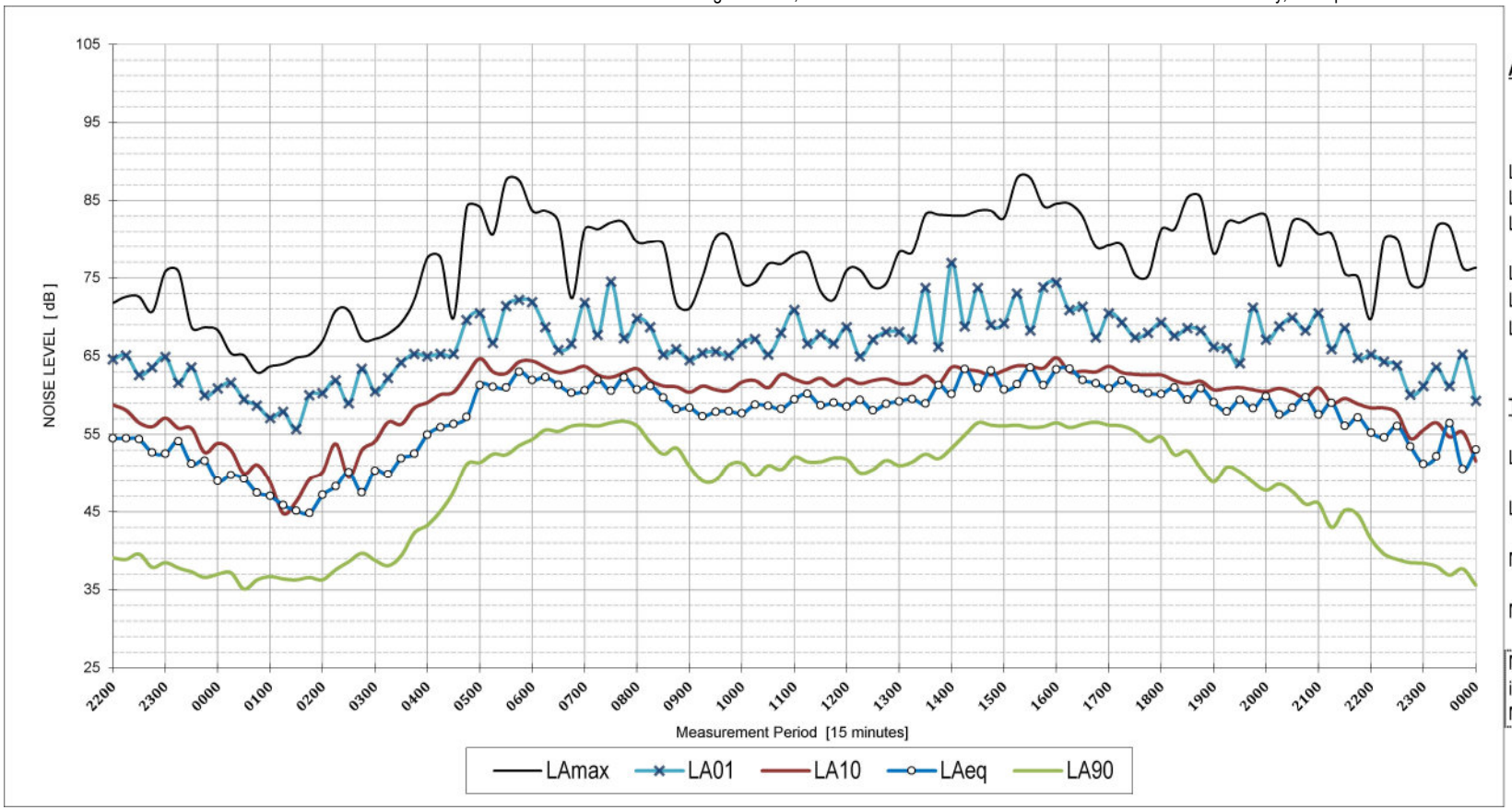
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	61	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	62	dB
Max LAeq 1 hour	2200-0700	57	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 6 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Monday, 11 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	45	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	57	dB

