



DA Noise Impact Assessment

Childcare Centre

73 Lachlan Street, Warwick Farm



Report Number 22145.1

FLDC Architects

PREPARED FOR: FLDC ARCHITECTS

**PREPARED BY: VMS Australia Pty Ltd
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Quality Management

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1 Introduction

VMS Australia Pty Ltd has been commissioned by FLDC Architects to undertake a noise impact assessment for a proposed Childcare Centre (CCC) to be located at 73 Lachlan Street, Warwick Farm. This assessment has been prepared to assist Liverpool City Council's consideration of a Development Application submission.

This report presents an assessment of both the potential noise impact associated with the childcare centre, and the suitability of the site for the purposes of a childcare centre development. Where required, recommendations are documented for design measures to mitigate potential noise impacts to achieve acoustical amenity requirements within the childcare centre and at surrounding receivers.

The assessment makes reference to the NSW Planning and Environment *Child Care Planning Guideline* (August 2017) and the Association of Australasian Acoustical Consultants *Guideline for Child Care Centre Acoustic Assessment* V3.0 (September 2020).

A glossary of the acoustical terminology used throughout this report is contained within **Appendix A**.

2 Project Site

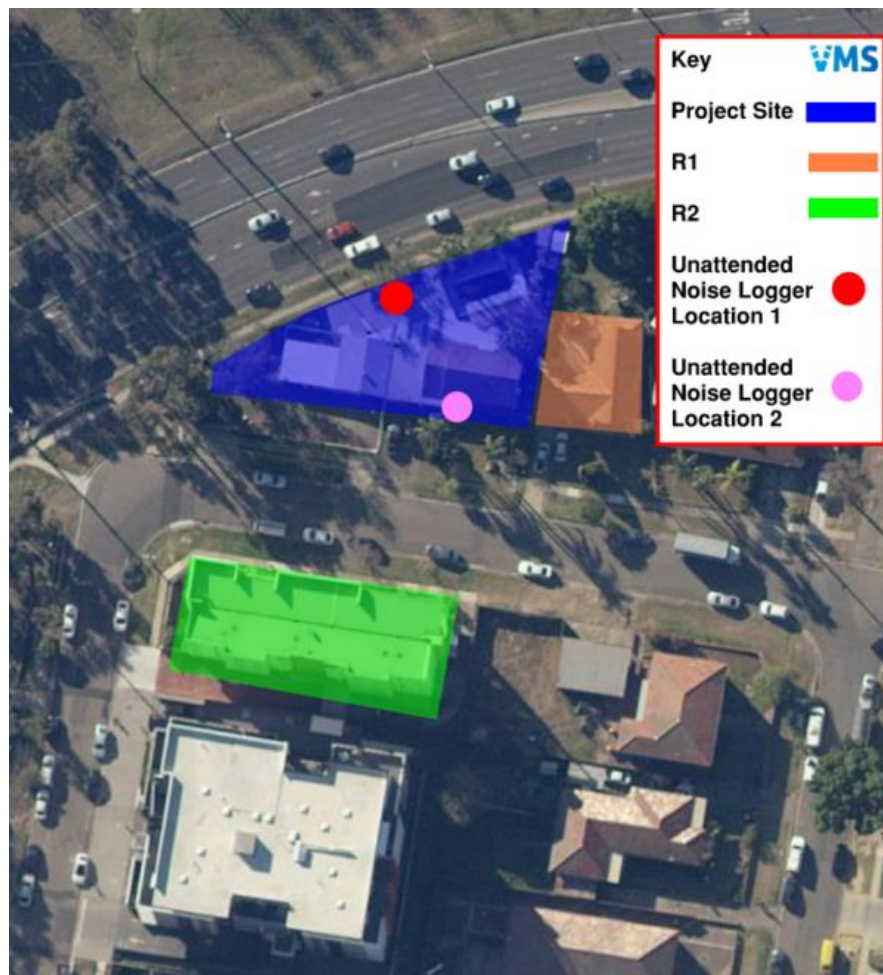
2.1 Site Location

The proposed project site is located at 73 Lachlan Street, Warwick Farm. The project site is surrounded by multiple-storey residential receivers to the south of the project site, and single/double storey receivers to the east of the project site.

The southern boundary of the project site adjoins Lachlan Street and northern boundary of the project site adjoins Sydney Road/Hume Highway. Lachlan Street is a local road that carries two-way traffic, Sydney Road/Hume Highway is a state road.

The site and surrounding receivers are shown in **Figure 2-1**.

Figure 2-1 Site Locality and Surrounding Receivers



Source: SIX Maps (as marked up by VMS)

The receivers most potentially impacted by the operation of the CCC are as documented in **Table 2-1** and can be identified in **Figure 2-1**.

Table 2-1 Receivers Potentially Impacted by the Operation of the CCC

Receiver ID	Receiver Type	Receiver Address
R1	2-Storey Residential	East of the project site at 71 Lachlan Street, Warwick Farm
R2	Multi-Storey Residential	South of the project site at 2 Castlereagh Street, Warwick Farm

2.2 Proposed Development

The proposal is to develop 124-place childcare centre catering for children aged from 0 – 6 years.

The 3-storey childcare centre (CCC) is proposed to accommodate the following:

- 2 basement level car parks.
- 4 indoor rooms, an outdoor play area, kitchen, laundry and staff rooms on the ground level.
- 3 indoor rooms, an outdoor play area and staff rooms on the first level.
- 2 indoor rooms, an outdoor play area and staff rooms on the second level.

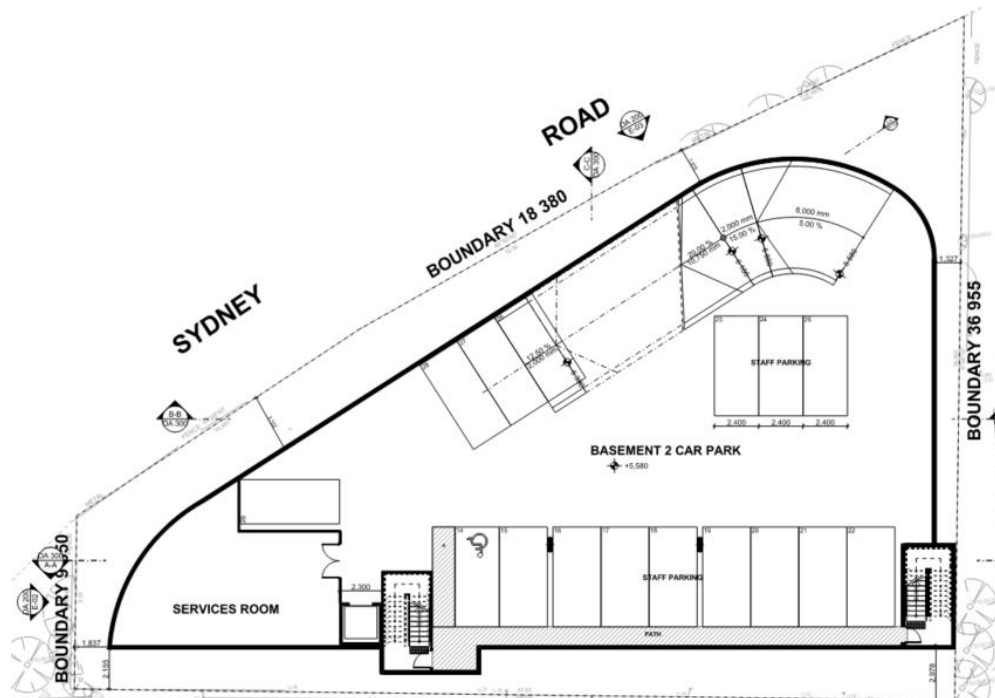
Basement carparking will be accessed via the entry off Lachlan Street.

This assessment references the DA architectural drawings prepared by FLDC Architects dated 4 November 2022. The proposed floor layouts are shown in **Figures 2-2 – 2-6**.

The centre will operate between 7.00am and 6.00pm Monday to Friday and will accommodate a maximum of 124 children and 16 staff. The age breakdown of children is as follows:

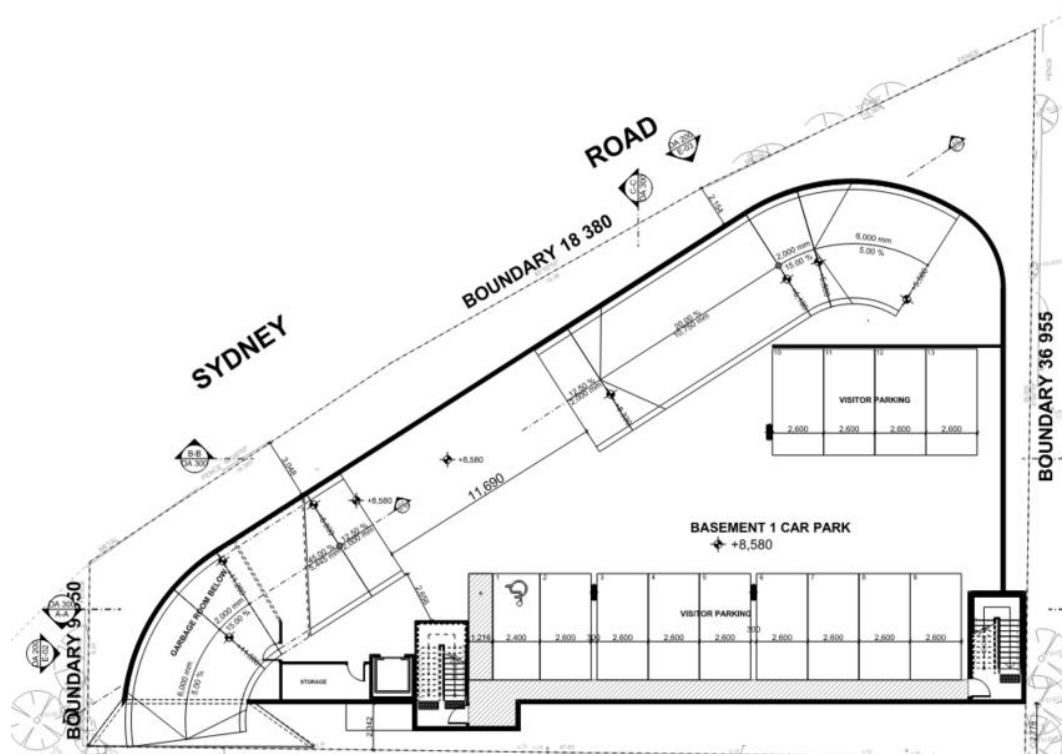
- 0 – 2 years 24 Children
- 2 – 3 years 40 Children
- 3 – 6 years 60 Children

