

# **Riverstone East Precinct (Stage 3) Package C**

Acoustic and Vibration Assessment

**Department of Planning and Environment**

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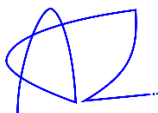

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# 1 Executive summary

## Overview

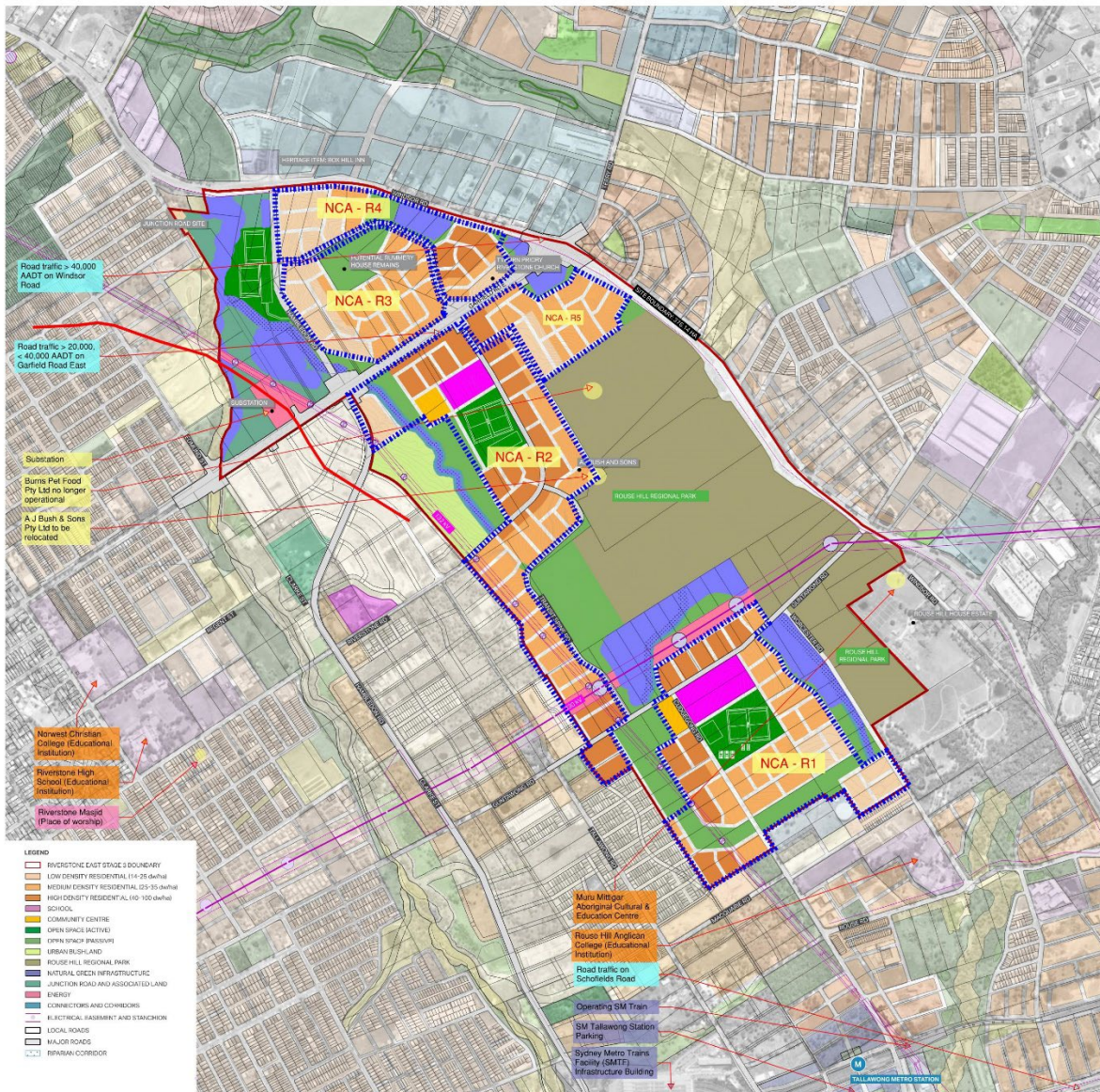
- I. The Department of Planning and Environment (the Department) is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct (Stage 3) of the North West Growth Area (NWGA), nominally identified as Stage 3, in collaboration with Blacktown City Council (Council).
- II. The preliminary noise and vibration assessment undertaken in the earlier stages of planning for the Precinct investigated and identified all the major noise contributors within the precinct and listed out all the existing and future sensitive land uses based on the draft Indicative Layout Plan (ILP).
- III. This Noise and Vibration Assessment provides indicative extent of noise and vibration impacts associated with existing uses and the proposed development of the Precinct for residential purposes. Considerations have been taken into account for road expansion requirements, proposed transport routes and heavy vehicle traffic levels from existing/ proposed development. It also provides recommendations and management strategies for addressing impacts that reflect best practice noise abatement.

## Key findings

- IV. The key noise and vibration risks that have been identified in this assessment are as follows:
  - External noise (aircraft noise/ traffic noise) impacts on the Precinct.
  - Temporary construction noise currently on site which has escalated the background noise within the Precinct.
  - Noise impacts to the surrounding environment associated with operations:
    - AJ Bush meat rendering facility
    - Metro train operations
    - Surface car parking at Tallawong Station
    - SMTF associated with Sydney Metro
    - Proposed substation
  - Local environmental noise within the Precinct.
- V. The nearest residential development (NCA R2) proposed in the draft ILP is adjacent to the AJ Bush meat rendering facility. Based on acoustic analysis of the AJ Bush facility, predicted industrial noise of more than  $L_{eq}$  80 dBA from the operation of AJ Bush & Sons facility at the nearest residential development are expected. These predicted levels are compared to the EPA Noise Policy for Industry Project Noise Trigger Level (PNTL) of 53 (day time) /43 (evening time) /38 (night time) refer to Table 5-6, indicates significant exceedances at the nearest future sensitive receivers. Mechanical noise from the facility will exceed the stipulated noise criteria during day, evening and night time periods. Significant noise mitigation measures are required to reduce the impacts. Typical mitigation measures such as noise barriers and shielding from the mechanical equipment are suggested in this report.
- VI. Sydney metro trains operation have negligible airborne noise impacts which is predominantly generated by a combination of noise from propulsion of the rolling stock and from its interaction with the track around the area. The nearest medium density residential properties (NCA R1) as per the draft ILP is proposed to be approximately 720 m away from the Sydney metro train tracks. Noise from rail operations at the nearest sensitive receivers (within NCA R1) is predicted to be approximately  $L_{eq}$  32 dBA compared to the stipulated noise criteria 60 dBA (day time) /55 dBA (night time). Noise impacts from the operational Sydney Metro are negligible and are not expected to result

in adverse impacts at any of the nearest existing or future sensitive receivers. No further mitigation measures are expected to be required.

- VII. All Sydney Metro operations are controlled and monitored from the Sydney Metro Trains Facility (SMTF) in Rouse Hill, which was built as part of Metro North West Line. SMTF also provides maintenance and stabling facilities. Measured noise at 6 Oak Street Schofields NSW provide no evidence of noisy activities within the SMTF during day time. A detailed analysis is required based on the information from *Sydney Metro Train Facility (SMTF) Operational Noise and Vibration Review (ONVR)* specific to SMTF North which will have noise impacts from the SMTF during standard and OOHV periods.
- VIII. An operational carpark noise assessment has been undertaken for the surface carpark associated with Tallawong Station. The carpark contains 1000 car park spaces and 30 motorcycle spaces. The derived source noise level (Sound Power Level) for the carpark is 105 dBA calculated based on the *Bavarian State Agency for the Environment 2007, Parking Area Noise, 6th Edition, Bavarian State Ministry for the Environment, Germany*. The predicted noise impact from the operation of the carpark is less than the daytime and evening shoulder period intrusiveness noise level of 42 dB(A) $L_{eq(15min)}$  and 41 dB(A) $L_{eq(15min)}$  respectively. The propagation of the carpark noise to nearby sensitive receivers would not exceed the NPfl noise criterion and noise emanating from the car park would not be an issue.
- IX. The precinct is surrounded by major roads such as Windsor Road, Garfield Road East and Schofields Road. Table 5-4 provides a summary of current and future traffic volumes (AADT) on these three major roads. The summary indicates traffic volumes for Windsor Road and Schofields Road is exceeding 20,000 AADT currently and for future scenarios, traffic volumes for Garfield Road East will exceed 20,000 AADT in future scenarios. Figure 6-4 highlights the future residential properties (predominantly within NCA R2, NCA R3 and NCA R4 facing Windsor Road and Garfield Road East) which will be affected by high traffic noise from these roads.
- X. Aircraft noise with respect to RAAF Richmond airport was assessed in accordance with AS 2021 – 2015. Riverstone East precinct is located in the region which is less than 20 ANEF as per Richmond RAAF Airport 2014 ANEF Map. The buildings within the precinct are therefore deemed “Acceptable” and no further assessment is required for the precinct with respect to AS 2021-2015.
- XI. There are no major vibration inducing activities or equipment within the Precinct that can impact adversely on any of the sensitive receivers. No further vibration mitigation measures are required. The vibration impacts during construction stage may warrant consideration at the development application stage. Typically vibration impacts from the construction phase would be mainly due to vibration intensive construction equipment such as compactor, excavator with a rock breaker attachment etc. While the impacts will be occurring for a temporary duration, the effects from these vibration impacts will be temporary, negligible and minor as the construction area is located beyond the safe working buffer distance.
- XII. A map overlain with the draft ILP which provides the nearest sensitive receivers is provided in **Figure 1-1** below.



**Figure 1-1: Nearest sensitive receivers with respect to the Riverstone East (Stage 3) draft ILP (Aurecon and Hatch Roberts Day, August 2023)**

## Key Recommendations

### Industrial Noise

- XIII. Based on the predicted noise emissions from the AJ Bush site, a combination of site separation and barriers may be required to reduce noise emissions to within the NPfI limits at residential uses, particularly if the site operates during the night period.
- XIV. Based on the predicted existing emissions from the site, the following indicative separation distances (from the noise sources such as mechanical plant) have been identified. Further acoustic modelling and studies would be required to be undertaken to validate these indicative values.

