

# Acoustic Assessment - Planning Proposal

Keswick Estate Stages 7, 8 and 9  
180 Boundary Road  
Dubbo, NSW

Prepared for: Dubbo Regional Council  
C/- Barnson Pty Ltd  
September 2024  
MAC242158-01RP1V1



# Document Information

## Acoustic Assessment – Planning Proposal

Keswick Estate Stages 7, 8 and 9

180 Boundary Road, Dubbo, NSW

**Prepared for:** Dubbo Regional Council

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# 1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by Barnson Pty Ltd, on behalf of Dubbo Regional Council (Council) to prepare an Acoustic Assessment (AA) to inform and support the Keswick Estate Stages 7, 8 and 9 Planning Proposal at Lot 101 in DP1301426 (180 Boundary Road), Dubbo, NSW (the project).

The AA has been completed to identify existing noise sources in the locality, including road traffic noise and industrial noise, and quantify their potential impacts on the project site.

The assessment has been undertaken in general accordance with the following policies and guidelines:

- NSW Environment Protection Authority (EPA) 2017, Noise Policy for Industry (NPI);
- Department of Planning (DoP) 2008, Development Near Rail Corridors and Busy Roads – Interim Guideline;
- State Environmental Planning Policy (SEPP) (Transport and Infrastructure), 2021;
- Standards Australia AS 2107:2016 - Acoustics - Recommended design sound levels and reverberation times for building interiors;
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures; and
- NSW Environment Protection Authority (EPA), Approved methods for the measurement and analysis of environmental noise in NSW, 2022.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

*Technical Note: The EPA's Road Noise Policy (RNP) (EPA, 2011) is designed to quantify the noise intrusion from the road network on existing receptors. As this project relates to a proposed new subdivision, the RNP is not applicable to this assessment.*

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## 2 Project Description

### 2.1 Project Location

The project site is located at 180 Boundary Road, Dubbo (legally known as Lot 101 of DP1301426), to the east of the Dubbo city centre, in the Orana Region of New South Wales (NSW). The site is bounded by Sheraton Road and Boundary Road, which define its eastern and southern boundaries respectively. The project site, encompassing an area of approximately 70.5 hectares (ha) is currently vacant (refer **Figure 1**).

To the west of the site is a large regional open space (40ha), which will contain significant stormwater infrastructure. To the north are a number of existing and proposed residential developments as well as schools and a range of commercial facilities. To the south of the site, across Boundary Road is a large residential development, while existing industrial and extractive premises are located to the southeast of the project site. The future Southern Distributer is planned to extend along Hennessy Drive to the south of the project site, before turning north on Sheraton Road to the east of the project site.

### 2.2 Project Overview

Council's Property and Land Development (PALD) branch is planning to submit a planning proposal (PP) for a change in land use and minimum lot size for some proposed future lots at Keswick Estate.

Part of the land to be rezoned is currently zoned as R2 – Low Density Residential and this to be rezoned to R1 – General Residential. The PP as highlighted on the master plan also proposed to change R2 – Low Density Residential lot size from 600m<sup>2</sup> to 200m<sup>2</sup>.

The development will provide a total of 1,068 lots comprising 278 R1 residential lots and 790 R2 residential lots. The development will provide a range of housing types including duplexes, terrace housing and the opportunity for shop top housing along the southern entry from Boundary Road.

The master plan for the development is provided in **Appendix B**.



FIGURE 1  
Project Site  
MAC242158-01  
Keswick Estate

**KEY**

-  Project Site
-  Proposed Residential Areas
-  Proposed Parks
-  Southern Distributor Road



### 3 Existing Environment

A review of aerial imagery identifies that the project site is surrounded by developing residential areas to the north, west and south, while to the northeast are existing schools and commercial premises, and to the southeast are industrial facilities and extractive industries.

#### 3.1 Unattended Noise Monitoring

To evaluate the existing ambient noise levels in the area, including road traffic noise, three unattended noise monitors were installed at the project site, adjacent to Sheraton Road (L1), the corner of Sheraton Road and Boundary Road (L2), and adjacent to Boundary Road (L3) (refer to **Figure 2**). The unattended noise monitoring was completed from Monday 22 July 2024 to Wednesday 31 July 2024 using Svantek 977 Type 1 noise analysers. The results of the unattended noise monitoring are summarised in **Table 1** for background and ambient noise levels and **Table 2** for road traffic noise levels. **Appendix C** presents the noise logging charts for the assessment period.

**Table 1 Unattended Noise Monitoring Summary**

| Monitoring Location                       | Measured Background Noise Level<br>(LA90) dB |         |       | Measured Ambient Noise Level<br>dB LAeq(period) |         |       |
|-------------------------------------------|----------------------------------------------|---------|-------|-------------------------------------------------|---------|-------|
|                                           | Day                                          | Evening | Night | Day                                             | Evening | Night |
|                                           |                                              |         |       |                                                 |         |       |
| Sheraton Road (L1)                        | 36                                           | 38      | 30    | 55                                              | 54      | 47    |
| Cnr Sheraton Road /<br>Boundary Road (L2) | 37                                           | 36      | 25    | 58                                              | 56      | 51    |
| Boundary Road (L3)                        | 35                                           | 37      | 27    | 54                                              | 54      | 50    |

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

**Table 2 Measured Road Traffic Noise Levels**

| Monitoring Location                       | Road Traffic Noise Levels, dB LAeq(period) |                     |
|-------------------------------------------|--------------------------------------------|---------------------|
|                                           | Day (7am to 10pm)                          | Night (10pm to 7am) |
|                                           |                                            |                     |
| Sheraton Road (L1)                        | 54.5                                       | 47.4                |
| Cnr Sheraton Road /<br>Boundary Road (L2) | 58.0                                       | 51.2                |
| Boundary Road (L3)                        | 54.3                                       | 50.2                |

All measurements were conducted in general accordance with the procedures described in Standards Australia AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise". All acoustic instrumentation used carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022) and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed  $\pm 0.5$  dBA.

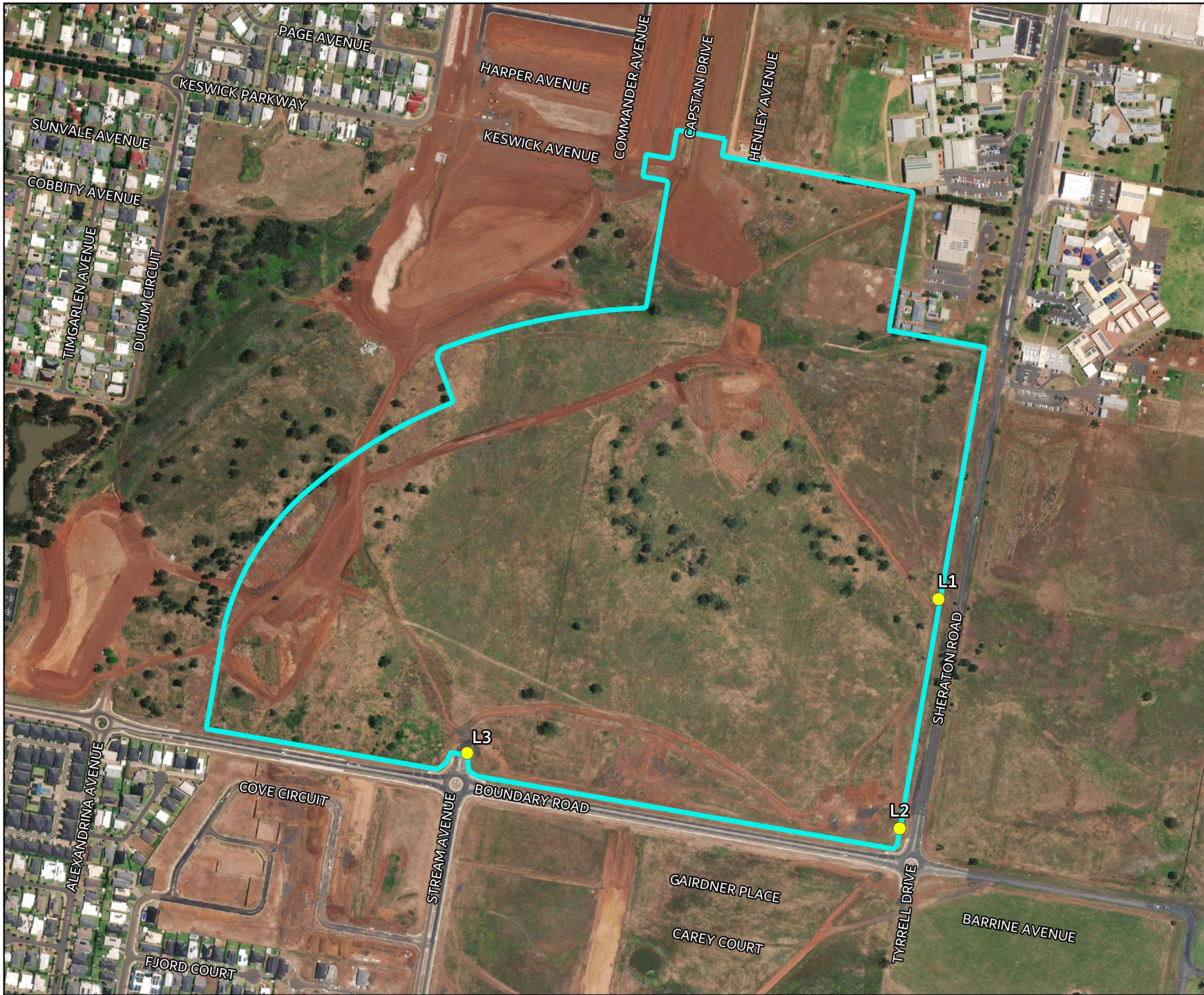


FIGURE 2  
Noise Monitoring Locations  
MAC242158-01  
Keswick Estate

**KEY**

 Project Site

 Noise Logger Locations

0 75 150 225 300 m



### 3.2 Attended Noise Monitoring

To supplement the unattended noise assessment, and to qualify and quantify ambient noise sources at the project site, 15-minute attended measurements were completed at each of the unattended noise monitoring locations

The attended noise surveys were conducted using a Svantek 971 noise analyser on Monday 22 July 2024 and Tuesday 23 July 2024. The monitoring was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise", and the EPA's Approved methods for the measurement and analysis of environmental noise in NSW (EPA, 2022).

The results of the short-term noise measurements and observations are summarised in **Table 3**.

| Table 3 Operator-Attended Noise Survey Results |                                |                   |                   |             |                          |
|------------------------------------------------|--------------------------------|-------------------|-------------------|-------------|--------------------------|
| Date/Time (hrs)                                | Noise Descriptor (dB re 20μPa) |                   |                   | Meteorology | Description and SPL, dBA |
|                                                | L <sub>A</sub> max             | L <sub>A</sub> eq | L <sub>A</sub> 90 |             |                          |
| Location: L1 Sheraton Rd                       |                                |                   |                   |             |                          |
| 22/07/2024                                     | 75                             | 53                | 44                | WD: WNW     | Traffic 39 – 75          |
| 16:12                                          |                                |                   |                   | WS: 0.1m/s  | Birds 39 – 58            |
|                                                |                                |                   |                   | 19°C        | Dog Barking <39          |
| 23/07/2024                                     | 67                             | 58                | 50                | WD: N/A     | Traffic 48 – 67          |
| 06:49                                          |                                |                   |                   | WS: Calm    | Birds 48 – 55            |
|                                                |                                |                   |                   | 2°C         |                          |
| Location: L2 Cnr Sheraton Rd / Boundary Rd     |                                |                   |                   |             |                          |
| 22/07/2024                                     | 74                             | 58                | 49                | WD: NNW     | Traffic 45 – 74          |
| 16:33                                          |                                |                   |                   | WS: 1m/s    |                          |
|                                                |                                |                   |                   | 19°C        |                          |
| 23/07/2024                                     | 75                             | 64                | 48                | WD: N/A     | Traffic 50 – 72          |
| 06:33                                          |                                |                   |                   | WS: Calm    | Trucks 50 – 75           |
|                                                |                                |                   |                   | 0°C         |                          |
| Location: L3 Boundary Rd                       |                                |                   |                   |             |                          |
| 22/07/2024                                     | 70                             | 53                | 48                | WD: WNW     | Traffic 43 – 64          |
| 17:00                                          |                                |                   |                   | WS: 0.1m/s  | Birds 43 – 70            |
|                                                |                                |                   |                   | 18°C        | Aircraft 43 – 52         |
| 23/07/2024                                     | 66                             | 53                | 47                | WD: N/A     | Traffic 45 – 66          |
| 07:09                                          |                                |                   |                   | WS: Calm    | Birds 45 – 56            |
|                                                |                                |                   |                   | 0°C         |                          |

It is noted that industrial noise from the Holcim Dubbo Quarry, South Keswick Quarry and South Keswick Concrete Works were inaudible at all times during the noise measurements.

### 3.3 Existing Road Traffic Volumes

Existing traffic flows were provided by council for the road network surrounding the project site. MAC understands that hourly, classified traffic counts were conducted between Tuesday 26 April 2022 and Wednesday 25 May 2022 for the following road segments:

- Boundary Road west of Sheraton Road Roundabout;
- Sheraton Road north of Boundary Road Roundabout;
- Sheraton Road between Wellington Road and the Bunnings Driveway; and
- Sheraton Road between 24R and 20L Sheraton Road.

A summary of the traffic data used for this assessment are presented in **Table 4**.

**Table 4 Existing Measured Traffic Flows (2022)**

| Road        | Location Description               | Day (07:00 to 22:00) |                | Night (22:00 to 07:00) |                |
|-------------|------------------------------------|----------------------|----------------|------------------------|----------------|
|             |                                    | Light Vehicles       | Heavy Vehicles | Light Vehicles         | Heavy Vehicles |
| Boundary Rd | West of Sheraton Rd                | 1,506                | 141            | 108                    | 11             |
| Sheraton Rd | North of Boundary Rd               | 1,460                | 221            | 116                    | 17             |
| Sheraton Rd | Between Wellington Rd and Bunnings | 4,897                | 1,327          | 210                    | 59             |
| Sheraton Rd | Between 24R and 20L Sheraton Rd    | 112                  | 132            | 17                     | 21             |

A review of aerial imagery at the time of the 2022 traffic counts, identified that the primary access to the Southlakes Estate via Stream Avenue, off Boundary Road, had not yet been completed. Furthermore, MAC understands that in the period following the completion of the traffic counts, further industrial development and/or modification to existing industrial developments along Sheraton Road have been approved, including:

- Dubbo Holcim Quarry;
- South Keswick Concrete Works; and
- South Keswick Quarry.

To project to 2024 traffic flows, accounting for additional traffic on Sheraton Road and Boundary Road from increased traffic from Southlakes Estate and approved industrial facilities, the following corrections and assumptions have been applied to the measured 2022 traffic flows:

- Assume 50% of vehicles from the Southlakes Estate use Stream Avenue to access Boundary Road, with each residential lot (~700 lots) generating 7.4 traffic movements (regional areas), as per The Guide to Traffic Generating Developments (RMS, 2013); and
- Approved traffic movements for industrial facilities as per **Table 5**.

**Table 5 Existing Measured Traffic Flows (2022)**

| Facility       | Road Segment | Day (07:00 to 22:00) |                | Night (22:00 to 07:00) |                |
|----------------|--------------|----------------------|----------------|------------------------|----------------|
|                |              | Light Vehicles       | Heavy Vehicles | Light Vehicles         | Heavy Vehicles |
| Holcim Quarry  | Boundary Rd  | 36                   | 60             | 6                      | n/a            |
|                | Sheraton Rd  | 36                   | 140            | 6                      | 42             |
| South Keswick  | Boundary Rd  | 16                   | 60             | 16                     | n/a            |
| Concrete Works | Sheraton Rd  | 16                   | 74             | 16                     | 36             |
| South Keswick  | Boundary Rd  | 16                   | 60             | 16                     | n/a            |
| Quarry         | Sheraton Rd  | 16                   | 120            | 16                     | 40             |

A summary of the projected existing traffic flows (2024) to allow for validation of the road traffic noise model is provided in **Table 6**.

**Table 6 Projected Existing Traffic Flows (2024)**

| Road        | Location Description               | Day (07:00 to 22:00) |                | Night (22:00 to 07:00) |                |
|-------------|------------------------------------|----------------------|----------------|------------------------|----------------|
|             |                                    | Light Vehicles       | Heavy Vehicles | Light Vehicles         | Heavy Vehicles |
| Boundary Rd | West of Sheraton Rd                | 2,737                | 189            | 229                    | 11             |
| Sheraton Rd | North of Boundary Rd               | 2,685                | 424            | 242                    | 114            |
| Sheraton Rd | Between Wellington Rd and Bunnings | 6,157                | 1,541          | 337                    | 156            |
| Sheraton Rd | Between 24R and 20L Sheraton Rd    | 136                  | 514            | 76                     | 118            |

## 4 Noise Policy and Guidelines

### 4.1 Noise Intrusion – Industrial Noise Sources

The Noise Policy for Industry (2017) (NPI) identifies that ambient noise levels within an area from all industrial sources combined should remain below the recommended Amenity Noise Levels specified in Table 2.2. The objective of the recommended Amenity Noise Levels is to protect against noise impacts such as speech interference, community annoyance and some sleep disturbance. The recommended amenity noise levels for a rural environment are reproduced in **Table 7**.

**Table 7 Recommended Amenity Noise Levels**

| Receiver    | Noise Amenity Area | Time of Day            | Recommended Amenity Noise Level |                             |
|-------------|--------------------|------------------------|---------------------------------|-----------------------------|
|             |                    |                        | dB LAeq(period)                 | dB LAeq(15min) <sup>1</sup> |
| Residential | Rural Residential  | Day                    | 50                              | 53                          |
|             |                    | Evening                | 45                              | 48                          |
|             |                    | Night/Morning Shoulder | 40                              | 43                          |

Notes: The recommended Amenity Noise Levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Time of day is defined as follows: (These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

• day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays. • evening – the period from 6pm to 10pm, • night – the remaining periods.

Note 1: Includes a +3dB correction to convert from LAeq(period) to LAeq(15min)

It is noted that the recommended Amenity Noise Levels for residential receivers represent outdoor noise levels only. Recommended design sound levels for conditions affecting the acoustic environment within building interiors are prescribed by AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors. The objectives of the design criteria are to ensure healthy, comfortable, and productive environments for the occupants of an internal space. The recommended design sound levels take into account the functions of the area(s). The design criteria specific to residential dwellings is reproduced in **Table 8**.

**Table 8 Recommended Design Sound Levels for Different Areas of Occupancy in Buildings**

| Type of Occupancy / Activity |                | Design sound level range, LAeq, t dB(A) |
|------------------------------|----------------|-----------------------------------------|
| Residential Buildings        | Sleeping Areas | 35 to 40                                |
|                              | Living Areas   | 35 to 45                                |

In achieving the internal and external noise goals, it is considered that noise impacts at the sensitive receiver locations would be minimised.

## 4.2 Noise Intrusion – Road Traffic Noise

Guidance for the specification of internal noise levels of habitable rooms from road traffic noise is prescribed in Department of Planning's (DoP) Development near Rail Corridors and Busy Roads – Interim Guidelines (2008) (the guideline).

The guideline outlines internal criterion levels for Clause 2.120 of the State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021 (previously Clause 102 of the SEPP (Infrastructure)):

*“If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*

- *in any bedroom in the residential accommodation: 35 dBA at any time 10pm–7am; and*
- *anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway): 40dBA at any time.”*

Table 3.1 of the guideline clarifies that the above noise criteria are to be determined as an LAeq(15hr) for the day and LAeq(9hr) for the night period.

The guideline assists in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads and supports the SEPP (Transport and Infrastructure). The guidelines are mandatory for residential developments proposed adjacent to busy roads with an Annual Average Daily Traffic (AADT) of greater than 40,000 vehicles or for projects where traffic noise impacts are anticipated.

### 4.2.1 Indicative Attenuation Levels

The Environmental Noise Management Manual (ENMM) (2001) provides a summary of indicative attenuation from standard building types. The indicative attenuation levels are summarised in **Table 9**, which provides typical performance of buildings with respect to noise reduction. A light frame residence with single glazing would be expected to provide a reduction of 20dBA from external to internal with windows closed. Where windows are closed, the fresh air requirements outlined in the Building Code of Australia (BCoA) are to be satisfied.

| Table 9 Indicative Building Noise Attenuation |                        |                               |
|-----------------------------------------------|------------------------|-------------------------------|
| Building Type                                 | Windows                | Internal noise reduction, dBA |
| All                                           | Open                   | 10                            |
| Light frame                                   | Single glazed (closed) | 20                            |
|                                               | Single glazed (closed) | 25                            |
|                                               | Double glazed (closed) | 30                            |

Note: Sourced from ENMM, 2001.