Figure 2-2 Proposed Basement 2 Floor Layout



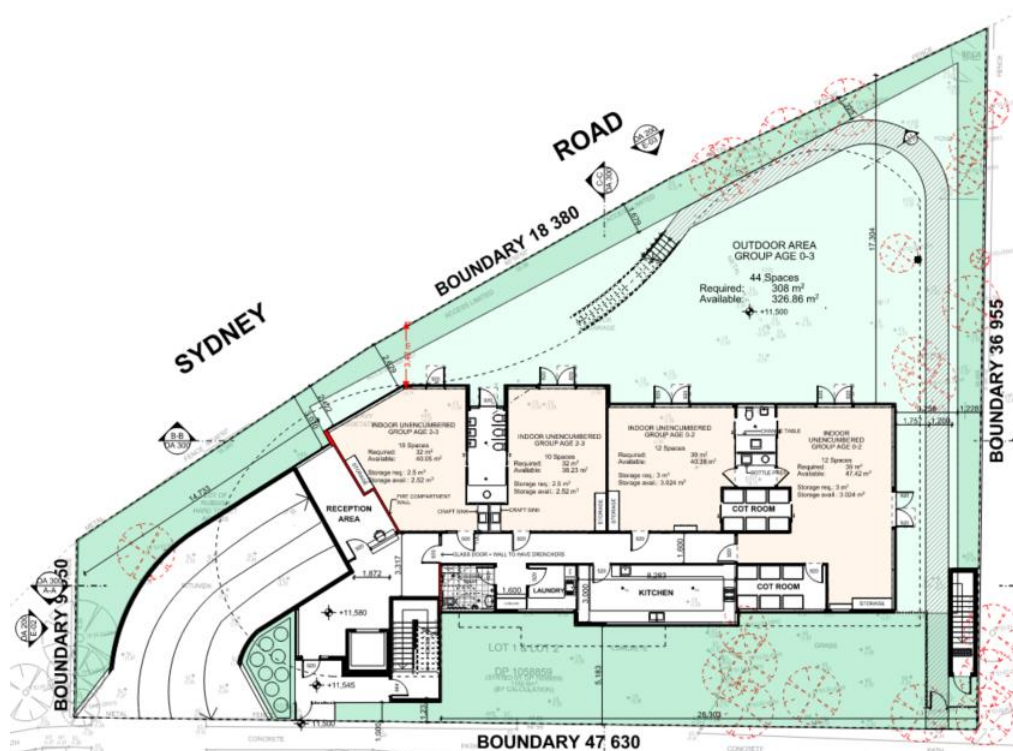
Source: FLDC Architects

Figure 2-3 Proposed Basement 1 Floor Layout



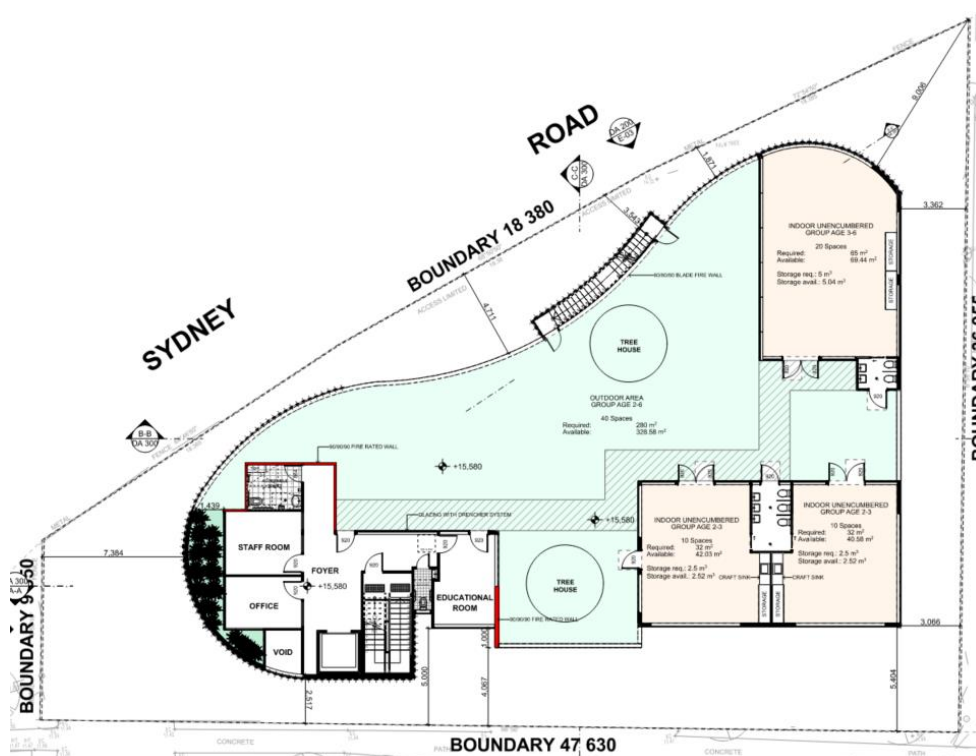
Source: FLDC Architects

Figure 2-4 Proposed Ground Floor Layout



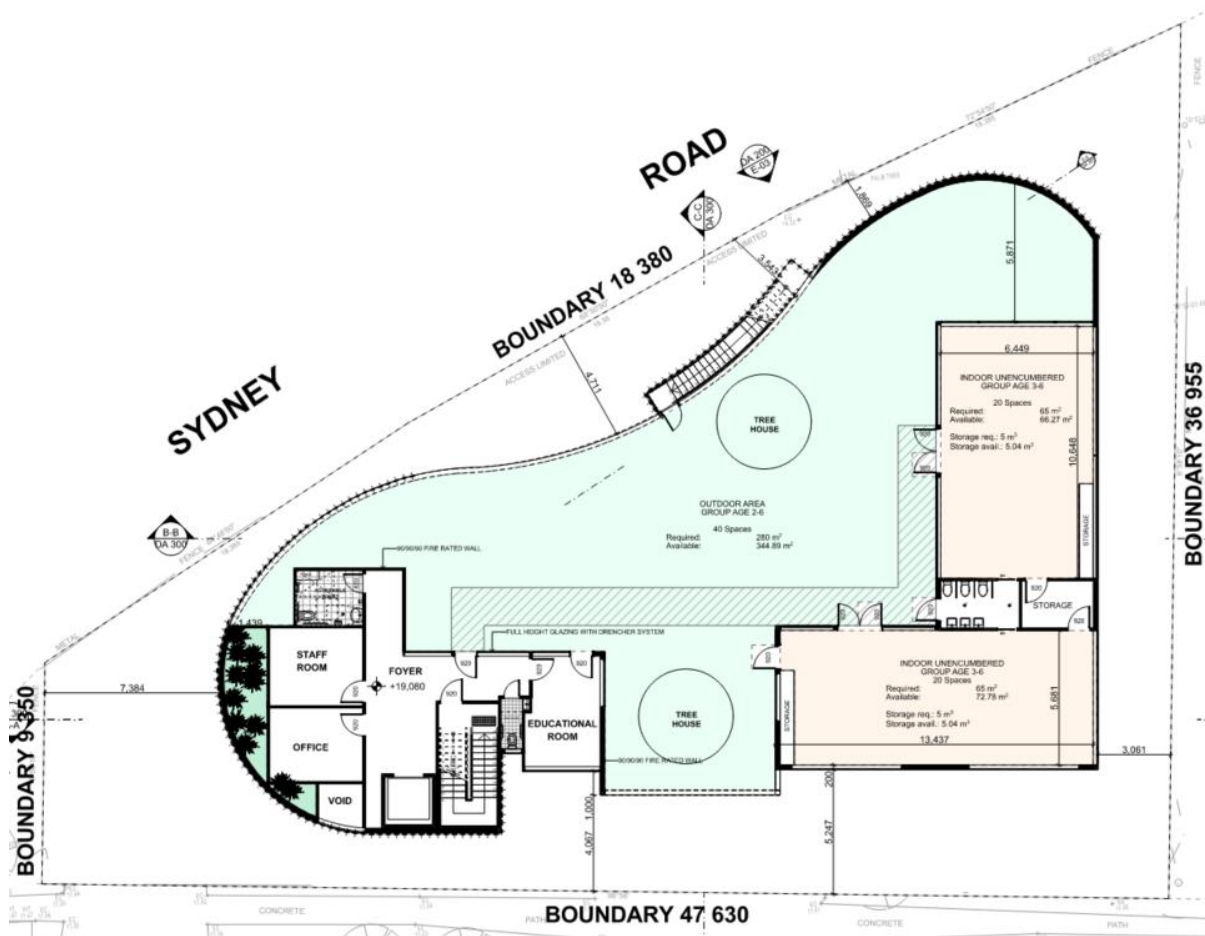
Source: FLDC Architects

Figure 2-5 Proposed Level 1 Floor Layout



Source: FLDC Architects

Figure 2-6 Proposed Level 2 Floor Layout



Source: FLDC Architects

3 Existing Noise Environment

3.1 Unattended Noise Monitoring

In order to characterise the existing acoustical environment of the area, unattended monitoring was conducted between Thursday 28 July 2022 and Sunday 07 August 2022 at 73 Lachlan Street, Warwick Farm.

Instrumentation for the survey comprised of two BSWA 308 environmental noise loggers (serial numbers: 600101 & 600102) each fitted with microphone windshields. Calibration of the loggers were checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The locations of the two unattended noise monitors are shown in **Figure 2-1** above.

Charts presenting summaries of the measured daily noise data are attached in **Appendix B**. The charts present each 24-hour period by incorporating the L_{Amax}, L_{Aeq} and L_{A90} noise levels for the corresponding 15-minute periods.

The measured data has been filtered to remove periods affected during adverse weather conditions following consultation of weather reports recorded at the Bureau of Meteorology (BOM) Bankstown weather station. The filtered data is shown in **Appendix B**.

The results of the analysis are presented in Error! Reference source not found..

Table 3-1 Background Noise Levels Corresponding to Defined NPfl Periods

Date	ABL ¹ Day L ₉₀ dBA 7:00am – 6:00pm Location 1	ABL ¹ Day L ₉₀ dBA 7:00am – 6:00pm Location 2
Thursday, 28 July 2022	55	51
Friday, 29 July 2022	54	50
Saturday, 30 July 2022	53	51
Sunday, 31 July 2022	50	49
Monday, 1 August 2022	54	51
Tuesday, 2 August 2022	53	50
Wednesday, 3 August 2022	54	52
Thursday, 4 August 2022	55	52
Friday, 5 August 2022	55	52
Saturday, 6 August 2022	53	50
Sunday, 7 August 2022	50	48
RBL¹ (Median)	54	51

Note 1: Assessment Background Level (ABL) is the single figure background level for each assessment period (day, evening and night), whereas the Rating Background Level (RBL) is the single figure background level over the entire monitoring period taken to be the median of the relevant ABLs.

The data obtained from the noise logging was processed in accordance with the procedures contained in the NSW EPA's Road Noise Policy (RNP, 2011) to establish representative traffic noise levels which can be expected in the vicinity of the site. The result of this analysis is presented in **Table 3-2**.

Table 3-2 Measured Traffic Noise Levels - Day Period

Location	Measured Noise Levels dBA Day $L_{Aeq}(1hr)$		
	During Dropoff/Pickup Time Period	Outside of Dropoff/Pickup Time Period	During Entire Operation of the CCC
Location 1 – Facing Sydney Road/Hume Highway	65 - 66 ¹ 64 – 65 ²	64 - 66 ³	64 - 66 ⁴
Location 2 – Facing Lachlan Street	59 - 60 ¹ 58 ²	57 – 58 ³	57 - 60 ⁴

Note 1: Corresponds to the time period 7am – 9am

Note 2: Corresponds to the time period 4pm – 6pm

Note 3: Corresponds to the time period 9am – 4pm

Note 4: Corresponds to the time period 7am – 6pm

4 Assessment Criteria

There are typically two considerations when conducting a noise impact assessment for a childcare centre:

- The impact that the operation of the CCC may have on nearby receivers; and
- The impact of noise from the surrounding environment on the development itself.

Assessment of operational noise from the childcare centre includes the following sources:

- Children, primarily from outdoor (and indoor) play areas;
- Mechanical plant (in-principle);
- Vehicular movement events associated with the carpark/drop-off/pick-up; and
- Additional traffic on nearby local/arterial roads.

Assessment of the impact of noise from the surrounding environment on the centre includes:

- Road traffic noise impacting internal and external areas of the childcare centre.

4.1 Relevant Guidelines

For this project, consideration has been given to the following applicable guidelines:

- SEPP (Educational Establishments and Child Care Facilities) 2017.
- Child Care Planning Guideline (NSW DPI&E 2017).
- Guideline for Child Care Centre Acoustic Assessment Version 3.0 (AAAC, October 2020).
- Noise Policy for Industry (NSW EPA 2017).
- NSW Road Noise Policy (NSW EPA 2011).
- SEPP (Infrastructure) 2007.
- Development Near Rail Corridors and Busy Roads - Interim Guideline 2008

4.2 Impacts to Residential Receivers

SEPP (*Educational and Child Care Facilities*) 2017 requires the consent authority to consider the applicable provisions of the Child Care Planning Guideline prior to determining a development application in relation to a proposed development.

The *Child Care Planning Guideline* documents general planning measures to promote acoustic privacy for children attending a centre and for the surrounding neighbours. The impact of environmental noise is to be assessed against recommended acceptable limits. Criteria for assessment are not quantified in either the SEPP or Guideline.

A guideline for the assessment of noise from childcare centres has been prepared by the Association of Australasian Acoustical Consultants (AAAC) as a result of an NSW Australian Acoustical Society (AAS) Technical Meeting held in September 2007 on Child Care Noise. The document, *AAAC Guideline for Child Care Centre Acoustic Assessment*, Version 3.0 (October 2020), provides criteria for the assessment of noise intrusion into and noise emissions from childcare centres and also provides recommendations for treatment to minimise acoustical impacts upon neighbouring premises. The guideline has been placed before the Land and Environment Court during matters involving Child Care Centre applications.

4.2.1 Outdoor Play

The AAAC guideline considers the following criteria for childcare developments:

“Background Greater Than 40 dBA – The contributed $L_{eq,15min}$ noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (ie background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).

Up to 4 hours (total) per day – If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\text{ minute}}$ noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.

More than 4 hours (total) per day – If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\text{ minute}}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.”

Considering receivers along Lachlan Street (logger location 2) and the time in which children are involved in outdoor play is more than 4 hours (total) per day, the noise level emitted from outdoor play shall not exceed the following noise criteria (RBL + 5dBA).

- $L_{Aeq(15\text{minute})}$ 56 dBA when assessed at the most affected point on or within any residential property boundary.

4.2.2 Indoor Activities, Mechanical Plant and On-Site Vehicular Movements

The AAAC guideline recommends the $L_{Aeq(15\text{minute})}$ noise level emitted from the cumulative operation of indoor activities, mechanical plant and traffic on the site should not exceed the background noise level by more than 5dB at the assessment location. The assessment location is defined as the most affected point on or within any residential receiver property boundary.

On this basis, considering receivers along Lachlan Street (logger location 2), the recommended design limit for assessment of noise generated by indoor activities, mechanical plant and on-site traffic is as follows:

- $L_{Aeq(15\text{minute})}$ 56 dBA when assessed at the most affected point on or within any residential property boundary.

4.2.3 Additional Traffic on the Road Network

Road traffic generated by the proposed childcare centre may result in increased levels of noise at residential receivers primarily on Lachlan Street which is classified as a local road. Based on the recommendations of the NSW Road Noise Policy (EPA 2011) the relevant criterion for daytime operations is presented in **Table 4-1** to assess impacts along local roads.

Table 4-1 Road Traffic Noise Assessment Criterion – Additional Traffic (dBA)

Road Category	Type of Project/Land Use	Assessment Criterion - dBA
Local	Existing residences affected by additional traffic on existing local roads generated by land use developments	55 $L_{Aeq(1\text{hr})}$

Note: The assessment criteria are applied externally and to residential receivers only.

Where predicted noise levels exceed the project-specific noise assessment criterion, an assessment of all feasible and reasonable mitigation options should be considered. The RNP states that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.3 Noise Intrusion to the Child Care Centre

The AAAC childcare centre guideline also presents recommendations for external noise impact upon children in childcare centres.

- The $L_{Aeq,1\text{hr}}$ intrusive noise level from road traffic or industry at any location within an outdoor play area should not exceed 55dBA.
- The $L_{Aeq,1\text{hr}}$ intrusive noise level from road traffic or industry within the indoor play areas should not exceed 40dBA and 35dBA in sleeping areas.

5 Assessment of Noise Impacts

5.1 Noise Modelling

Site-related noise intrusion and emissions were modelled using the iNoise 2022 noise prediction software. Acoustic factors which are considered in the modelling include:

- Source sound level emissions and locations;
- Screening effects from buildings and barriers;
- Receiver locations;
- Ground topography;
- Noise attenuation due to geometric spreading;
- Ground absorption; and
- Atmospheric absorption.

5.2 Noise Intrusion Impacts to the CCC

5.2.1 Analysis

Noise level criteria is assessed against noise generated primarily from traffic on Sydney Road/Hume Highway, which was identified in this assessment as the main source of noise intrusion into the CCC. Internal noise levels would mostly be a result of noise transmission through external walls, roof and glazed doors and windows.

Predicted internal noise levels take into account the measured external noise levels, the acoustic performance of the building elements and the rooms' acoustic characteristics and absorption as well as their volume and façade areas.

5.2.2 Complying Constructions

Presented below are the minimum recommended complying constructions in accordance with the criteria stated above in **Section 4.3**.