Table 1-1: Distance attenuation from noise source (such as mechanical plant within AJ Bush facility)

Operating period	NPfl limit, $L_{Aeq}$ , dBA	Separation distance to achieve noise limits	
		No Barrier	With barrier (10 dB attenuation)
Day	53	250m	80m
Evening	43	800m	250m
Night	38	1400m	400m

Road Noise

- XV. The T&I SEPP 2021 requires a detailed traffic noise assessment for residential properties that are on land adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW). Future residential properties as mapped on Figure 6-4 will be affected by high traffic noise from these roads. This would be undertaken at the Development Application stage. Refer to Figure 5-1 for TfNSW Map showing traffic volumes near busy roads such as Windsor Road and Garfield East Road. Windsor Road is subject to traffic with more than 20,000 vehicles (year 2036), so in accordance with the *State Environmental Planning Policy (Transport and Infrastructure) 2021*, urban developments in these locations may warrant a detailed traffic noise assessment at the Development Application stage.
- XVI. At the Development application stage, detailed traffic noise assessments are to be prepared in accordance with the methodology pursuant to the RMS “*Preparing an Operational Traffic and Construction Noise and Vibration Assessment Report*”, RMS “*Road Noise Policy*”, TfNSW “*Road noise model validation guideline*” and DoP “*Development near Rail corridors and busy roads – Interim Guideline*”. The traffic noise assessment ensures the noise from operating traffic at the façade of the existing and new residential users are within the stipulated criteria in accordance with RMS Noise Criteria Guideline and other guidelines. The noise modelling should consider a hierarchy of noise mitigation measures including future planned commercial activities to assess the cumulative effect of noise mitigation measures on the predicted impacts.
- XVII. For receivers that qualify for consideration of additional noise mitigation measures, identify potential noise mitigation measures from the list below. Options for noise mitigation measures are listed below in the order of preference for application given in the RMS Road Noise Policy (RNP):
  - Quieter pavement surfaces
  - Noise mounds
  - Noise walls
  - At-property treatments.
- XVIII. For traffic generally, road tyre noise appears to dominate at around 70 km/h. This means that in areas with posted speeds of 70 km/h or more, the reduction of road tyre noise can be a useful noise reduction treatment. A quieter pavement surface should be considered where there are groups of four or more receivers that exceed the criteria and before the use of noise barriers.
- XIX. The vibration impacts during the construction stage may warrant consideration. Typically vibration impacts from the construction phase would be mainly due to vibration intensive construction equipment such as compactor, excavator with a rock breaker attachment etc. While the impacts will be occurring for a temporary duration, the effects from these vibration impacts will be temporary, negligible and minor as the construction area is located beyond the safe working buffer distance. This can be adequately addressed at the Development Application stage, post-rezoning.



# 2 Introduction

## 2.1 Site context

The Department is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct of the North West Growth Area (NWGA), nominally identified as Stage 3, in collaboration with Blacktown City Council (Council).

The Precinct, located within Blacktown local government area (**Figure 2-1**), is bound by Windsor Road to the northeast, lands designated for Rouse Hill Regional Park in the east including the developing lands within the Tallawong Station Precinct to the south, the developing Riverstone East Stage 1 and 2 lands to the west, and First Ponds Creek in the northwest. The precinct includes Lots 1 and 2 DP 218794 Junction Road to the north-western corner which partially straddle the adjacent Riverstone Precinct, and sites owned by Burns Pet Food and A J Bush and Sons. The Riverstone East Precinct is within North West Growth Area precincts in the Blacktown, Hills Shire and Hawkesbury local government areas. The Precinct covers approximately 174 hectares (excluding Rouse Hill Regional Park).

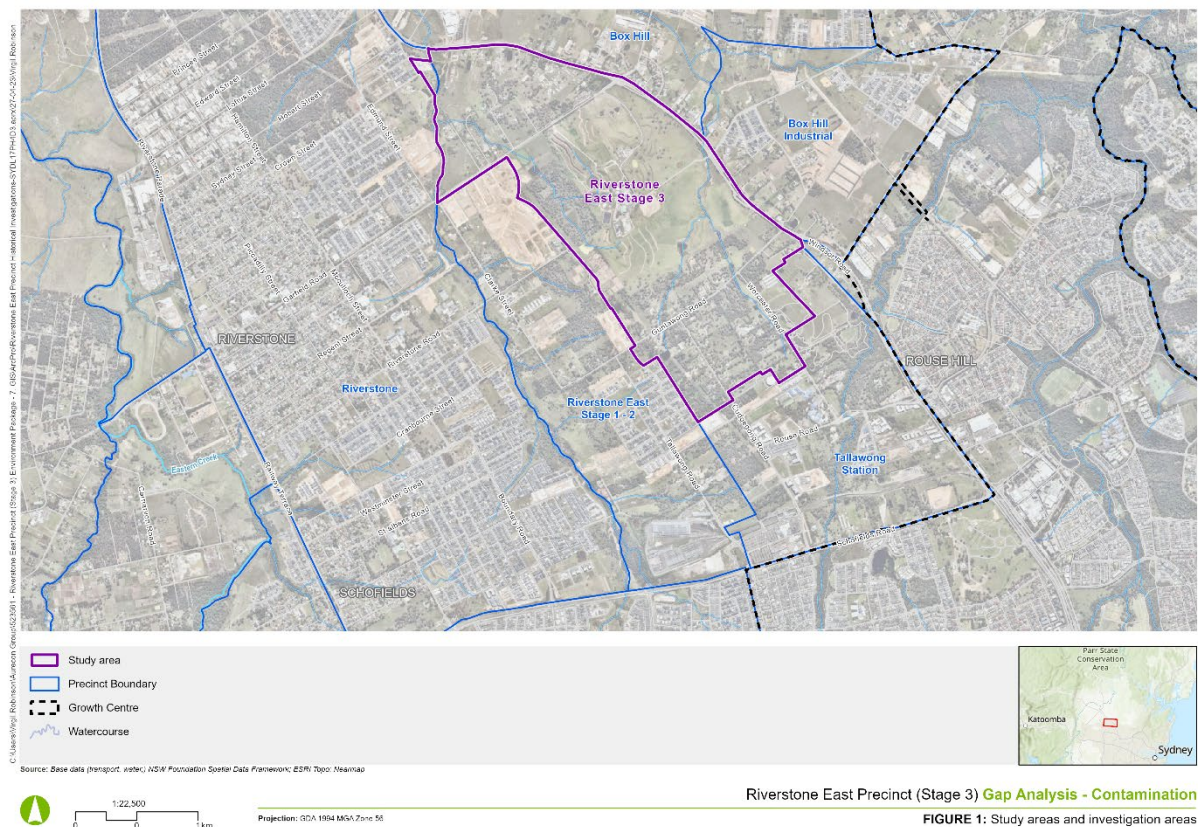


Figure 2-1 : Riverstone East stage 3 Precinct boundary (Aurecon, August 2023)

## 2.1.1 Background

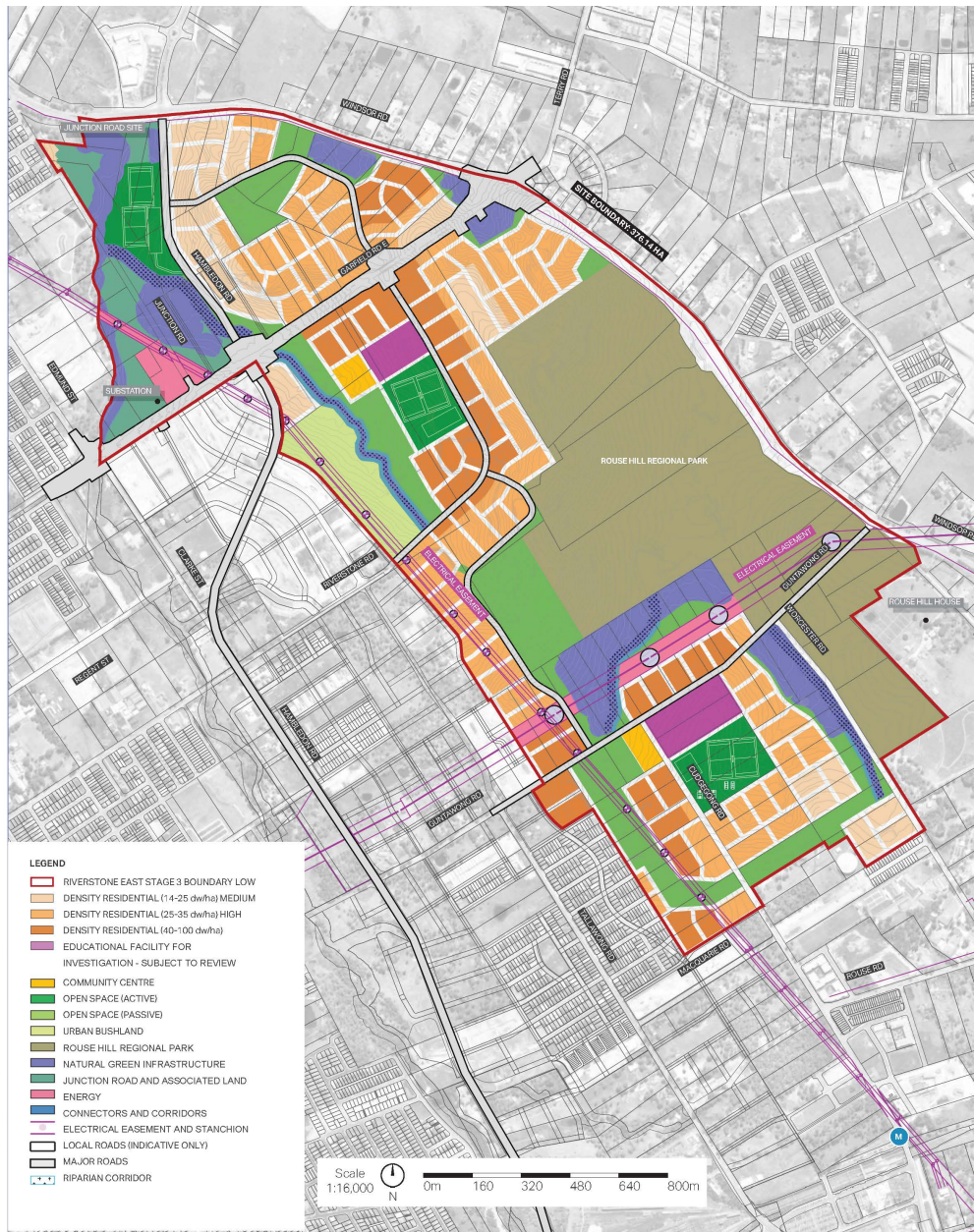
The Planning Minister released the Riverstone East Precinct for planning in August 2013. This will be the final stage of planning for the Riverstone East Precinct, building on the planning undertaken for Stages 1 and 2, which were rezoned in 2016. Preliminary urban design and technical analysis was undertaken for the Stage 3 area in conjunction with Stages 1 and 2. A draft Indicative Layout Plan (ILP) for Stage 3 was made available during the exhibition period for Stages 1 and 2 (**Figure 2-2**). This body of work remains relevant to precinct planning for Stage 3, though will need to be validated and updated to respond to changed site conditions and contemporary policy settings. The Department has prepared a summary of the findings from the work undertaken previously for Stage 3 which has been considered as part of this assessment.

The key impediment to the progression of Stage 3 was limited electrical and sewer servicing capacity. Although these capacity constraints have eased with planned network upgrades by Endeavour Energy and Sydney Water, it is acknowledged that the servicing will need to be confirmed as part of the master planning exercise.