## 5 Noise Assessment Review

### 5.1 Calculation of Industrial Noise

The Noise Assessment Review (NAR) included a desktop review of the acoustic environment to determine the potential cumulative noise impacts at the project site associated with the operation of the Holcim Dubbo Quarry, South Keswick Quarry and South Keswick Concrete Works. The review was undertaken with consideration of the following documents:

- Environment Protection Licence (EPL) 21017 for South Keswick Quarry (Regional Hardrock Pty Ltd);
- Muller Acoustic Consulting Pty Ltd (2016) Noise and Vibration Impact Assessment (NVIA) – Proposed South Keswick Quarry Project, Ref: MAC160254RP1V01;
- Muller Acoustic Consulting Pty Ltd (2023) Annual Noise Monitoring Assessment (NMA) – South Keswick Quarry, Ref: MAC231914-06RP1;
- Muller Acoustic Consulting Pty Ltd (2024) Noise and Vibration Impact Assessment (NVIA) – South Keswick Quarry Production Increase Project, Ref: MAC190962-04RP1V1;
- Muller Acoustic Consulting Pty Ltd (2024) Noise Impact Assessment (NIA) – South Keswick Concrete Works, Ref: MAC201127-02RP1V9;
- EPL 2212 for Dubbo Quarry (Holcim (Australia) Pty Ltd);
- EMM (2021) Noise and Vibration Impact Assessment (NVIA) – Dubbo Quarry Continuation Project, Ref: J180313 RP17; and
- Ramboll (2023) Annual Noise Monitoring Assessment (NMA) – Dubbo Quarry, Ref: 318001799.

It is noted that a review of monitoring locations (refer to **Figure 3**) for each of the assessments listed above, identified that there are no monitoring or assessment locations at or on the Keswick Estate project site. Hence, the nearest and/or most representative receivers from each of the assessments have been considered in the context of this NAR. Furthermore, as the project site is located further from the relevant industrial noise sources than the assessed receivers, the results of the NAR are considered to be highly conservative, and noise levels at the project site are anticipated to be lower.



FIGURE 3  
Historic Monitoring Locations  
MAC242158-01  
Keswick Estate

**KEY**

-  Project Site
-  Historic Monitoring Locations



### 5.1.1 South Keswick Quarry

The review of the facility EPL, NVIA and NMA documentation for the South Keswick Quarry is summarised as follows:

- in accordance with EPL 21017, noise limits at residential receiver nearest to the proposal (R30 – southeastern extent of future residential subdivision approximately 400m east of project site) – 36dB LAeq(15min) during the day, and 35dB LAeq(15min) during the evening and night periods; and
- noise monitoring undertaken near to R30 in October 2023 (MAC231914-06RP1) demonstrated that the quarry operations (quarrying and processing) were typically inaudible during the morning shoulder, day and evening periods, while the contribution from quarry trucks entering or exiting the site was calculated at less than 30dB LAeq(15min) during the morning shoulder, day and evening periods.

Based on the review of available information, it is demonstrated that South Keswick Quarry is operating within the noise limits prescribed by EPL 21017.

It is noted that MAC has recently prepared a NVIA (2024, Ref: MAC190962-04RP1V1) for the South Keswick Quarry Production Increase Project (EIS preparation stage). The NVIA has adopted contemporary criteria based on the NPI of 40dB LAeq(15min) for the day period and 35dB LAeq(15min) for the evening and night periods. Modelled noise levels, based on measured plant and equipment emissions and noise verification monitoring, demonstrates that:

- modelled noise levels at R30 for general mining operations were up to 37dB LAeq(15min) during the day period, up to 31dB LAeq(15min) during the evening period, and up to 33dB LAeq(15min) during the night period (inversion conditions). During surface drilling operations during the day period, modelled noise levels were up to 38dB LAeq(15min).

### 5.1.2 South Keswick Concrete Works

MAC has recently completed a Noise Impact Assessment (NIA) (2024, Ref: MAC201127-02RP1V9) to quantify potential noise impacts associated with the expansion of the existing South Keswick Concrete Works to 24-hour operations and increase in production rates. A review of predicted noise levels, based on measured plant and equipment emissions and noise verification monitoring, demonstrates that:

- modelled noise levels at R30 were up to 35dB LAeq(15min) during the day period, 32dB LAeq(15min) during the evening period and 34dB LAeq(15min) during the night period (inversion conditions).

Therefore, noise emissions from the operation of the concrete works are predicted to comply with the relevant criteria of 40dB LAeq(15min) during the day period and 35dB LAeq(15min) during the evening and night periods.

### 5.1.3 Dubbo Quarry

A review of EPL 2212 for the Dubbo Quarry indicates that there are no prescribed noise limits for receivers in the vicinity of the quarry site; however, annual noise monitoring is undertaken in accordance with the noise criteria outlined in the Development Consent. A review of the recent Annual Noise Monitoring Assessment (NMA) for the Dubbo Quarry, undertaken in December 2023 (Ramboll, Ref: 318001799) was undertaken and is summarised as follows:

- monitoring location R3 (Dubbo Quarry) is the closest monitoring location to the project site;
- the Development Consent noise limits at R3 are 43dB LAeq(15min) during the day period and 37dB LAeq(15min) during the night period;
- monitoring undertaken on 13 November 2023 demonstrated that the Dubbo Quarry contribution was <30dB LAeq(15min) at R3 during the day period; and
- no quarrying activities were occurring during the night period.

Based on the review of available information, it is demonstrated that Dubbo Quarry is operating within the noise limits outlined in the Development Consent.

### 5.1.4 Cumulative Industrial Noise Levels

Where noise level contributions from each of the quarry operations and the concrete works remain within their prescribed or theoretical noise limits, cumulative noise imissions at the project site would be up to 45dB LAeq(15min) during the day period and 40dB LAeq(15min) during the evening and night periods.

Therefore, the recommended amenity noise levels of 53dBA for the day period and 48dBA and 43dBA respectively for the evening and night periods would be achieved at the project site. Furthermore, where the Amenity Noise Levels are achieved, the internal noise levels would be satisfied also.

## 5.2 Calculation of Road Traffic Noise

A review of existing traffic flows identified that Sheraton Road and Boundary Road have daytime traffic volumes exceeding 1,000 vehicles per day. During the nighttime, however, traffic volumes are significantly lower, with fewer than 250 vehicles on Boundary Road and about 350 vehicles on Sheraton Road.

Due to the low traffic volumes, particularly during the nighttime, noise calculation methods such as Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) by Department of Transport (UK) 1988 or Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration are not considered appropriate as they are primarily intended to calculate noise emissions from motorways and highways. Whilst each method has a low volume correction, the project traffic volume is out of the scope of these methods.

Therefore, existing road traffic noise levels have been calculated using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods, representing the road traffic as “moving sources” along the transport route, assuming a sound power level of 96dBA for light vehicles and 104dBA (96dBA at exhaust height) for heavy vehicles, as per the CNOSSOS-EU database.

### 5.2.1 Road Traffic Noise Validation

The purpose of model validation is to demonstrate that the noise model is a reasonably accurate representation of the real world within the limitations of the algorithm. Validation of the road traffic noise model was undertaken via a combination of measurement of existing road traffic noise levels through unattended noise monitoring and predictive noise modelling using measured and projected traffic volumes.

Monitoring was undertaken at three locations (refer to **Section 3.1**) adjacent to Sheraton Road and Boundary Road to capture road traffic noise levels. It is noted that the measured  $L_{Aeq(period)}$  noise levels capture all noise sources in the locality, including but not limited to road traffic noise, environmental noise and other transportation noise (eq aircraft). On review of the unattended noise monitoring data, it was determined that the night period (10pm to 7am) data from monitoring location L3 was heavily influenced by extraneous sources and was excluded from the assessment.

A noise modelling scenario was developed based on the measured and projected road traffic volumes for Sheraton Road and Boundary Road. The results of the noise model validation (refer **Table 10**) indicate that the difference in modelled and measured noise levels are within the industry accepted tolerance of  $\pm 2$ dBA, and the noise model is considered representative of the real world within the limitations of the prediction algorithm. Hence, no model calibration is required.

**Table 10 Results of Model Validation**

| Monitoring Location | Daytime Noise Level, dB LAeq(15hr) |          |            | Nighttime Noise Level, dB LAeq(9hr) |          |            |
|---------------------|------------------------------------|----------|------------|-------------------------------------|----------|------------|
|                     | Measured                           | Modelled | Difference | Measured                            | Modelled | Difference |
| L1                  | 54.5                               | 53.1     | -1.4       | 47.4                                | 47.8     | +0.4       |
| L2                  | 58.0                               | 57.3     | -0.7       | 51.2                                | 50.8     | -0.4       |
| L3                  | 54.3                               | 53.8     | -0.5       | n/a                                 | n/a      | n/a        |

### 5.2.2 Projected Traffic Volumes – Opening Year

Opening year traffic volumes for Keswick Estate were projected for Boundary Road and Sheraton Road with consideration of the following traffic generating developments:

- The master plan for Keswick Estate identifies approximately 1,068 residential lots; and
- The master plan for Southlakes Estate identifies approximately 830 additional lots to those currently constructed.

Assuming 7.4 traffic movements per residential lot over a 24 hour period, in accordance with the Guide to Traffic Generating Developments (RMS, 2013), the additional traffic movements generated by Keswick Estate and Southlakes Estate would be approximately 14,045 traffic movements per day. For the purpose of this assessment, it has been assumed that the daytime / nighttime traffic split would remain consistent with the existing traffic flow patterns, and that traffic movements would be equally split between Boundary Road and Sheraton Road. It has also been assumed that as the Keswick Estate and Southlakes Estate developments are predominately residential developments, the composition of vehicles would typically comprise light vehicles.

A summary of the projected existing traffic flows (opening year) is provided in **Table 11**.

**Table 11 Projected Existing Traffic Flows (2024)**

| Road        | Location Description               | Day (07:00 to 22:00) |                | Night (22:00 to 07:00) |                |
|-------------|------------------------------------|----------------------|----------------|------------------------|----------------|
|             |                                    | Light Vehicles       | Heavy Vehicles | Light Vehicles         | Heavy Vehicles |
| Boundary Rd | West of Sheraton Rd                | 9,207                | 189            | 782                    | 11             |
| Sheraton Rd | North of Boundary Rd               | 9,126                | 424            | 762                    | 114            |
| Sheraton Rd | Between Wellington Rd and Bunnings | 12,598               | 1,541          | 857                    | 156            |
| Sheraton Rd | Between 24R and 20L Sheraton Rd    | 136                  | 514            | 76                     | 118            |

In addition to projected traffic flows on the existing road network, this assessment has included projected traffic flows along the Southern Distributor, which is planned to extend along Hennessy Drive and Sheraton Drive to intersect with Wellington Road (refer to **Figure 1**).

Traffic volumes provided by Council, identified that traffic volumes for the Southern Distributor in 2055 would be approximately 5,800 vehicles per day, with 2% heavy vehicles, which has been adopted for this assessment.

### 5.2.3 Road Noise Prediction Results

Road traffic noise levels were predicted to the proposed residential subdivision, based on the subdivision layout in the Keswick Estate master plan (refer to **Appendix B**).

The calculation scenario for this assessment includes 'free field' predictions for day and night road noise levels. **Figure 4** and **Figure 5** presents the 'free field' noise contours for each modelled day LAeq(15hr) and night LAeq(9hr) assessment periods.

Point calculations to the nearest and / or most affected residential allotments indicate that free field noise levels (external) of up to 62dB LAeq(15hr) and 53dB LAeq(9hr) are anticipated during the day and night periods respectively. Road traffic noise levels at the nearest recreational area, adjacent to Boundary Road, are anticipated at up to 58dB LAeq(15hr), which is below the RNP criterion of 60dB LAeq(15hr).

### 5.3 Cumulative Road Traffic and Industrial Noise Levels

Based on the review of industrial noise levels from the nearby industrial premises and the prediction of road traffic noise levels from Boundary Road, Sheraton Road and the Southern Distributor, it is demonstrated that road traffic noise is the dominant noise source for residential allotments within the Keswick Estate.

Given that the road traffic noise levels at the most affected residential allotments are predicted to be more than 10dBA higher than those from industrial sources, the nearby quarries and concrete works would not contribute to increased cumulative noise levels.

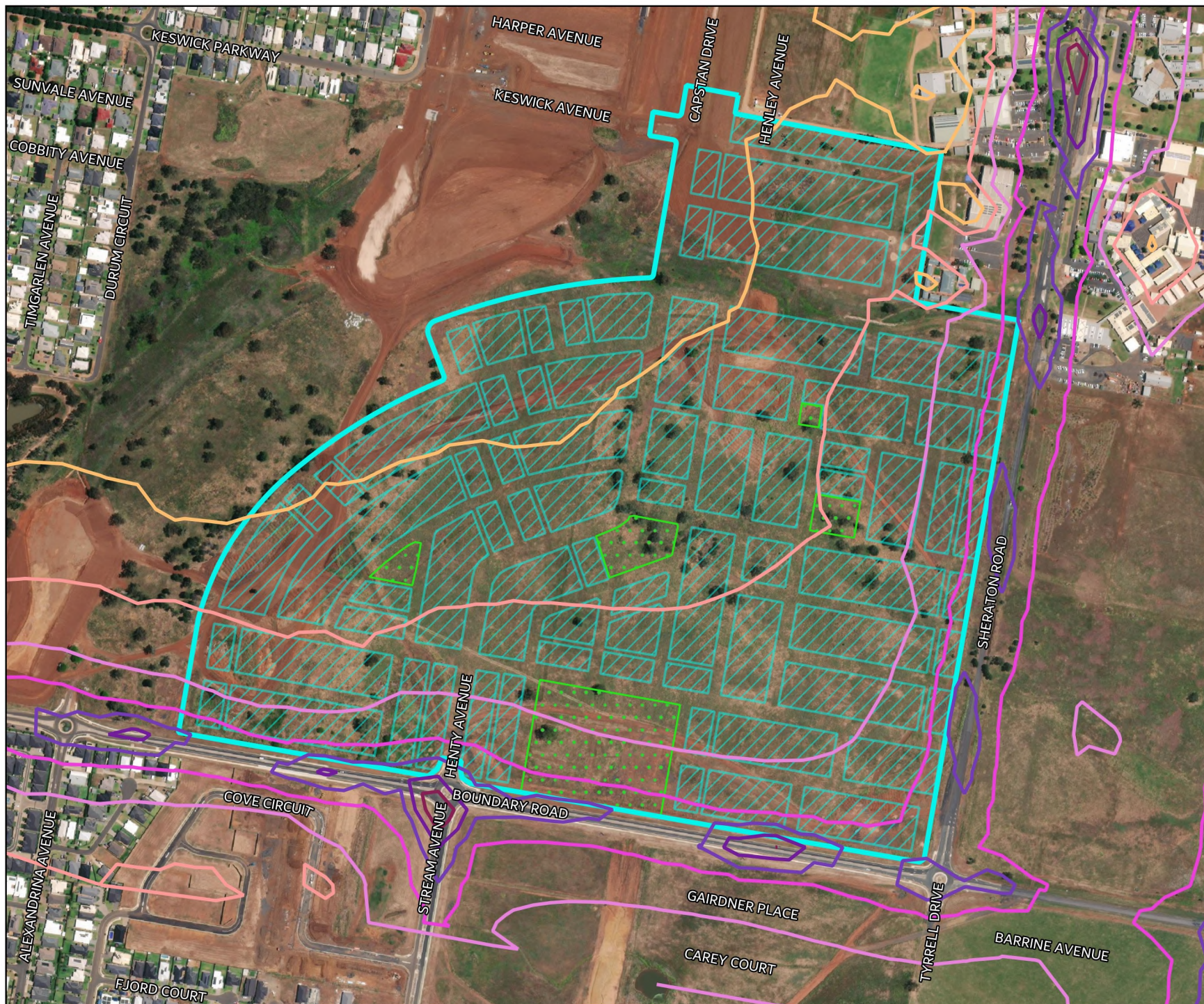


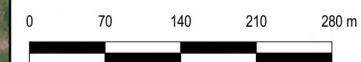
**FIGURE 4**  
**Road Noise Contours**  
 Day Period  
 MAC242158-01  
 Keswick Estate

**KEY**

- Project Site
- Proposed Residential Areas
- Proposed Parks

**LAeq(period) Road Noise**

- 40dB
- 45dB
- 50dB
- 55dB
- 60dB
- 65dB
- 70dB



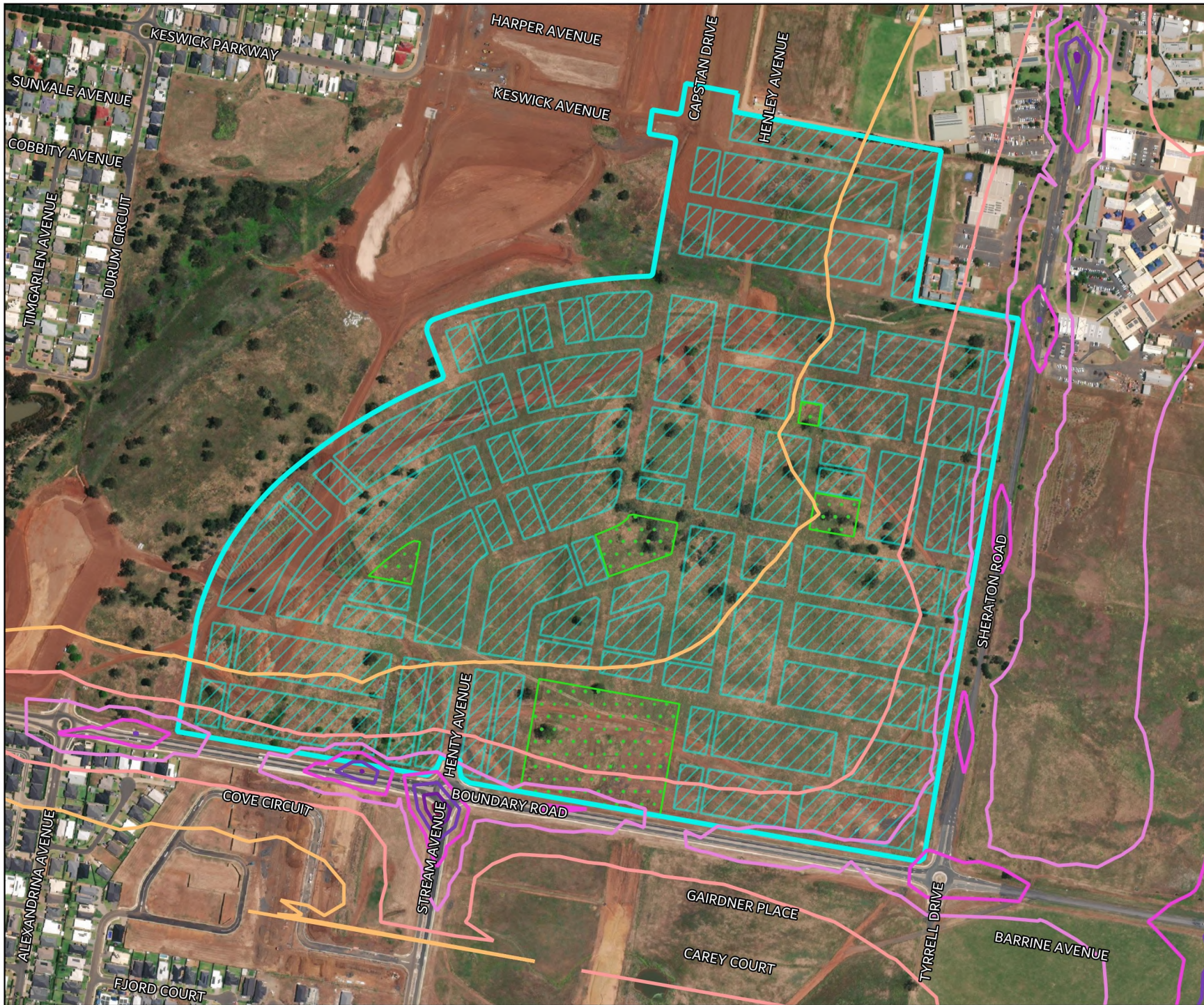


FIGURE 5  
Road Noise Contours  
Night Period  
MAC242158-01  
Keswick Estate

**KEY**

-  Project Site
-  Proposed Residential Areas
-  Proposed Parks

**LAeq(period) Road Noise**

-  40dB
-  45dB
-  50dB
-  55dB
-  60dB
-  65dB
-  70dB



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## 6 Recommendations – Internal Noise Levels

Internal noise levels were determined in accordance with the indicative attenuation levels detailed in **Section 4.2.1**. The predicted road traffic noise levels included a +2.5dBA façade correction factor in accordance with the RNP.