Windows and Doors (Glazed)

Internal noise levels can only be achieved when glazed windows/doors are fully closed along with **acoustic seals** excluding Mohair Seals as they do not offer acoustic insulation. On this basis, ventilation may be required with advice from a suitably qualified mechanical engineer. The minimum glazing requirements are detailed below in **Table 5-1**.

Table 5-1 Minimum Glazing Construction

Level	Facade	Space	¹ Minimum Rw Requirement	Minimum Glazing Construction
Ground	All Facades	Indoor Unencumbered	29	6mm Float
Level 1				
Level 2				

Note 1: It is critical that the glazing system (glass, frame and seals) selected MUST meet both of these minimum requirements AND be accompanied by a NATA approved airborne sound transmission test.

Walls

External walls constructed from concrete/brick/masonry elements will not require any upgrading to achieve acoustic requirements.

Roof/ceiling

Roof/ceiling constructed from concrete/brick/masonry elements will not require any upgrading to achieve acoustic requirements.

5.2.3 External Outdoor Play Areas

Noise intrusion to the outdoor play areas on the ground level, level 1 and level 2 can only be met given the following recommendations are implemented:

- A solid and continuous barrier with a minimum 2.1m height and a surface density of at least 15 kg/m² on the ground level's outdoor play area northern and eastern boundary. (Markup in Appendix B)
- Enclosing the northern façade on the first level's outdoor play area and installing a bulkhead along the facades ceiling to allow for ventilation. Bulkhead to be internally lined with an acoustic insulation of a minimum 50mm thickness and 32 kg/m³ density. (Markup in Appendix B)
- Enclosing the northern façade on the second level's outdoor play area and creating several gaps in the ceiling/roof to allow for ventilation. (Markup in Appendix B)

It is recommended that additional advice from a suitably qualified ventilation engineer be considered to confirm ventilation requirements.

5.3 Noise Emission Impacts to Receivers

5.3.1 Outdoor Play

On the basis of more than 4-hour outdoor play, a criterion of $L_{Aeq(15\text{minute})}$ 56 dBA at the most affected point on or within any residential property boundary (RBL + 5dBA) along Lachlan Street is appropriate. This is based on the background noise levels (RBL) measured at 73 Lachlan Street (logger location 2), representative of the nearby residential receivers.

Using the AAAC's range of sound power levels (refer Error! Reference source not found.2) applied to groups of children located across the outdoor play area, modelling of noise to the identified receivers has been undertaken.

Table 5-2 Effective Sound Power Levels for Groups of 10 Children Playing

Number and Age of Children	Sound Power Level - $L_{Aeq(15\text{min})}$ - dBA
10 Children – 0 to 2 years	78
10 Children – 2 to 3 years	85
10 Children – 3 to 5 years	87

The following control measures have been included in the project design and modelling:

- Within the proposed 44 spaces in the ground floor outdoor play area, 24 are children aged 0-2 and 20 are children aged 2-3 playing outside.
- Within the proposed 40 spaces in the level 1 outdoor play area, 20 are children aged 2-3 and 20 are children aged 3-6 playing outside.
- Within the total 40 spaces in the level 2 outdoor play area, 40 are children aged 3-6.
- Outdoor play corresponding to the number of children nominated occurring simultaneously in all 3 levels.
- At least 70% of the roof/ceiling finish in the ground level, first level and second level outdoor play areas covered by an absorptive material of an NRC no less than 0.8.
- The noise intrusion recommendations described in **Section 5.2.3**.

A summary of the predictions and comparison to criteria is provided in Error! Reference source not found.3.

Table 5-3 Predicted $L_{Aeq(15\text{ min})}$ Noise Levels from Outdoor Play

Receiver ¹	Predicted Noise Level $L_{Aeq(15\text{min})}$ - dBA	Assessment Criterion $L_{Aeq(15\text{min})}$ dBA	Assessment
R1 – East of the Project Site at 71 Lachlan Street	54	56	COMPLIES
R2 – South of the Project Site at 2 Castlereagh Street	39		

Note 1: External noise levels complying at the receivers assessed above will also comply at all other receivers not mentioned due to barrier, screening and distance attenuations.

Further recommendations include a plan of management to be prepared and adhered such that structured outdoor play is managed as recommended above and that both passive and active structured play are provided.

With the inclusion of the control measures as nominated, noise emissions from outdoor play can comply with the recommended noise criteria levels at surrounding potentially sensitive receiver locations as shown in Error! Reference source not found.3.

5.3.2 Indoor Activities, Mechanical Plant and On-Site Traffic

The reverberant noise level generated during indoor activities will vary depending on the space, activity, age group and number of children. The typical range of levels are between 60 to 75dBA, however it is unlikely that these levels would be sustained for more than 5 minutes. Considering the site layout and age groups, the following reverberant noise levels have been assumed over a 15-minute period:

- 0 - 2 age group in an internal space – typical reverberant sound level of 55dBA.
- 2 - 3 age group in an internal space – typical reverberant sound level of 65dBA.
- 3 - 5 age group in an internal space – typical reverberant sound level of 70dBA.

Impacts associated with breakout noise from within the spaces are considered negligible for this development, particularly when compared to the noise generated from outdoor play. Further assessment is therefore not considered warranted.

Specific details in regard to the mechanical plant selection are unavailable at this stage. Noise emission from mechanical plant is to comply with the criteria stated in Section Error! Reference source not found.. This can be confirmed at detailed design stage, however there are ample opportunities to reduce noise (if required) including:

- Plant selection and location.
- Acoustic treatment such as acoustic louvres, internally lined ducts, silencers, etc....

All on-site carparking is enclosed beneath the building at basement level. The basement level carpark is directly accessed via Lachlan Street. Given that vehicular noise emissions generated during drop off and pickup occur within the existing enclosed basement level carpark, and the distance from such noise to the residences fronting Lachlan Street, the noise from this activity is considered negligible and further assessment not considered necessary.

5.3.3 Road Traffic Noise

The NSW RMS Guide to Traffic Generating Development document publishes trip generation rates for “long day care” for childcare centres as follows:

- 0.8 trips per child between 7am and 9am.
- 0.7 trips per child between 4pm and 6pm.

Staff arrival will be staggered but some staff will arrive prior to the 7.00am commencement. Staff departure is expected to be staggered from 4.00pm until just after the 6.00pm close. The majority of staff enter and leave the carpark directly off Lachlan Street.

The morning arrival and drop-off period will generate a higher number of vehicular events being generally concentrated over a shorter period. The afternoon pickup and departure period tends to extend over a longer duration, commonly from 3.00pm onwards. This is reflected by the RMS trip generation rates.

On this basis, the estimated trips during the morning drop off and afternoon pickup are shown in Error! Reference source not found.4 with the net trip generation per peak hour including arrival and departure at a given time. It has been assumed that 50% of children would arrive/leave per hour over the two-hour peak period.

Table 5-4 Total Trips Generated

Peak Hour	Number of Children	Trip rate/child	Trips Generated	Net Trips Generated
AM	62	0.8	50	100
PM	62	0.7	44	88

The potential impact of noise from additional traffic generated as a result of the development has been considered to worst affected residential receivers along Lachlan Street (staff and parents/children).

For the hours when drop-off (~7 - 9am) and pick-up (~4 - 6pm) occurs, the existing traffic noise level measured at 73 Lachlan Street during the day period ranged between 58 – 60 dBA and exceeds the criterion documented in **Table 4-1**. In this case, adopting the relative exceedance approach of 2 dB is considered appropriate for assessment purposes. Assuming the lowest measured L_{Aeq1hr} noise level of 58dBA; this equates to 60dBA.

The *Calculation of Road Traffic Noise* (CoRTN) 1988 algorithm was used to predict the L_{Aeq1hr} traffic noise level generated by the proposed development at residential properties along Lachlan Street, the results of which are presented below in Error! Reference source not found.5. It is noted that these levels would only potentially occur during the afternoon peak periods.

Table 5-5 Predicted Peak Traffic Noise Levels

Receiver	Predicted $L_{Aeq(1hr)}$ dBA	Assessment Criterion $L_{Aeq(1hr)}$ dBA	Assessment
R1 – East of the Project Site at 71 Lachlan Street	53	60	COMPLIES
R2 – South of the Project Site at 2 Castlereagh Street	55		

6 Conclusion

VMS Australia Pty Ltd has undertaken a noise impact assessment for the Child Care Centre proposed to be located at 73 Lachlan Street, Warwick Farm, in order to accompany the Development Application submission to Liverpool City Council.

Traffic noise generated along the road network was predicted to be compliant with the nominated criteria. In addition, internal and external noise levels can meet the relevant criteria given the recommendations in **Section 5.2.2** and **Section 5.2.3** are implemented.

External noise emissions from the development have been determined to comply with the nominated criteria provided that the recommendations in **Section 5.3.1** and **Section 5.3.2** are implemented.

We trust this information meets with your immediate requirements. However, should you require additional information, or would like to discuss further, please do not hesitate to contact the undersigned directly on 0438 769 165.

Sincerely,

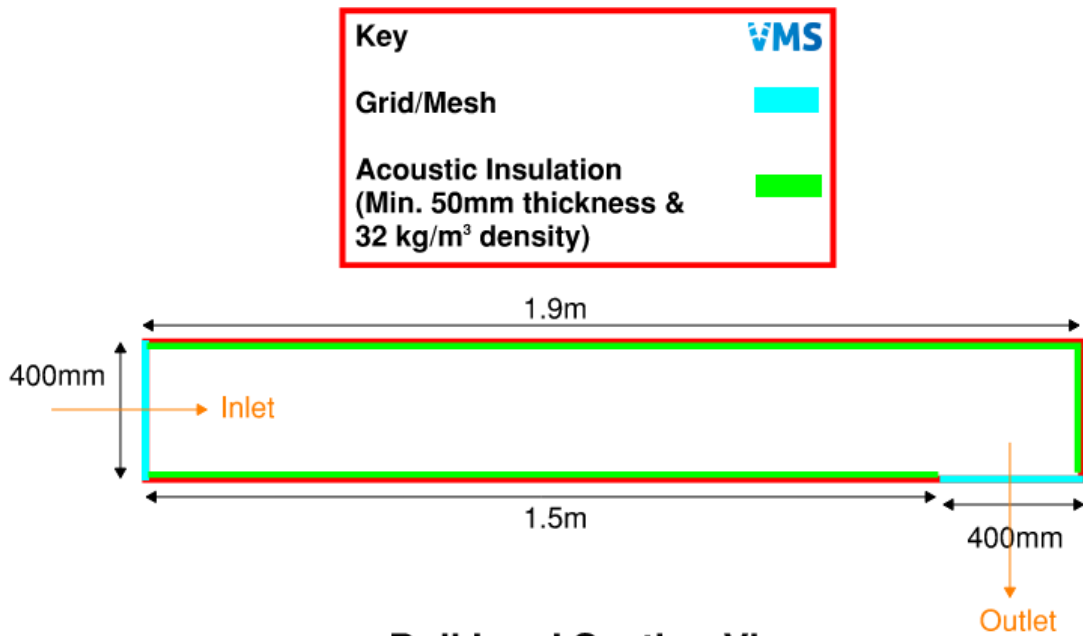
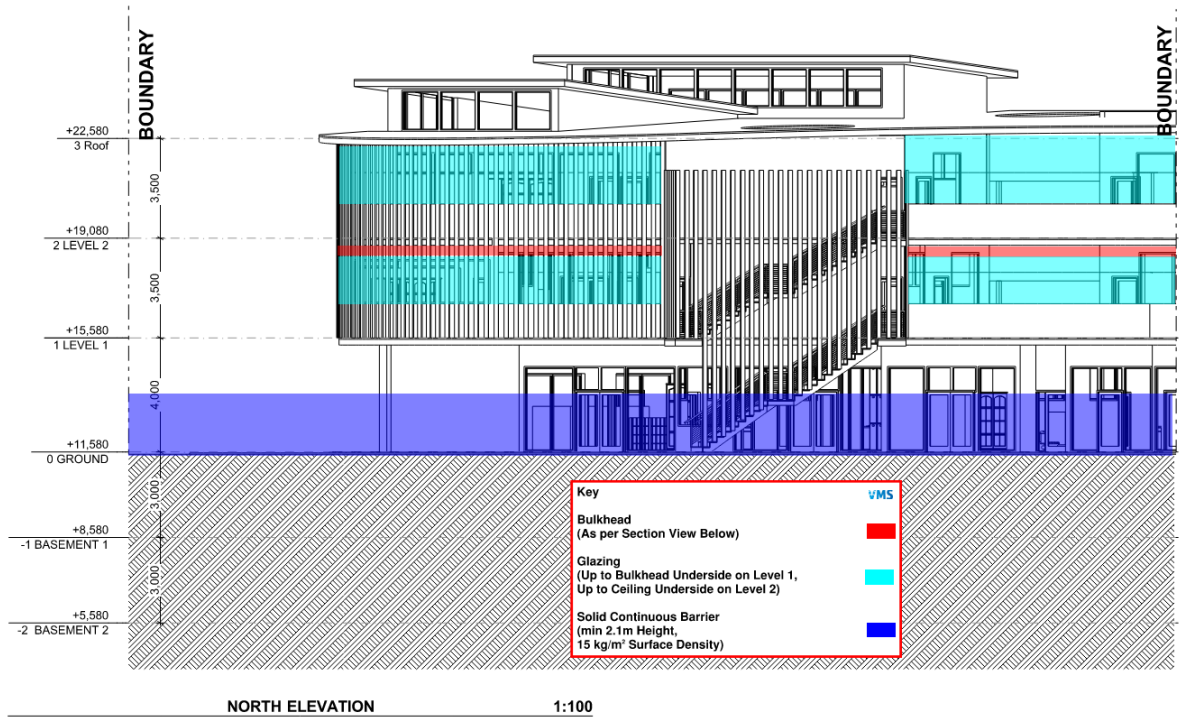