The refined draft ILP for Riverstone East Stage 3 is provided in **Figure 2-3**.



Figure 2-2 : Draft Indicative Layout Plan for Riverstone East (The Department, 2016)



**Figure 2-3: Draft Indicative Layout Plan for Stage 3 (Hatch Roberts Day, September 2023)**

## 2.1.2 Stage 2 assessment

As part of this assessment, opportunities and constraints mentioned in Stage 1 are consolidated and tested against the precinct's vision which will be iteratively tested and refined throughout the process, while identifying project ideas and opportunities for the precinct.

## 2.2 Reference documentation

- *Assessing Vibration: A Technical Guideline* (DEC, 2006)
- Australian/New Zealand Standard AS/NZS 1668.1:1998 *The use of ventilation and air-conditioning in buildings, Part 1: Fire and smoke control in multi-compartment buildings*
- Australian/New Zealand Standard AS/NZS 2107:2016 *Acoustics-Recommended Design Sound Levels*
- *Construction Noise and Vibration Strategy* (TfNSW, 2020)
- *Development Near Rail Corridors and Busy Roads – Interim Guideline* (NSW DoP, 2008)
- *Interim Construction Noise Guideline* (NSW DECC, 2009)

- *Noise Policy for Industry* (NSW EPA, 2017)
- *Road Noise Policy* (NSW DECCW, 2011)
- RMS Noise Criteria Guideline (NSW DECCW, 2014)
- Australian Standard AS 2021 – 2015 Acoustics – Aircraft noise intrusion – Building siting and construction
- *State Environmental Planning Policy (NSW Transport and Infrastructure) 2021* (T&I SEPP)
- *State Environmental Planning Policy (Precincts – Central River City) 2021*
- North West Growth Centre Development Control Plan 2010 (DCP)

## 2.3 Key noise and vibration risks

The key noise and vibration risks that have been identified in this assessment are as follows:

- External noise (aircraft noise/ traffic noise) impacts on the precinct.
- Temporary construction noise currently on site which has escalated the background noise within the precinct.
- Noise impacts to the surrounding environment associated with operations:
  - AJ Bush meat rendering facility
  - Metro train operations
  - Surface car parking at Tallawong Station
  - SMTF associated with Sydney Metro
  - Proposed substation
  - Local environmental noise within the precinct.

## 3 Site description

The Riverstone East Stage 3 Precinct (the Precinct), located within the Blacktown local government area, is generally bound by Windsor Road to the northeast, lands designated for Rouse Hill Regional Park in the east including the developing lands within the Tallawong Station Precinct to the south, the developing Riverstone East Stage 1 and 2 lands to the west, and First Ponds Creek in the northwest. The precinct, include Lots 1 and 2 DP 218794 Junction Road to the north-western corner which partially straddle the adjacent Riverstone Precinct, and sites owned by Burns Pet Food and A J Bush and Sons. The Riverstone East Precinct is surrounded by NWGA precincts in the Blacktown, Hills Shire and Hawkesbury local government areas. The Precinct covers approximately 174 hectares (excluding Rouse Hill Regional Park).

Mechanical noise associated with Poultry and Market Garden Services (currently on AJ Bush & Sons manufacturer site) is a predominant characteristic of the precinct. Currently, the AJ Bush and Sons industrial facility is contributing to industrial noise around the area and affecting the external noise criteria for all the existing and future residential properties surrounding the site. The noise assessment has considered the existing mechanical noise from this industrial premise and its impacts on the existing/ future uses. Burns Pet Food Pty Ltd is no longer operational and therefore no future noise impacts from that facility have been considered.

The precinct is bounded by Windsor Road on the north, Garfield Road East on the western side and Schofields Road on the east. Sydney Metro operations to and from Tallawong Station and the SMTF may impact on the sensitive receivers within the Precinct.

### 3.1 Surrounding sensitive receivers

Noise and vibration sensitive receivers are generally categorised by the type of occupancy and/or the activities performed within the property boundary. This includes:

- Residences (including multi-floor dwellings): Each floor of a multi-floor dwelling is considered to be a separate sensitive receiver as each floor could have separate property owners and/or land uses (e.g. commercial ground floor and residential first floor)
- Educational institutes including schools
- Places of worship
- Commercial or industrial premises

The potentially nearest affected sensitive receivers in relation to the site are summarised in Table 3-1:

Table 3-1: Sensitive receivers

NCA	Sensitive receivers	Type
NCA – R1 NCA – R2 NCA – R3 NCA – R4	Low/ Medium/ High density future residential properties within the precinct	Residential
NCA - Place of Worship	Riverstone Masjid	Place of worship
NCA - School	Rouse Hill Anglican College Riverstone High School Norwest Christian College	Educational institute
NCA – Passive recreational area	Rouse Hill Regional Park	Passive recreational area

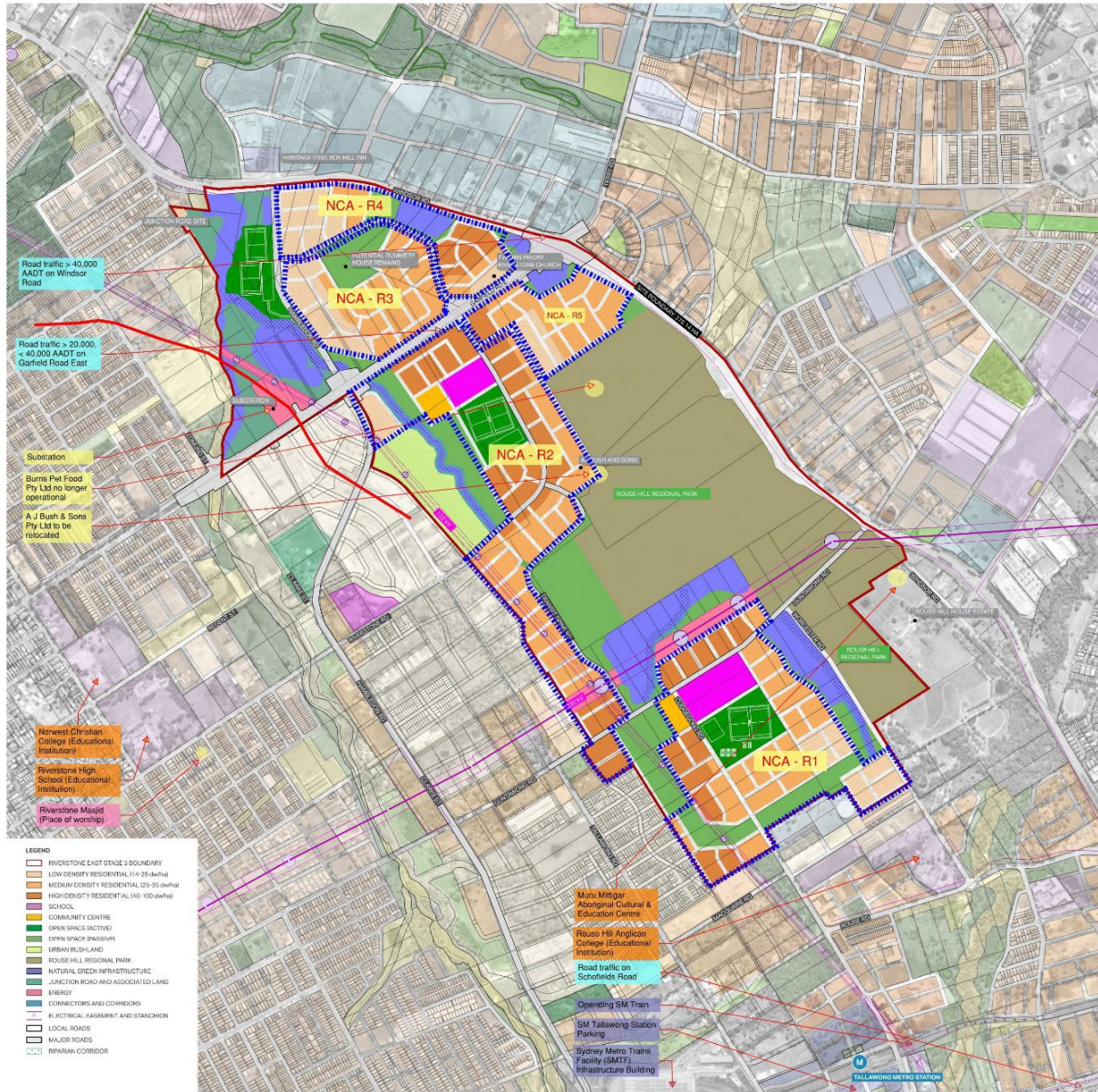


Figure 3-1 : Nearest sensitive receivers with respect to the draft ILP (Aurecon and Hatch Roberts Day, August 2023)

## 4 Ambient noise survey

A survey of the existing ambient noise levels around the site was conducted using both unattended and attended measurements. All instruments have current calibration from a NATA accredited laboratory and comply with Australian Standard AS-1259: *Sound Level Meters*. Noise measurements were conducted between 19 July 2023 and 2 August 2023, at two locations as illustrated in **Figure 3-1**.

### 4.1 Methodology

Baseline noise measurement location considerations included land topography, distance from main roads to surrounding existing sensitive residencies and contribution from other environmental noise sources (e.g. road traffic, metro etc.).

During a site visit on 19<sup>th</sup> July 2023 the background noise was predominantly affected by road traffic and well as construction work related to land development across a number of sites within the precinct. Noise loggers were placed away from these construction activities to exclude the extraneous noise from these activities. Post processing of the noise data was also undertaken to exclude extraneous noise based on guidance within NPfI. The noise levels measured at these locations would also be representative of the noise levels at future residential properties within the site.

All measurements were performed in accordance with the Australian Standard AS1055 2018 '*Acoustics – Description and measurement of environmental noise*'.

### 4.2 Unattended and attended noise measurements

Long-term unattended noise monitoring was carried out using two RIONs, one ARL Ngara and one Larson and Davis LXT environmental noise loggers (Refer to Table 4-1 for details), installed with microphone at a height of 1.5m and at least 2.5 from any reflecting façade. Monitoring was conducted from the 19 July 2023 and 2 August 2023, with all monitors set to measure continuously using an A-weighted fast response mode. The monitors were calibrated before and after the monitoring period and no calibration drift exceeding  $\pm 1$  dB(A) was observed.

Attended measurements was undertaken using B&K 2270 Type 1 Sound Level Meter on 19<sup>th</sup> July and 2<sup>nd</sup> August 2023.

The data collected by the noise monitors was analysed, and any invalid data removed. Invalid data generally refers to periods where average wind speeds were greater than 5m/s and/or when rainfall occurred, in accordance with the requirements of *Noise Policy for Industry* (NPfI) (NSW EPA, 2017). Concurrent weather data was sourced from the Bureau of Meteorology's Penrith Lakes (station ID: 067113), Automatic Weather Station (AWS), approximately 21 km from the site, to identify any periods of weather which may have affected the monitoring results. Additional weather data was also collected from Richmond RAAF (Station ID: 067105) AWS which is 15 km from the site.