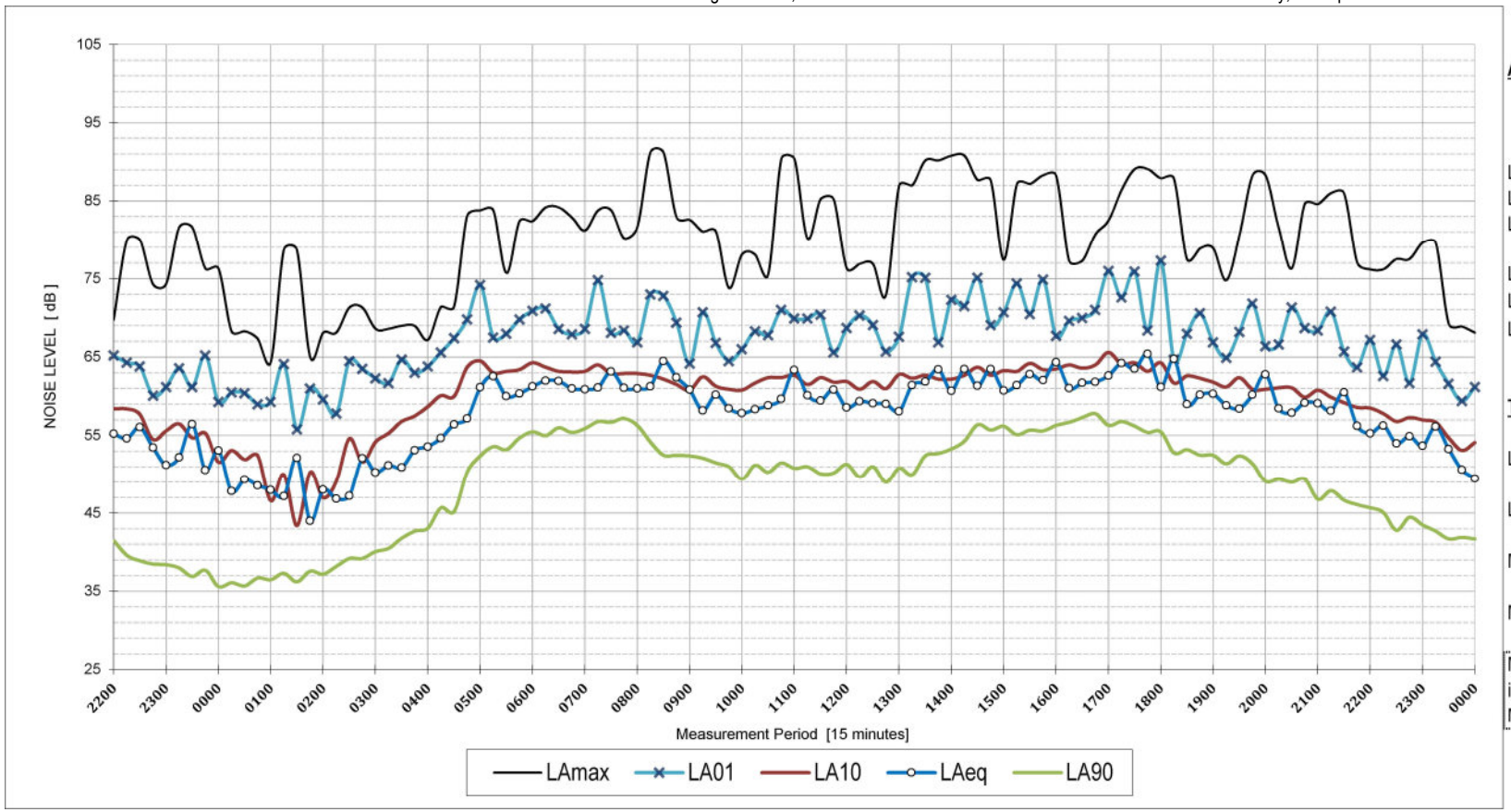
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	60	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	62	dB
Max LAeq 1 hour	2200-0700	62	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 7 **LOGGER LOCATION:** 24 Bergalia Close, Prestons **DATE:** Tuesday, 12 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	62	dB
LAeq Evening	1800-2200	60	dB
LAeq Night-time	2200-0700	57	dB

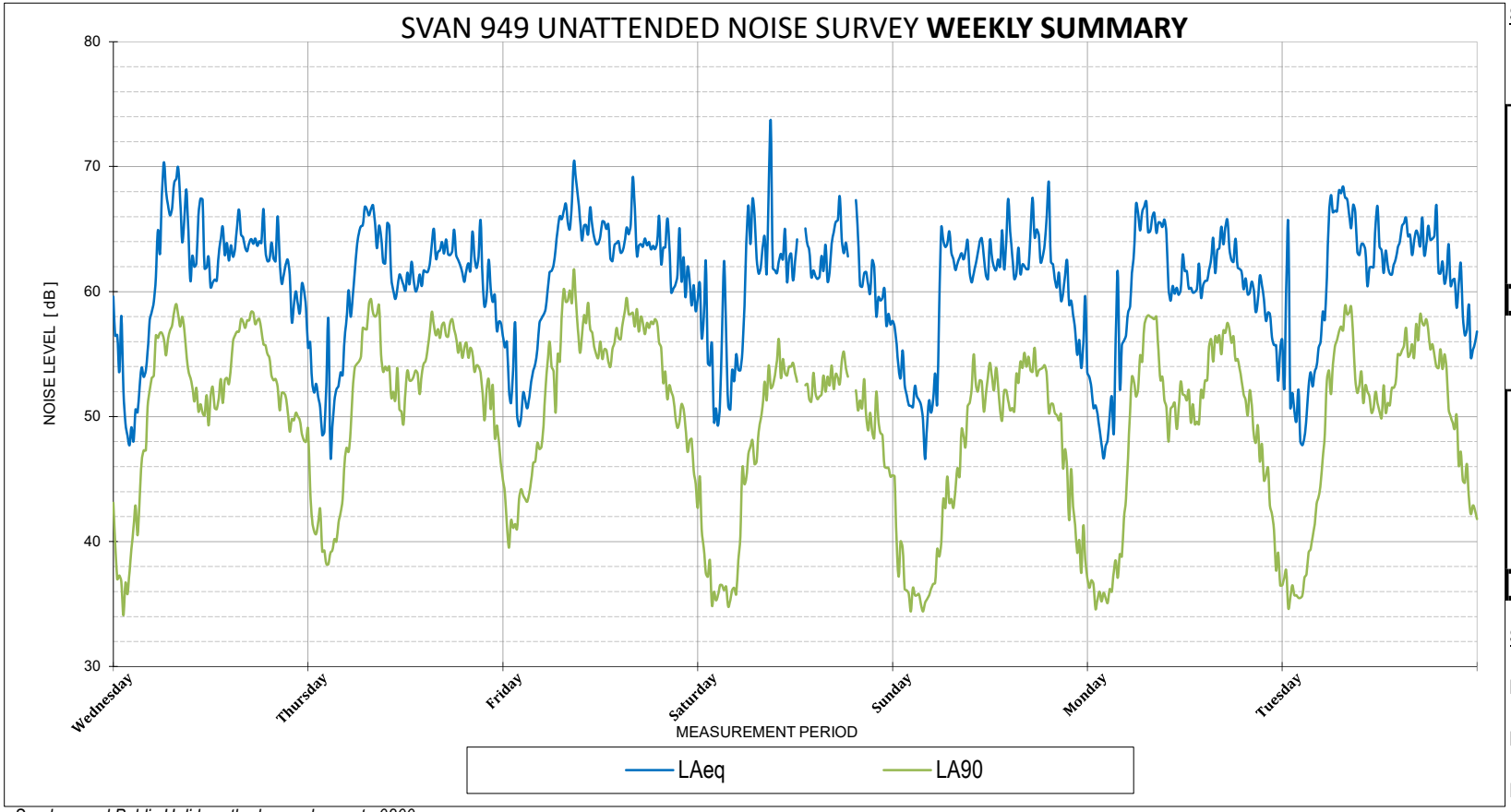
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	61	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	63	dB
Max LAeq 1 hour	2200-0700	61	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	33