FERAS AHMED

Project Consultant – Acoustics and Vibration

Terminology Relating to Noise and Vibration

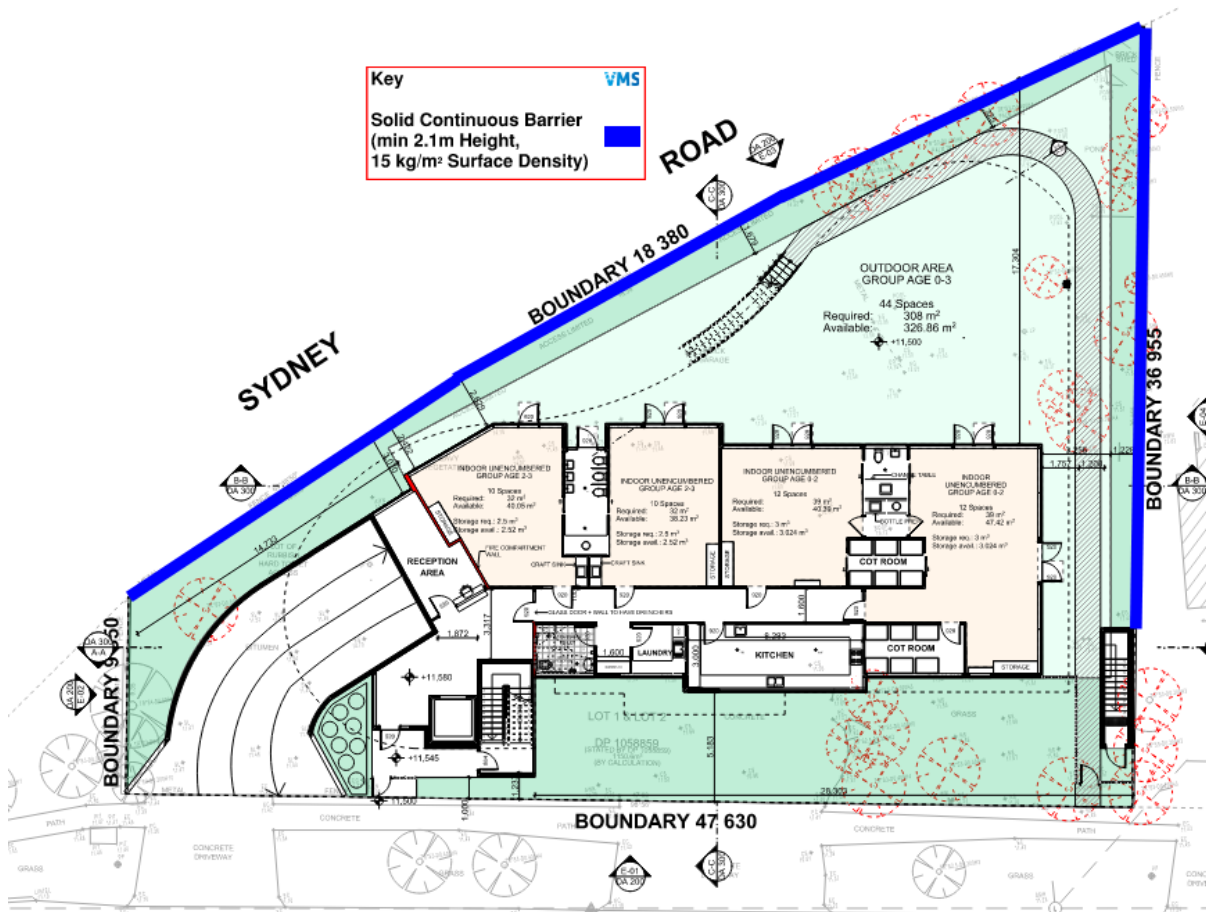
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	<p>The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula:</p> $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ <p>Note that the above formula is only valid for sound propagation in the free-field (see below).</p>
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	<p>When assessing intermittent vibration it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period.</p> <p>The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s^{1.75}.</p>



Appendix B

Markups

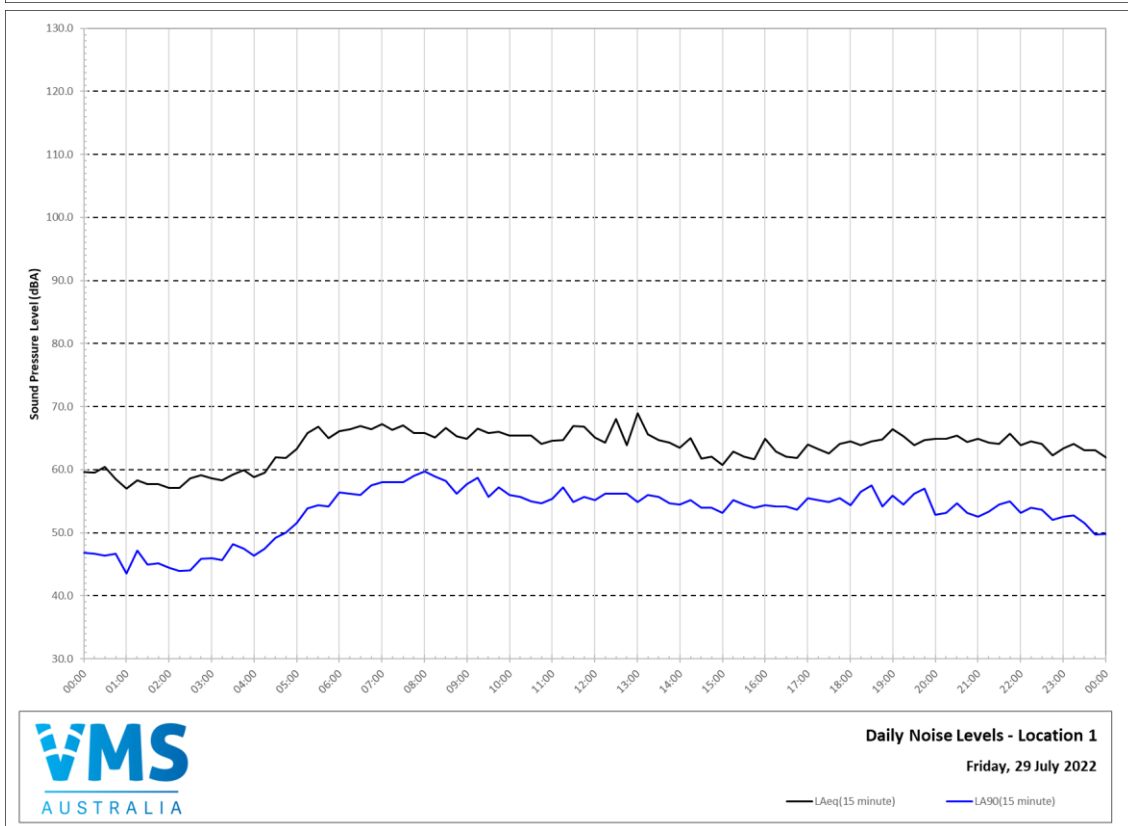
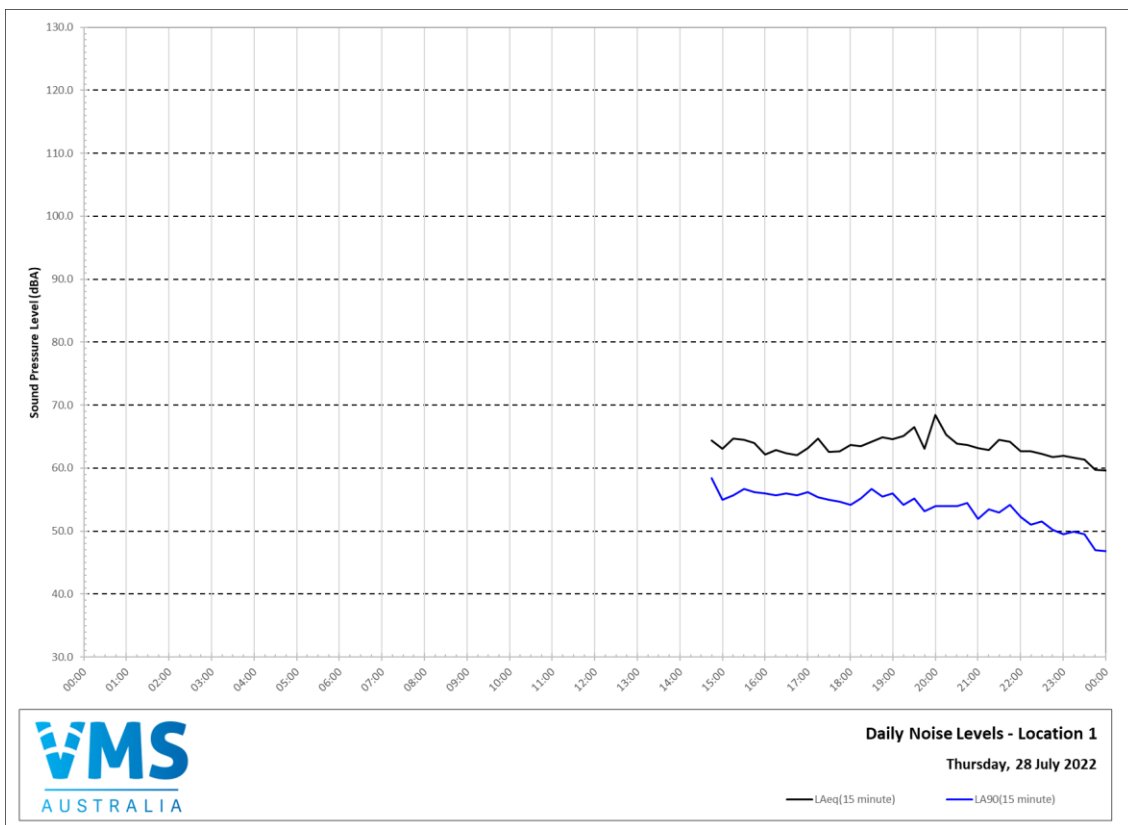
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Appendix C

Unattended Noise Monitoring Data – Location 1

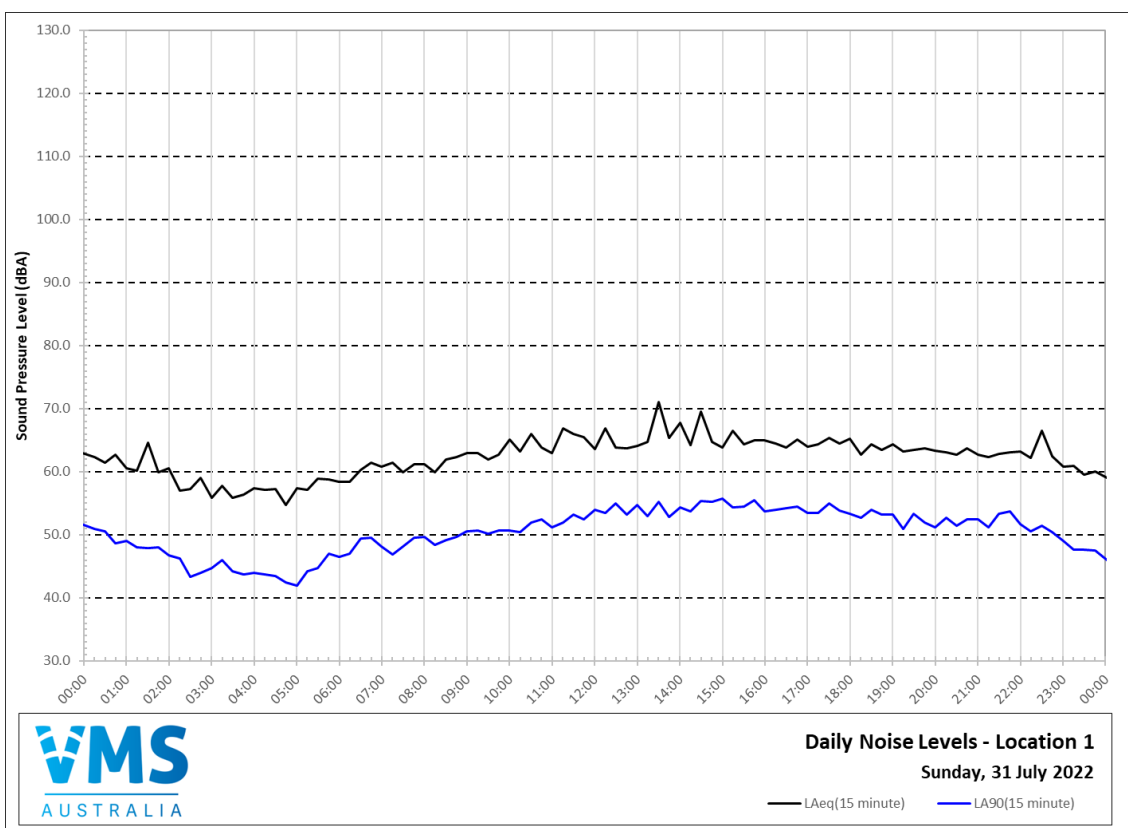
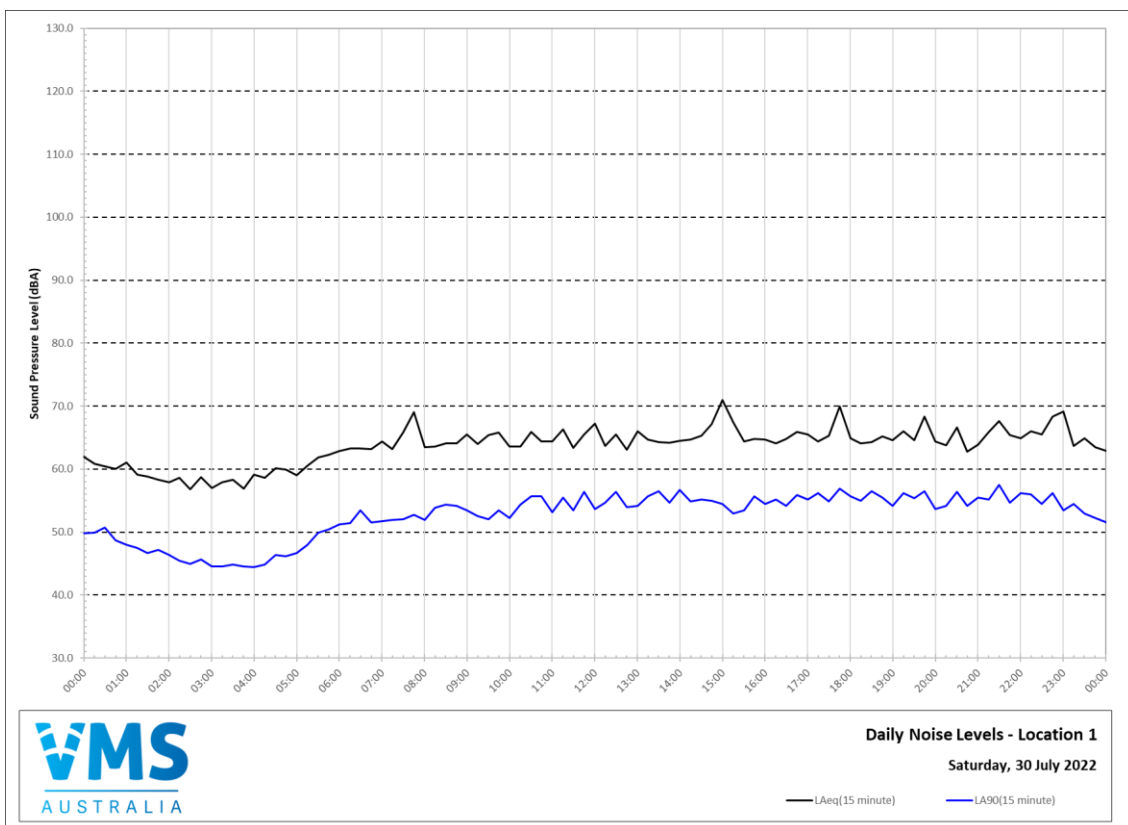
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Appendix C