A summary of the unattended continuous noise monitoring at each location is presented in Table 4-2 and attended noise measurement results are summarised in Table 4-3. Detailed noise monitoring data is attached in Appendix B. Local construction work associated with land development was audible at few monitoring locations. These extraneous noises have been excluded from the results in accordance with NPfI methodology.

Table 4-1: Noise logger details

Logger location	Address	Logger make / model	Serial number	Calibration due date
L1	1034 Windsor Road, Rouse Hill NSW 2155	Rion NL-21	00709529	08/07/2024
L2	293 Garfield Road East, Riverstone NSW 2765	Larson Davis LxT 1 SoundExpert	0001719	12/07/2024

Logger location	Address	Logger make / model	Serial number	Calibration due date
L3	150 Cudgegong Road, Rouse Hill NSW 2155	Rion NL-21	00709528	08/07/2024
L4	Corner of Garfield Road East and Windsor Road, Riverstone NSW	Ngara	878000	05/05/2024

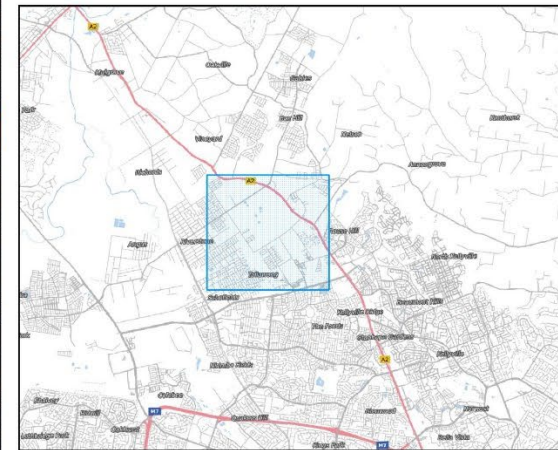


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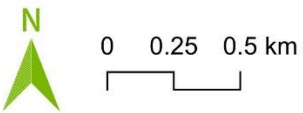
**Legend**

- Attended monitoring location
  - Unattended noise monitoring location
  - Riverstone East Stage 3 Boundary
- Roads**
- Motorway or Highway
  - Primary, Secondary or Tertiary
  - Local roads
  - Cycleway, footpath etc.



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Co-ordinate system: GDA2020 / MGA zone 56 ( EPSG:7856)

**Riverstone East Stage 3 Precinct Noise  
Noise monitoring locations**

**Figure 4-1 : Noise monitoring locations with respect to the Precinct (Aurecon, August 2023)**

Table 4-2: Unattended noise monitoring results

Location	Rating background noise level (RBL) dB(A)L <sub>90</sub> (period)			Average noise level dB(A)L <sub>eq</sub> (period)						
	Day	Evening	Night	Day	Evening	Night	Day (15hr)	Night (9hr)	Day (worst 1hr)	Night (worst 1hr)
L1 (1034 Windsor Rd Rouse Hill)	67	62	57	76	72	70	75	70	77	75
L2 (293 Garfield Road East, Riverstone)	43	43	36	51	50	48	51	48	53	52
L3 (150 Cudgegong Road, Rouse Hill)	38	38	34	55	52	48	54	48	57	52
L4 (328 Garfield Road East, Riverstone) <sup>1</sup>	43 (42)	43 (42)	42 (38)	52 (51)	54 (52)	52 (50)	53 (52)	52 (50)	56 (54)	55 (53)

Note 1: RBL is the median of the measured LA90 noise level during the day, evening and high-time periods of the monitoring programme.

Note 2: For the rating background and ambient noise levels, the periods are defined as per the NPI (EPA, 2017):

- Day: the period from 7.00 am to 6.00 pm Monday to Saturday or 8.00 am to 6.00 pm on Sundays and public holidays
- Evening: the period from 6.00 pm to 10.00 pm
- Night: the remaining periods.

For the 15-hour and 9-hour ambient noise levels, as per the Development Near Rail Corridors and Busy Roads – Interim Guideline (NSW DoP, 2008), day refers to the 7am to 10pm while night refers to 10pm to 7am.

<sup>1</sup> Measured average ambient noise level with, (without insect noise). Insect noise was a feature of the site. All the data was reviewed and the periods with significant extraneous noise from insects (> 2000 Hz) was removed from the analysis.

Table 4-3: Attended noise monitoring result

ID	Location	Start Time	Finish Time	Duration m:ss	L <sub>Aeq</sub>	L <sub>A90</sub>	L <sub>A10</sub>	L <sub>Amin</sub>	L <sub>Amax</sub>	Description
<b>19<sup>th</sup> July 2023</b>										
A2a	293 Garfield Road East, Riverstone NSW	10:34	10:50	15:41	68	52	71	47	87	Distant construction noise (extraneous) from adjacent land redevelopment was clearly audible (LAF 51.8 dBA). Crane/ Dump Truck/ Excavator/ Water Cart/ Light vehicle. Traffic on Garfield Rd E was mainly light vehicle + few heavy trucks.
		10:52	10:59	06:55	68	49	72	46	87	
A3	150 Cudgegong Road, Rouse Hill NSW	11:45	12:06	20:46	61	39	62	36	84	Occasional traffic (light vehicles) on Cudgegong Road. Distant construction noise from nearby land development, LAF - 42.4, 40.1 dBA.
		12:02	12:17	15:05	64	40	65	34	87	
A1	1034 Windsor Road, Rouse Hill NSW	12:27	12:45	17:44	71	59	75	51	85	Predominantly light vehicles on Windsor Road with occasional heavy vehicles dominating the background noise.
A4	Burns Pet Food, 328 Garfield Road East, Riverstone NSW	13:07	13:22	15:00	56	46	57	44	79	Occasional mechanical hum at the measurement location from AJ Bush Plant operation, LAF 51.5 dBA. Occasional heavy trucks pass-bys within AJ Bush Premises. Insect noise and few dogs barking extraneous noises
A5	51 Worcester Road, Rouse Hill NSW	13:43	13:58	15:00	58	41	56	39	78	Distant construction noise LAF 40.5 dBA. Few Metro train horns. Animal extraneous noises (Dogs/ Chicken/ Hen)
<b>2<sup>nd</sup> August 2023</b>										
A4	Burns Pet Food 328 Garfield Road East, Riverstone NSW	13:28	13:30	02:35	48	45	49	44	59	Moderate traffic on Windsor Road and Garfield Road East are the dominant sources of noise. LAF between 47 and 49 dB. Bird/ insect noises are occasional but excluded. Noise from AJ Bush facility is inaudible at this location.
		13:32	13:33	00:21	47	46	48	45	49	
		13:36	13:42	06:35	48	43	49	41	66	
A2b	293 Garfield Road East - next to logger	13:57	14:04	07:03	47	42	50	38	57	Moderate traffic on Garfield Road. Construction noise is inaudible. Traffic noise ranges from LAF 46 to 50 dBA
		14:06	14:07	00:33	47	44	49	42	51	
A2b	293 Garfield Road East - in front of gate	14:12	14:17	04:28	70	52	73	47	88	Traffic on Garfield Road is the dominant source of noise at around LAF 69 to 78 dBA. No construction noise audible
A3	150 Cudgegong Road, Rouse Hill	14:33	14:37	04:00	64	41	68	36	78	Local traffic (light vehicles) on Cudgegong Road is the dominant noise source at around LAF 71 to 76. Distant traffic around 41 dBA LAF. No construction noise is audible. Birds chirping with LAF around 46 dBA.
A7	6 Oak St, Schofields NSW 2762	15:20	15:25	04:50	43	38	46	36	59	Noise from Sydney Metro Headquarters is inaudible. It is likely there were no noisy activities during the measurement period. Construction activity on land adjacent to Tallawong road across the site is the dominant source of noise (excavator, loader and dump truck)

ID	Location	Start Time	Finish Time	Duration m:ss	L <sub>Aeq</sub>	L <sub>A90</sub>	L <sub>A10</sub>	L <sub>Amin</sub>	L <sub>Amax</sub>	Description
A8	Sydney Metro Headquarters - Tallawong Road bridge	15:38	15:40	01:53	69	51	74	47	83	Construction noise is inaudible during lulls of traffic on Tallawong road. It is likely there were no noisy activities during the measurement period. Frequent traffic on Tallawong Road with LAF varying from 55 to 75 dB
A9	259 Riverstone Road	15:53	15:59	05:52	47	45	48	43	66	Mechanical plant noise from the AJ Bush is the dominant source of noise at this location with LAF 47.3 dB. No construction noise is audible. Occasional birds chirping with LAF up to 58 dB
A6	54 Terry Road, Rouse Hill NSW	14:48	14:49	00:31	52	40	58	39	60	Strategic location chosen to measure Sydney Metro train pass-bys. Occasional traffic noise from Schofields Road. Sydney Metro pass-bys was clearly audible and had >10 dB Signal to Noise Ratio (SNR)
		14:52	14:52	00:25	52	42	57	41	57	
		14:58	14:59	00:41	50	43	55	41	58	
		15:02	15:03	00:30	51	43	56	42	57	

# 5 Noise and vibration criteria

## 5.1 External (road traffic) noise impacts

### 5.1.1 NSW Department of Planning

The T&I SEPP 1 Clause 2.120 *Impact of Road noise or vibration on non-road development* stipulates:

- (1) *This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration -*
- *residential accommodation*
  - *a place of public worship*
  - *a hospital*
  - *an educational establishment or centre based child care centre*

Map 10<sup>2</sup> of the traffic volume maps for the T&I SEPP classifies Windsor Road with traffic volume more than 40,000 AADT vehicles and Garfield Road East with AADT of more than 20,000 Vehicles. A detailed traffic noise assessment should be undertaken to assess traffic noise impact at the precinct in accordance with RMS Road Noise Policy and other relevant guidelines as follows:

- (2) *Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this section and published in the Gazette.*
- (3) *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 L<sub>Aeq</sub> levels are not exceeded—*
- *in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,*
  - *anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*

The *Development Near Rail Corridors and Busy Roads – Interim Guideline* (NSW DoP, 2008) provides guidance for planning, design and assessment of development in, or adjacent to, rail corridors and busy roads. The Guideline applies to development impacted by the provisions of the T&I SEP. The T&I SEPP sets guidelines for developments that are proposed in, or adjacent to, specific roads.