The results of the assessment demonstrate that during the day period (7am to 10pm), dwellings constructed within about 200m of Sheraton Road and about 165m of Boundary Road would potentially experience noise levels above the design sound level of 40dB LAeq(15hr), with windows partially open for ventilation. For a light-framed dwelling with windows closed (with adequate mechanical ventilation), internal noise levels would typically achieve the design sound levels, with only dwellings constructed close to the roundabout intersections of Boundary Road and Henty Avenue (~40m), and Boundary Road and Sheraton Road (~35m), anticipated to experience noise levels above the design sound levels. It is noted that internal noise levels for dwellings constructed of masonry (with windows closed) are anticipated to achieve the design sound levels at all residential allotments.

During the night period (10pm to 7am), dwellings constructed within about 225m of Sheraton Road, and about 170m of Boundary Road would potentially experience noise levels above the design sound level of 40dB LAeq(15hr), with windows partially open for ventilation. For a light-framed dwelling with windows closed (with adequate mechanical ventilation), internal noise levels would typically achieve the design sound levels.

Therefore, the following noise controls and / or management measures should be considered to ameliorate noise levels for future dwellings within the Noise Management Zone (**Figure 6** and **Figure 7**):

- consider potential noise affected areas / set back distances in the final subdivision plan;
- dwellings within the Noise Management Zone should be constructed of materials that provide improved attenuation compared to standard materials; or/and
- construction of a noise barriers to block line of sight from the intersections to nearest residential allotment, noting that barriers are typically most effective for single storey dwellings.

As this assessment has relied on preliminary information, the precise number of residential allotments may be quantified in more detail assessment at a more advanced stage of the subdivision design, and noise control measures may be specifically tailored to the project.

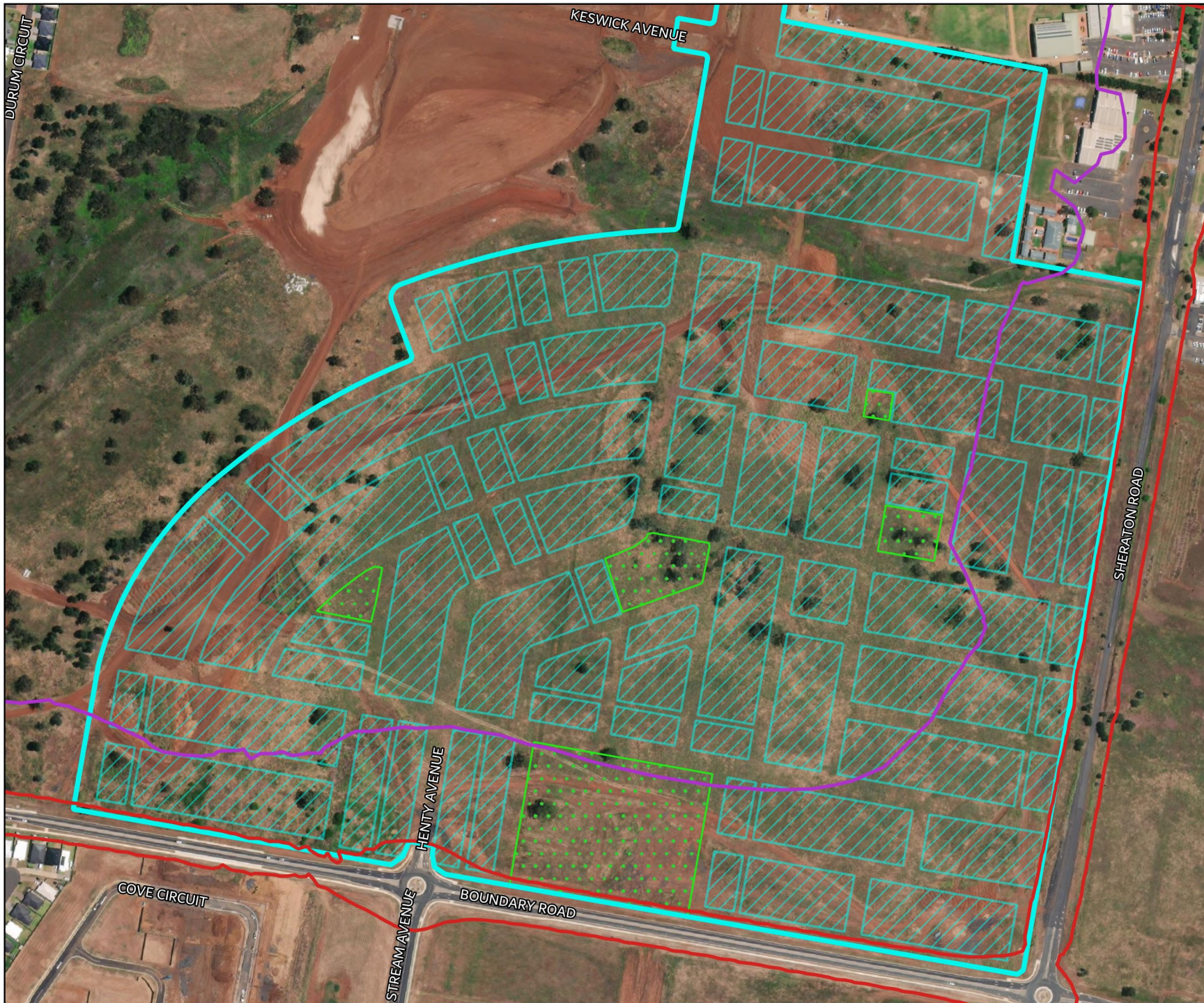


**FIGURE 6**  
**Noise Management Zone**  
**Day Period**  
**MAC242158-01**  
**Keswick Estate**

**KEY**

-  Project Site
-  Proposed Residential Areas
-  Proposed Parks

**Noise Management Zone**

-  Dwelling - Windows Open
-  Dwelling - Light Framed



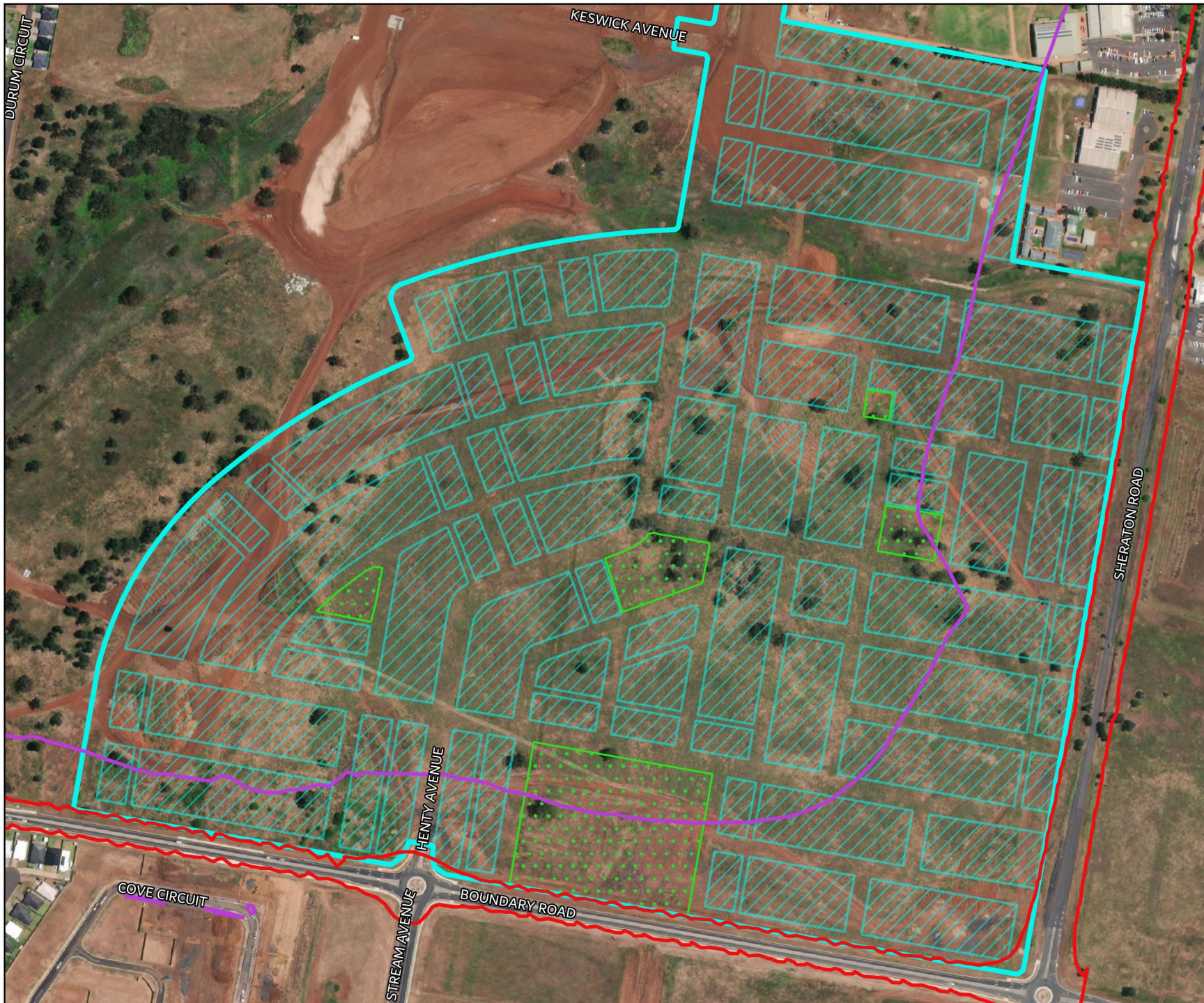


**FIGURE 7**  
**Noise Management Zone**  
**Night Period**  
**MAC242158-01**  
**Keswick Estate**

**KEY**

-  Project Site
-  Proposed Residential Areas
-  Proposed Parks

**Noise Management Zone**

-  Dwelling - Windows Open
-  Dwelling - Light Framed



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## 7 Discussion

### 7.1 Road Noise and at Dwelling Treatments

Standard domestic glass is usually inadequate acoustically and can reduce the acoustic attenuation performance of the overall building facade. Upgrade options include thicker laminated glass or double-glazed laminated windows with an air gap between panels. The frames and air gaps should be adequately sealed to optimise noise reduction. This is especially pertinent to dwellings of two storey construction. It is recommended that buildings within the Noise Management Zone, are to be constructed adopting materials that meet (or exceed) Category 2 glazing specifications as per Appendix C of the guideline (see **Appendix D**). In particular, this includes:

- Windows/Sliding Doors: Openable with minimum 6mm monolithic glass and full perimeter acoustic seals.

As windows must remain closed for effective noise reduction, alternative means of internal ventilation (eg air conditioning or wall ventilators) must be considered to allow windows to remain fully closed (refer to BCoA requirements).

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## 8 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed an Acoustic Assessment to inform and support the Keswick Estate Stages 7, 8 and 9 Planning Proposal at 180 Boundary Road, Dubbo, NSW. The assessment was completed to identify existing noise sources in the locality, including road traffic noise and industrial noise, and quantify their potential acoustic impacts on the project site.

Attended noise monitoring undertaken at the project site, identified that the dominant noise source in the locality is road traffic noise from Boundary Road and Sheraton Road. Industrial noise from Holcim Dubbo Quarry, South Keswick Quarry and South Keswick Concrete Works was inaudible at all times during the attended noise measurements.

A desktop review of potential cumulative noise impacts at the Keswick Estate from the operation of the South Keswick Quarry, South Keswick Concrete Works and Dubbo Quarry demonstrated that where the quarries achieve their EPL requirements or theoretical criteria based on minimum assumed RBLs, cumulative noise levels would remain below the amenity criteria, and hence recommended design sound levels at all residential allotments.

Road traffic noise predictions identified that dwellings constructed within about 200m of the carriageway will potentially experience noise levels above the recommended internal noise criteria with windows partially open for ventilation. Where windows remain closed, and adequate ventilation is provided, internal noise levels are anticipated to exceed the recommended internal noise criteria for light framed dwellings close to Boundary Road and Henty Avenue roundabout intersection, and Boundary Road and Sheraton Road roundabout intersection. Therefore, the final subdivision layout should take into the potentially affected areas, or dwellings constructed within the Noise Management Zone should be required to be constructed using building materials equivalent of Category 2 treatments as per the guideline.

It is recommended that a more detailed assessment be completed following finalisation of the Keswick Estate subdivision plan, with reference to updated traffic counts, and / or traffic modelling. Notwithstanding, the development of the Keswick Estate is a feasible option with respect to traffic noise emissions albeit with the inclusion of the noise control measures outlined in this report.

In regard to cumulative noise levels from road traffic and industrial sources, the assessment found that industrial noise sources would not contribute to an increase in total noise levels at the project site.

Therefore, based on the findings of this report, with the inclusion of several noise control measures, there are no noise related issues which would prevent Council from supporting the planning proposal.

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# Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

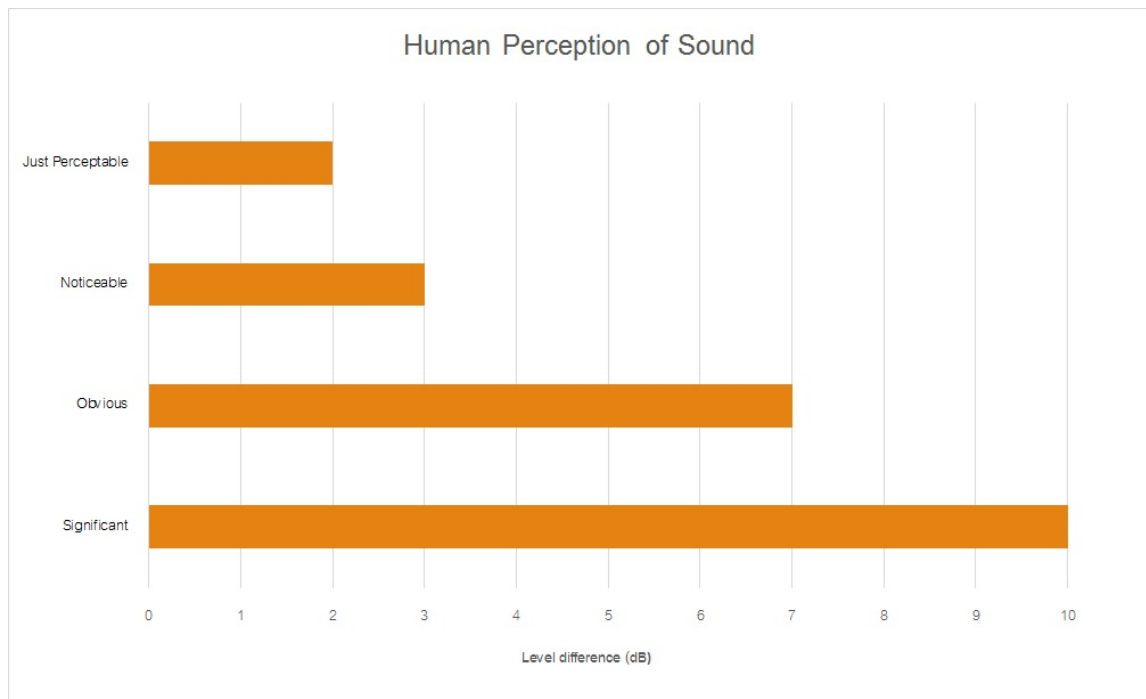
| Table A1 Glossary of Acoustical Terms |                                                                                                                                                                                                                                                                       |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Term                                  | Description                                                                                                                                                                                                                                                           |
| 1/3 Octave                            | Single octave bands divided into three parts                                                                                                                                                                                                                          |
| Octave                                | A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.                                                                                                                                           |
| ABL                                   | Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.                                             |
| Ambient Noise                         | The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.                                                                                               |
| A Weighting                           | A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.                                                                                                                                                           |
| Background Noise                      | The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor                                                                      |
| dBA                                   | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.                                           |
| dB(Z), dB(L)                          | Decibels Z-weighted or decibels Linear (unweighted).                                                                                                                                                                                                                  |
| Extraneous Noise                      | Sound resulting from activities that are not typical of the area.                                                                                                                                                                                                     |
| Hertz (Hz)                            | The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.                                                                                                                                                             |
| LA10                                  | A sound level which is exceeded 10% of the time.                                                                                                                                                                                                                      |
| LA90                                  | Commonly referred to as the background noise, this is the level exceeded 90% of the time.                                                                                                                                                                             |
| LAeq                                  | Represents the average noise energy or equivalent sound pressure level over a given period.                                                                                                                                                                           |
| LAmx                                  | The maximum sound pressure level received at the microphone during a measuring interval.                                                                                                                                                                              |
| Masking                               | The phenomenon of one sound interfering with the perception of another sound.<br>For example, the interference of traffic noise with use of a public telephone on a busy street.                                                                                      |
| RBL                                   | The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period. |
| Sound power level<br>(Lw or SWL)      | This is a measure of the total power radiated by a source in the form of sound and is given by $10 \cdot \log_{10} (W/W_0)$ . Where W is the sound power in watts to the reference level of $10^{-12}$ watts.                                                         |
| Sound pressure level<br>(Lp or SPL)   | the level of sound pressure; as measured at a distance by a standard sound level meter.<br>This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.                                               |

Table A2 provides a list of common noise sources and their typical sound level.

**Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA**

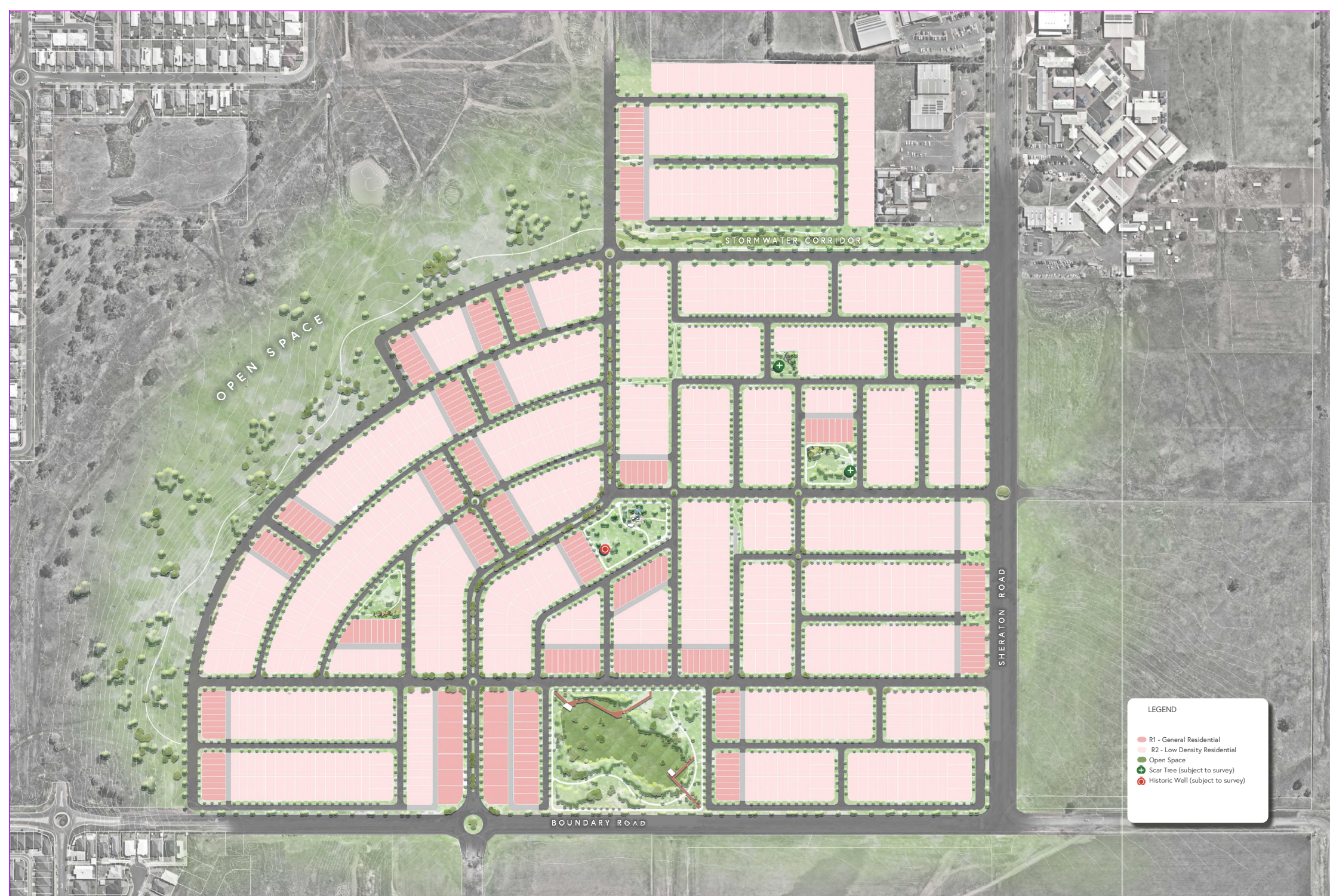
| Source                              | Typical Sound Pressure Level |
|-------------------------------------|------------------------------|
| Threshold of pain                   | 140                          |
| Jet engine                          | 130                          |
| Hydraulic hammer                    | 120                          |
| Chainsaw                            | 110                          |
| Industrial workshop                 | 100                          |
| Lawn-mower (operator position)      | 90                           |
| Heavy traffic (footpath)            | 80                           |
| Elevated speech                     | 70                           |
| Typical conversation                | 60                           |
| Ambient suburban environment        | 40                           |
| Ambient rural environment           | 30                           |
| Bedroom (night with windows closed) | 20                           |
| Threshold of hearing                | 0                            |