Unattended Noise Monitoring Data – Location 1

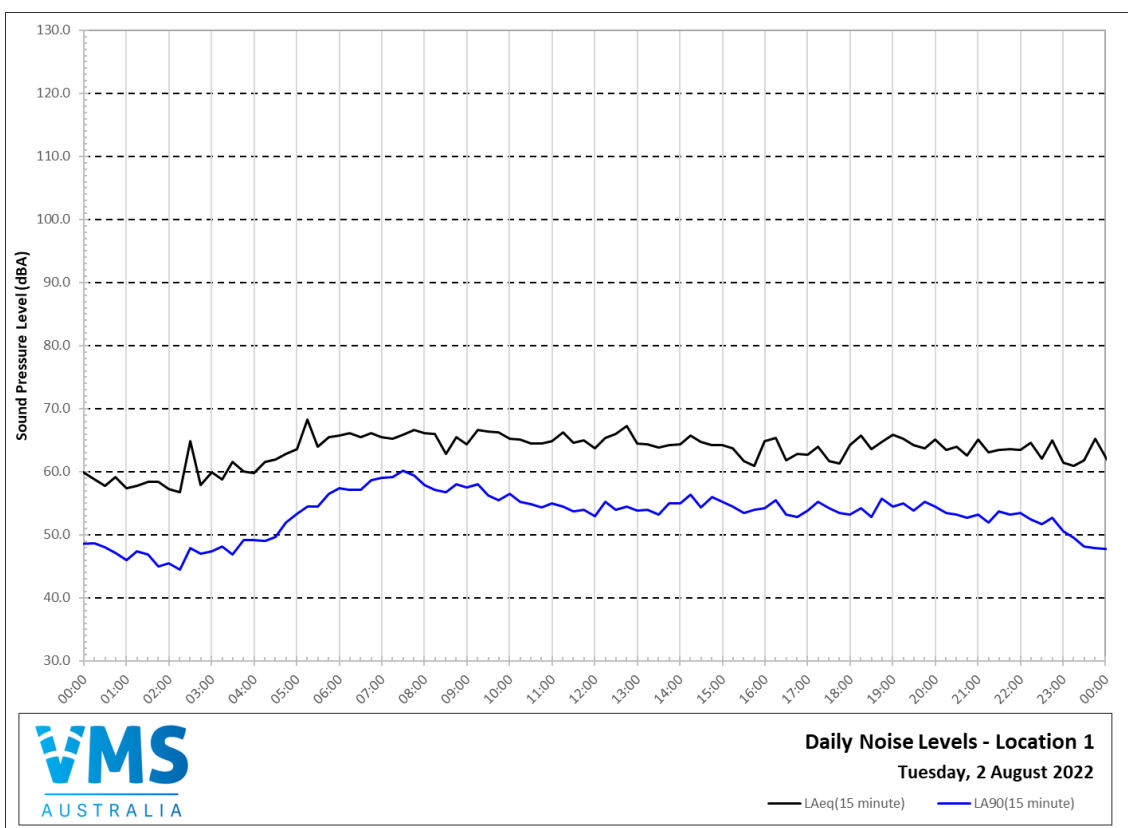
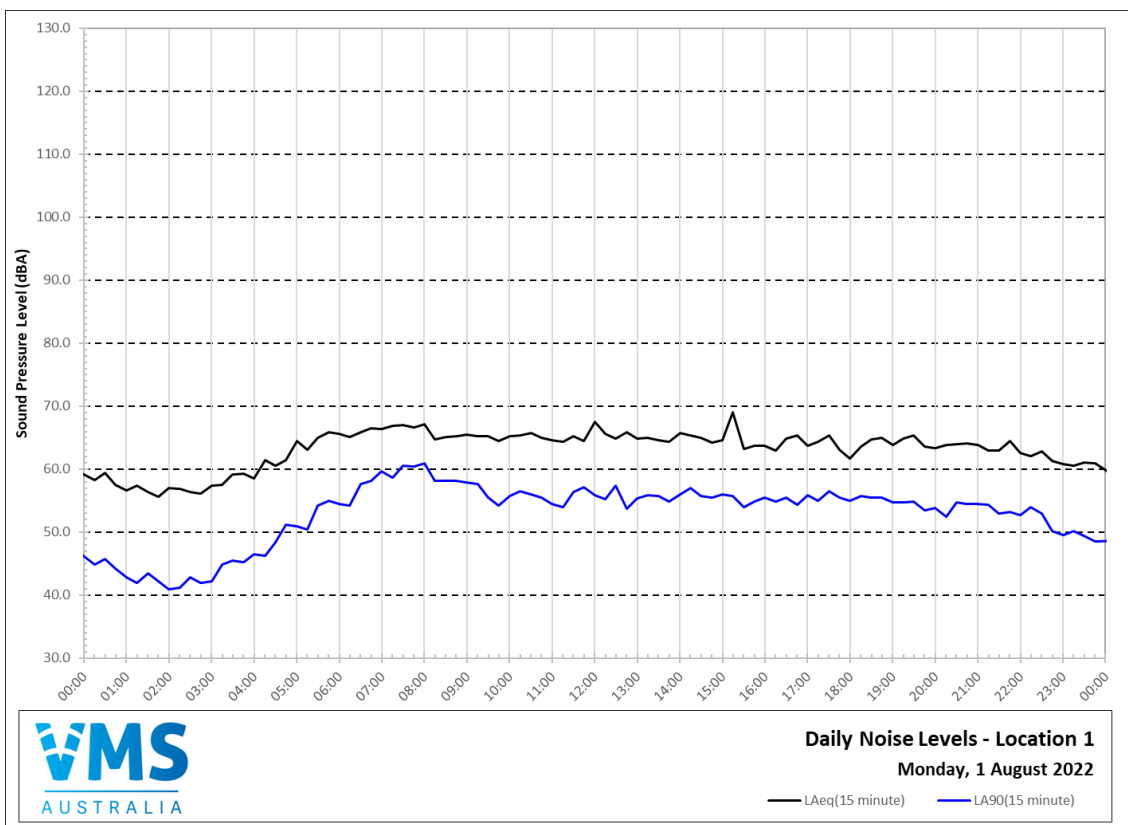
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Appendix C

Unattended Noise Monitoring Data – Location 1

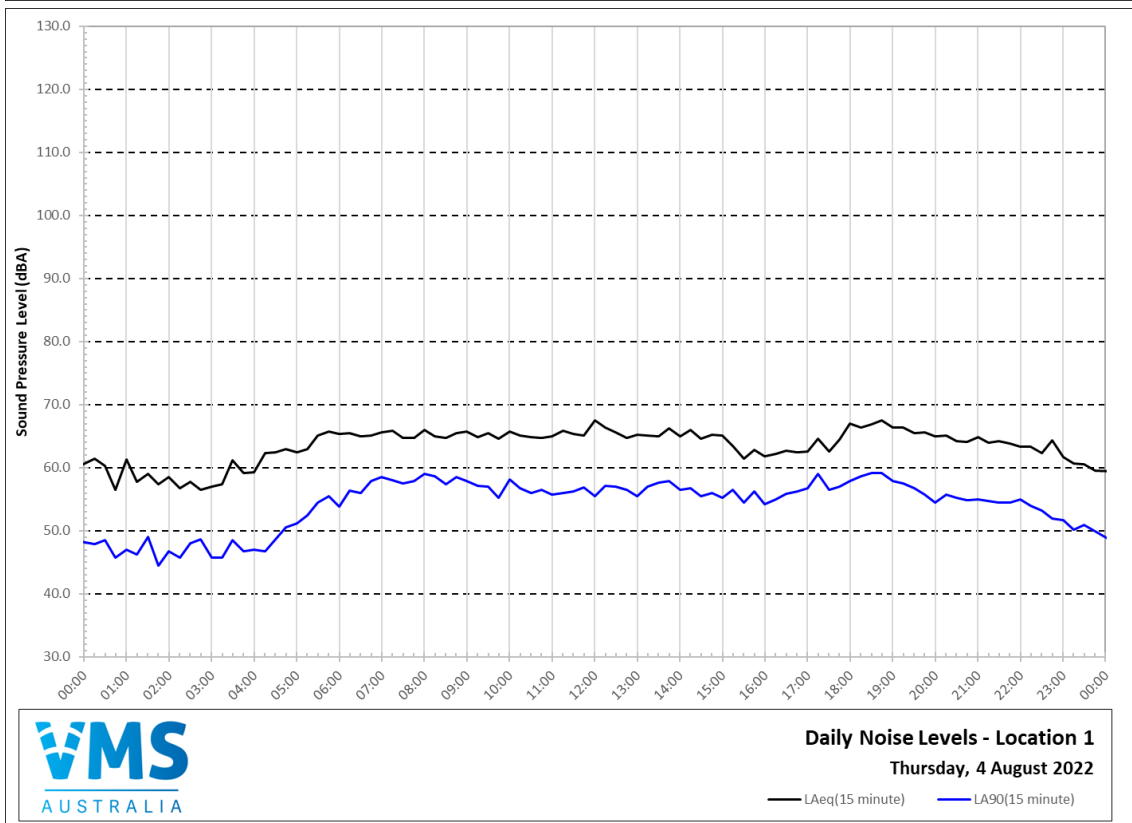
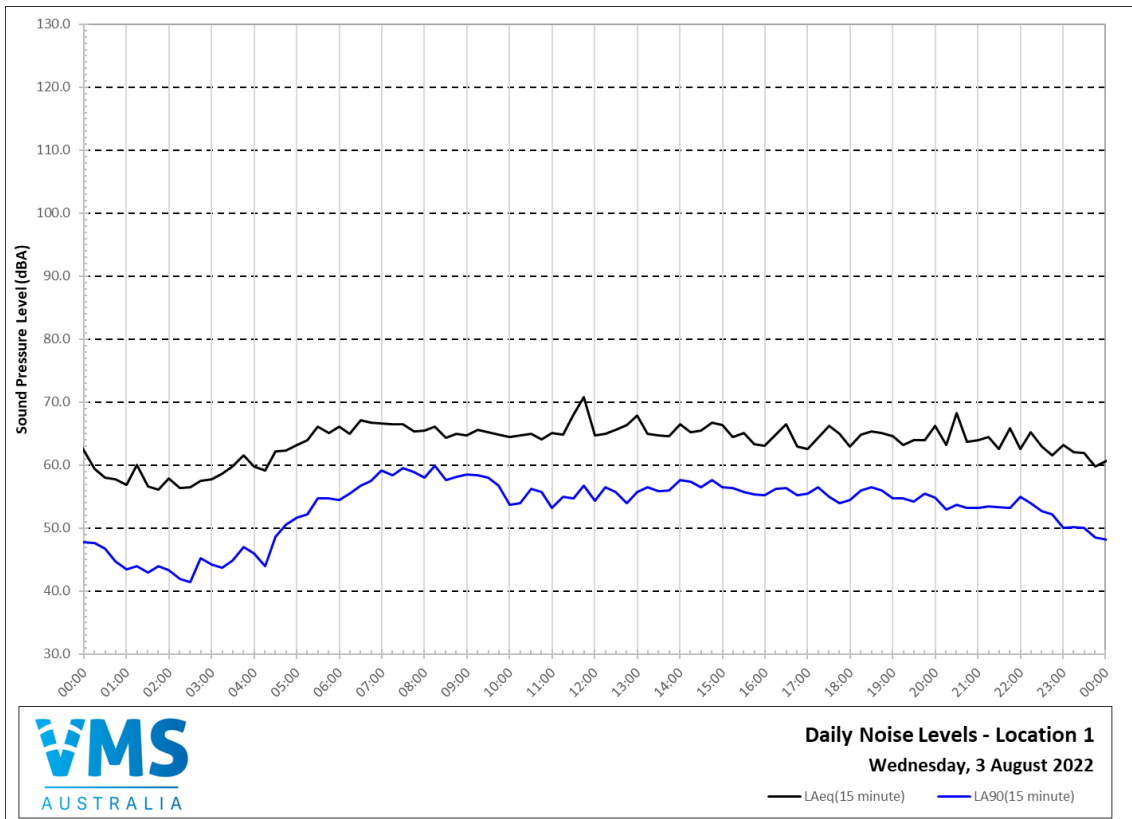
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Appendix C