Table 5-1: T&ISEPP 2021 internal noise criteria for residential development near road or rail corridor<sup>3</sup>

Room	Location	L <sub>Aeq</sub> 15 hr (Day) 7am – 10pm	L <sub>Aeq</sub> 9 hr (Night) 10pm – 7am
Living rooms <sup>4</sup>	Internal, windows closed	40	40

<sup>2</sup>NSW Government Roads and Maritime website (<https://www.rms.nsw.gov.au/about/environment/reducing-noise/traffic-volume-maps-for-infrastructure-sepp.html>)

<sup>3</sup> Requisite for residential development adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles and a rail corridor

<sup>4</sup> anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)

Room	Location	L <sub>Aeq</sub> 15 hr (Day) 7am – 10pm	L <sub>Aeq</sub> 9 hr (Night) 10pm – 7am
	Internal, windows open	50	50
	External free-field (windows open) <sup>5</sup>	60	60
Bedrooms	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (windows open) <sup>5</sup>	60	55

### 5.1.2 Noise from increased traffic generation on surrounding public road network

The redevelopment within the precinct will increase population growth. This will result in increased traffic volumes on the surrounding public road network, which in turn has the potential for increased noise impacts to the surrounding residential properties.

For land use developments with the potential to create additional traffic on public streets, guidance is provided in the *Road Noise Policy* (RNP) (NSW DECCW, 2011). Section 2.3.1 of this policy sets out road traffic noise assessment criteria for residential land uses. Criteria relevant to this project are summarised in Table 5-2.

Table 5-2: Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Sub-arterial roads	Existing residences affected by <b>additional traffic</b> on existing local roads generated by land use developments	L <sub>Aeq</sub> (15hour) 60 (external)	L <sub>Aeq</sub> (9hour) 50 (external)
Local roads		L <sub>Aeq</sub> (1hour) 55 (external)	L <sub>Aeq</sub> (1hour) 50 (external)

In addition to the assessment criteria outlined in Table 5-2, any increase in the total traffic noise level at a location due to a proposed project must be considered. Where existing traffic noise levels are above the noise assessment criteria, Section 3.4 of the RNP outlines that the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. An increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

## 5.2 External (rail traffic) noise impacts

The *Development Near Rail Corridors and Busy Roads – Interim Guideline* (NSW DoP, 2008) applies to development impacted by the provisions of the State Environmental Planning Policy. State Environment Planning Policy (Transport and Infrastructure) 2021 sets requirements for developments that are impacted by rail noise and vibration on non-rail development. Refer to Table 5-1 for internal noise criteria.

The T&I SEPP Clause 2.100 Impact of Rail noise or vibration on non-rail development is similar to Clause 2.120 and stipulates:

- (1) *This section applies to development for any of the following purposes that is on land in or adjacent to the rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration -*
- residential accommodation
  - a place of public worship

<sup>5</sup> ISEPP states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

- *a hospital*
  - *an educational establishment or centre based child care centre*
- (2) *Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this section and published in the Gazette.*
- (3) *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  $L_{Aeq}$  levels are not exceeded—*
- *in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,*
  - *anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*

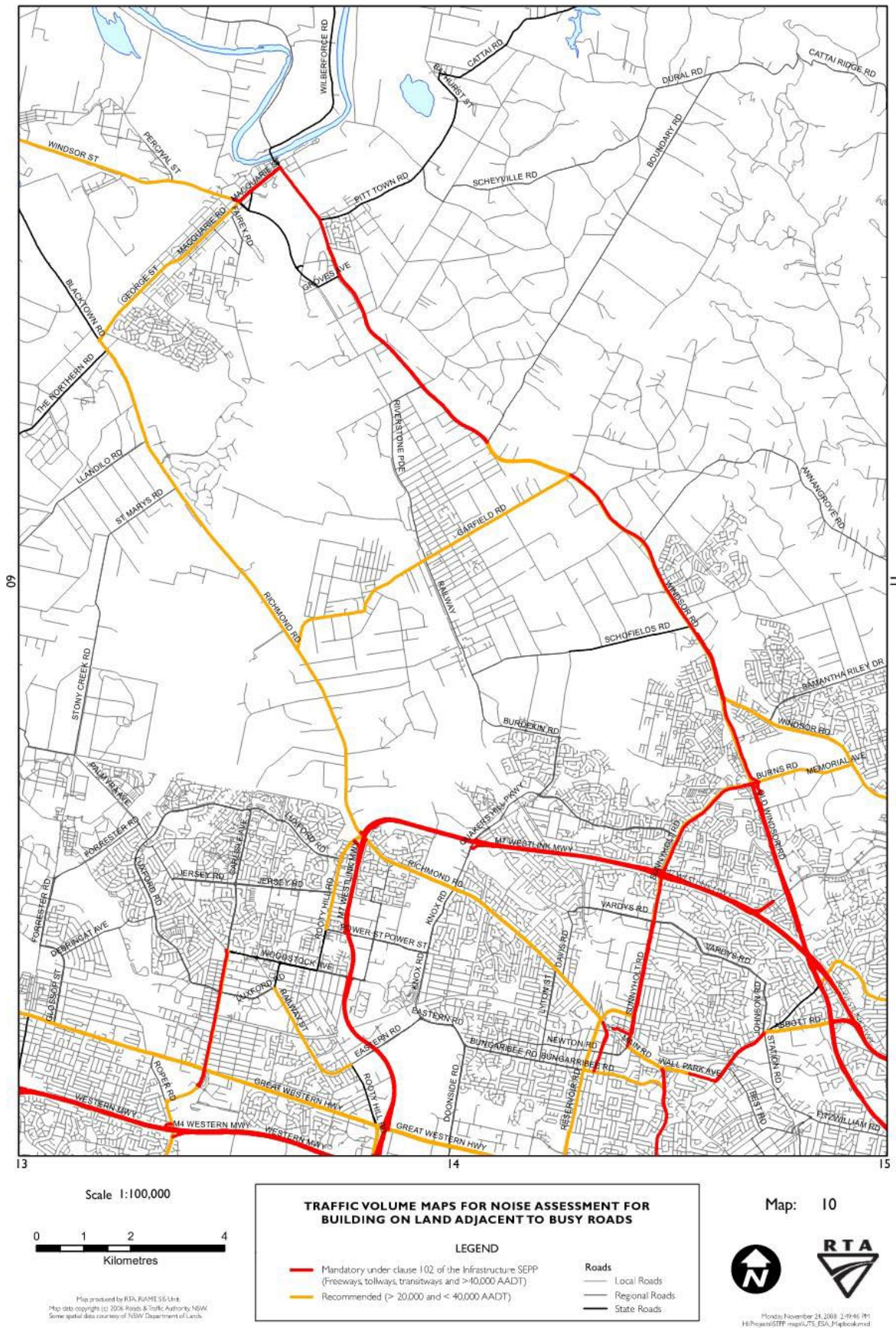


Figure 5-1: Traffic volumes map for noise assessment for building on land adjacent to busy roads (TfNSW)



## 5.3 Internal noise

Typically, the recommended internal noise level  $L_{Aeq}$  for fully furnished spaces should meet the criteria presented in Australian/ New Zealand Standard AS/NZS 2107:2016: *Recommended design sound levels and reverberation times for building interiors*. Note that the designs for internal noise levels detailed in AS2107 are applicable only for steady state or quasi-steady state noise sources.

Table 5-3: Recommended  $L_{Aeq}$  internal noise levels from AS2107:2016

Type of occupancy/activity	Design Sound level	Recommended reverberation time (T), sec
	$L_{Aeq, t}$ range (dBA)	
<b>Houses and apartments in suburban areas or near minor roads -</b>		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	-
Living areas	30 to 40	-
Sleeping areas (night time)	30 to 35	-
Work areas	35 to 40	-
<b>Houses and apartments near major roads</b>		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	-
Living areas	35 to 45	-
Sleeping areas (night time)	35 to 40	-
Work areas	35 to 45	-
<b>Educational institution (Schools)</b>		
Teaching spaces	35 to 45	*Dependent on volume
Sports Hall	< 50	*Dependent on volume
<b>Shop Buildings</b>		
Small retail stores (General)	< 50	**Minimised
Enclosed carparks	< 65	-
Speciality shops	< 45	**Minimised

\*\*: Reverberation time shall be minimised as far as practicable for noise control

\*Depending on the actual size/volume of the individual space, the optimal reverberation is within approximately +/- 0.2-0.3sec of the recommended reverberation time.

## 5.4 Operational noise emissions

The *Noise Policy for Industry* (NPfI) (NSW EPA, 2017) is referenced for the assessment of environmental noise emissions, and this policy is specifically aimed at assessing noise from industrial sources scheduled under the *Protection of Environment Operations Act 1997* (POEOA) (NSW EPA, 1997).

### 5.4.1 NSW EPA Noise Policy for Industry

The NPfI provides the framework and process for deriving the noise limits for assessments under the *Protection of the Environment Operations Act 1997*. The guideline specifies that there are two aspects of environmental noise that require assessment. The first relates to the intrusiveness of a noise source, and allows for the noise under assessment to be a margin above the background, whilst the other procedure relates to the acceptability of the resulting noise, in relation to maintaining the amenity of the surrounding area. The more stringent of the amenity or intrusive criteria would define the appropriate criteria for a project.

## Project intrusiveness noise level

The intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment. A noise source would generally be considered non-intrusive, if the monitored average noise level ( $L_{Aeq}$ ) for a period does not exceed the RBL by more than 5 dB(A). Intrusive noise levels are only applied to residential receivers (residences).

$$L_{Aeq,15min} = \text{rating background noise level} + 5 \text{ dB}$$

Based on the results of noise monitoring detailed in Section 4, the following project intrusive noise criteria have been calculated.

Table 5-4: Project intrusiveness noise criteria

Location	Time period	Rating background noise level (RBL) dB(A) $L_{90(\text{period})}$	Allowance	Intrusiveness noise level dB(A) $L_{eq}(15\text{min})$
Residential <sup>6</sup> NCA R1 NCA R2	Daytime (7am – 6pm)	38	+5dB	43
	Evening (6pm – 10pm)	38		43
	Night-time (10pm – 7am)	34		39
Residential <sup>7</sup> NCA R3	Daytime (7am – 6pm)	43	+5dB	48
	Evening (6pm – 10pm)	43		48
	Night-time (10pm – 7am)	36		41
Residential <sup>8</sup> NCA R4	Daytime (7am – 6pm)	67	+5dB	72
	Evening (6pm – 10pm)	62		67
	Night-time (10pm – 7am)	57		62

## Project amenity noise level

To limit continuing increases in noise levels from the application of intrusiveness objective alone, this guideline recommends amenity noise levels for different receivers within a study area (Table 2.2 of the NPfl), to ensure ambient levels from all sources combined within this area are suitably controlled. To ensure the noise levels (existing + new) remain within the recommended amenity noise levels for an area, the project amenity noise level is defined by the recommended noise levels minus 5 dB(A).

$$\text{Project Amenity noise level } L_{Aeq,15min} = \text{recommended amenity noise level} - 5 \text{ dB} + 3 \text{ dB}$$

For this project, all residential receivers have been defined as ‘Suburban’ or ‘Urban’ based on their proximity to the Windsor Road. This classification is based on the measured existing ambient noise levels and the description of noise environments in the NPfl.