**Figure A1 – Human Perception of Sound**



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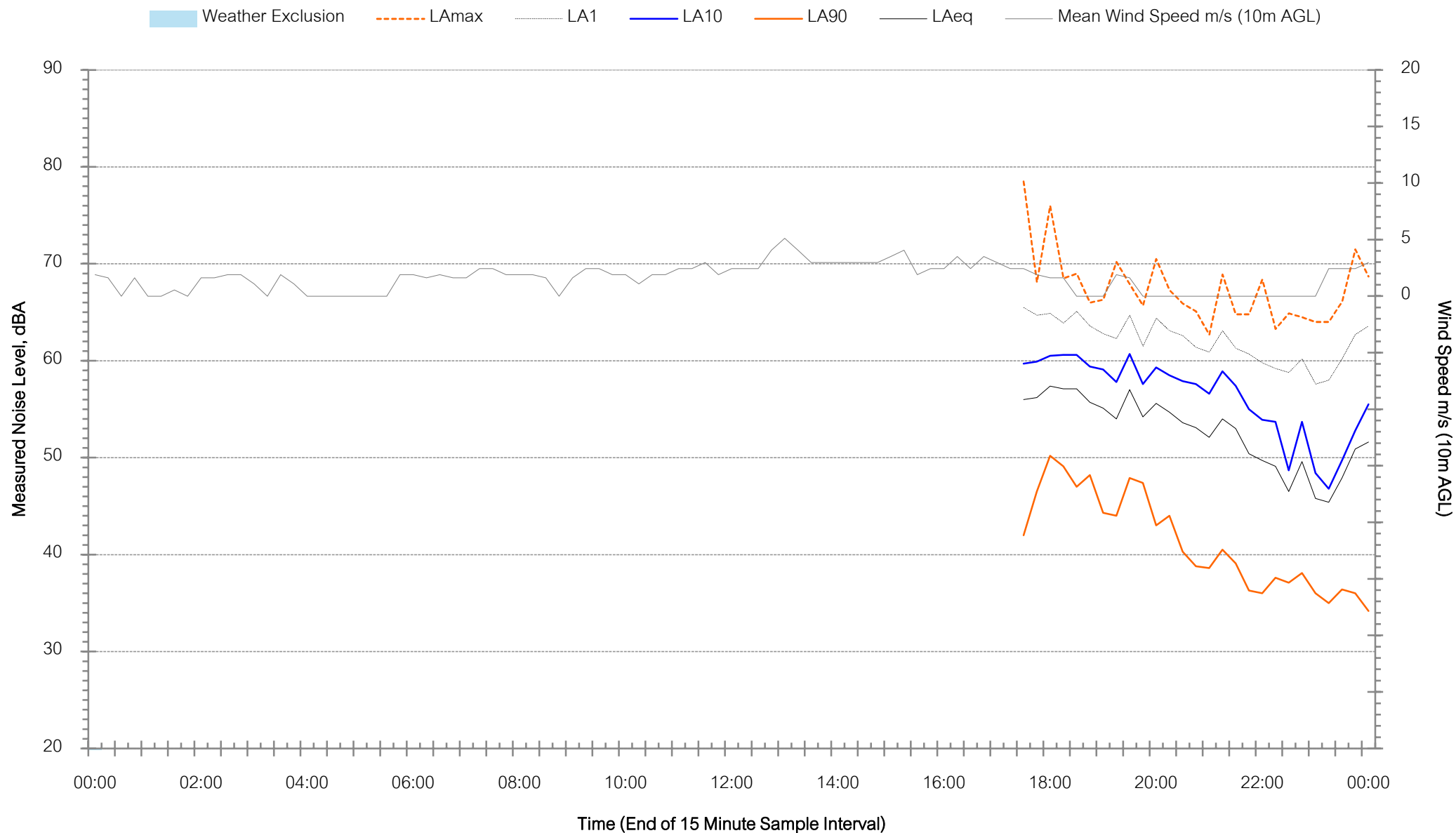
# Appendix B – Master Plan



# Appendix C – Noise Monitoring Charts

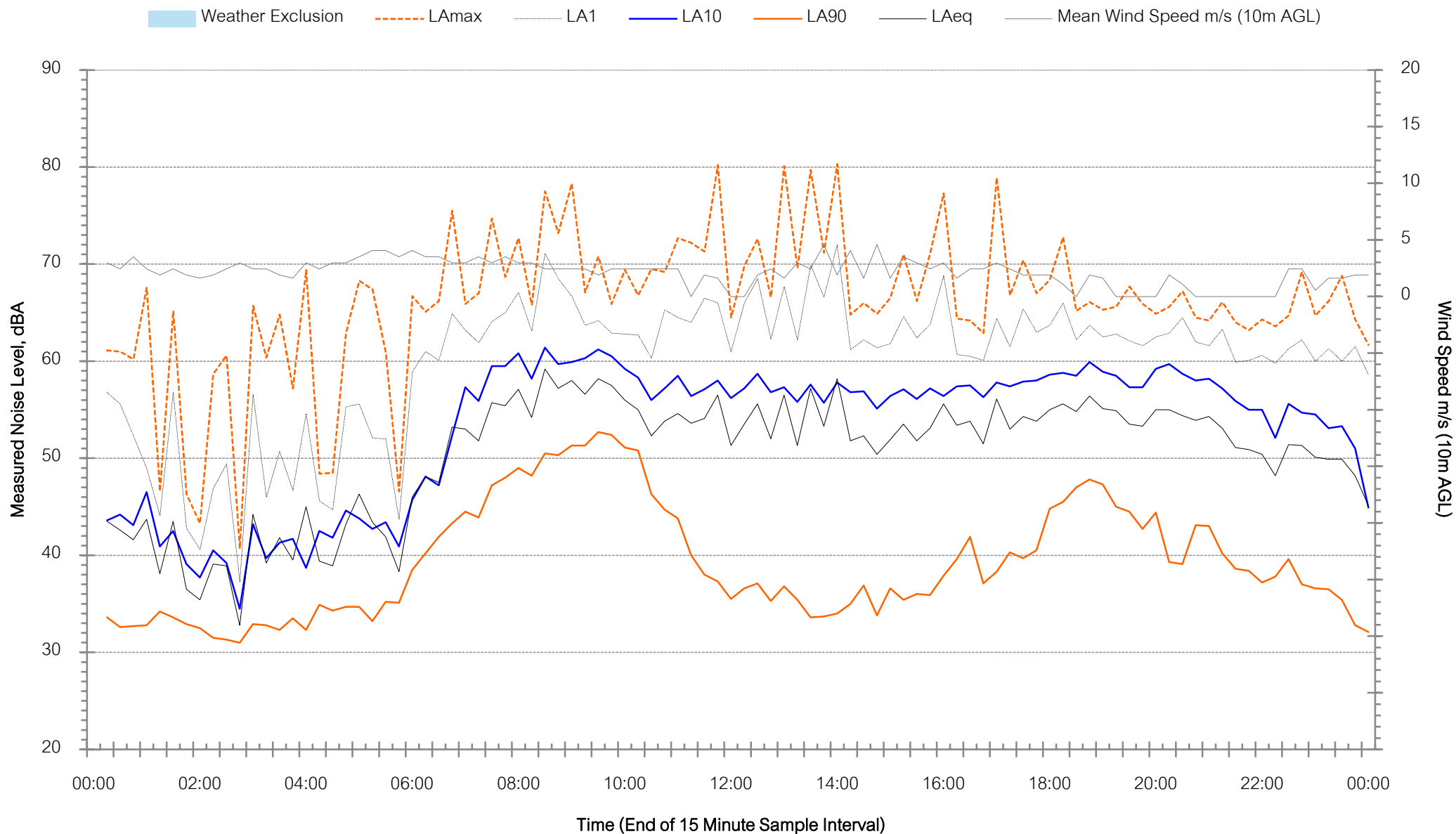
# Background Noise Levels

Sheraton Road, Dubbo, NSW - Monday 22 July 2024



# Background Noise Levels

Sheraton Road, Dubbo, NSW - Tuesday 23 July 2024



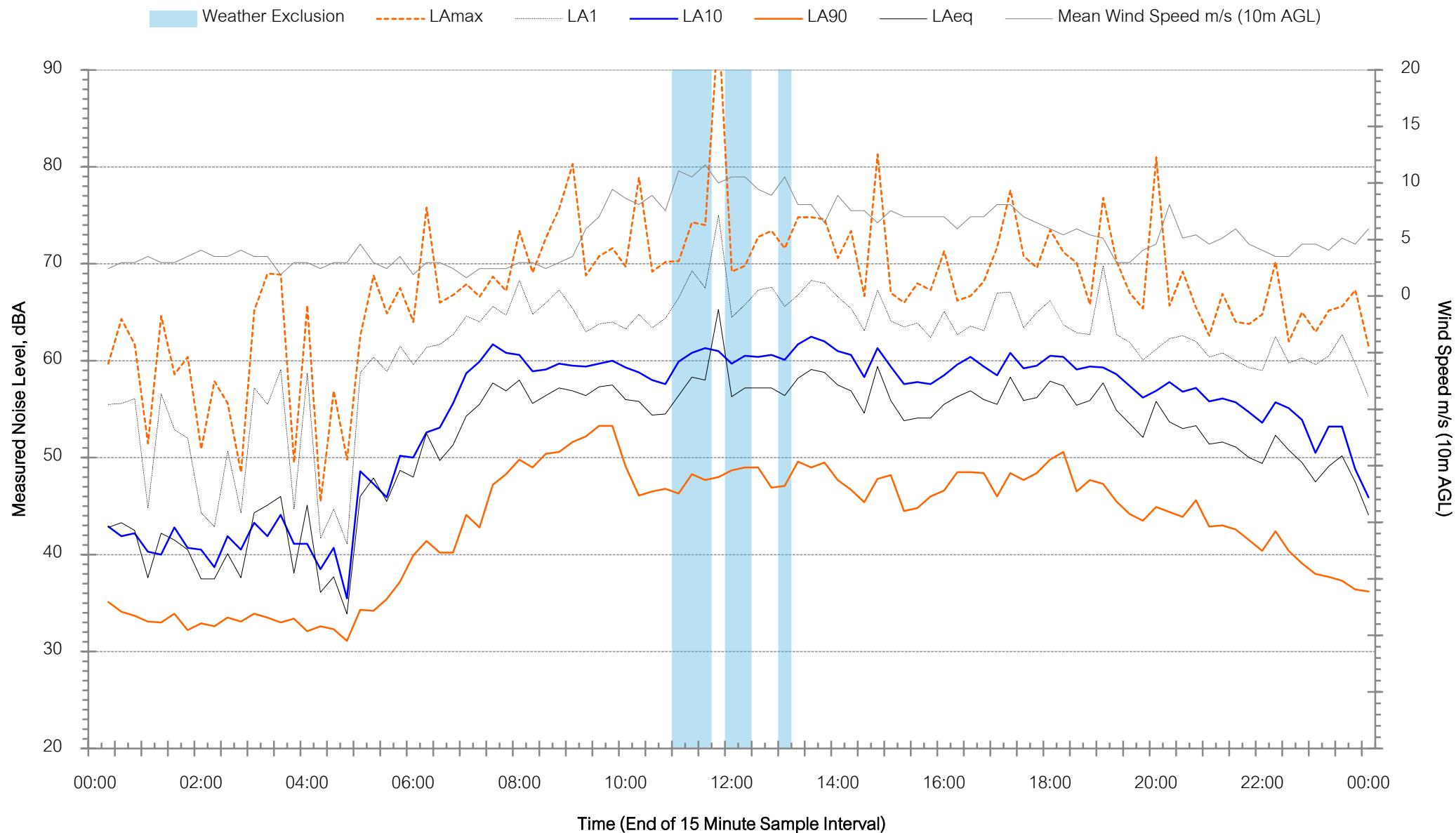
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Sheraton Road, Dubbo, NSW - Wednesday 24 July 2024



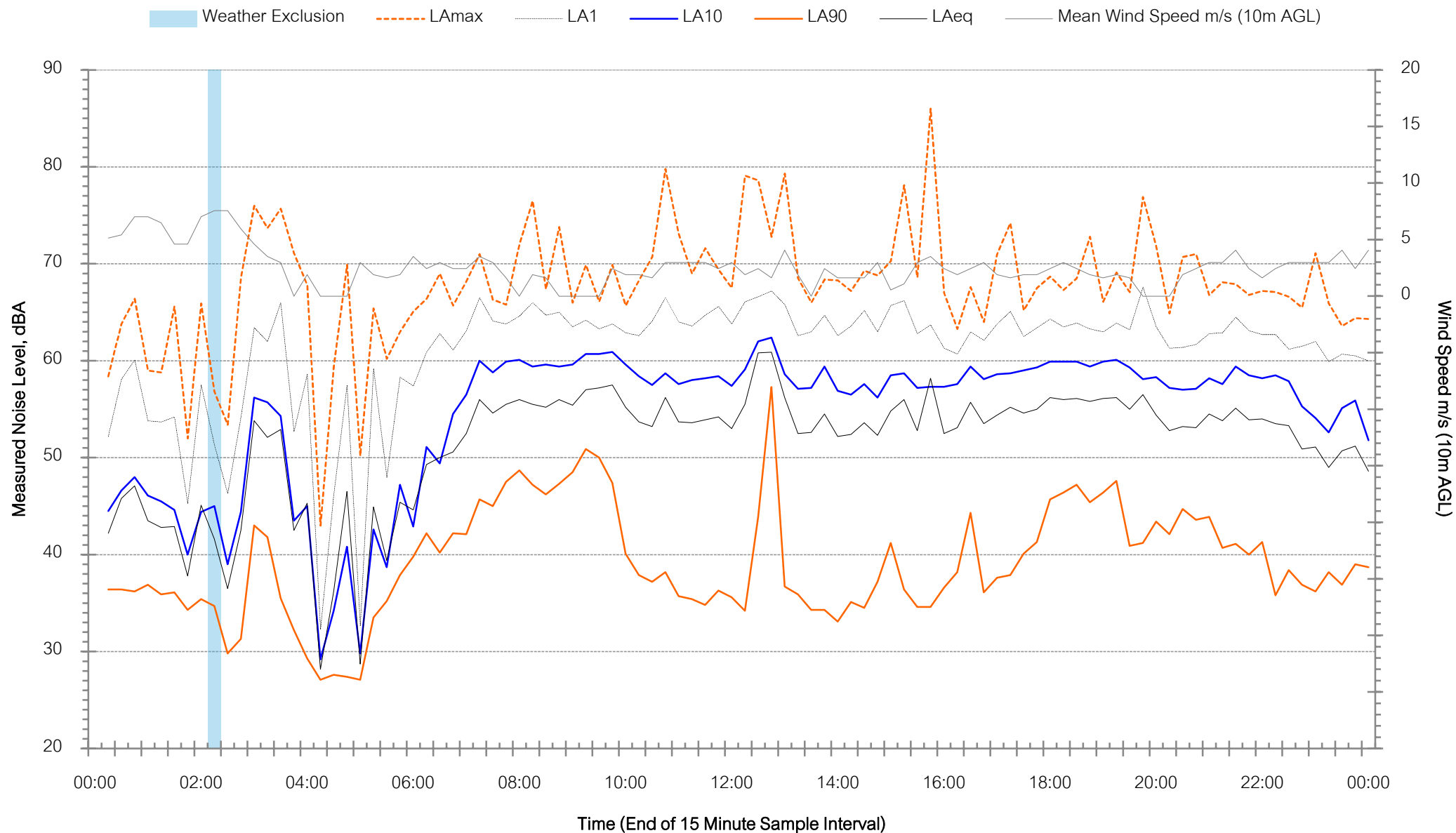
# Background Noise Levels

Sheraton Road, Dubbo, NSW - Thursday 25 July 2024



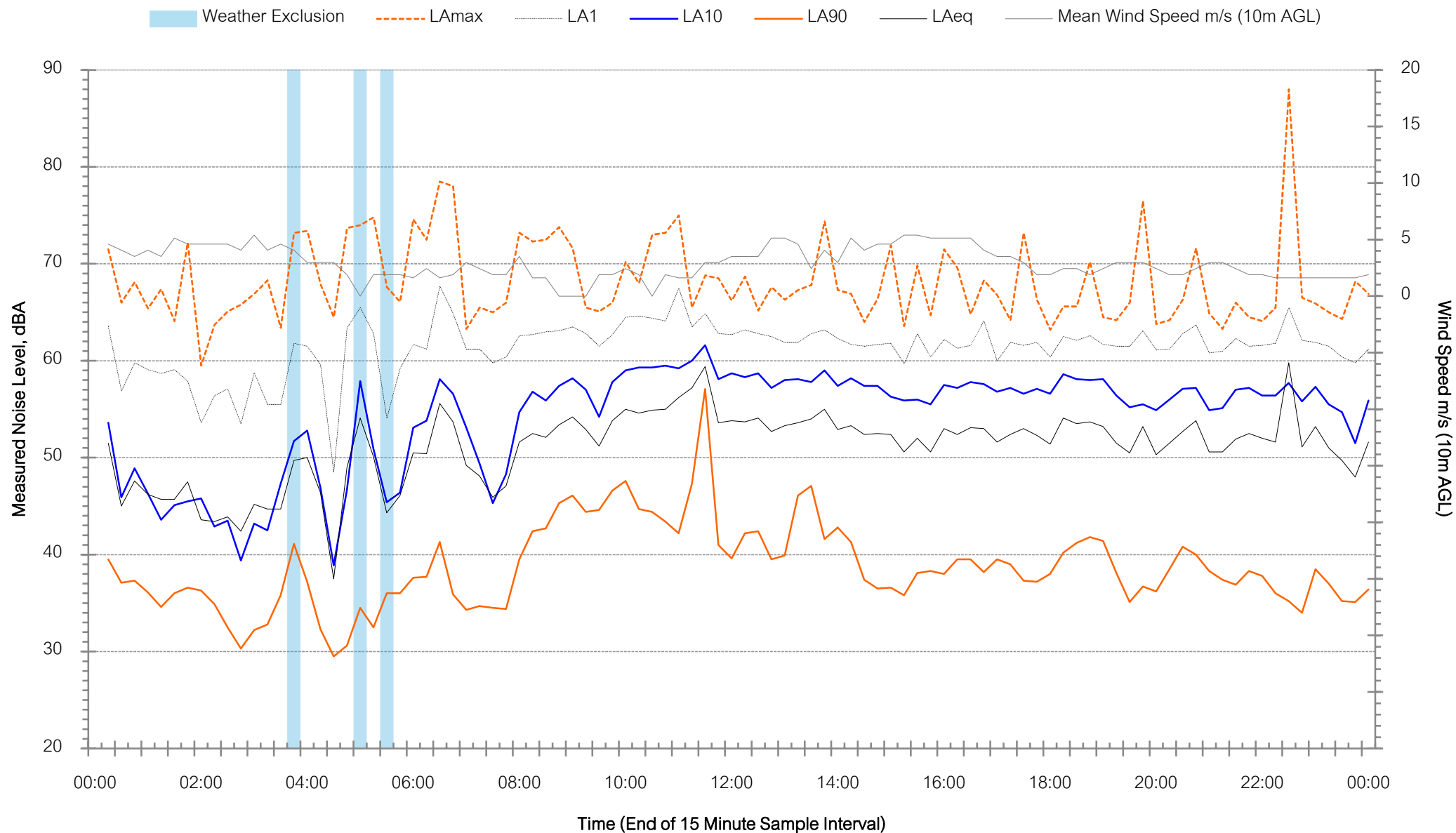
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Sheraton Road, Dubbo, NSW - Friday 26 July 2024