Unattended Noise Monitoring Data – Location 1

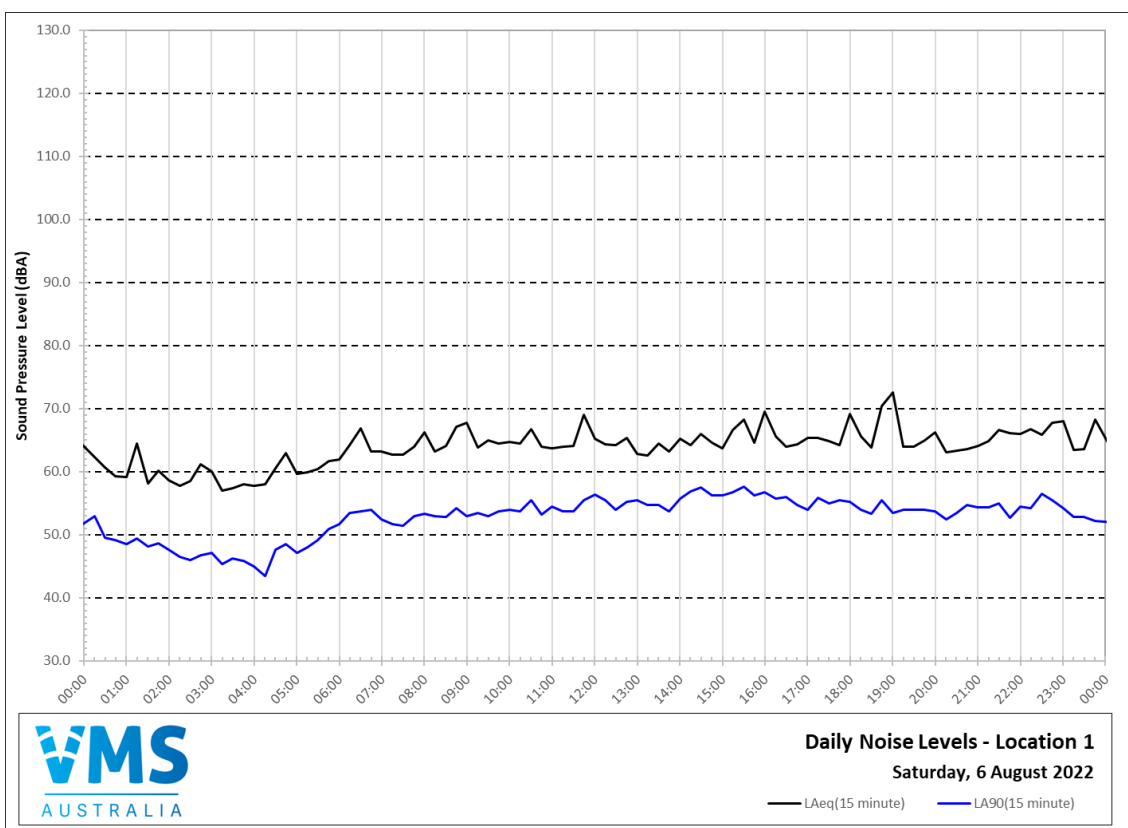
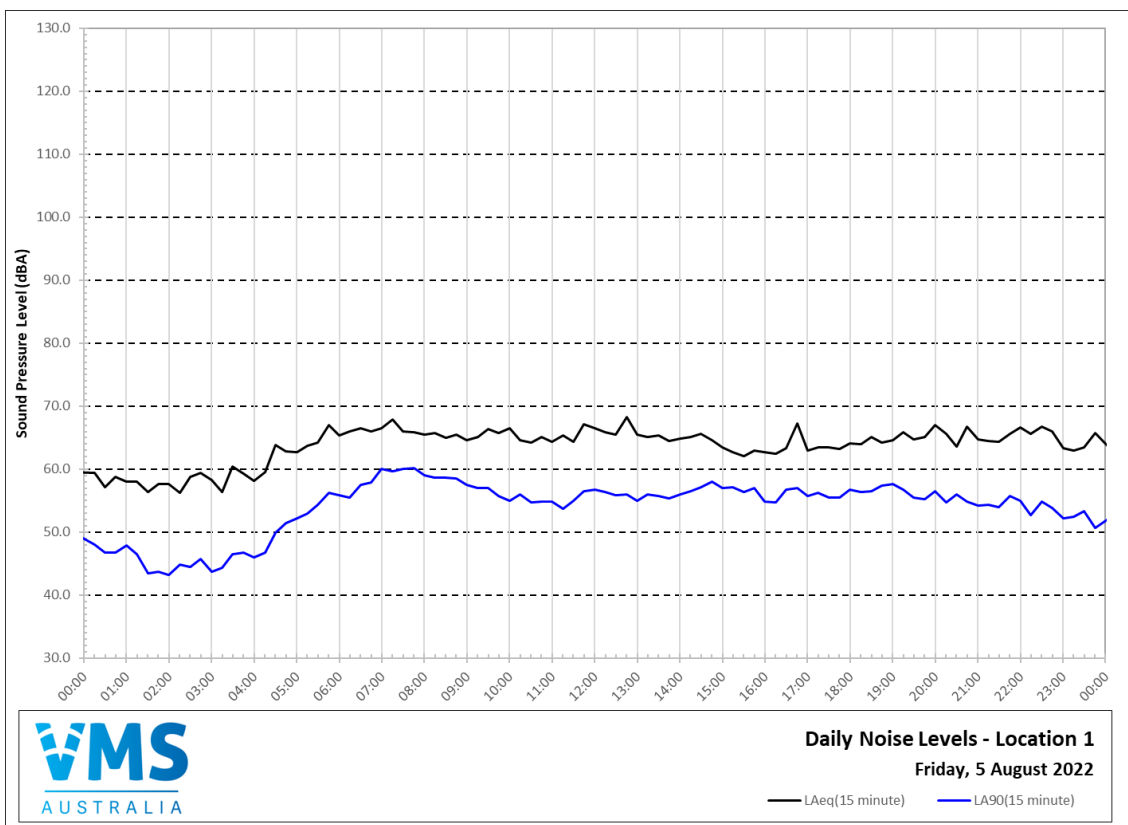
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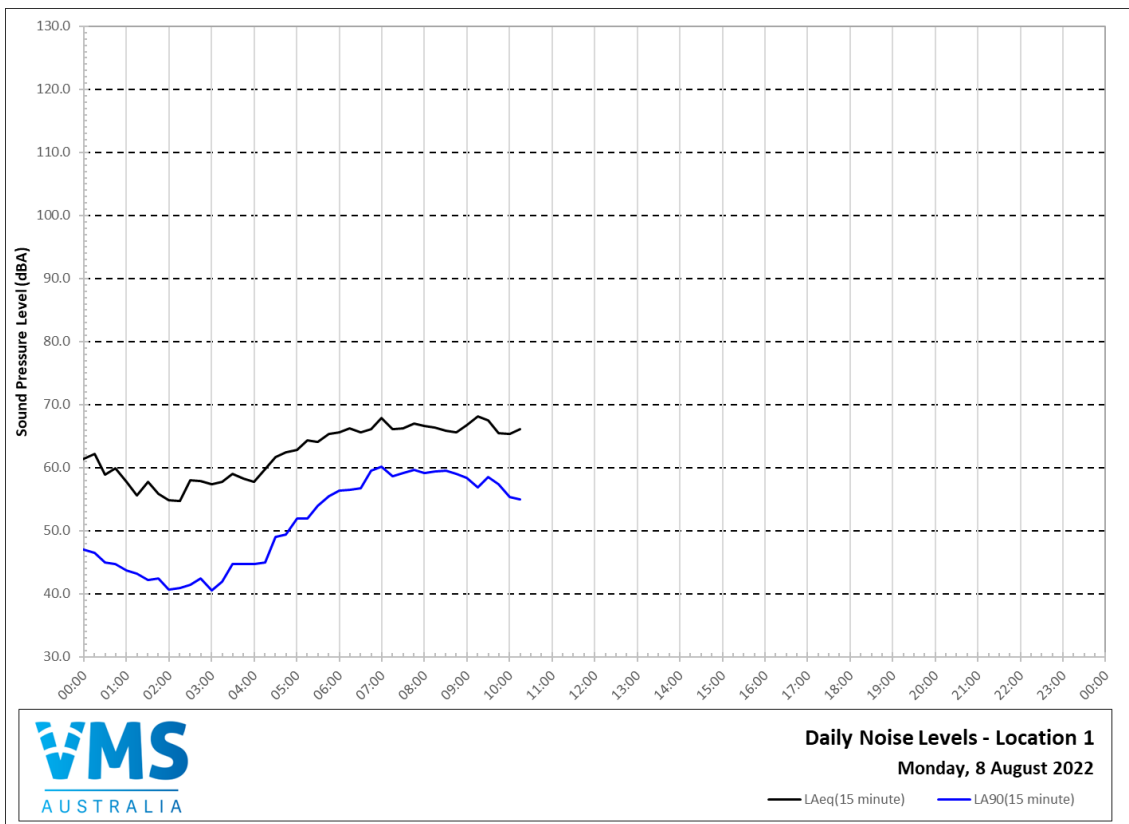
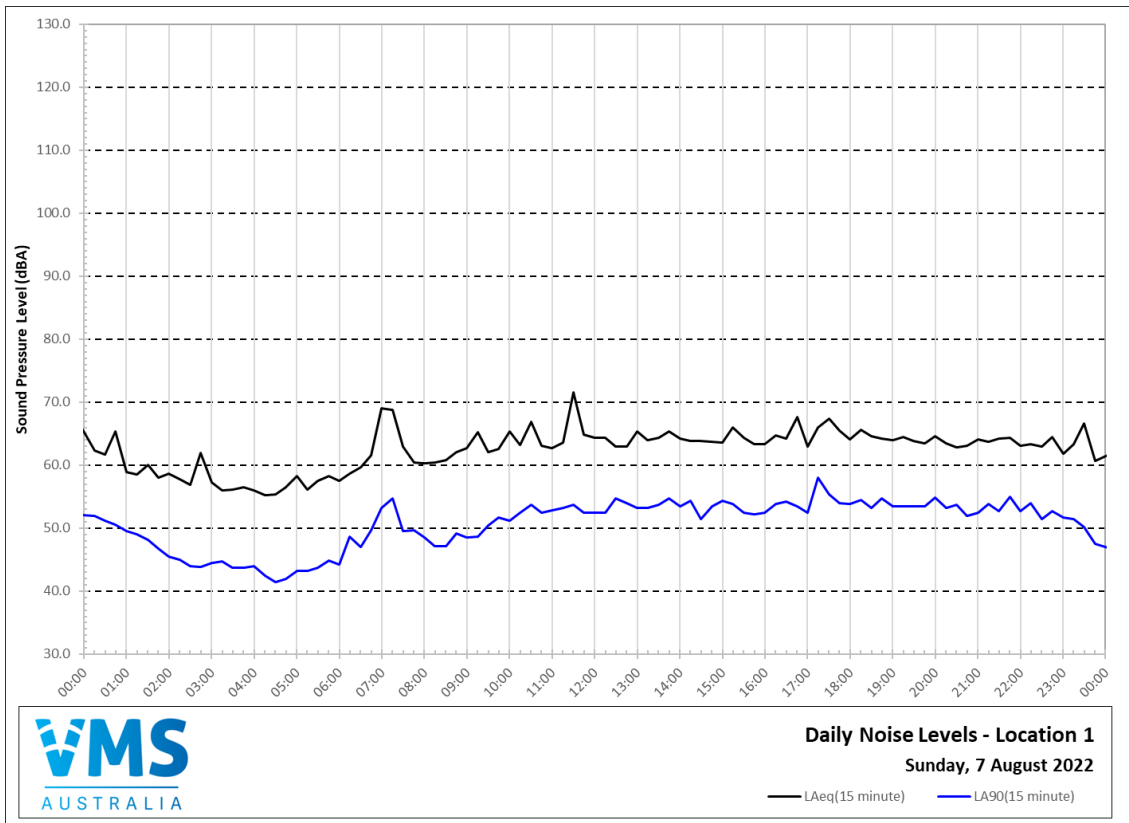