As per NPfl, residential premises near heavy traffic during peak periods and subject to a background noise of above 35 dBA during night time should be categorised as ‘Urban’ which is usually dominated by ‘urban hum’ or industrial source noise. With high residential growth, future commercial premises envisaged for the Riverstone East precinct the category “Urban” is relevant for certain Noise Catchment Areas (NCA). The classification is used for the portions of the development that are expected to meet the descriptions for urban amenity within the Noise Policy for Industry for example NCA R4 (includes High Density Residential) which is closer to Windsor Road and have a night time background noise as  $L_{A90}$  57 dBA. Category of Suburban can also be used within the Riverstone East precinct based on the projected traffic counts on Garfield Road East.

<sup>6</sup> Logger location L3 applicable to develop intrusive and amenity criteria

<sup>7</sup> Logger location L2 applicable to develop intrusive and amenity criteria

<sup>8</sup> Logger location L1 applicable to develop intrusive and amenity criteria

## Effects of changing land use

When land uses in an area are undergoing significant change, for example, residential subdivisions with associated development of local and regional roads, the background noise levels would be expected to change, sometimes significantly. The impact of noise from an existing industry on a proposed new residential area should be made using the recommended amenity noise level for the residential land use, not the project intrusiveness noise level.

Table 5-5: Project amenity noise criteria

Receiver	Time of day	Recommended amenity noise level dB(A) $L_{eq}(\text{period})$	Adjusted amenity noise level dB(A) $L_{eq}(15\text{min})^9$
Residential (Suburban) NCA R1 NCA R2	Daytime (7am – 6pm)	55	53
	Evening (6pm – 10pm)	45	43
	Night-time (10pm – 7am)	40	38
Residential (Suburban) NCA R3	Daytime (7am – 6pm)	55	53
	Evening (6pm – 10pm)	45	43
	Night-time (10pm – 7am)	40	38
Residential (Urban) NCA R4 <sup>10</sup>	Daytime (7am – 6pm)	60	76 – 15 + 3 = 64
	Evening (6pm – 10pm)	50	72 – 15 + 3 = 60
	Night-time (10pm – 7am)	45	70 – 15 + 3 = 58
Place of worship	When in use	40 (Internal) 50 (External) <sup>11</sup>	40 (Internal) 50 (External)
Active recreation area (School Playground, Sporting fields)	When in use	55	55
Areas for passive recreation (e.g. Rouse Hill Regional Park)	When in use	50	50
School classroom - internal	Noisiest 1 – hour period when in use	35 (Internal) 45 (External)	35 (Internal) 45 (External)
Commercial premises	When in use	65	65
Industrial premises (AJ Bush)	When in use	70	70

## Project noise trigger level

PNTL is the lowest value of intrusiveness or project amenity noise level are conversion to  $L_{Aeq}$  15 minute dBA equivalent level.

<sup>9</sup> Converted from  $L_{Aeq}(\text{period})$  to  $L_{Aeq}(15\text{mins})$  for consistency and ease of comparison with intrusiveness noise level requirement. This conversion is in accordance with the guidance provided in Fact Sheet E of the NPfI.

<sup>10</sup> The level of transport noise, road traffic noise is high (existing traffic noise level is 10 dB or more above the recommended amenity noise level) and unlikely to decrease in the future, will make noise from an industrial source effectively inaudible. High traffic project amenity noise level =  $L_{Aeq}$  minus 15 dB + 3. Refer to NPfI Fact Sheet E for more details.

<sup>11</sup> External noise level – As per ICNG the difference between the internal noise level and external noise level is typically 10 dB with windows open for adequate ventilation.

Table 5-6: Project noise trigger level

Receiver	Time of day	Intrusiveness noise level dB(A) <sub>L<sub>eq</sub>(15min)</sub>	Project amenity noise level dB(A) <sub>L<sub>eq</sub>(15min)</sub>	Project noise trigger level dB(A) <sub>L<sub>eq</sub>(15min)</sub>
Residential (Suburban) NCA R1 NCA R2	Daytime (7am – 6pm)	43	53	53 <sup>12</sup>
	Evening (6pm – 10pm)	43	43	43
	Night-time (10pm – 7am)	39	38	38
Residential (Suburban) NCA R3	Daytime (7am – 6pm)	48	53	53 <sup>12</sup>
	Evening (6pm – 10pm)	48	43	43 <sup>12</sup>
	Night-time (10pm – 7am)	41	38	38 <sup>12</sup>
Residential (Urban) NCA R4	Daytime (7am – 6pm)	72	64	64 <sup>12</sup>
	Evening (6pm – 10pm)	67	60	60 <sup>12</sup>
	Night-time (10pm – 7am)	62	58	58 <sup>12</sup>
Place of worship - Internal	When in use	-	40 (Internal) 50 (External)	40 (Internal) 50 (External)
Active recreation area (School Playground, Sporting fields)	When in use	-	55	55
Areas for passive recreation (e.g. Rouse Hill Regional Park)	When in use	-	50	50
School classroom - internal	Noisiest 1 – hour period when in use	-	35 (Internal) 45 (External)	35 (Internal) 45 (External)
Commercial premises	When in use	-	65	65
Industrial premises (AJ Bush)	When in use	-	70	70

## 5.4.2 Sleep disturbance criteria

The NPfl provides the latest Environment Protection Authority (EPA) guidance for the assessment of sleep disturbance. It recommends an assessment of maximum noise levels which have the potential to cause sleep disturbance impacts. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages. The NPfl recommends an initial screening test for maximum noise level events, with the following screening levels:

- $L_{Aeq(15\ min)}$  40 dB(A) or the prevailing RBL plus 5 dB, whichever is greater, and/or
- $L_{AFmax}$  52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater

Furthermore, the *NSW Road Noise Policy* (RNP) (DECCW, 2011) states that based on research and review of a wide range of literature:

- Maximum internal noise levels below 50 to 55 dB(A) would be unlikely to result in people's sleep being disturbed
- If the maximum internal noise exceeds 65 to 70 dB(A) once or twice each night, the disturbance would be unlikely to have any notable health or wellbeing effects

This indicates that internal noise levels of 50 to 55 dB(A) are unlikely to cause sleep awakenings. At levels above 55 dB(A), sleep disturbance would be considered a risk. Assuming that residential receivers have

<sup>12</sup> Effects of changing land use (NPfl) – The impacts from existing industry in such areas on a proposed new residential development should be made using recommended amenity noise level.

windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicated in the ICNG, resulting in external limit of 65 dB(A). Hence, based on the guidance provided by the NPfl and RNP, a trigger level-based assessment on the emergence of noise for sleep disturbance will be used for this assessment:

- **Screening criterion:**  $L_{AFmax} - 52$  dB(A) or  $RBL + 15$  dB
- **Awakening reaction:**  $L_{AFmax} - 65$  dB(A)

## 5.5 Construction noise criteria

The *Interim Construction Noise Guideline* (ICNG) (NSW DECC 2009) generally applies to the management of construction noise in NSW and is also referenced by the SEARs. This guideline provides recommendations on standard construction hours and construction noise management levels (NMLs).

### 5.5.1 Recommended standard hours of work

Section 2.2. of the ICNG recommends standard hours for construction work as follows:

- Monday to Friday: 7am to 6pm,
- Saturday: 8am to 1pm, and
- No work on Sundays or public holidays

The ICNG notes that the recommended standard hours of work are not mandatory and acknowledges that some activities could be undertaken outside the recommended standard hours of work, assuming all feasible and reasonable mitigation measures are implemented to minimise the impacts to any surrounding sensitive land uses. These activities include:

- the delivery of oversized plant or structures that police or other authorities determine requires special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- public infrastructure works that shorten the length of the project and are supported by the affected community
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels at receivers to below the noise management levels outside of the recommended standard construction hours.

### 5.5.2 Construction noise management levels

Recommended construction NMLs for residential receivers and non-residential receivers are presented in Table 5-6 and Table 5-7 respectively. The NMLs represent a noise level that, if exceeded, would require management measures including the following:

- reasonable and feasible work practices
- contact with residences to inform them of the nature of works to be carried out, the expected noise levels and durations and contact details.

The management measures aim to reduce noise impacts on the residential receivers; however, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The construction NMLs during recommended standard hours of work are not intended as a noise limit but rather a level where noise management is required. The construction NMLs outside of recommended standard hours would be considered as noise limits unless a private agreement has been reached with the affected residential receivers.

Table 5-7: ICNG recommended construction noise criteria for residential receivers

Time of day	Management level dB(A)Leq <sub>(15min)</sub> <sup>13</sup>	How to apply
<b>Recommended standard hours:</b> Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays.	Noise affected RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise.  Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.  The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ul style="list-style-type: none"> <li>■ times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)</li> <li>■ if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ul>
<b>Outside recommended standard hours (OOHW)</b> <sup>14</sup>	Noise affected RBL + 5 dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level.  Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Table 5-8: ICNG recommended construction noise criteria for non-residential receivers

Receiver type	Time of day	Management level dB(A)Leq <sub>(15min)</sub> <sup>15</sup>
Commercial properties	When in use (typically, daytime only, during standard business hours)	70 (external)
Industrial properties		75 (external)
Educational institutes		45 (internal) 55 (external) <sup>15</sup>
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)		75 (external)

<sup>13</sup> Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence.

<sup>14</sup> OOHW Period 1 (Day) – Saturdays 7am to 8am and 1pm to 6pm; Sundays and public holidays 8am to 6pm.  
OOHW Period 1 (Evening) – Monday to Saturday 6pm to 10pm.

OOHW Period 2 – Monday to Saturday 10pm to 7am; Sundays and public holidays 6pm to 8am.

<sup>15</sup> Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most affected point within 50 metres of the area boundary. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB. Some buildings may achieve greater performance, such as where windows are fixed (that is, cannot be opened).

### 5.5.3 Project construction noise criteria

The relevant project specific construction NMLs are presented in Table 5-9 for residential receivers and Table 5-10 for non-residential receivers. The NMLs have been calculated based on the ambient noise survey results (see Section Ambient noise survey4) and the guidance in Section 5.5.2.

Table 5-9: Residential construction NML

Location	Recommended standard hours NML dB(A) $L_{eq}(15min)$	Outside of standard hours NML dB(A) $L_{eq}(15min)$ <sup>16</sup>			Highly affected NML dB(A) $L_{eq}(15min)$
		OOHW period 1 (day)	OOHW period 1 (evening)	OOHW period 2 (night)	
Residential (Suburban) NCA R1 NCA R2	48	43	43	39	75
Residential (Suburban) NCA R3	53	48	48	41	75
Residential (Urban) NCA R4	77	72	67	62	75

Table 5-10: Non-residential construction NMLs

Receiver type	Noise management level (NML) dB(A) $L_{eq}(15min)$
All commercial properties (including retail, offices etc.)	70 (external)
All industrial properties	75 (external)
Educational institutes	55 (external)
Active recreation areas	75 (external)

## 5.6 Vibration criteria

The effects of vibration impacts on buildings and structures can be divided into two categories:

- Human comfort impacts – where the occupants or users of the affected building are possibly disturbed
- Structural impacts – effects on building contents and structural integrity

The ICNG make reference to the *Assessing Vibration: A Technical Guideline (AVTG)* (NSW DEC, 2006), for consideration of acceptable vibration levels. This guideline is also referenced by the SEARs.