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

WEEKLY SUMMARY **LOGGER LOCATION:** 33 Huskisson Street, Prestons **PERIOD:** 6th to the 12th September 2023



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	***LA90*** Evening	***LA90*** Night-time
Day 1	50	50	37
Day 2	52	53	39
Day 3	55	50	41
Day 4	51	49	35
Day 5	49	46	35
Day 6	50	47	35
Day 7	50	49	36
RBL	**50**	**49**	**36**

	LAeq Daytime	***LAeq*** Evening	***LAeq*** Night-time
Day 1	65	63	61
Day 2	63	63	59
Day 3	66	64	58
Day 4	64	63	60
Day 5	63	63	59
Day 6	63	61	59
Day 7	65	63	60
Average	**64**	**63**	**60**

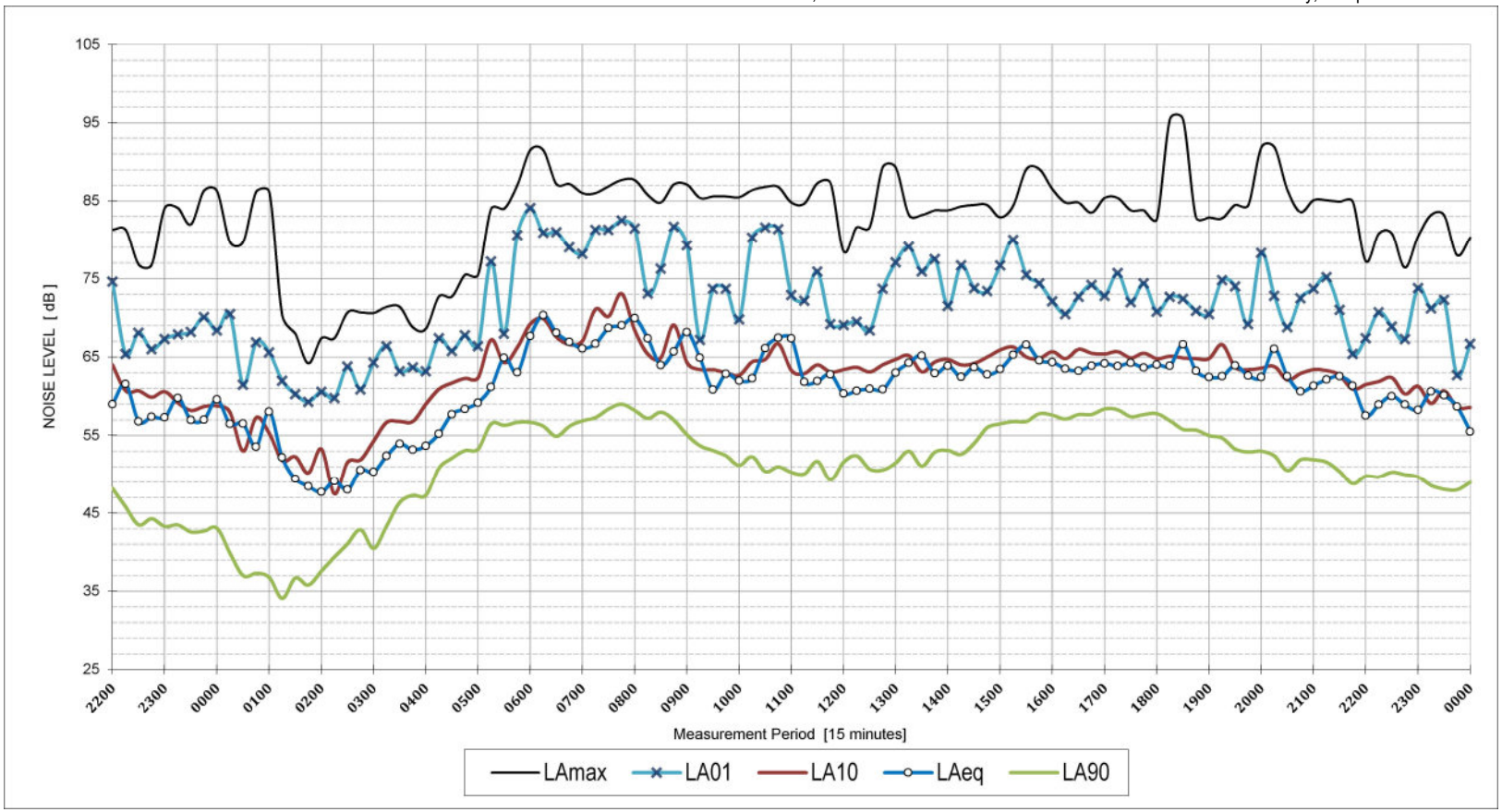
SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	64	dB
LAeq 9 hrs	2200-0700	60	dB
Max LAeq 1 hr	0700-2200	66	dB
Max LAeq 1 hr	2200-0700	61	dB