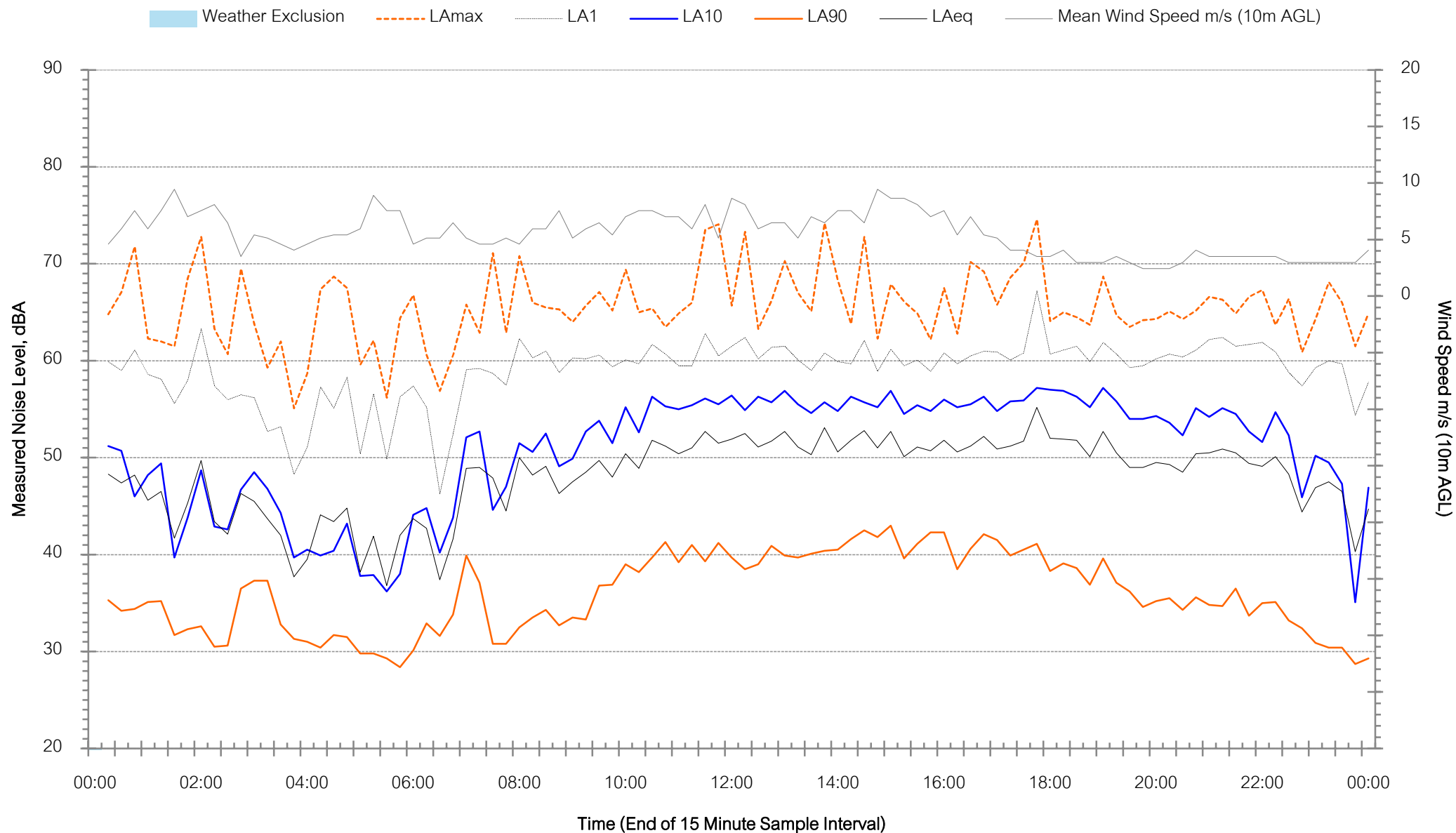
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Sheraton Road, Dubbo, NSW - Saturday 27 July 2024