### 5.6.1 Human comfort

Construction vibration can adversely affect the amenity of occupants inside buildings as it may affect their quality of life or working efficiency. Human comfort impacts are experienced at levels well below those that can damage or affect a structure and its contents. Though it may not always be possible to comply with the more stringent human comfort criterion for infrastructure projects in close proximity to residential dwellings, human comfort should always be used as the objective to aim for and be the basis of assessment.

Guidance in relation to acceptable vibration levels for human comfort are provided in AVTG, which in turn is based on the guidelines contained in British Standard *BS 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 hertz (Hz) to 80 Hz)*. *BS 6472-1:2008* superseded this British Standard

<sup>16</sup> OOHW Period 1 (Day) – Saturdays 7am to 8am and 1pm to 6pm; Sundays and public holidays 8am to 6pm.

OOHW Period 1 (Evening) – Monday to Saturday 6pm to 10pm.

OOHW Period 2 – Monday to Saturday 10pm to 7am; Sundays and public holidays 6pm to 8am.

in 2008. Although a new version of BS 6472 has been published, AVTG still references the 1992 version of this standard and the EPA still advises vibration to be assessed in accordance with this version of the standard.

AVTG classifies vibration as one of three types:

- Continuous – where vibration occurs uninterrupted and can include sources such as machinery and constant road traffic.
- Impulsive – where vibration occurs over a short duration (typically less than two seconds) and occurs less than three times during an assessment period. This may include activities such as occasional dropping of heavy equipment or loading / unloading activities.
- Intermittent – occurs where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving and pavement breakers.

Construction activities typically generate ground vibrations of an intermittent nature and are assessed using vibration dose value (VDV). VDV is calculated using the acceleration rate of the vibration event and the time over which it occurs. This method emphasises on the level of vibration rather than its duration and is a measure of the total quantity of vibration perceived. The VDV method is the most suitable for assessing human comfort amenity from intermittent vibration sources and the vibration limits relevant to the surrounding sensitive receiver types (see Section 3.1) are presented in Table 5-11.

Table 5-11: Human comfort intermittent vibration limits

Receiver type	Assessment Period	Intermittent vibration dose value, m/s <sup>2</sup>	
		Preferred values	Maximum values
Residences	Daytime <sup>17</sup>	0.2	0.4
Offices, schools, educational institutions and places of worship		0.4	0.8
Workshops		0.8	1.6

## 5.6.2 Structural damage

Vibration transmission through the ground can cause a structure and structure coupled elements (walls, windows, roof etc.) to radiate. The transmitted vibration energy has the potential to damage and compromise the integrity of a structure as well as increase the risk of damage to building contents.

There is no current Australian Standard that sets criteria for the assessment of building damage caused by vibrations. Guidance on limiting vibration values with the potential to cause structural damage is typically referenced from the German Standard DIN 4150: Part 3 – 2016 *Effects of Vibration on Structures* (DIN guideline).

The DIN guideline recommended maximum permissible levels of vibration (expressed as peak particle velocity or PPV) that reduce the likelihood of building damage caused by vibration and are presented in Table 5-12. PPV is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

*It should be noted that heritage structures should be considered on a case by case basis, as a heritage listed structure may not necessarily be more sensitive to vibration than a standard structure. Where a historic heritage structure is deemed to be sensitive to damage, the criteria in Line 3 of Table 5-12, should be considered.*

<sup>17</sup> The NSW EPA's Assessing Vibration guideline defines daytime period as 7am – 10pm.



Table 5-12: Guideline values for short-term vibration on structures

Line	Type of Structure	Peak Particle Velocity (PPV), mm/s			
		at foundation @ a frequency of			plane of floor of uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz <sup>18</sup>	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15

## 5.7 Aircraft noise criteria

Australian Standard 2021 – 2015 is concerned with land use planning and building treatments in the vicinity of an airport. The objective is to provide guidance to regional and local authorities, organizations, communities and others associated with urban and regional planning and building development on the siting and construction of new buildings against aircraft noise intrusion and on the acoustical adequacy of existing buildings in areas near aerodromes.

This Standard, together with the relevant Australian Noise Exposure Forecast (ANEF) chart or locality map available for the aerodrome under consideration, provides guidelines for determining:

- whether the extent of aircraft noise intrusion makes building sites ‘acceptable’, ‘unacceptable’ or ‘conditionally acceptable’ for the types of activity to be, or being, undertaken (Clause 2.3);
- for ‘conditionally acceptable’ sites, the extent of noise reduction required to provide acceptable noise levels indoors for the types of activity to be, or being, undertaken; and
- the type of building construction necessary to provide a given noise reduction, provided that external windows and doors are closed (see Note 1).

The acceptability of the building site is dependent on the type of building proposed and on the ANEF zone in which it is to be located. For the particular building type under consideration, determine from Table 2.1 the building site acceptability, i.e. acceptable, conditionally acceptable or unacceptable, for the ANEF zone in which it is to be located.

Table 5-13: Building site acceptability based on ANEF Zones

Building Type	ANEF Zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
House, home unit flat	Less than 20 ANEF <sup>19</sup>	20 to 25 ANEF <sup>20</sup>	Greater than 25 ANEF
School	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Commercial building	Less than 25	25 to 35 ANEF	Greater than 35 ANEF

Riverstone East precinct is located in the region which is less than 20 ANEF as per Richmond RAAF Airport 2014 ANEF Map. The buildings within the precinct are therefore deemed “Acceptable” and no further assessment is required for the precinct with respect to AS 2021-2015.

<sup>18</sup> At frequencies above 100 Hz, the values given in this column may be used as minimum values.

<sup>19</sup> The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside but near to the 20 ANEF contour.

<sup>20</sup> Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate

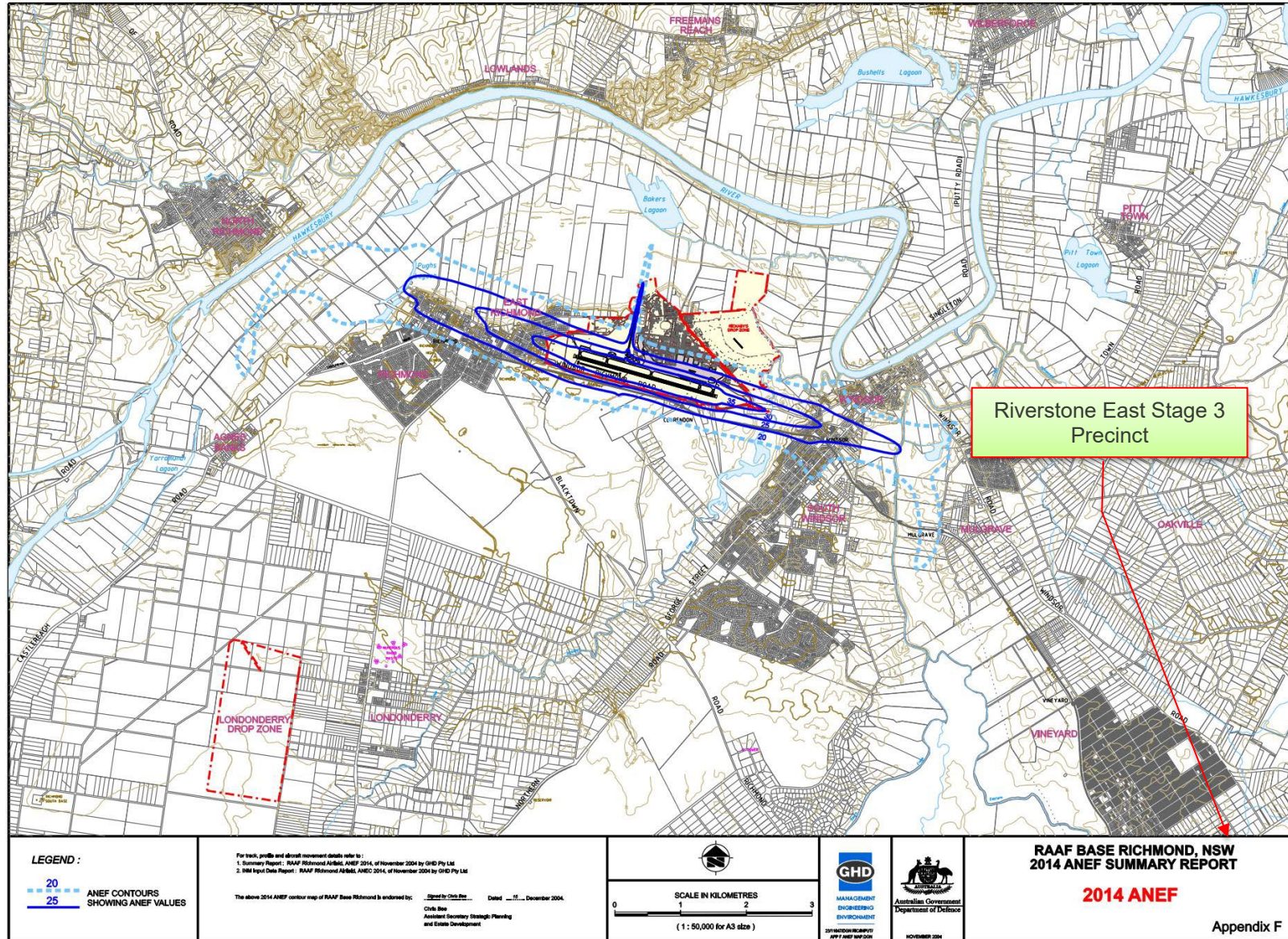


Figure 5-2: ANEF RAAF Base Richmond (GHD)

# 6 Assessment

## 6.1 Industrial noise

Extensive background and ambient noise survey was undertaken within the precinct to understand the noise impact from current industrial facilities.

A J Bush & Sons facility was operational during the survey and mechanical noise was clearly audible around the facility. Table 6-1 provides an average measured noise levels based on the multiple measurements conducted on site and Figure 6-1 illustrates the noise around the facility.

Table 6-1: Industrial noise impact from AJ Bush and Sons facility

Location ID	Average $L_{A90}$ dBA (Measured) <sup>21</sup>	Distance from source metres
A9	45	540m

Although AJ Bush & Sons facility may relocate in the future once rezoned, this assessment takes into account the noise impact to the surrounding premises in case it remains operational after residential development commences.

Nearest medium density residential development (NCA R2) proposed in the draft ILP is directly adjacent to the AJ Bush facility. Predicted industrial noise of more than 80 dBA from the operation of AJ Bush & Sons facility at the nearest residential development are expected (refer to Figure 6-1).