Maximum noise events as defined in the Environmental Noise Management Manual 7 day average - [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 1 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Wednesday, 6 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	50	dB
LA90 Night-time	2200-0700	37	dB
LAeq Daytime	0700-1800	65	dB
LAeq Evening	1800-2200	63	dB
LAeq Night-time	2200-0700	61	dB

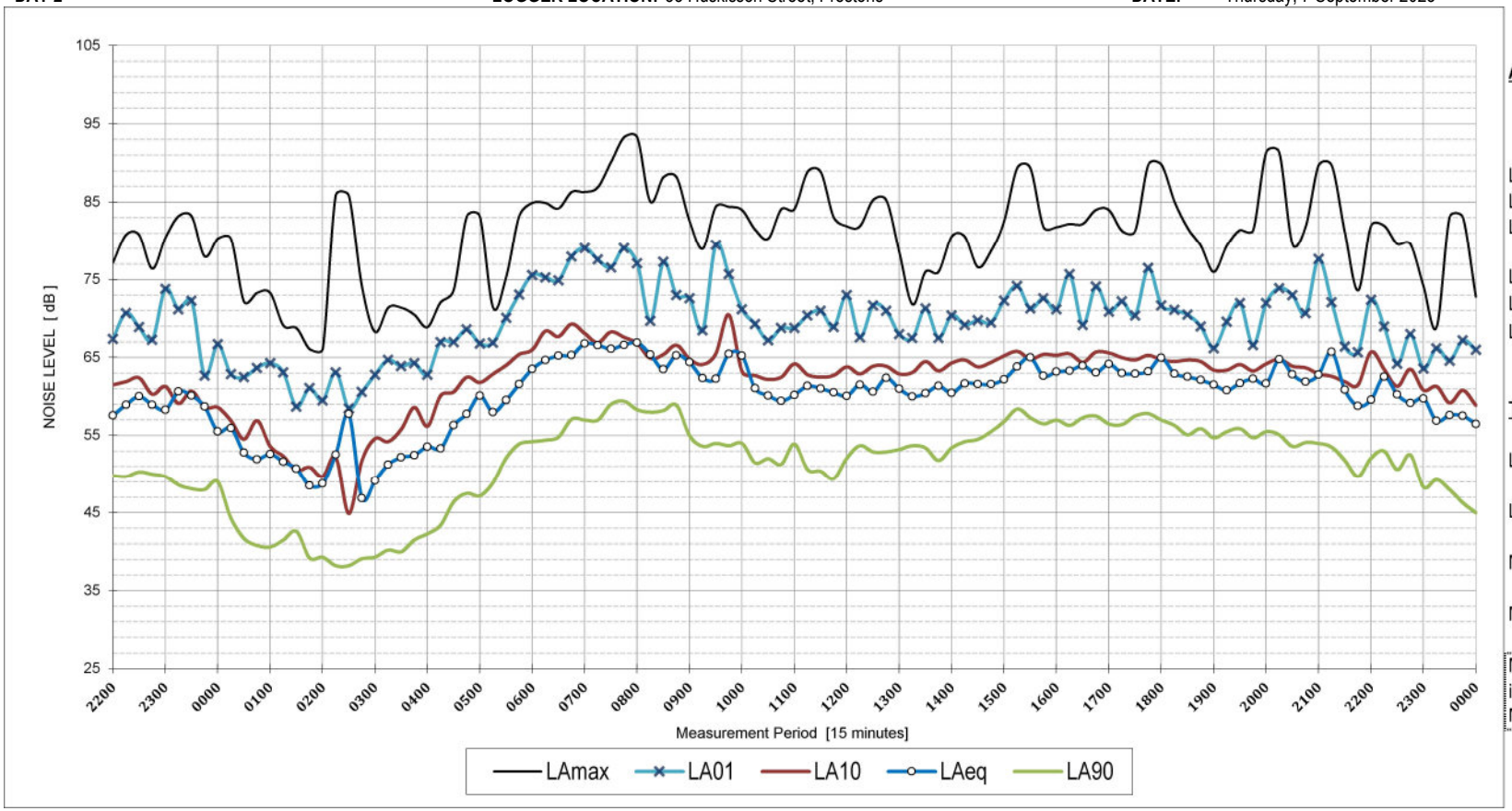
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	65	dB
LAeq 9 hours	2200-0700	61	dB
Max LAeq 1 hour	0700-2200	66	dB
Max LAeq 1 hour	2200-0700	64	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 2 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Thursday, 7 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	52	dB
LA90 Evening	1800-2200	53	dB
LA90 Night-time	2200-0700	39	dB
LAeq Daytime	0700-1800	63	dB
LAeq Evening	1800-2200	63	dB
LAeq Night-time	2200-0700	59	dB