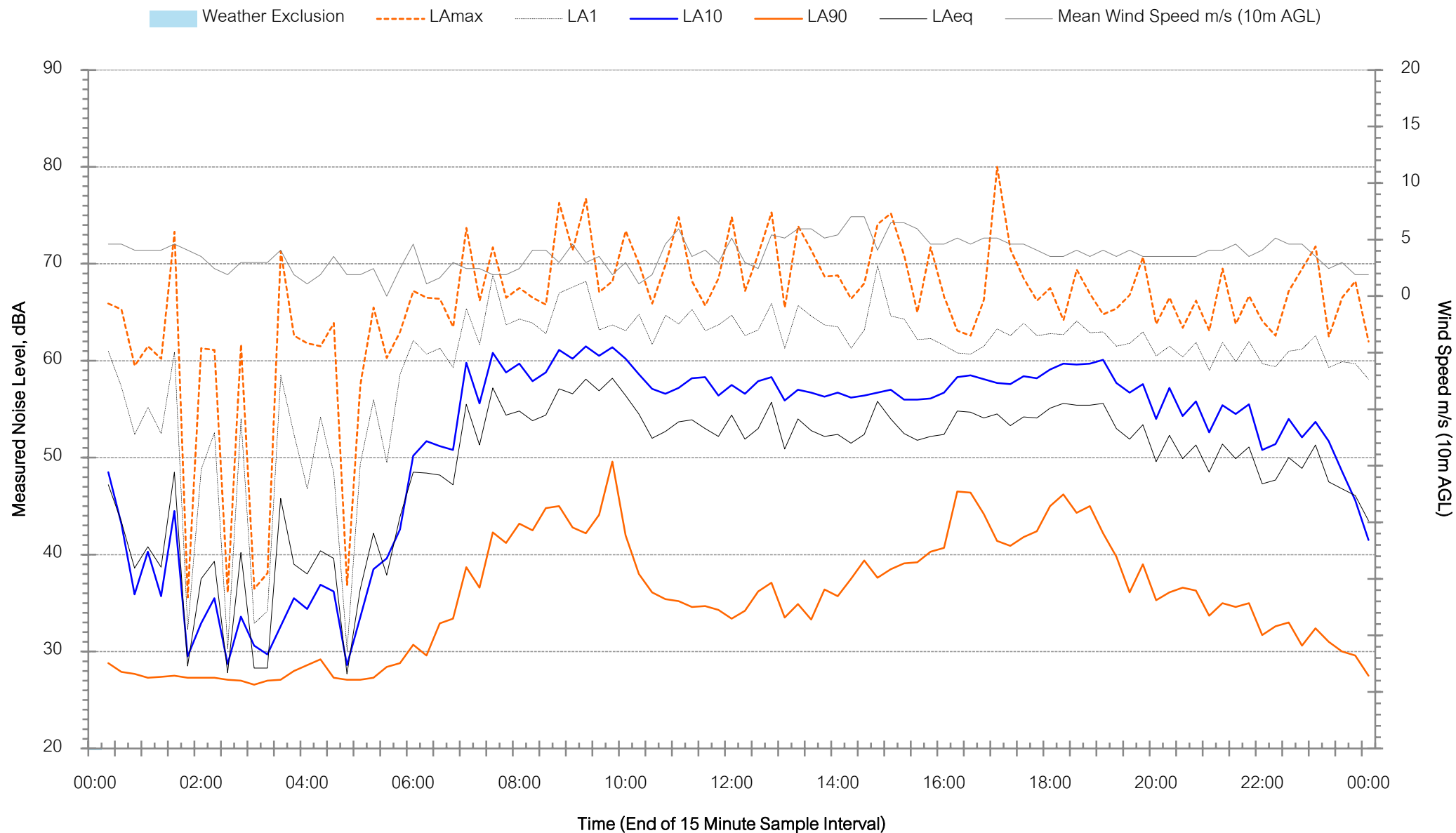
# Background Noise Levels

Sheraton Road, Dubbo, NSW - Sunday 28 July 2024



## Background Noise Levels

Sheraton Road, Dubbo, NSW - Monday 29 July 2024



# Background Noise Levels

Sheraton Road, Dubbo, NSW - Tuesday 30 July 2024



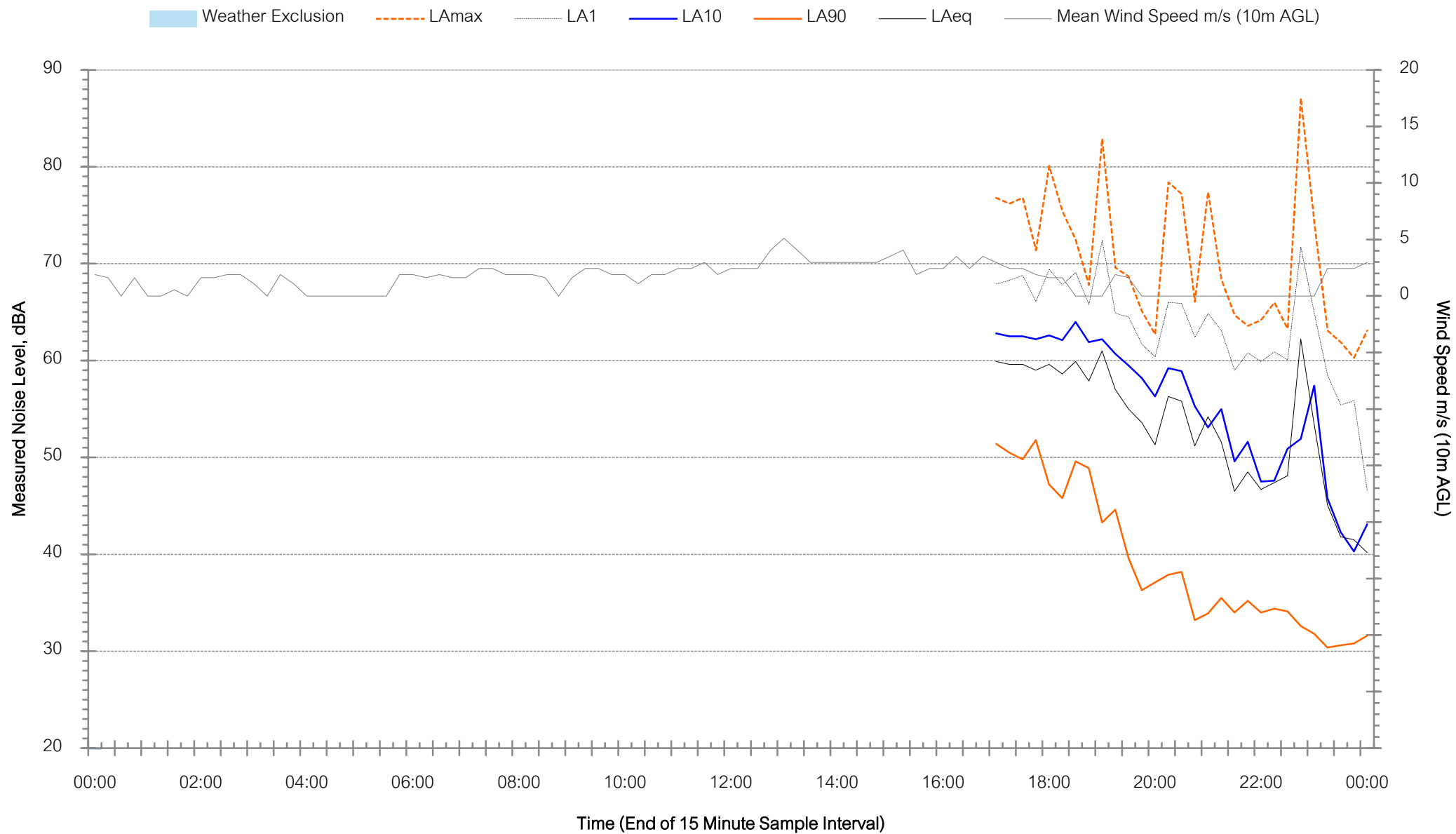
## Background Noise Levels

Sheraton Road, Dubbo, NSW - Wednesday 31 July 2024



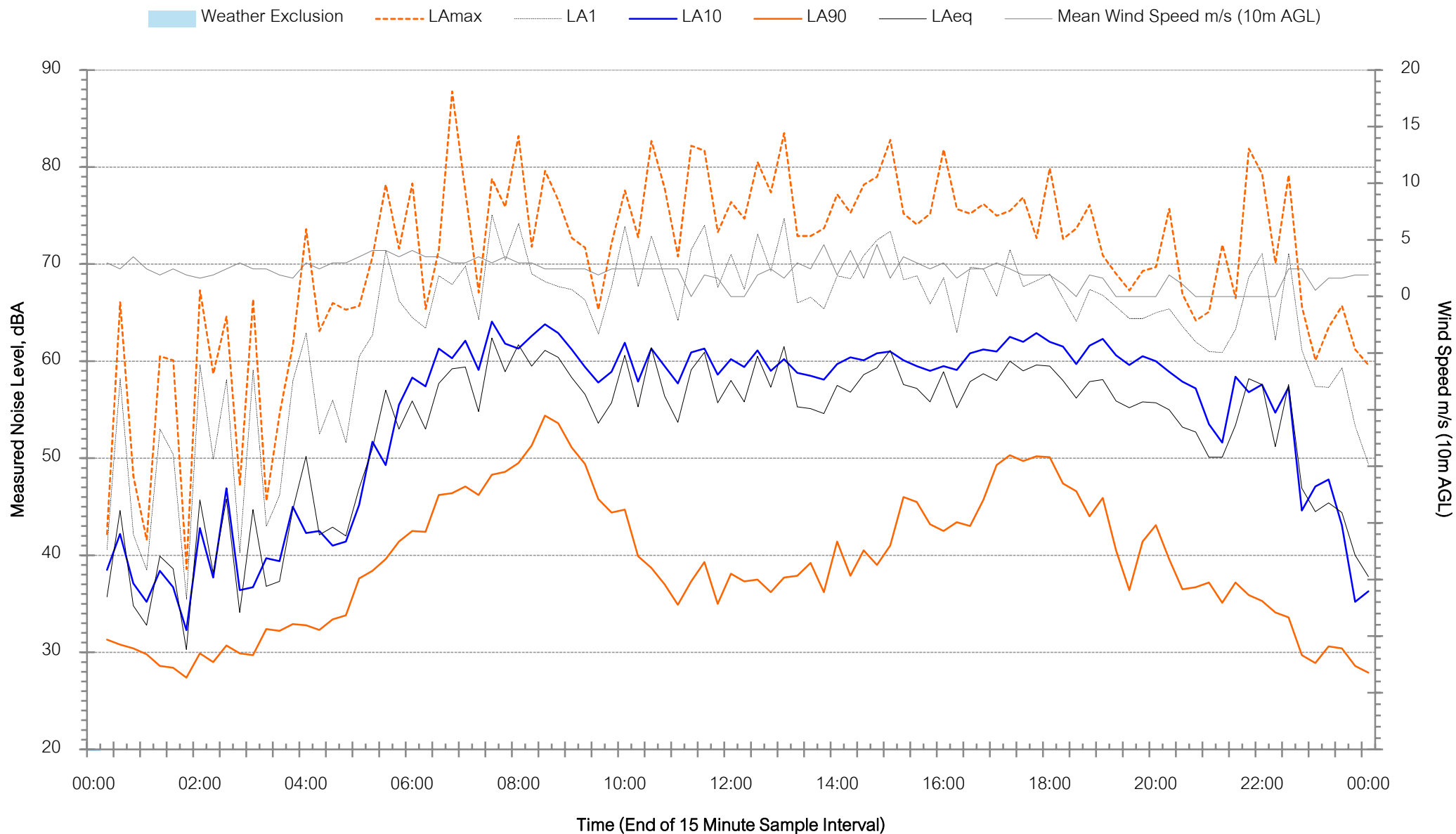
## Background Noise Levels

Cnr Boundary Road and Sheraton Road, Dubbo - Monday 22 July 2024



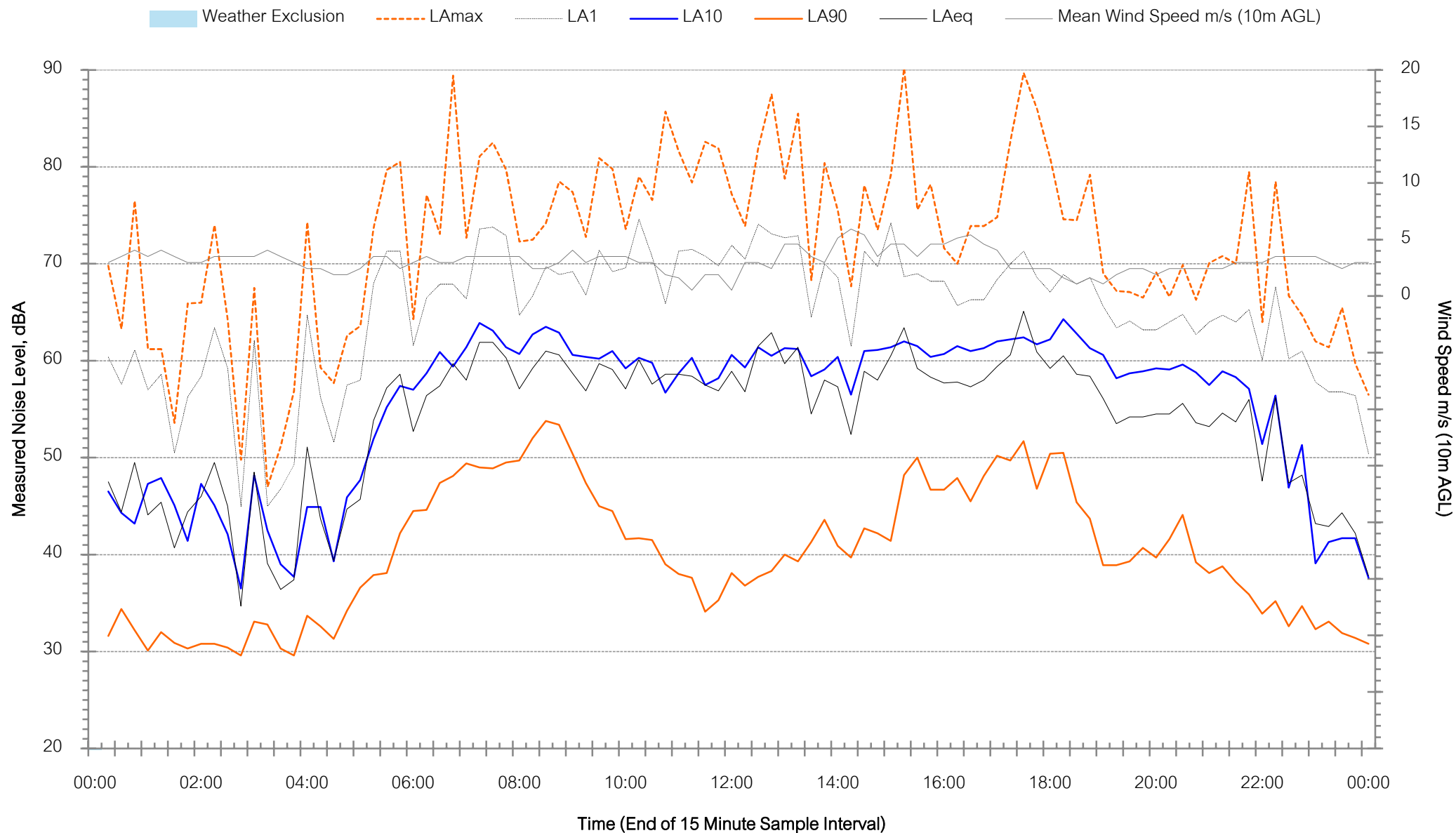
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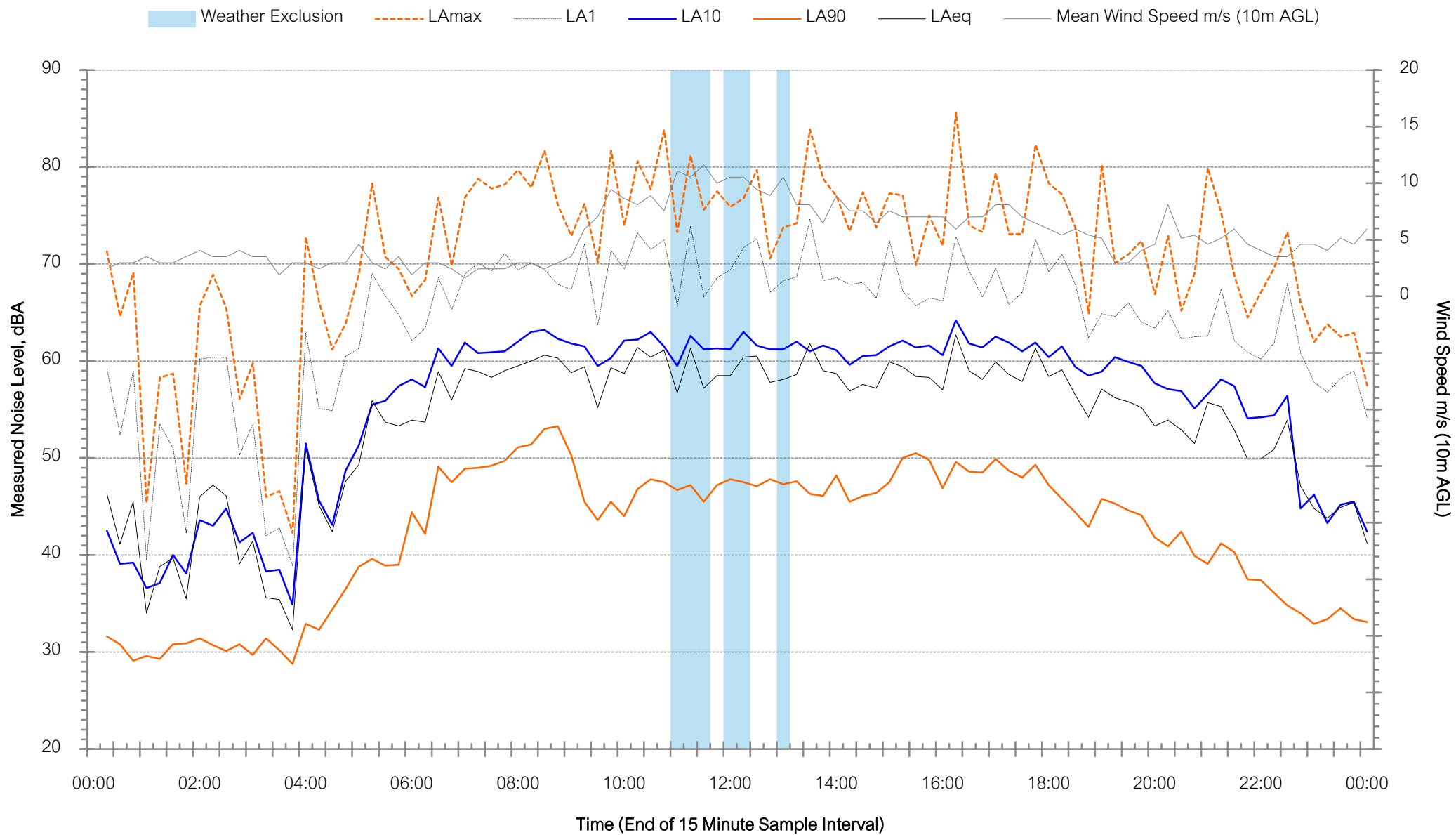
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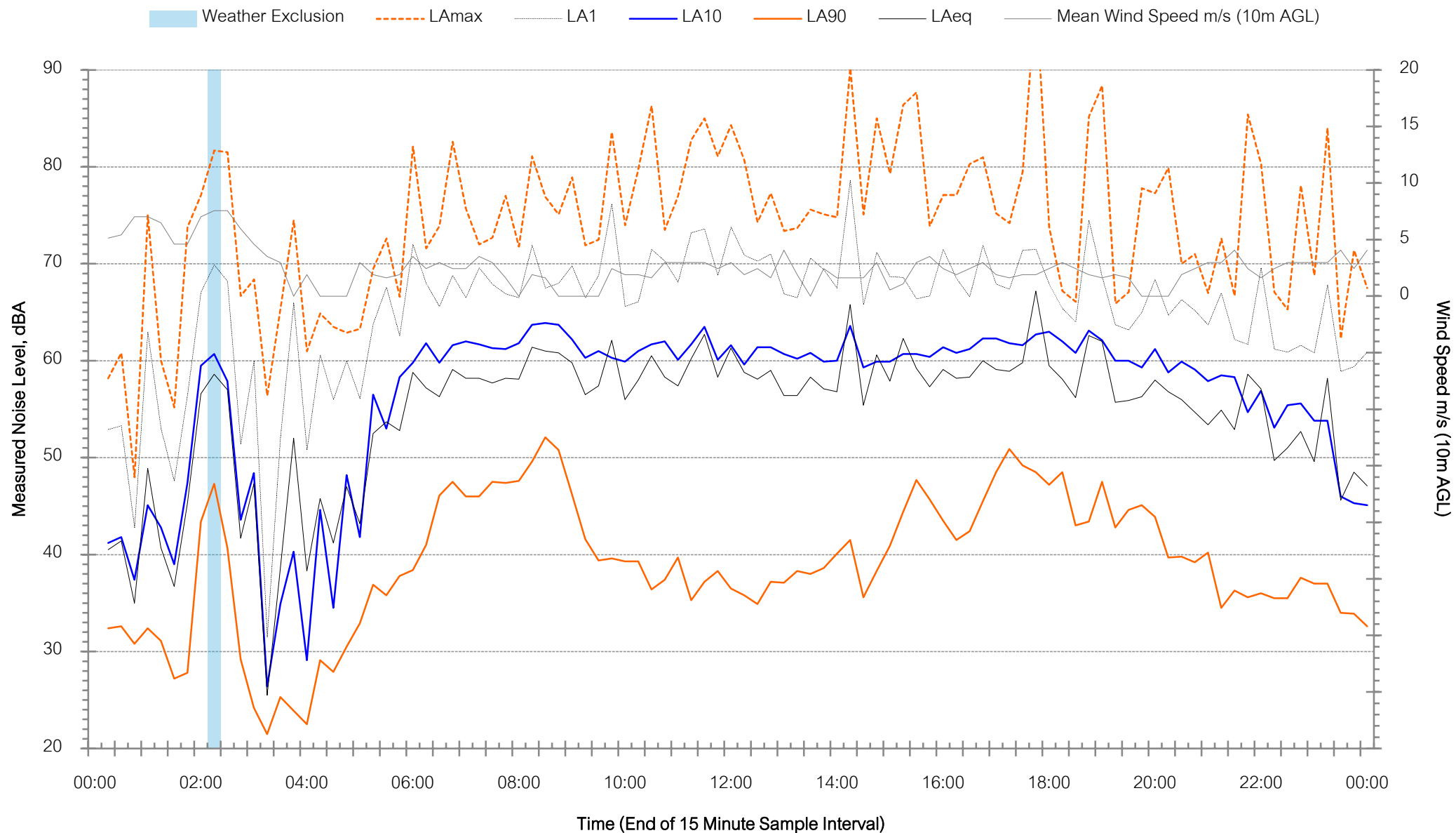
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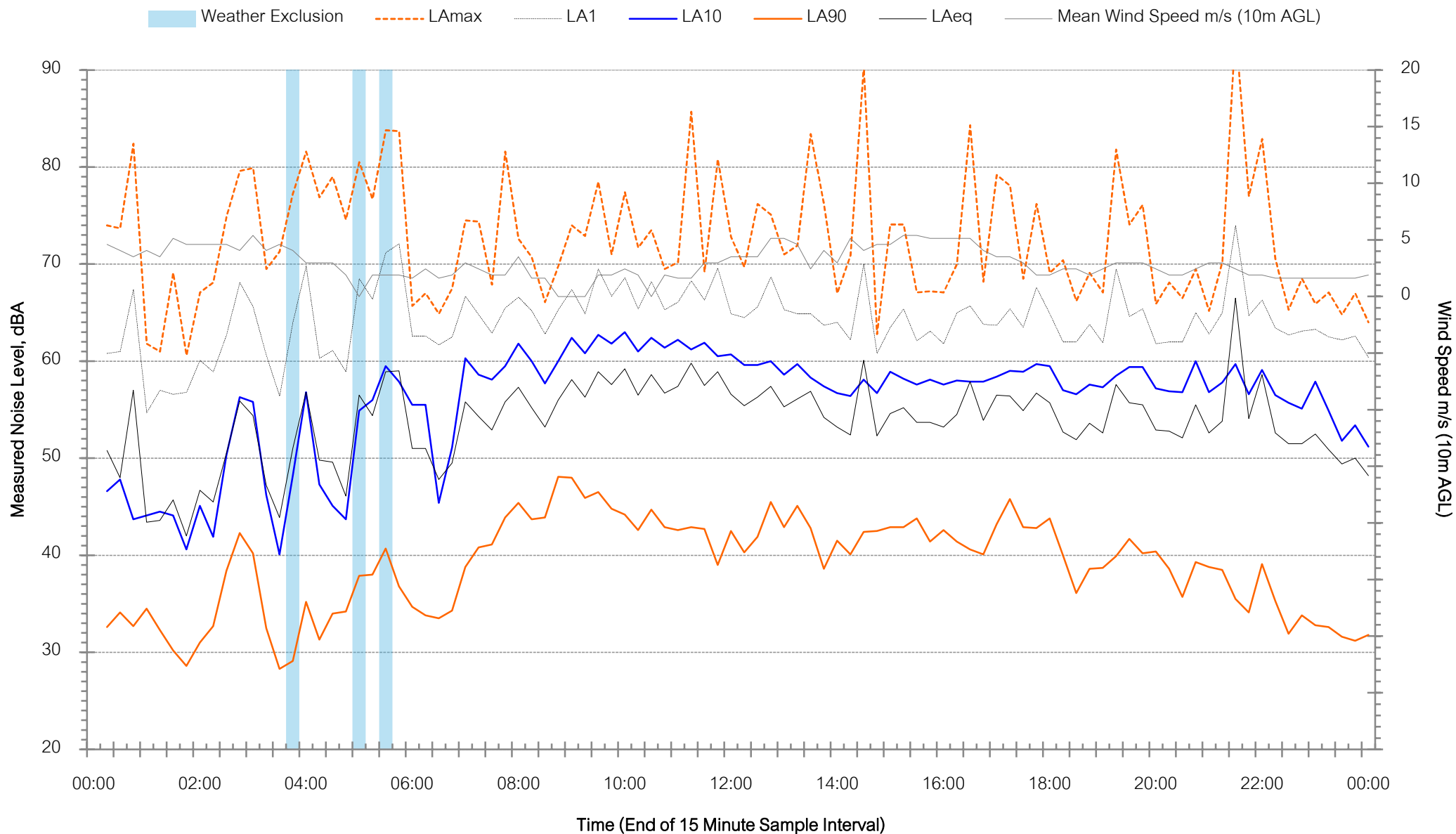
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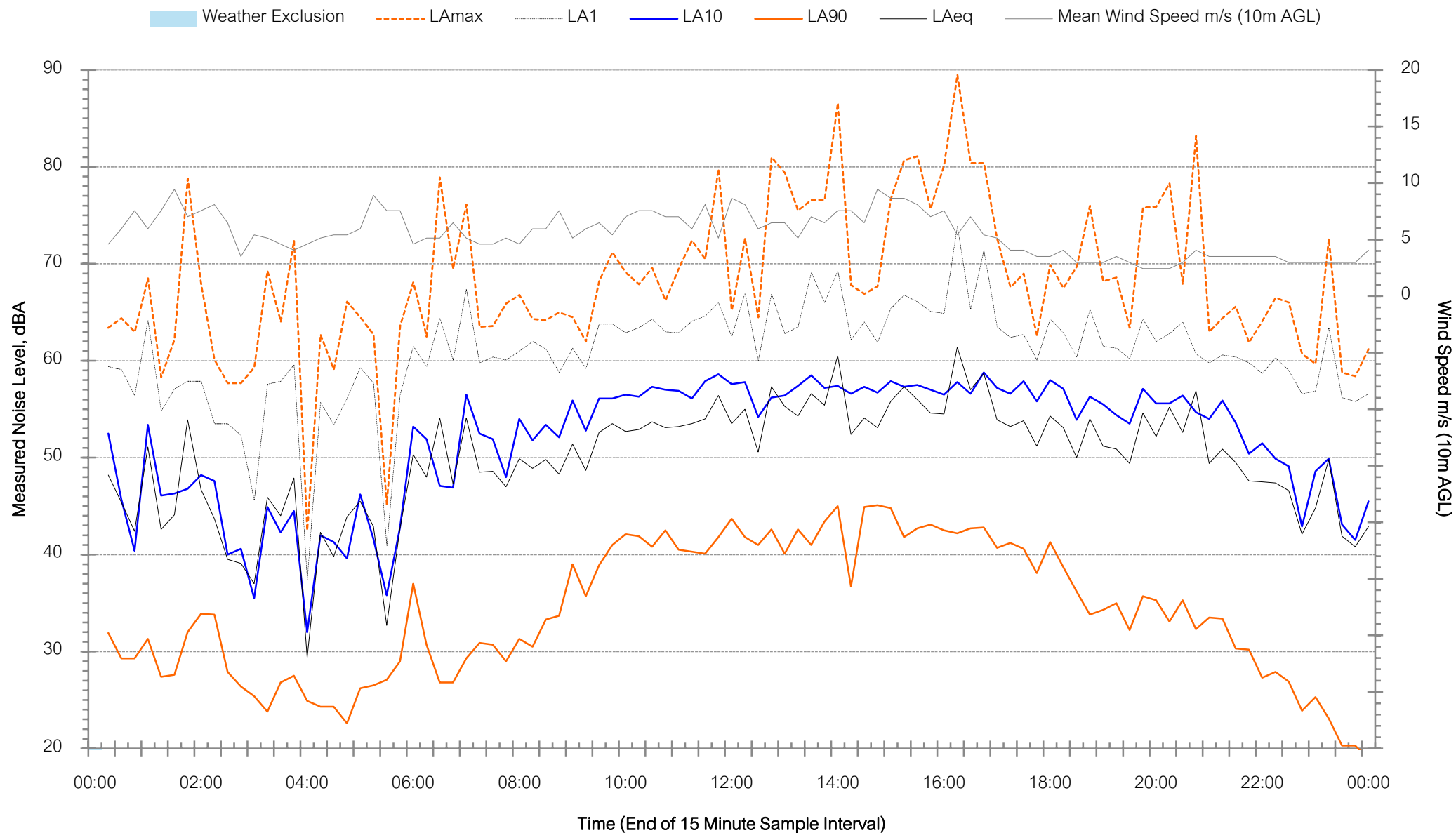
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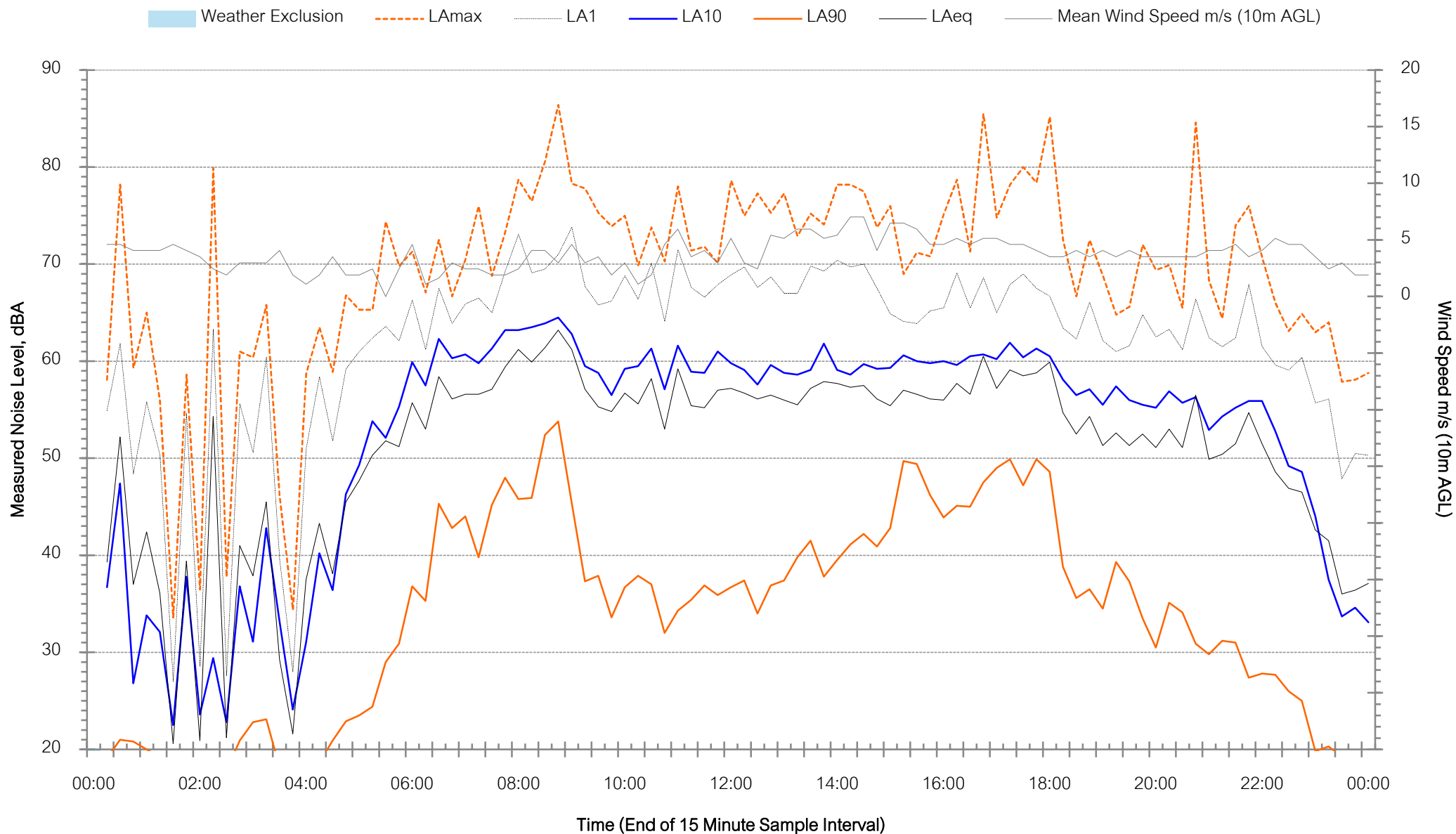
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Cnr Boundary Road and Sheraton Road, Dubbo - Sunday 28 July 2024