Appendix C

Unattended Noise Monitoring Data – Location 1

22145.1

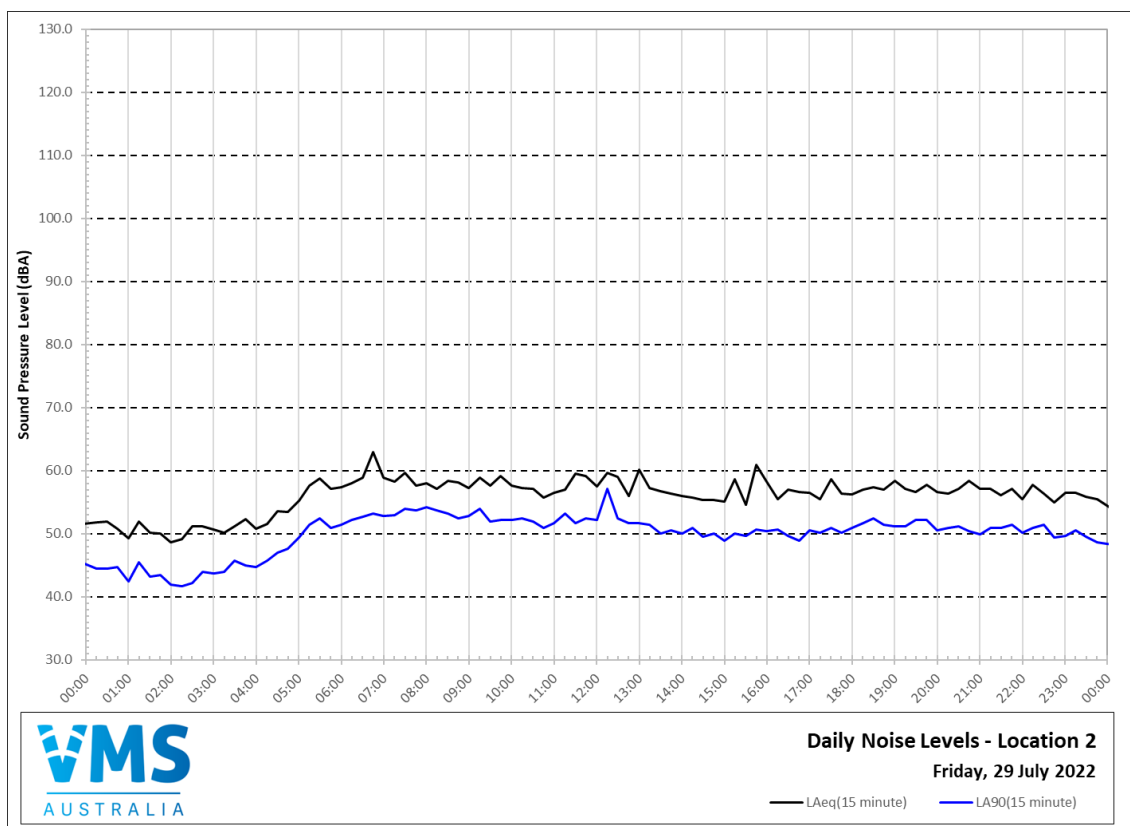
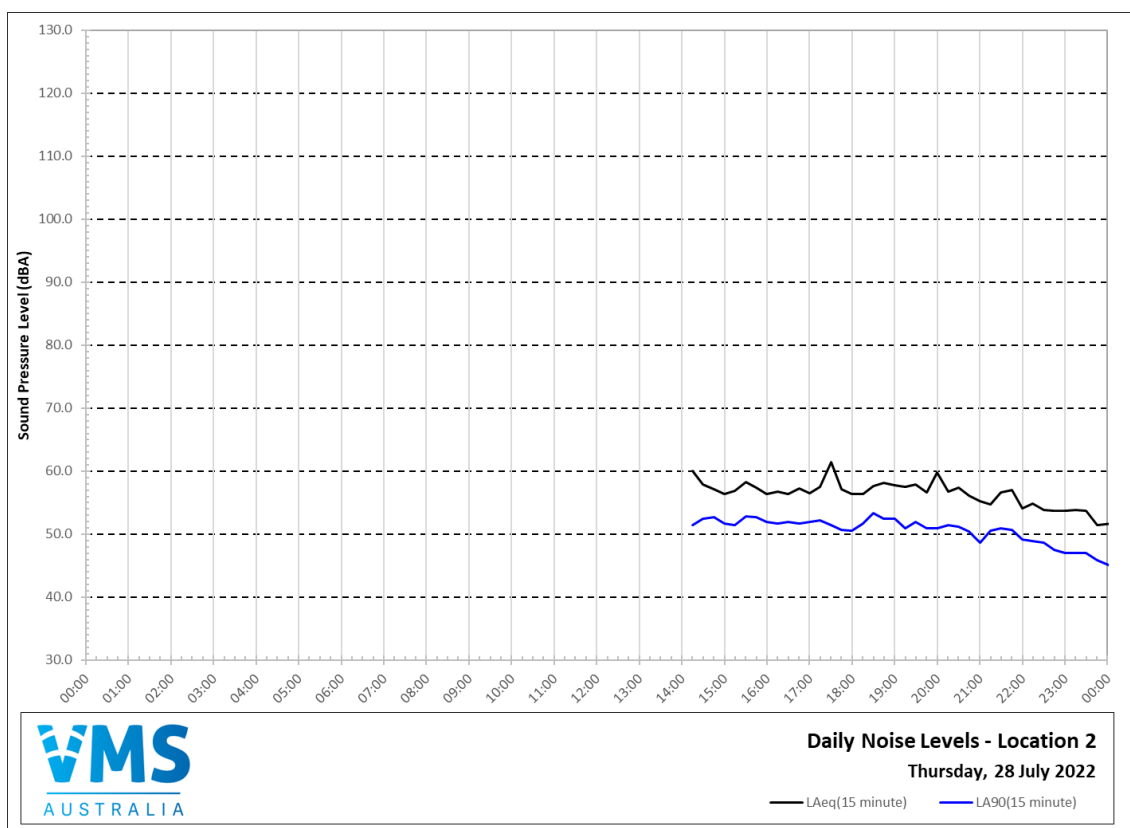




Appendix D

Unattended Noise Monitoring Data – Location 2

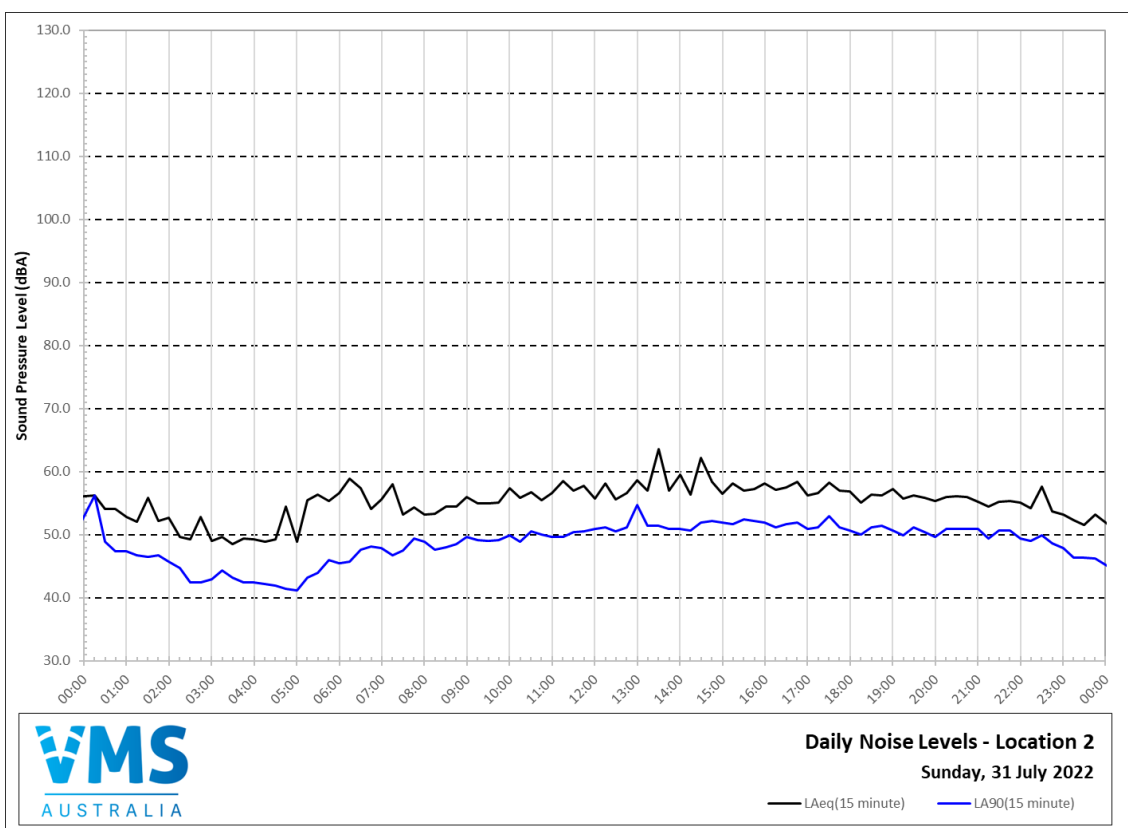
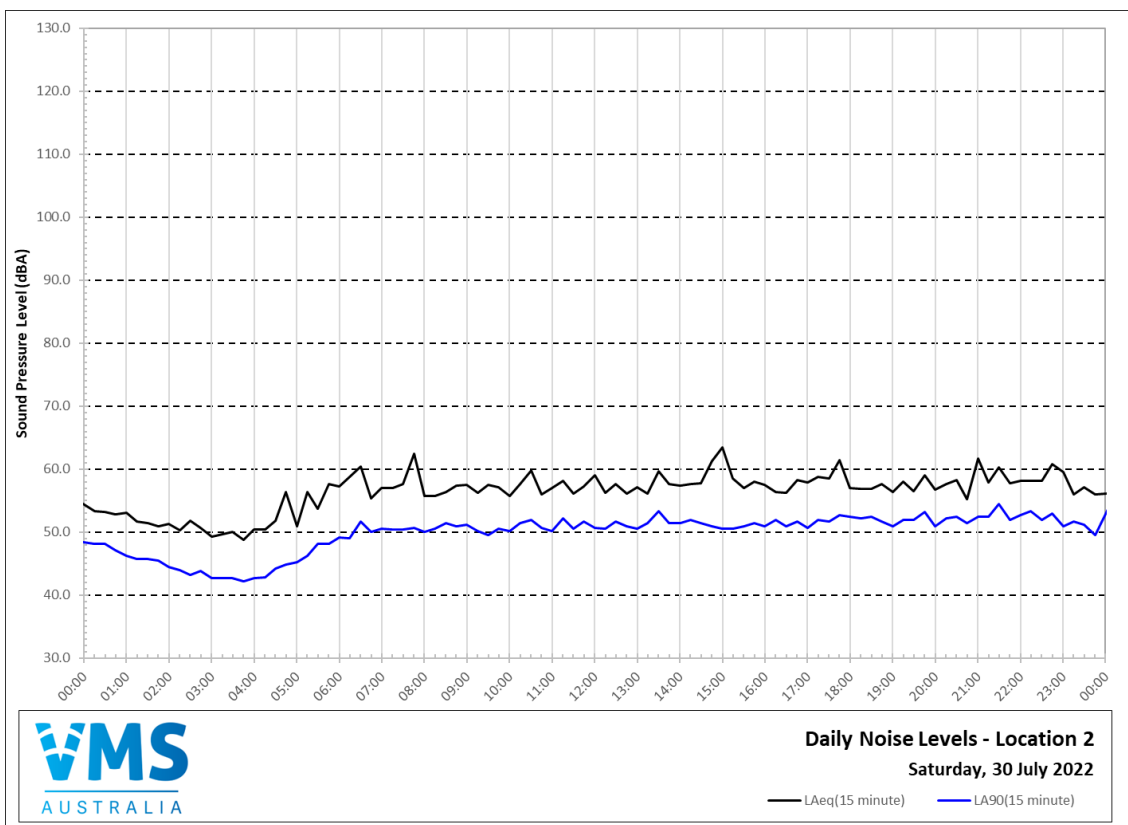
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Appendix D

Unattended Noise Monitoring Data – Location 2

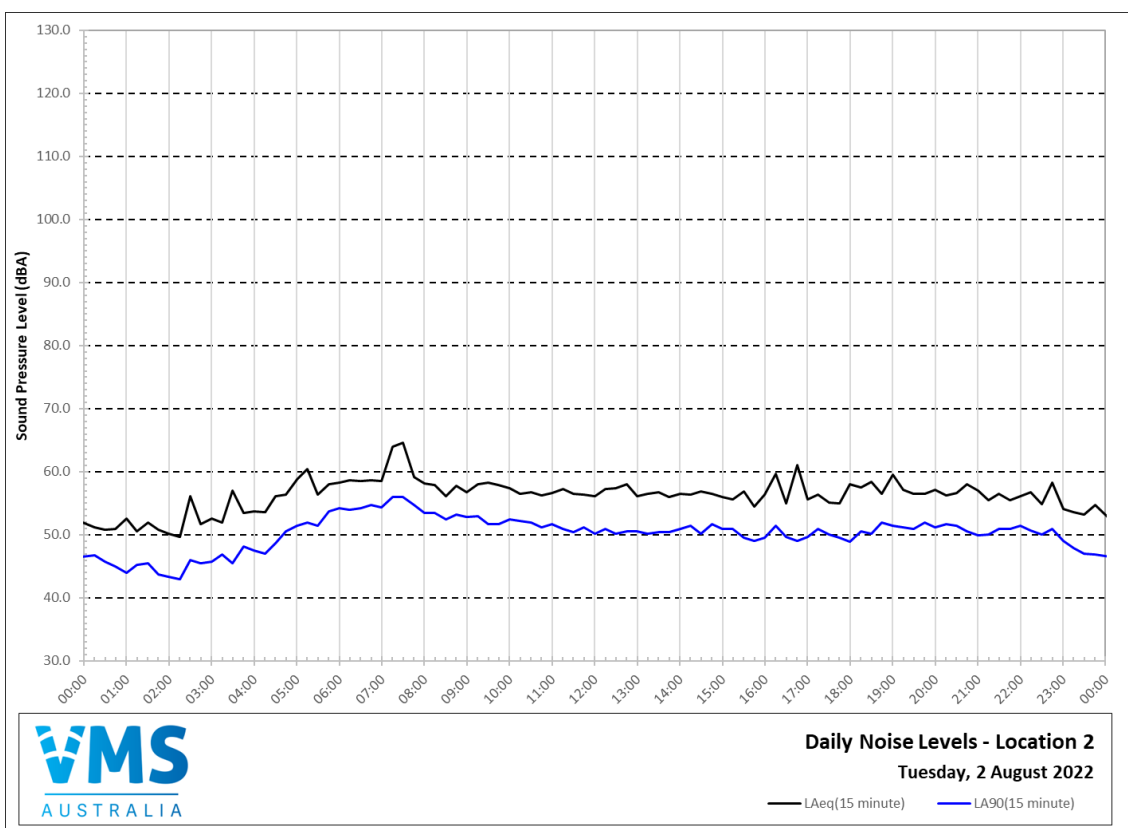
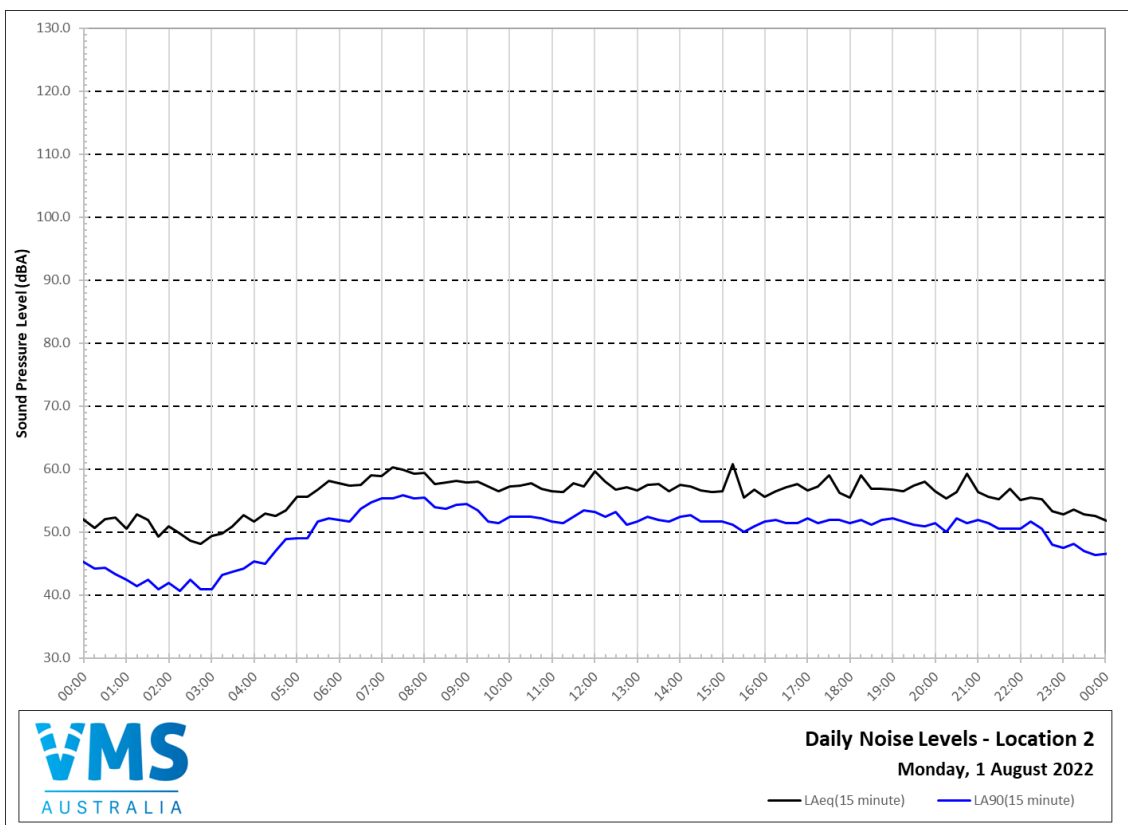
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Appendix D