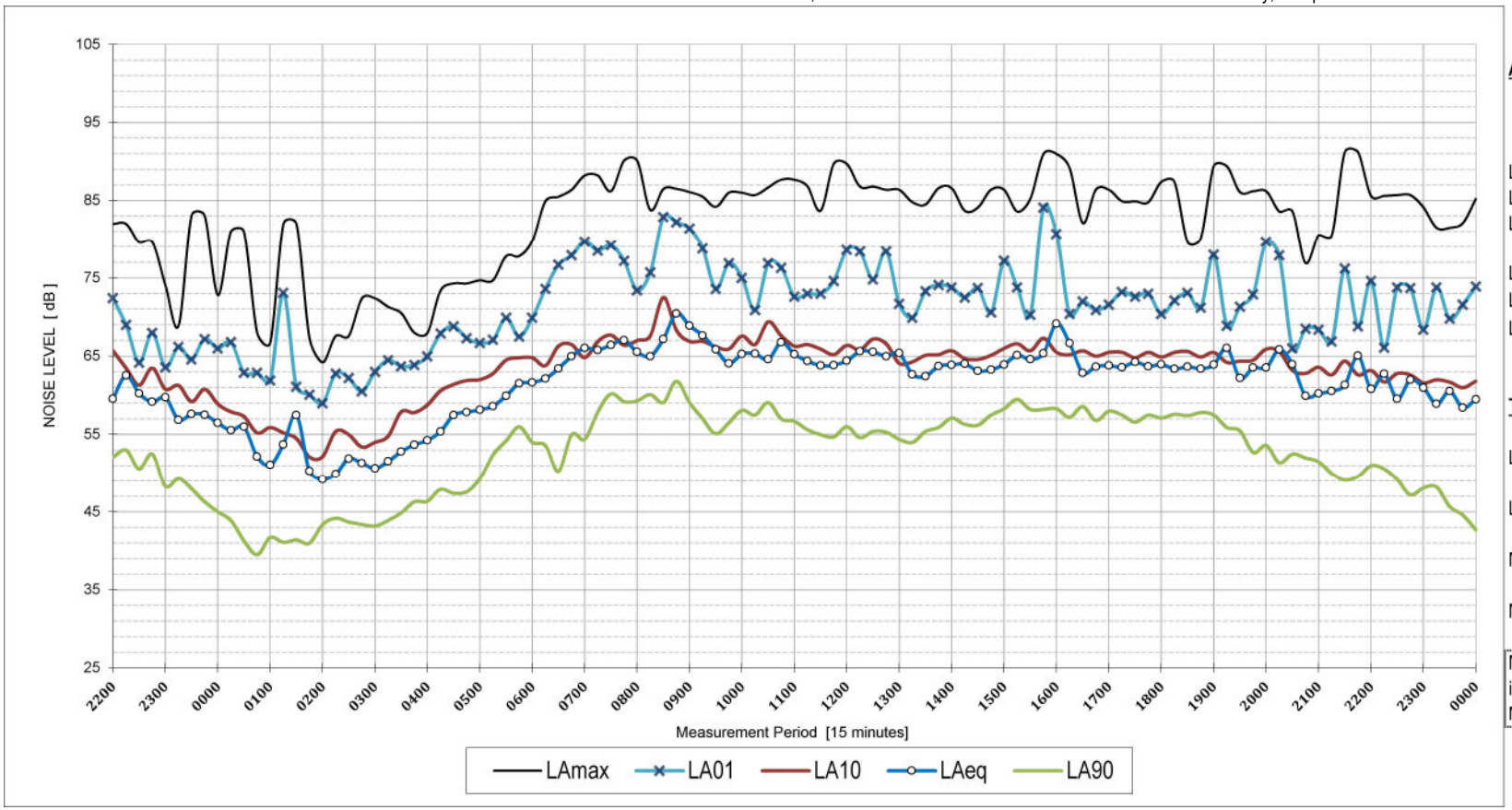
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	63	dB
LAeq 9 hours	2200-0700	59	dB
Max LAeq 1 hour	0700-2200	64	dB
Max LAeq 1 hour	2200-0700	61	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 3 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Friday, 8 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	55	dB
LA90 Evening	1800-2200	50	dB
LA90 Night-time	2200-0700	41	dB
LAeq Daytime	0700-1800	66	dB
LAeq Evening	1800-2200	64	dB
LAeq Night-time	2200-0700	58	dB