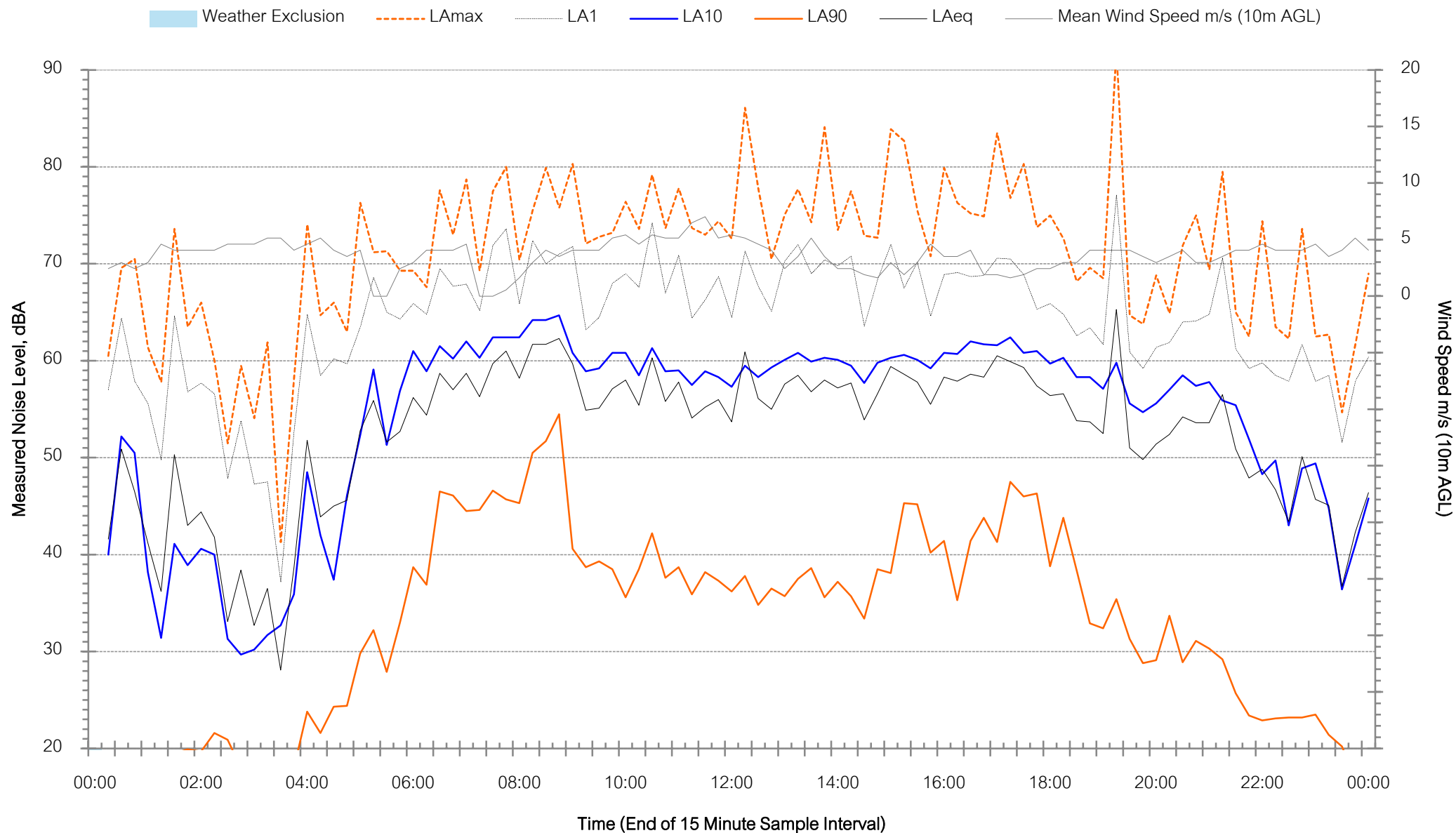
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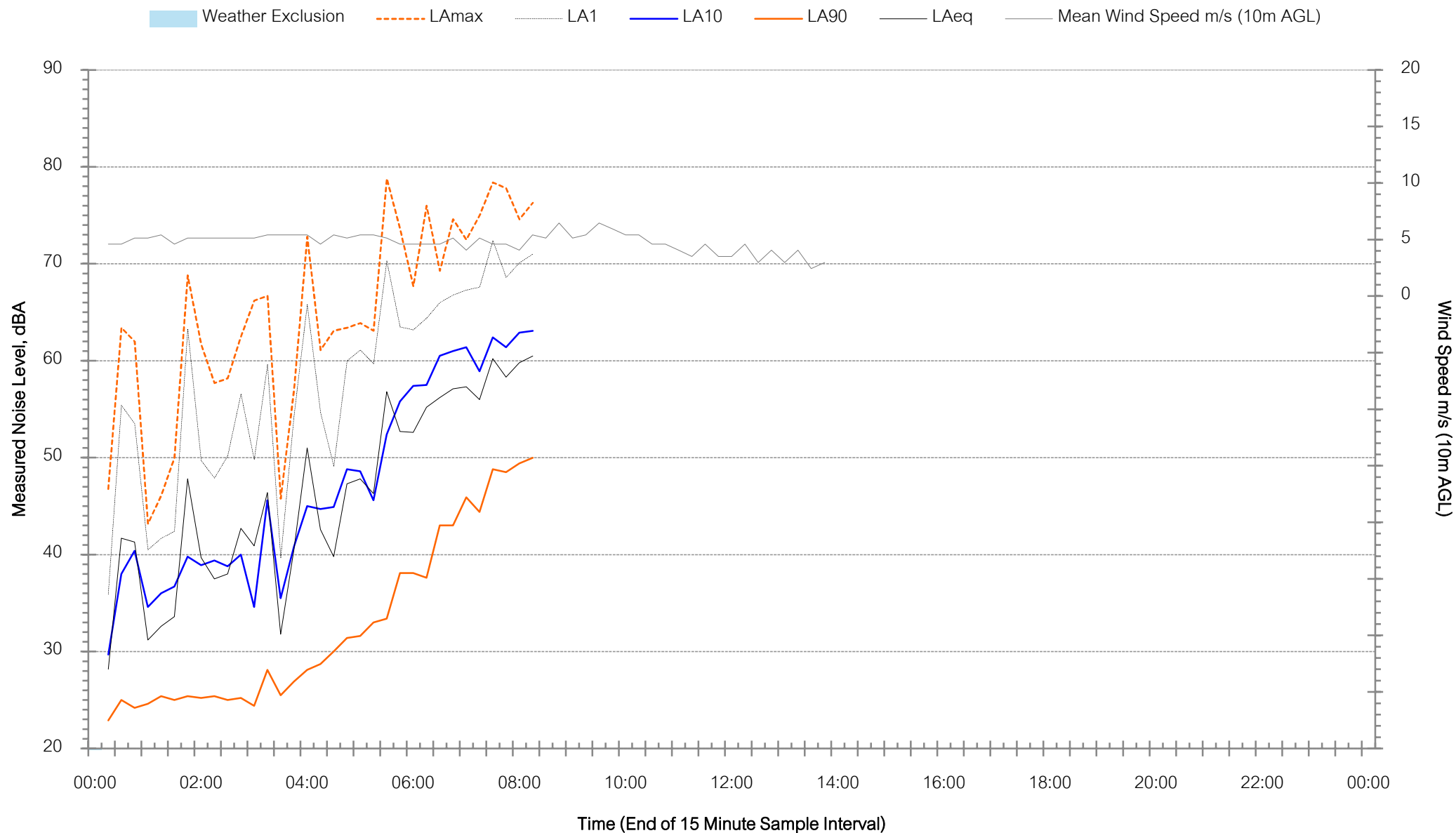
## Background Noise Levels

Cnr Boundary Road and Sheraton Road, Dubbo - Tuesday 30 July 2024



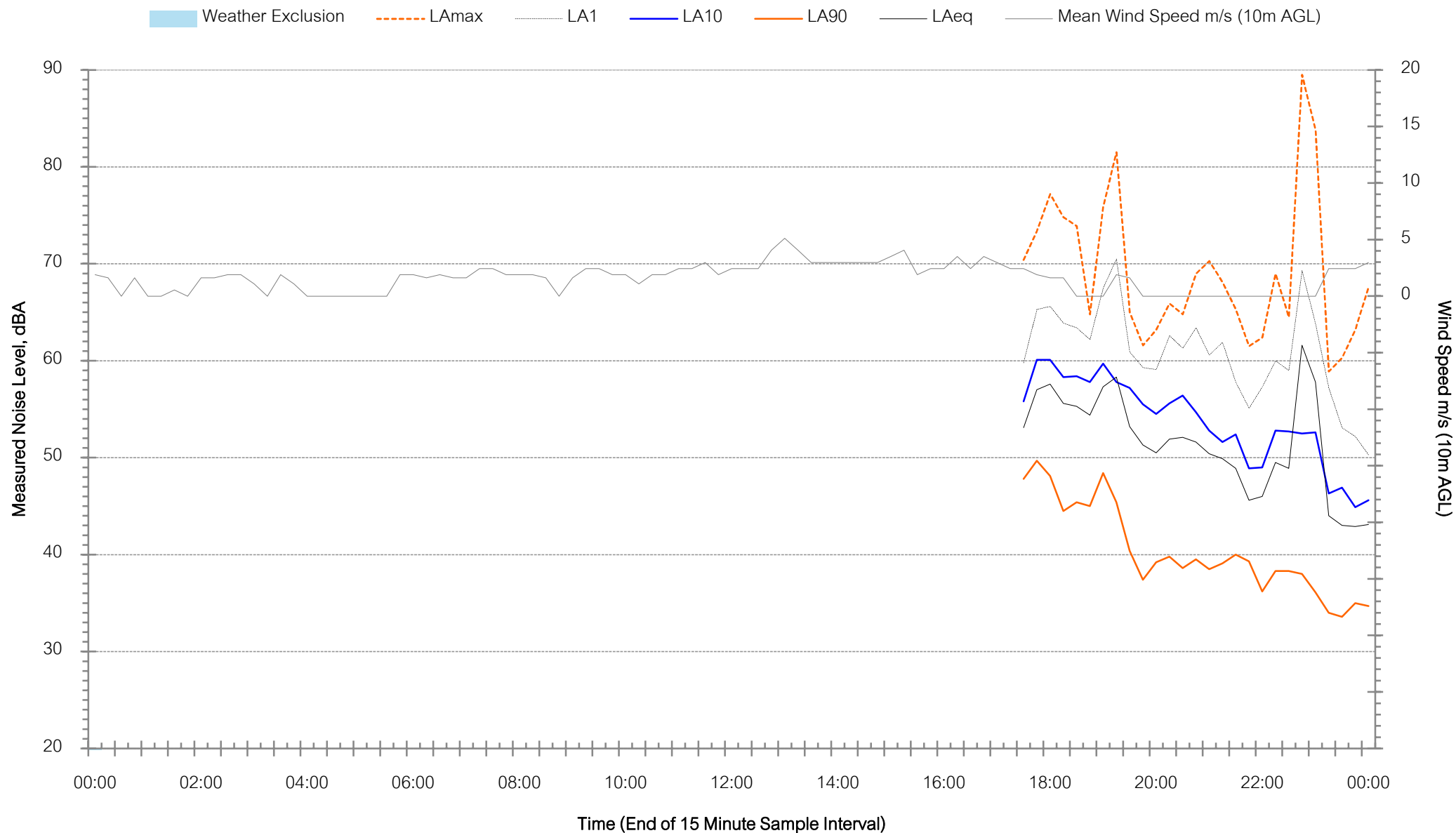
# Background Noise Levels

Cnr Boundary Road and Sheraton Road, Dubbo - Wednesday 31 July 2024



# Background Noise Levels

Boundary Road, Dubbo, NSW - Monday 22 July 2024



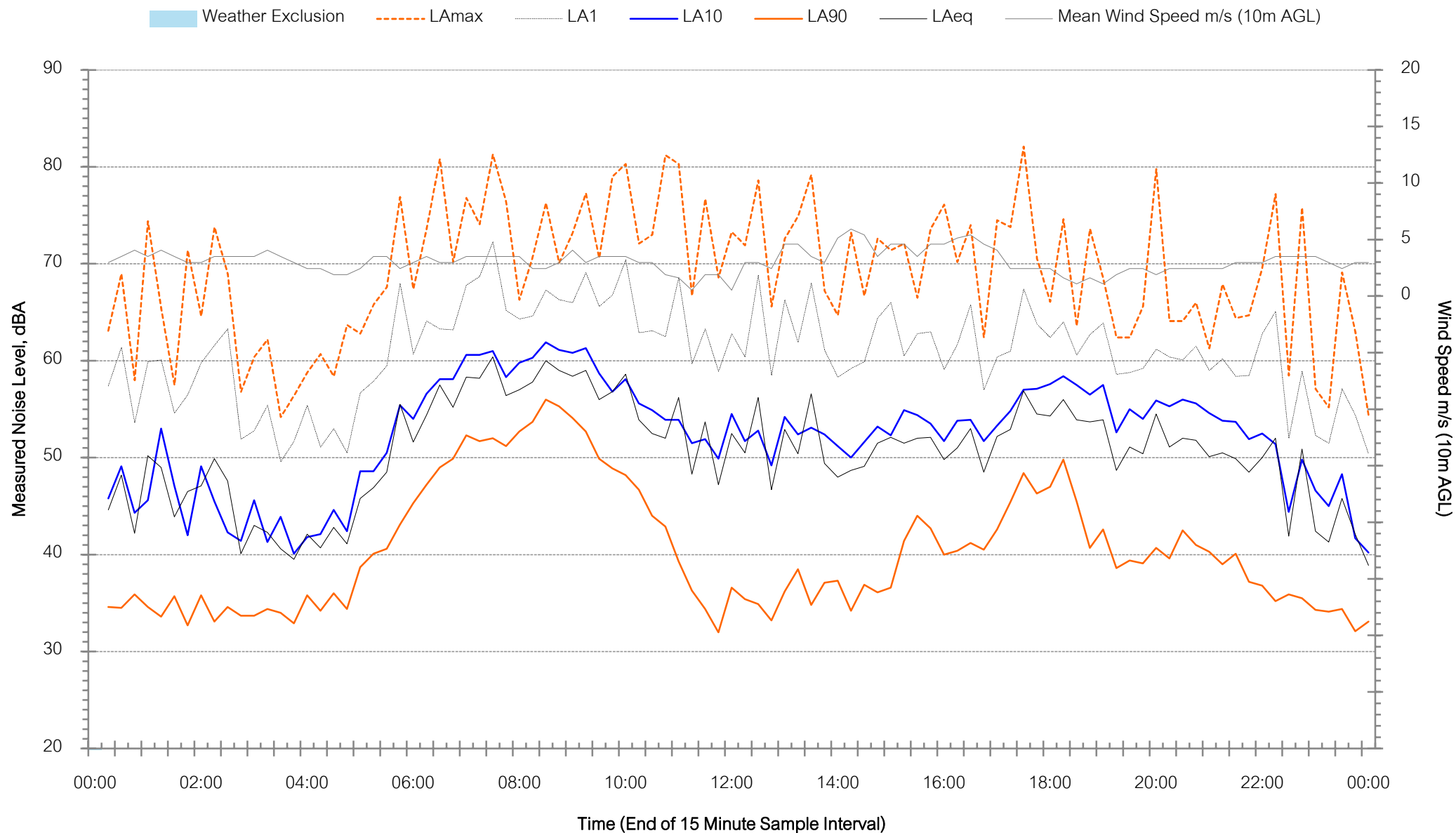
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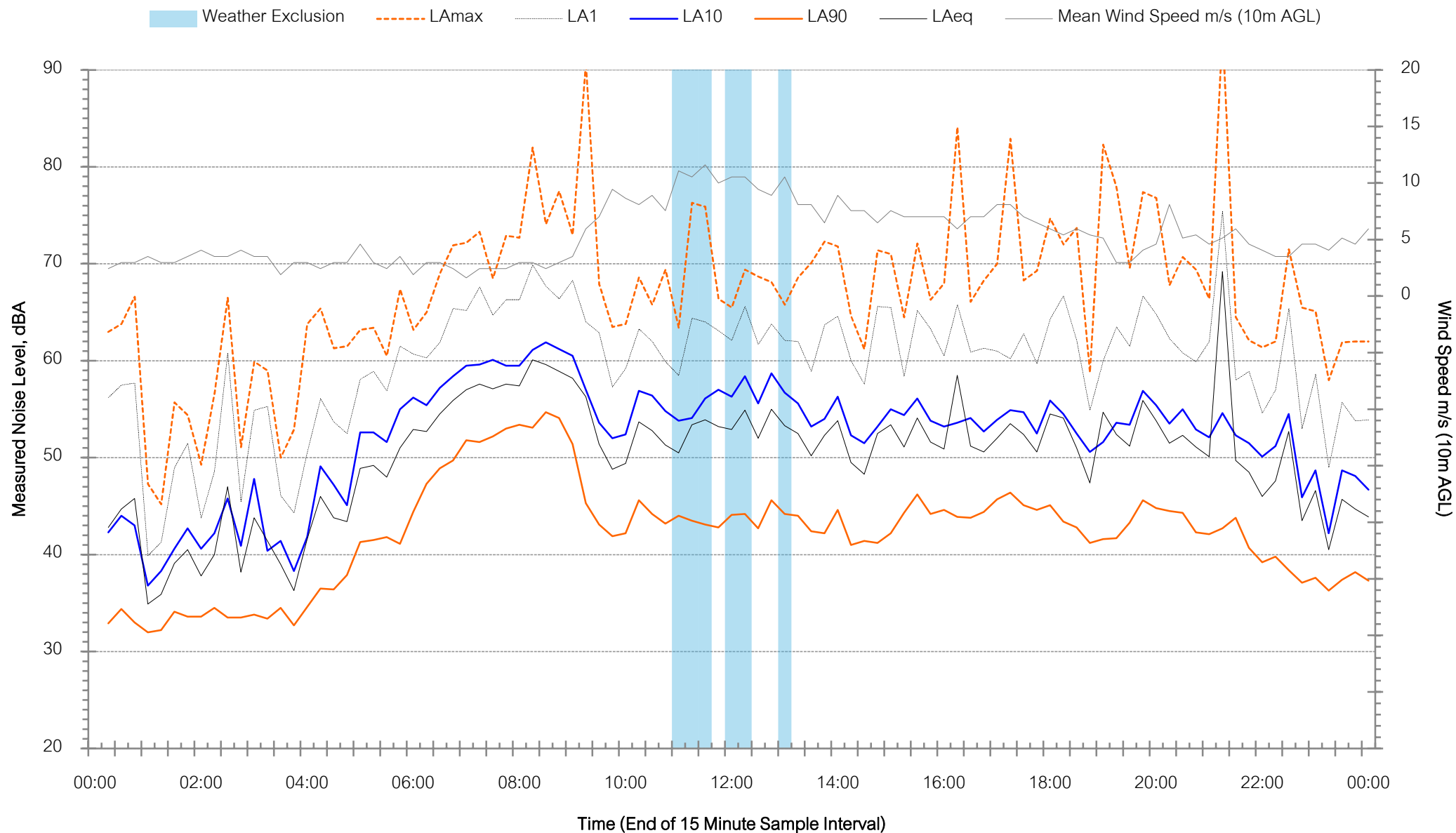
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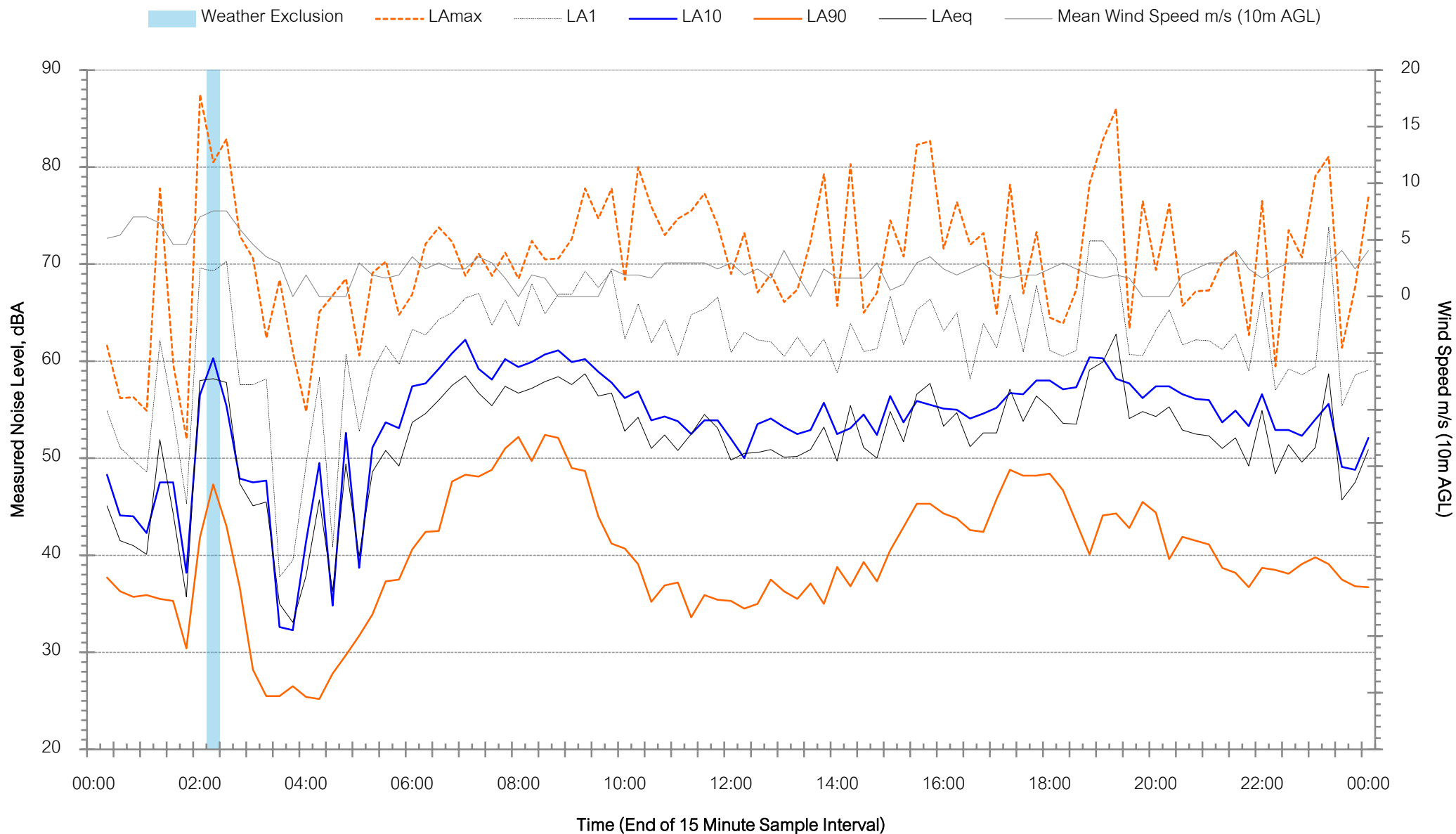
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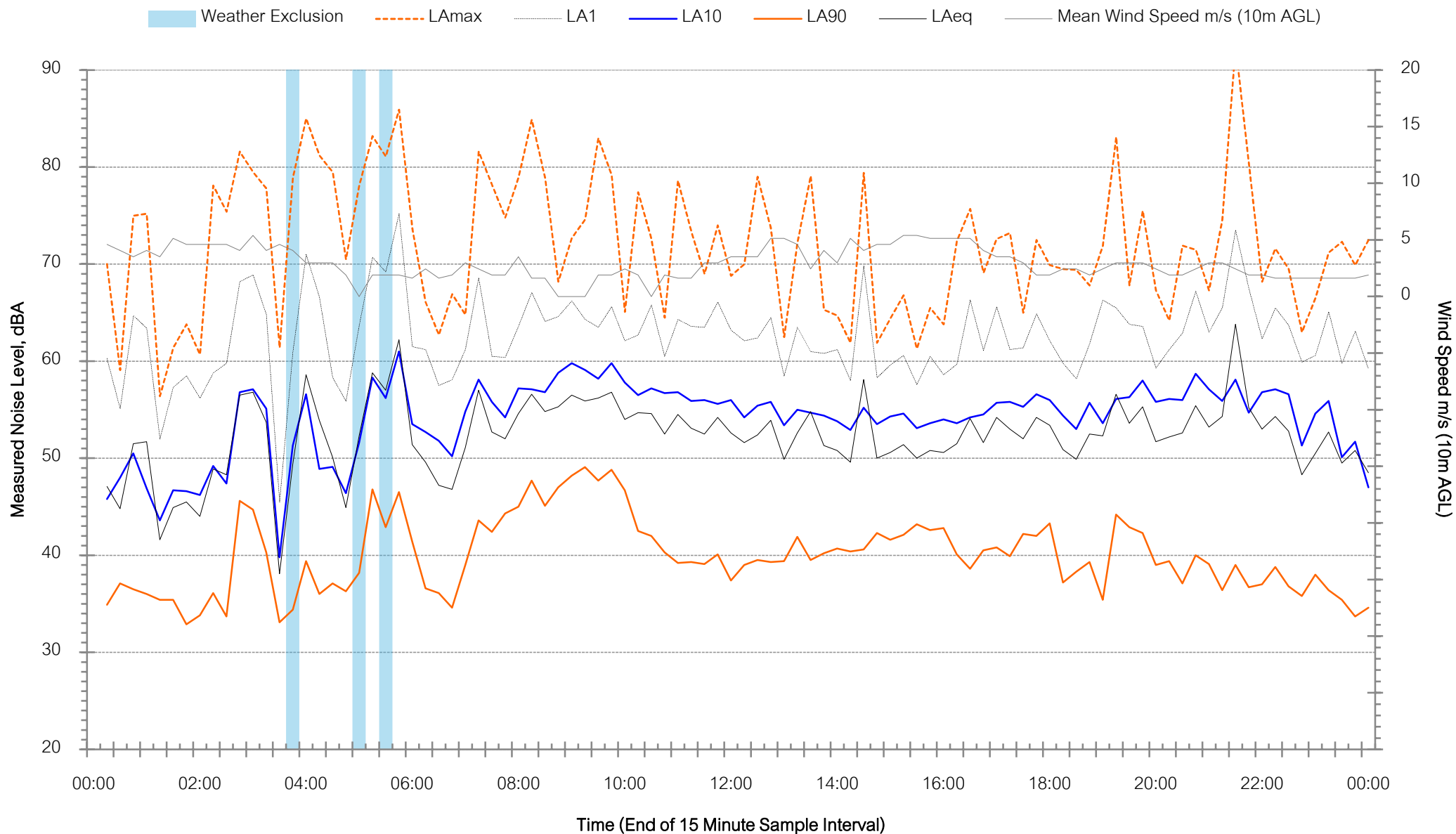
## Background Noise Levels