Unattended Noise Monitoring Data – Location 2

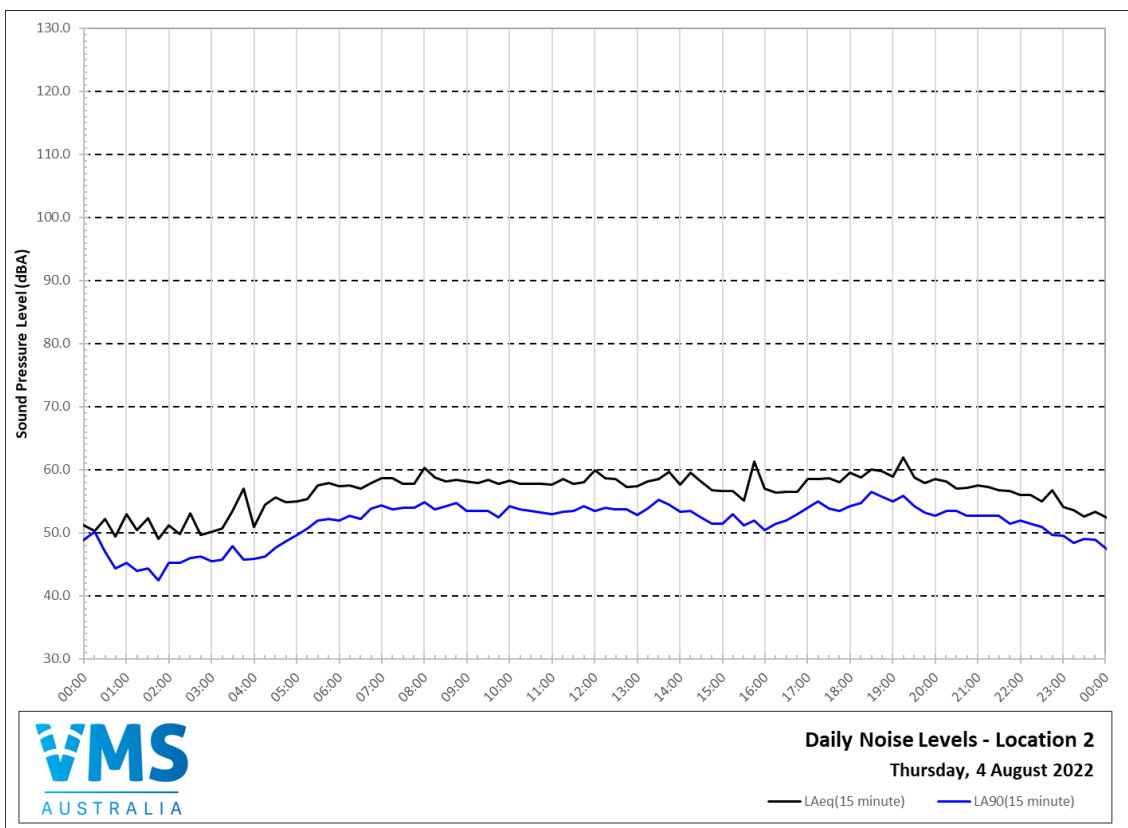
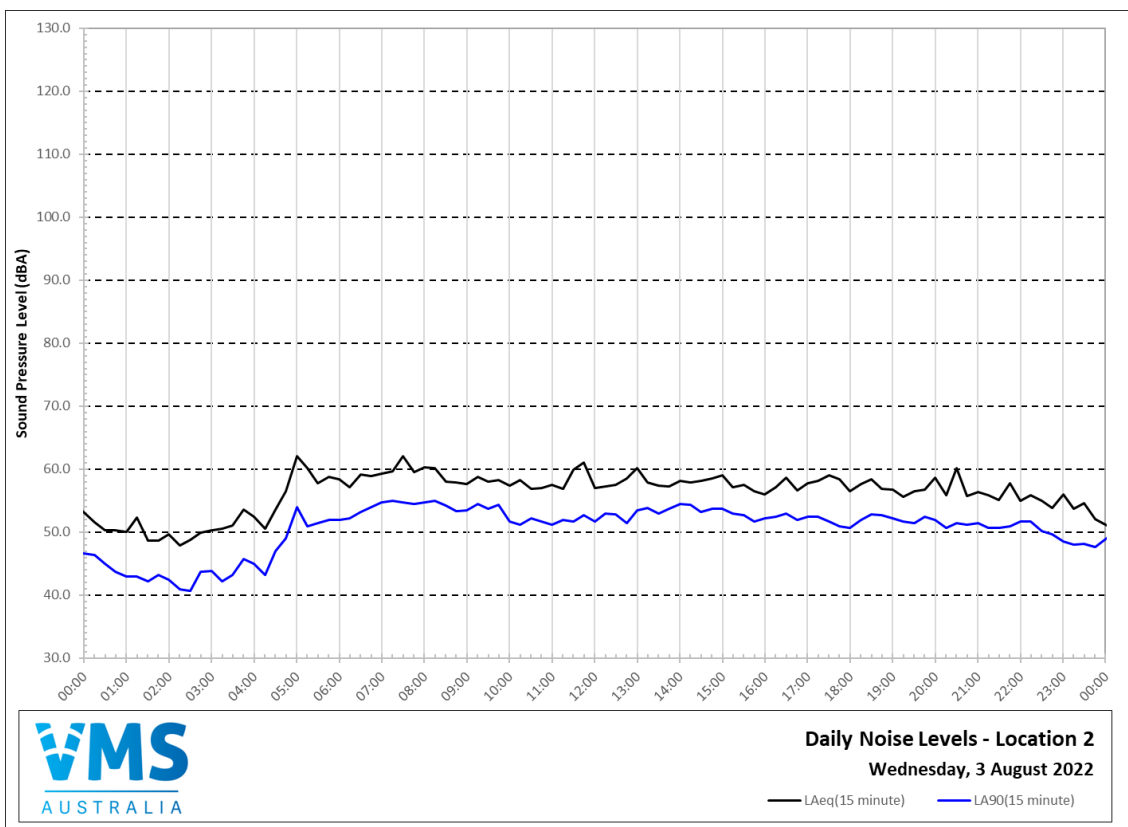
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Appendix D

Unattended Noise Monitoring Data – Location 2

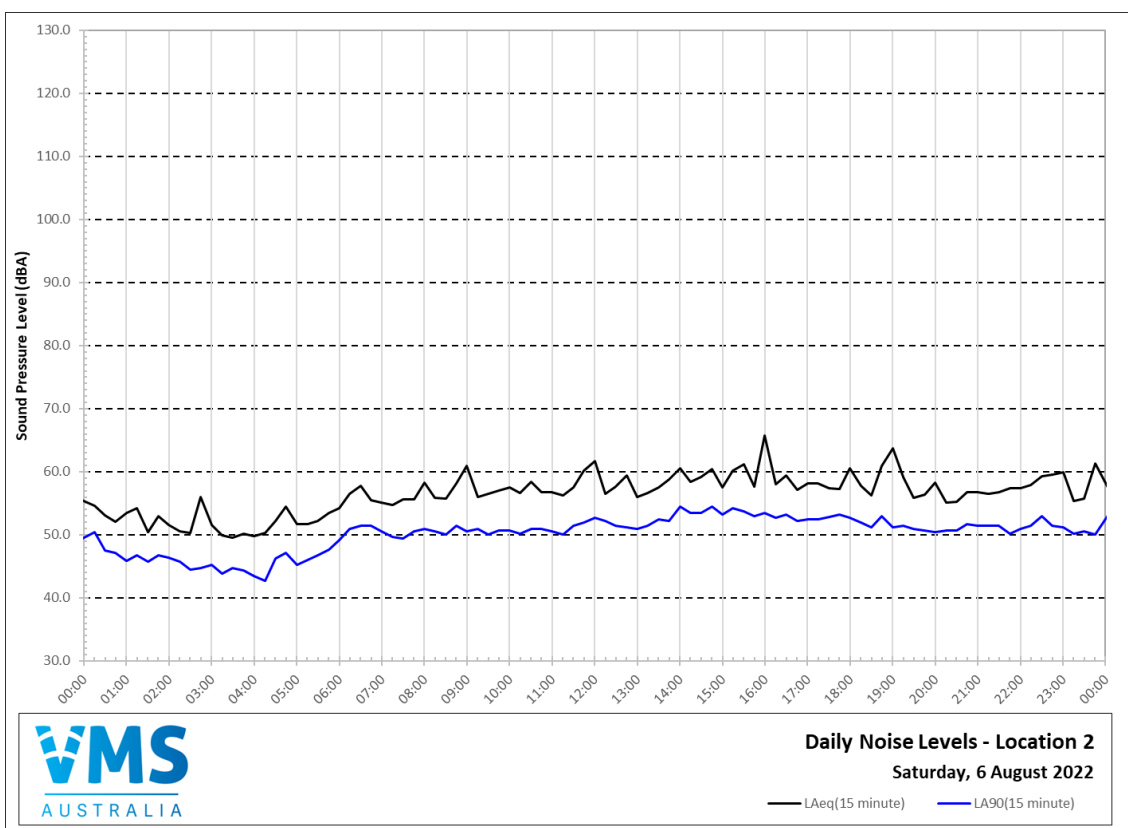
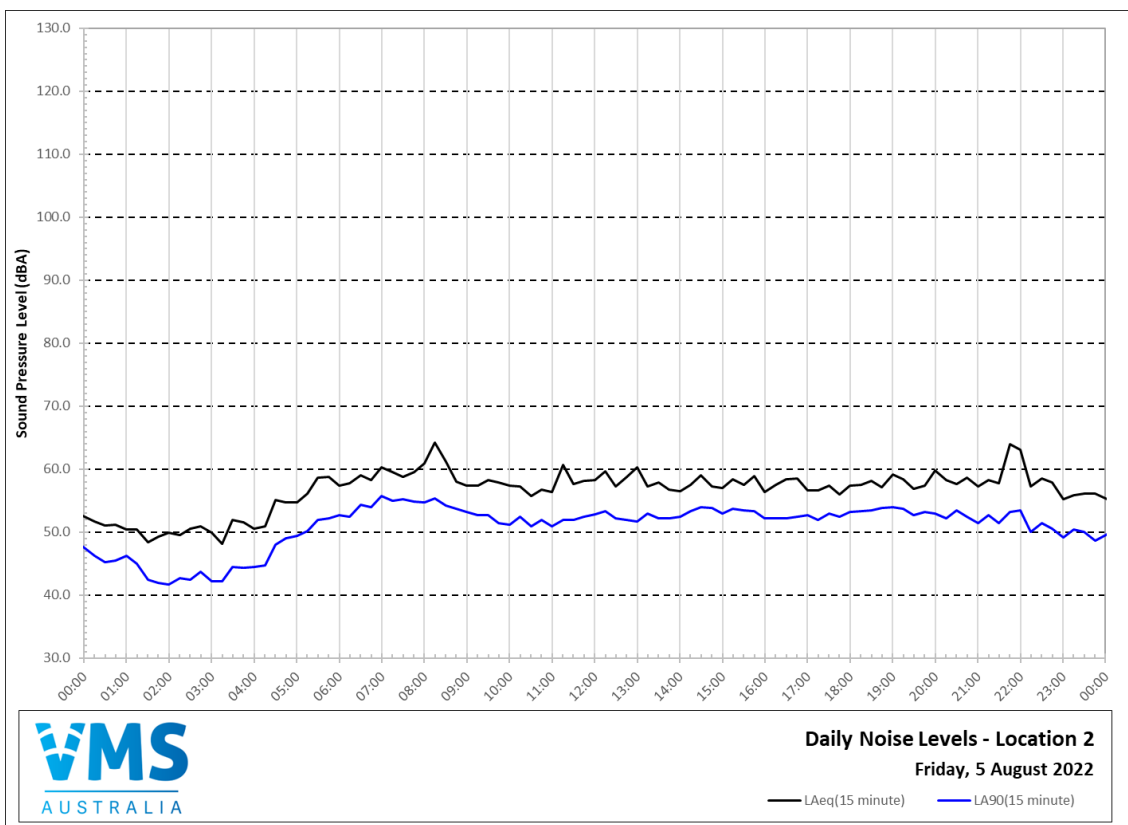
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Appendix D

Unattended Noise Monitoring Data – Location 2

22145.1



Appendix D

Unattended Noise Monitoring Data – Location 2

22145.1