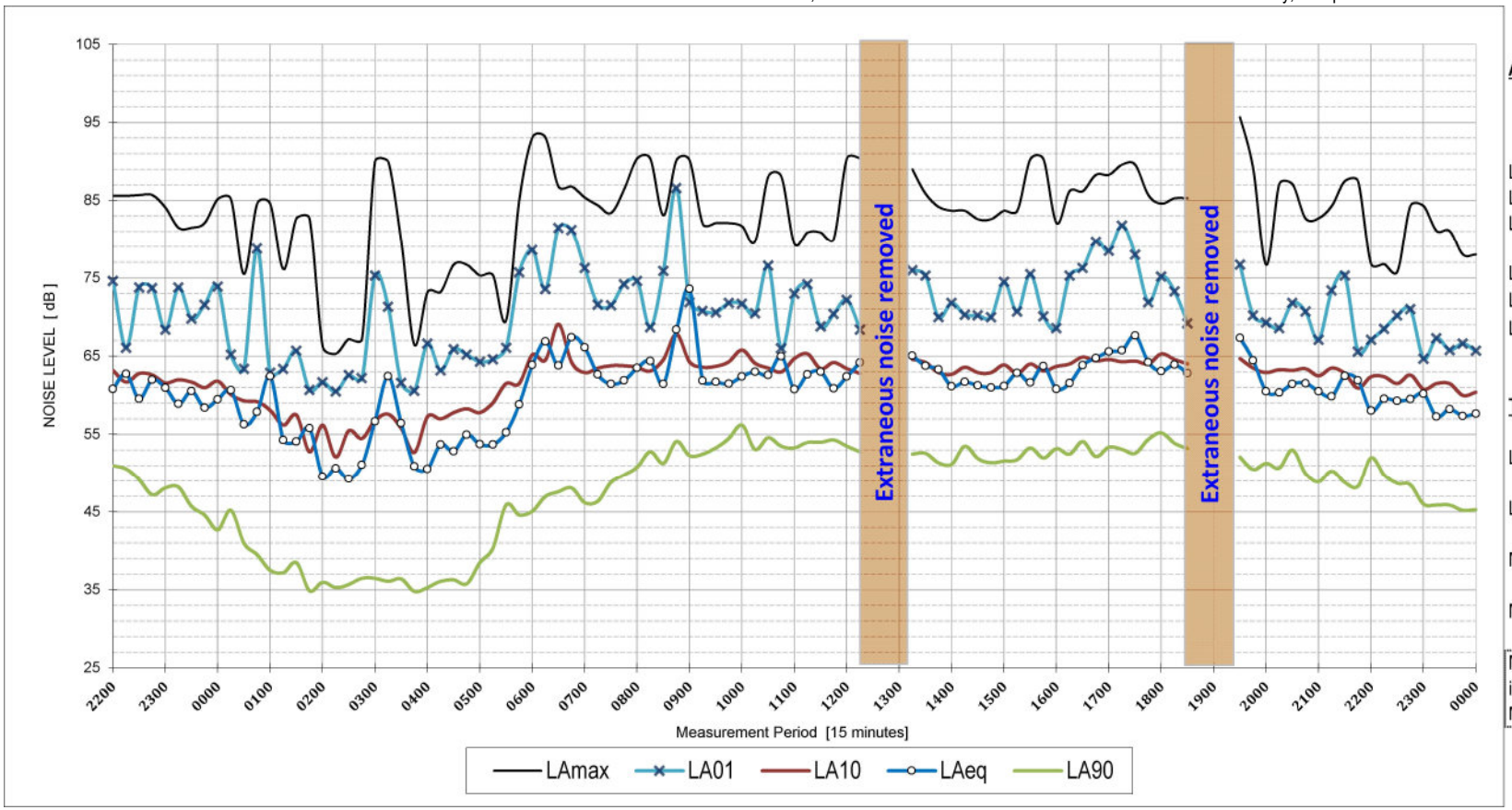
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	65	dB
LAeq 9 hours	2200-0700	58	dB
Max LAeq 1 hour	0700-2200	67	dB
Max LAeq 1 hour	2200-0700	61	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	31

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 4 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Saturday, 9 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	51	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	64	dB
LAeq Evening	1800-2200	63	dB
LAeq Night-time	2200-0700	60	dB

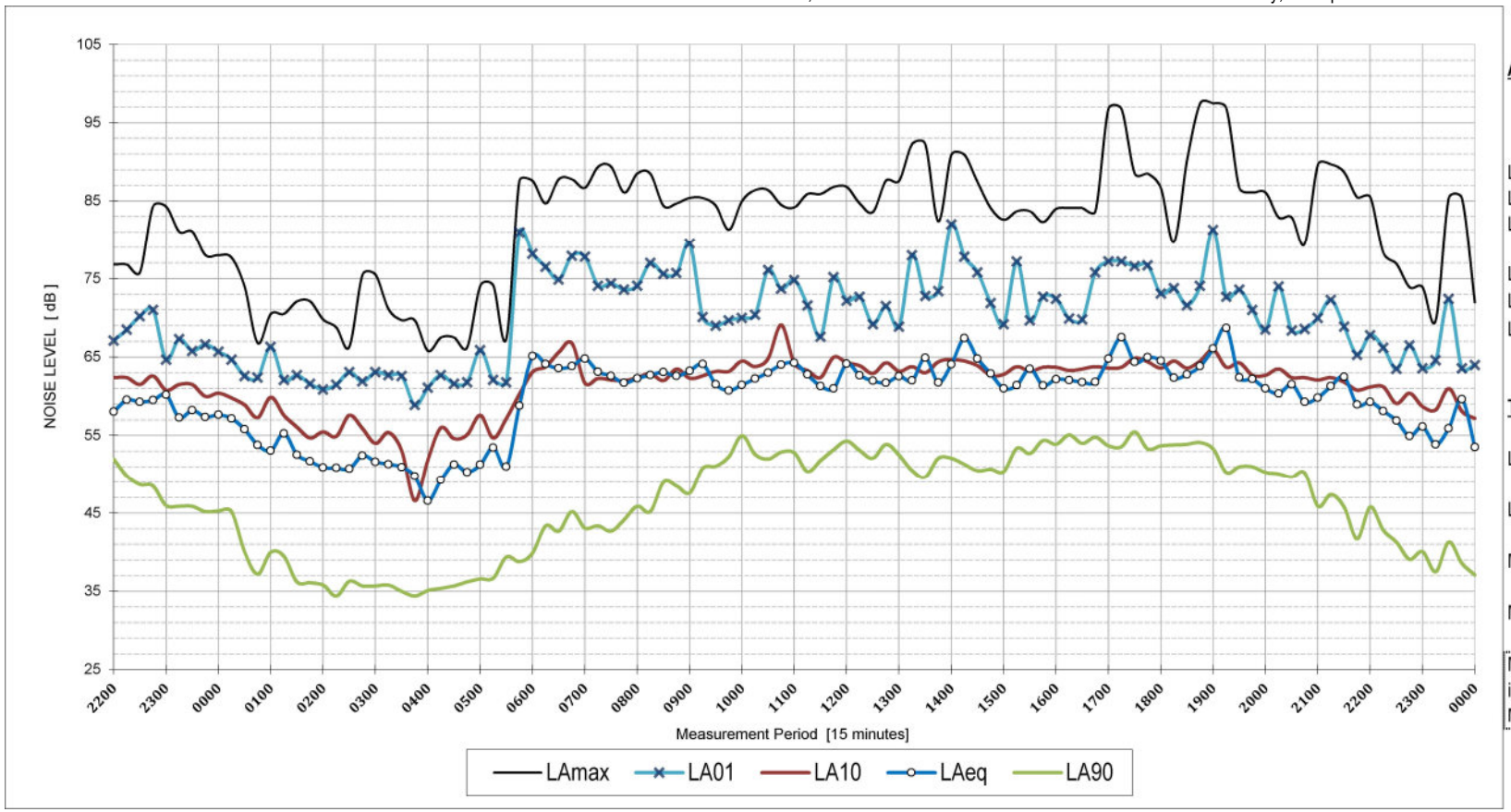
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	64	dB
LAeq 9 hours	2200-0700	60	dB
Max LAeq 1 hour	0700-2200	66	dB
Max LAeq 1 hour	2200-0700	61	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	34