Boundary Road, Dubbo, NSW - Friday 26 July 2024



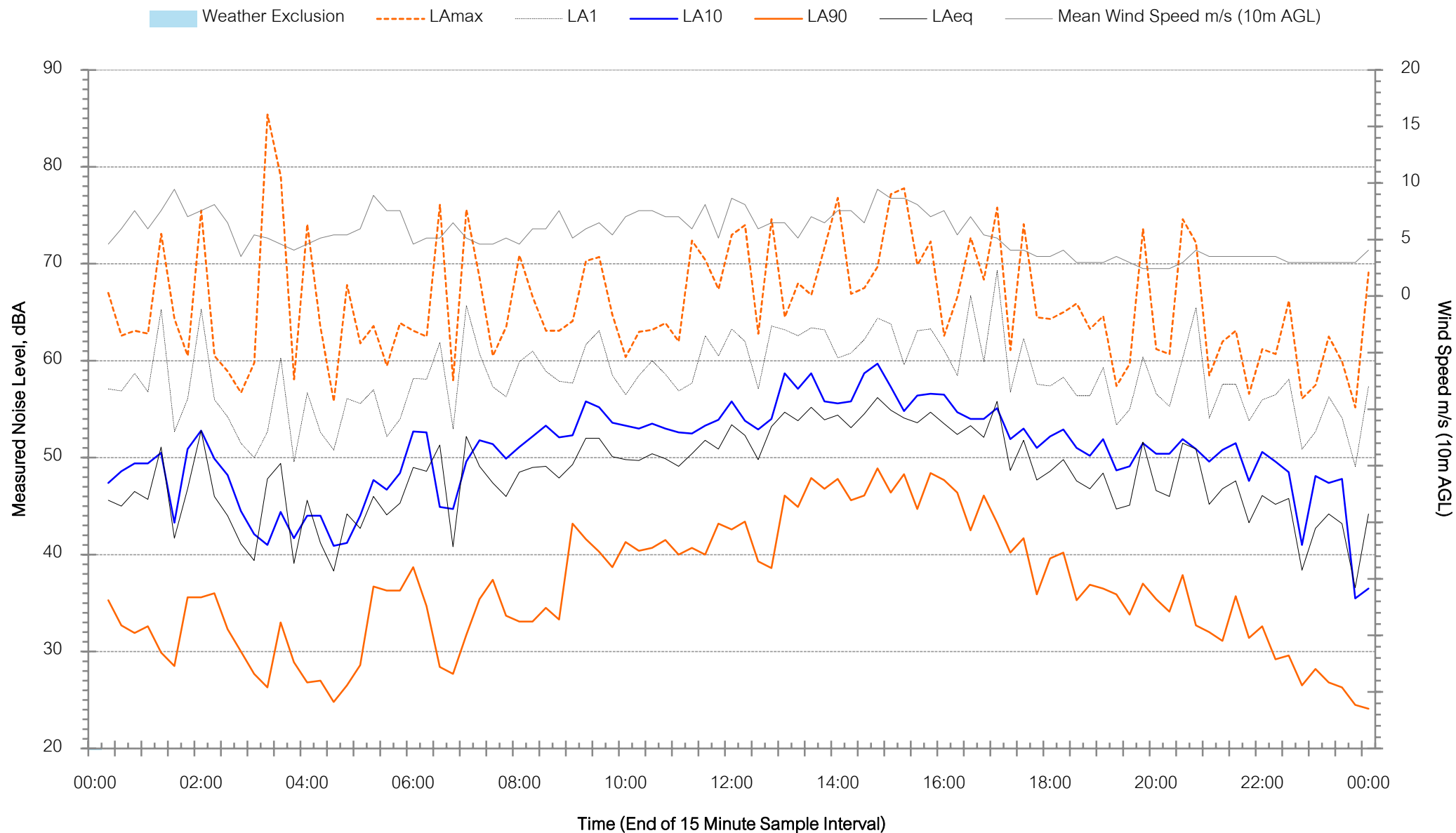
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Boundary Road, Dubbo, NSW - Saturday 27 July 2024



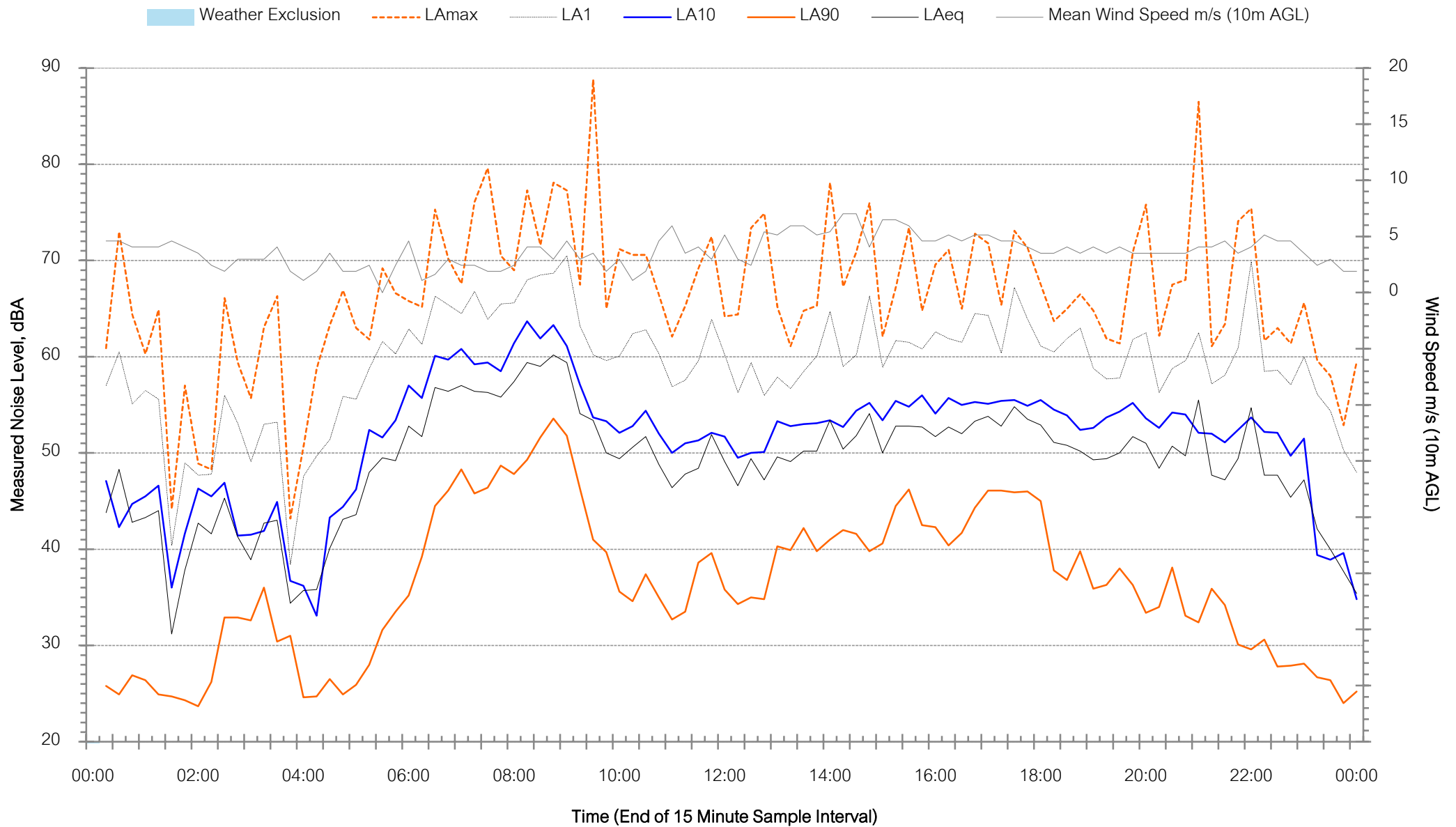
# Background Noise Levels

Boundary Road, Dubbo, NSW - Sunday 28 July 2024



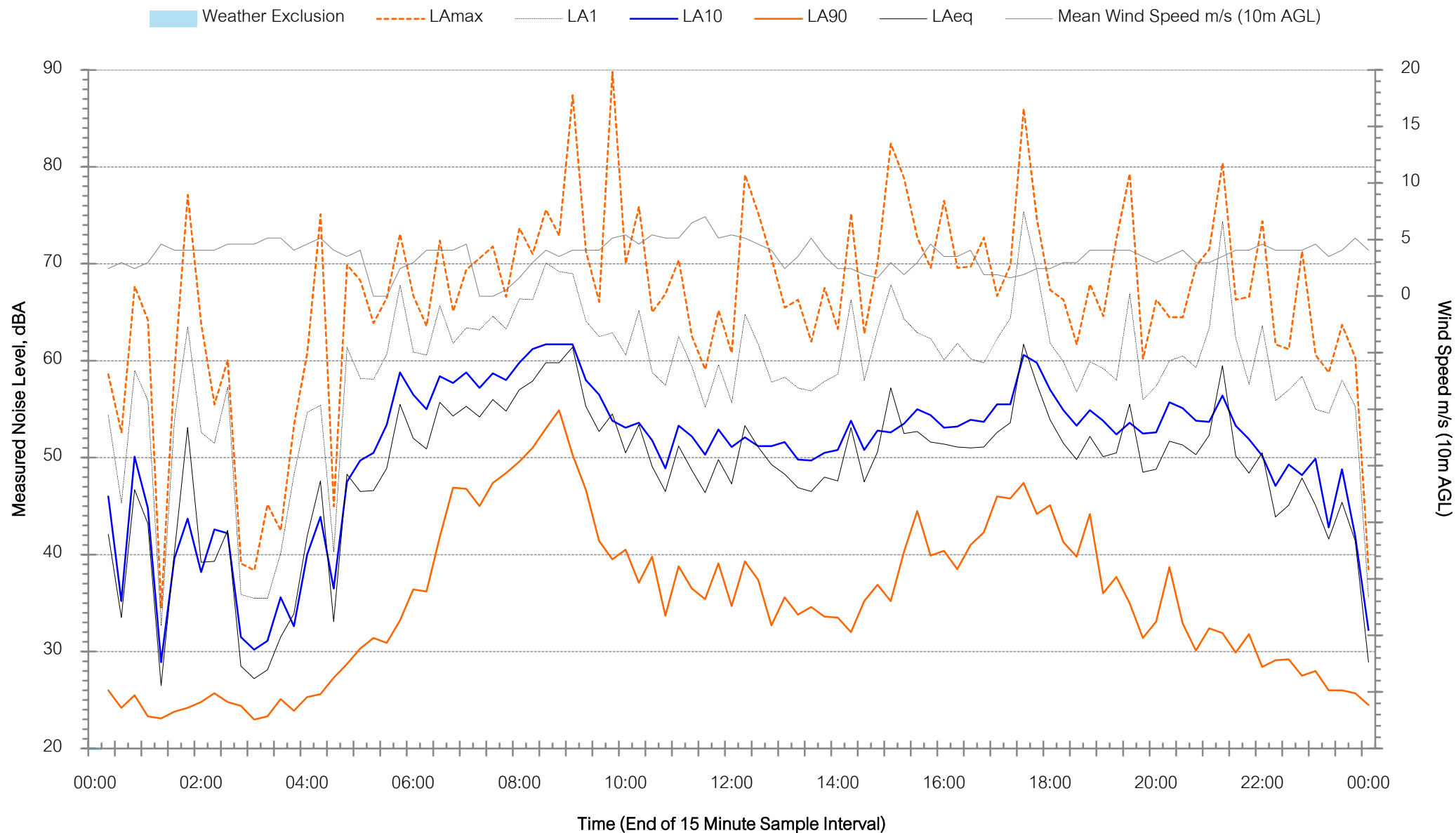
# Background Noise Levels

Boundary Road, Dubbo, NSW - Monday 29 July 2024



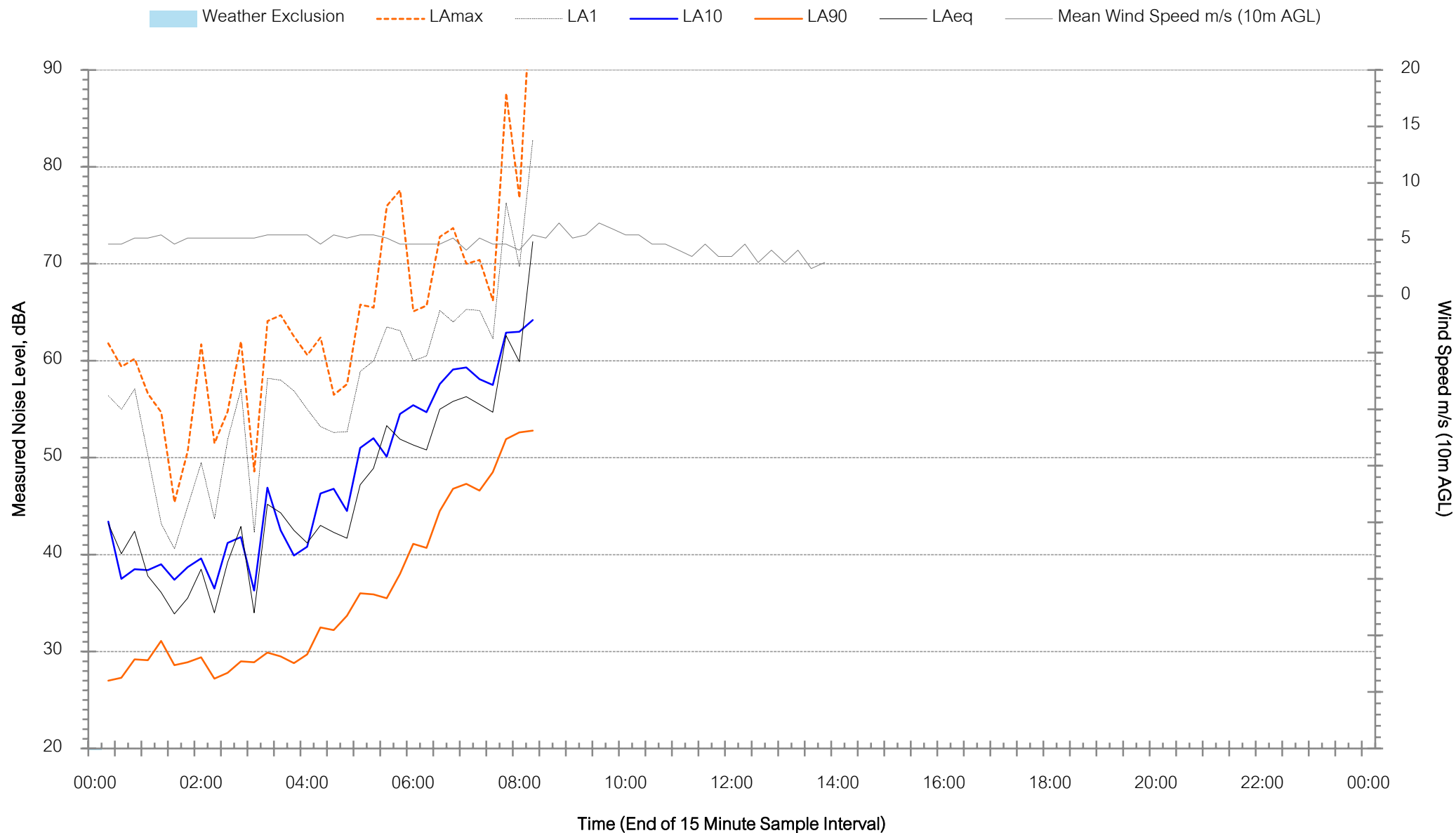
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Boundary Road, Dubbo, NSW - Tuesday 30 July 2024



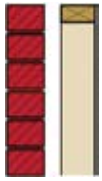
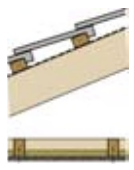
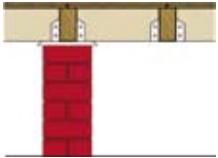
# Background Noise Levels

Boundary Road, Dubbo, NSW - Wednesday 31 July 2024



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# Appendix D – Category 2 Building Elements

| Category No. | Building Element      | Standard Constructions                                                                                                                                                                                                                       | sample                                                                                |
|--------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2            | Windows/Sliding Doors | Openable with minimum 6mm monolithic glass and full perimeter acoustic seals                                                                                                                                                                 |    |
|              | Frontage Facade       | <b>Timber Frame or Cladding Construction:</b><br>6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity. |    |
|              |                       | <b>Brick Veneer Construction:</b><br>110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.                                                   |    |
|              |                       | <b>Double Brick Cavity Construction:</b><br>2 leaves of 110mm brickwork separated by 50mm gap                                                                                                                                                |   |
|              | Roof                  | Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.                                                                                 |  |
|              | Entry Door            | 40mm solid core timber door fitted with full perimeter acoustic seals                                                                                                                                                                        |  |
|              | Floor                 | 1 layer of 19mm structural floor boards, timber joist on piers                                                                                                                                                                               |  |
|              |                       | Concrete slab floor on ground                                                                                                                                                                                                                |  |

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