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

DAY 5 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Sunday, 10 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	49	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0800	35	dB
LAeq Daytime	0800-1800	63	dB
LAeq Evening	1800-2200	63	dB
LAeq Night-time	2200-0800	59	dB

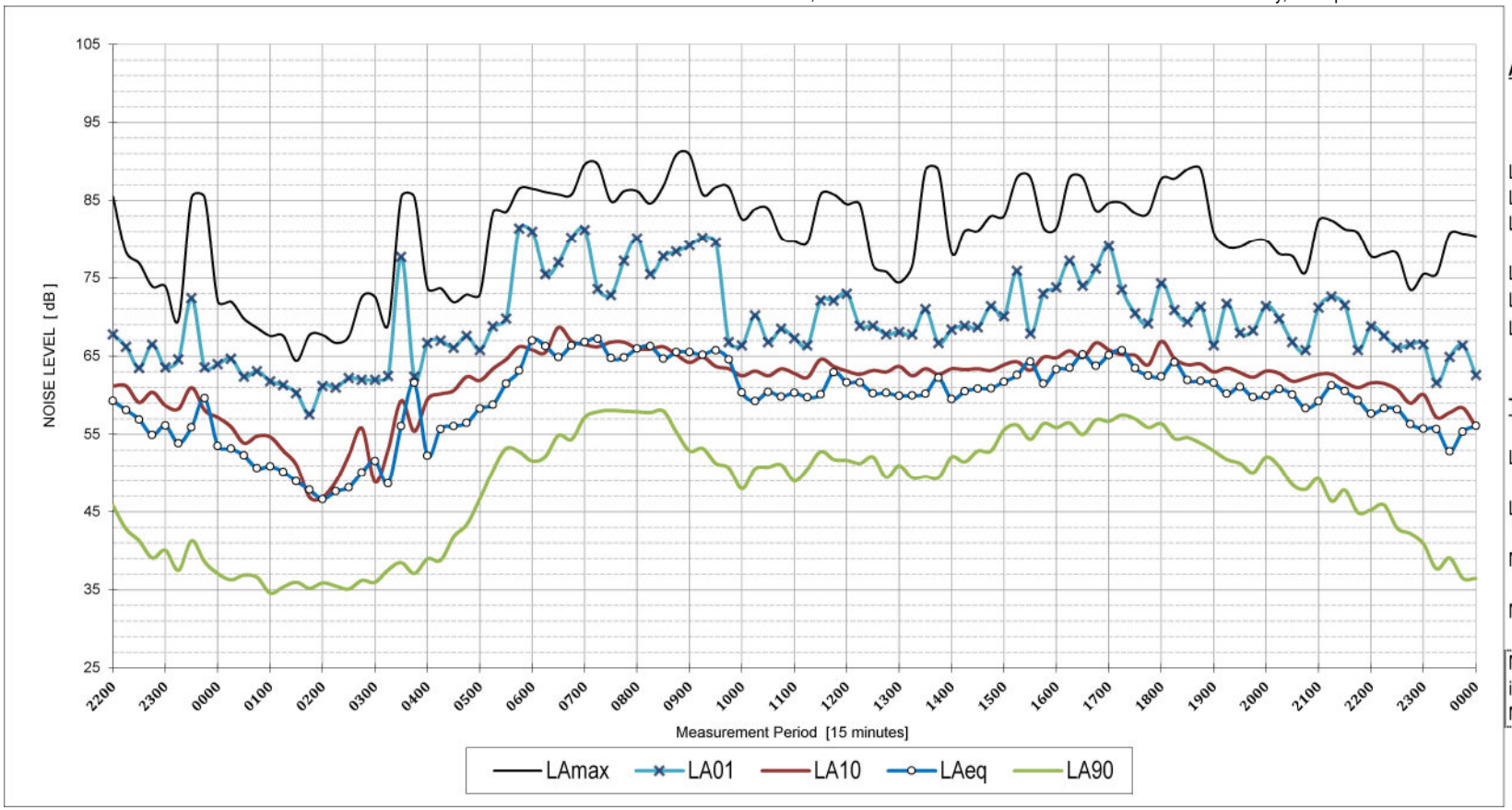
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	63	dB
LAeq 9 hours	2200-0700	58	dB
Max LAeq 1 hour	0700-2200	65	dB
Max LAeq 1 hour	2200-0700	60	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 6 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Monday, 11 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	47	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	63	dB
LAeq Evening	1800-2200	61	dB
LAeq Night-time	2200-0700	59	dB

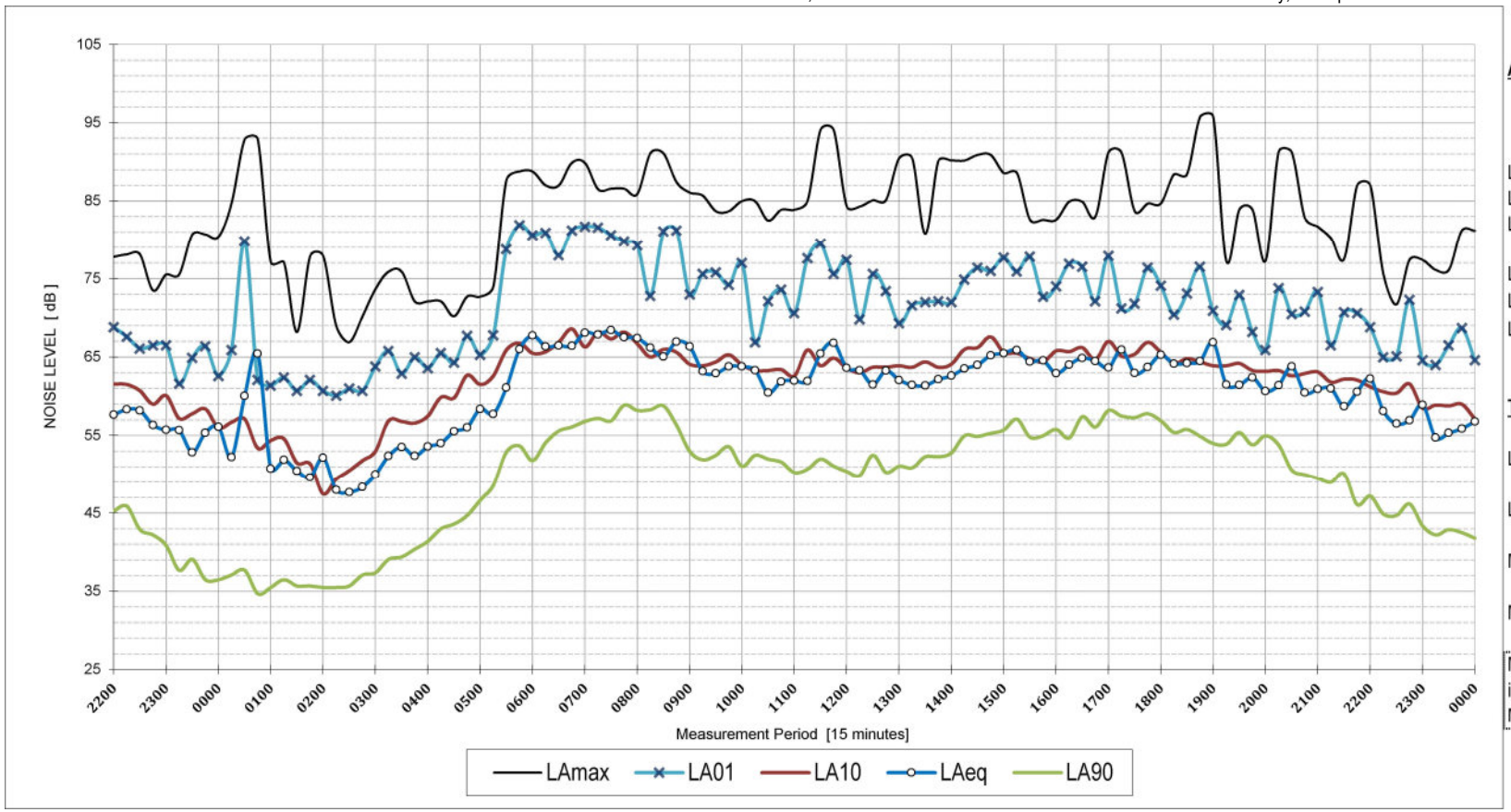
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	63	dB
LAeq 9 hours	2200-0700	59	dB
Max LAeq 1 hour	0700-2200	65	dB
Max LAeq 1 hour	2200-0700	63	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 7 **LOGGER LOCATION:** 33 Huskisson Street, Prestons **DATE:** Tuesday, 12 September 2023



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	49	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	65	dB
LAeq Evening	1800-2200	63	dB
LAeq Night-time	2200-0700	60	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	64	dB
LAeq 9 hours	2200-0700	60	dB
Max LAeq 1 hour	0700-2200	66	dB
Max LAeq 1 hour	2200-0700	64	dB

Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]	34

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