When compared to the Project Noise Trigger Level (PNTL) of 53 dBA (day time) /43 dBA (evening time) /38 dBA (night time) (refer to Table 5-6), the predicted noise levels from the AJ Bush site significantly exceed the limits at the nearest future sensitive receivers. Mechanical noise from the facility will exceed the stipulated noise criteria during day, evening and night time periods. Significant noise mitigation measures are required to reduce the impacts.

A substation is also proposed in the draft ILP which is in proximity to NCA R3. There is noise data or specifications provided for the substation, therefore the noise impacts at the nearest low density residential properties are unknown. Usually, the substations house a transformer along with other mechanical fans and colling systems. Noise from a transformer has low frequency content which may trigger tonal characteristics. Tonal low frequency noise should be carefully dealt using suitable mitigation measures included in the Substation design. This should be considered in the later stages of the project when more comprehensive data on the substation is available.

Measures for reducing noise impacts from industrial activities follow three main control strategies:

- reducing noise at the source
- reducing noise in transmission to the receiver
- reducing noise at the receiver.

These control strategies should be considered in a hierarchical way so that all the measures that reduce noise for a large number of receivers (that is, source controls) are exhausted before more localised mitigation measures are considered.

The scope for applying feasible and reasonable mitigation measures to existing industrial activities is generally more limited and potentially more costly than for new greenfield developments. Implementing

<sup>21</sup> As per NPfI Section 7.1.1, noise descriptor such as  $L_{A90}$  can be used to filter extraneous noise such as dominant and continuous mechanical noise and the difference the source  $L_{Aeq}$  and  $L_{A90}$  is small.

effective noise management strategies is an integral part of the planning phase for industrial developments and is potentially a cost-saving approach compared to retrospective mitigation.

When determining whether noise mitigation is 'feasible and reasonable', the starting point is identifying mitigation measures that would result in achieving the relevant project noise trigger levels, and then identifying why particular measures may not be either feasible or reasonable. Some of the typical strategies that can be applied to reduce noise are:

- Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Barriers are more effective if they are near the source or the receiver. Their effectiveness is also determined by their height, the materials used (absorptive or reflective), and their density. The relationship of these design features to attenuation is well documented. Barriers can take a number of forms including free-standing walls between a source and a receiver, grass or earth mounds or bunds, and trenches or cuttings within which noise sources are sited or buildings that can act as barrier. They are employed when source and receiver control is either impractical or too costly. The use of noise barriers should be carefully considered as they can have negatives, such as unattractive visual impacts, or be associated with unwanted behaviours such as graffiti or littering, particularly when poorly sited or designed.

Based on the predicted noise emissions from the AJ Bush site, a combination of site separation and barriers may be required to reduce noise emissions to within the NPfl limits at residential uses. Particularly if the site operates during the night period.

Based on the predicted existing emissions from the site, the following indicative separation distances have been identified. Further acoustic modelling and studies would be required to be undertaken to validate these indicative values. At this stage the hours of operation are unknown and would need to be confirmed.

Table 6-2: Noise attenuation with barriers

Operating period	NPfl limit, $L_{Aeq}$ , dBA	Separation distance to achieve noise limits	
		No Barrier	With barrier (10 dB attenuation)
Day	53	250m	80m
Evening	43	800m	250m
Night	38	1400m	400m

## Residual noise impacts

A residual noise impact may exist where the best-achievable noise level from a development, when assessed at a sensitive receiver location, remains above the project noise trigger levels. Residual noise impacts are identified after all source and pathway feasible and reasonable noise mitigation measures have been considered. The significance of the residual impact and the need to assess receiver-based treatment options may need to be considered as part of an authority's determination/approval process at the Development Application stage.

Planning decisions for proposed developments take into account social, economic and environmental factors. Noise impact is one factor taken into account and decisions can be made that result in residual noise impacts (that is, noise levels above the project noise trigger level). In these cases, a consent may include an obligation on proponents to undertake noise mitigation at receiver locations. Residual noise impacts are taken into account in decision-making processes in accordance with the requirements of the relevant legislation or process. As a general guide, where all source and pathway feasible and reasonable noise mitigation measures have been applied, the significance of residual noise levels (that is, noise levels above the project noise trigger level) will be considered, as outlined in Table 6-3 and Table 6-4.

Table 6-3: Significance of residual noise impacts

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Then the significance of residual noise level is:
≤ 2 dB(A)	Not applicable	Negligible
≥ 3 but ≤ 5 dB(A)	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1dB	Marginal
≥ 3 but ≤ 5 dB(A)	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dB(A)	≤ recommended amenity noise level	Moderate
> 5 dB(A)	> recommended amenity noise level	Significant

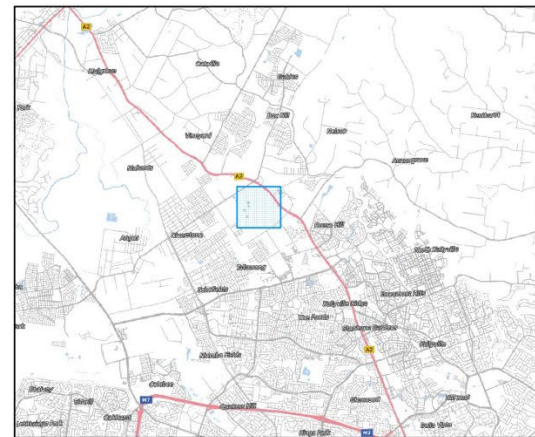
Table 6-4: Examples of receiver-based treatments to mitigate residual noise

Significance of residual noise level	Example of potential treatment
Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Significant	May include suitable commercial agreements where considered feasible and reasonable.



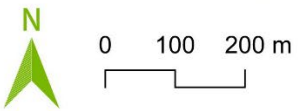
**Legend**

- Attended monitoring location
  - Unattended noise monitoring location
  - Riverstone East Stage 3 Boundary
- Roads**
- Motorway or Highway
  - Primary, Secondary or Tertiary
  - Local roads



Date: 08/09/2023

Version: 1



Job No.: P523561

Co-ordinate system: GDA2020 / MGA zone 56 ( EPSG:7856)

**Riverstone East Stage 3 Precinct Noise**

Estimated noise levels from AJ Bush facility

Figure 6-1: Noise measurement in proximity to the A J Bush & Sons facility (Aurecon, August 2023)

## 6.2 Sydney Metro noise

### 6.2.1 Operational train noise

Sydney metro trains operation have negligible airborne noise impacts which is generated by a combination of noise from propulsion of the rolling stock and from its interaction with the track around the area. Other type of impacts from operational trains are ground-borne or regenerated noise in building typically noted at receiver locations where the level of ground-borne noise is likely to be greater than airborne noise (typical example of building over rail tunnels). Vibration in buildings associated with movements on a rail network can cause disturbance. As there are no adjacent buildings or underground rail line near the precinct, there is no impacts of ground-borne noise or rail vibration expected. This section specifically addresses airborne noise impacts from operating metro trains.

Noise measurements were conducted north of Tallawong Station at around 90m away from the centre of the railway tracks (refer to Figure 6-2).

Table 6-4: Sydney Metro train operations

Number	Direction	No. of Metro cars	Duration of passbys (sec)	L <sub>Aeq</sub> dBA	SEL	L <sub>Amax</sub> dBA	L <sub>Amin</sub> dBA
1	East to West	6	31	52	67	60	39
2	West to East	6	25	52	66	57	41
3	East to West	6	41	50	67	58	41
4	West to East	6	30	51	66	57	42

The nearest medium density residential properties (NCA R1) as per ILP is approximately 720 m away from the Sydney metro train tracks. Predicted noise at these nearest sensitive receiver will be around 32 dBA compared to the stipulated noise criteria 60 dBA (day time) /55 dBA (night time). Noise impacts from the operational Sydney Metro are negligible and are not expected to provide any adverse impacts at any of the nearest existing or future sensitive receivers. No further mitigation measures are required.

### 6.2.2 Sydney Metro Train Facility (SMTF)

All Sydney Metro operations are controlled and monitored from the Sydney Metro Trains Facility (SMTF) in Rouse Hill, which was built as part of Metro North West Line. SMTF also provides maintenance and stabling.

Measured noise at 6 Oak Street Schofields NSW provide no evidence of noisy activities within the SMTF during day time. A detailed analysis is required based on the information from Sydney Metro Train Facility (SMTF) Operational Noise and Vibration Review (ONVR) specific to SMTF North which will have noise impacts from the SMTF during standard and OOHV periods.

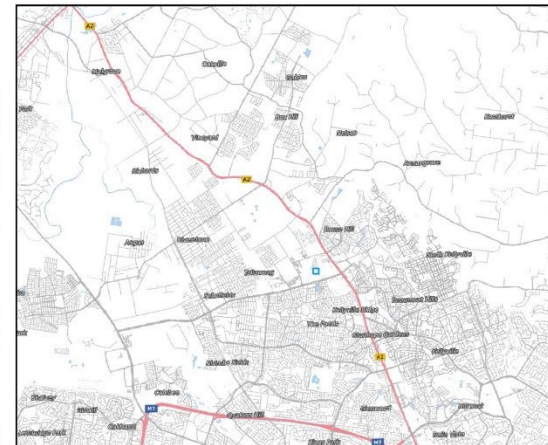


**Legend**

● Attended monitoring location

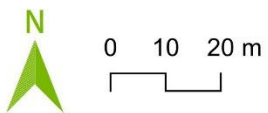
**Roads**

— Local roads



Date: 08/08/2023

Version: 1



Job No.: P523561

Co-ordinate system: GDA2020 / MGA zone 56 ( EPSG:7856)

**Riverstone East Stage 3 Precinct Noise**

**Attended measurement location to capture noise from Sydney Metro**

Figure 6-2: Measurement of Sydney Metro train pass-bys (Aurecon, 2023)



### 6.2.3 Car park at Tallawong Station

An operational carpark noise assessment has been undertaken for the surface carpark associated with Tallawong Station. The carpark contains 1000 car park spaces and 30 motorcycle spaces. In summary:

- Motorcycle spaces: 30
- Regular car spaces : 820
- Accessible car spaces: 30
- Compact car spaces: 150

#### Assumptions and methodology

The following assumptions and methodologies have been made with respect to the use of the carpark, see below for details.

- The sound power level of the carpark has been calculated based on the *Bavarian State Agency for the Environment 2007, Parking Area Noise, 6th Edition, Bavarian State Ministry for the Environment, Germany*. This standard derives sound power levels for carparks of various uses based on the number of carpark spaces, area of the carpark and number of movements during certain time periods.
- Carpark operational peak hours have assumed to be between 6am – 8am and 4:30pm – 6:30pm. As per NPfl, these are considered as “Shoulder” periods. During morning and evening periods mentioned above, it may be unreasonable to expect such operations to be assessed against the night-time project noise trigger levels – especially if existing background noise levels are steadily rising in these early morning hours. Specific intrusiveness noise levels are generated for these periods.
- The carpark is assumed to have an asphalt surface finish.
- The peak traffic movements within the carpark are to occur during the day and evening periods.

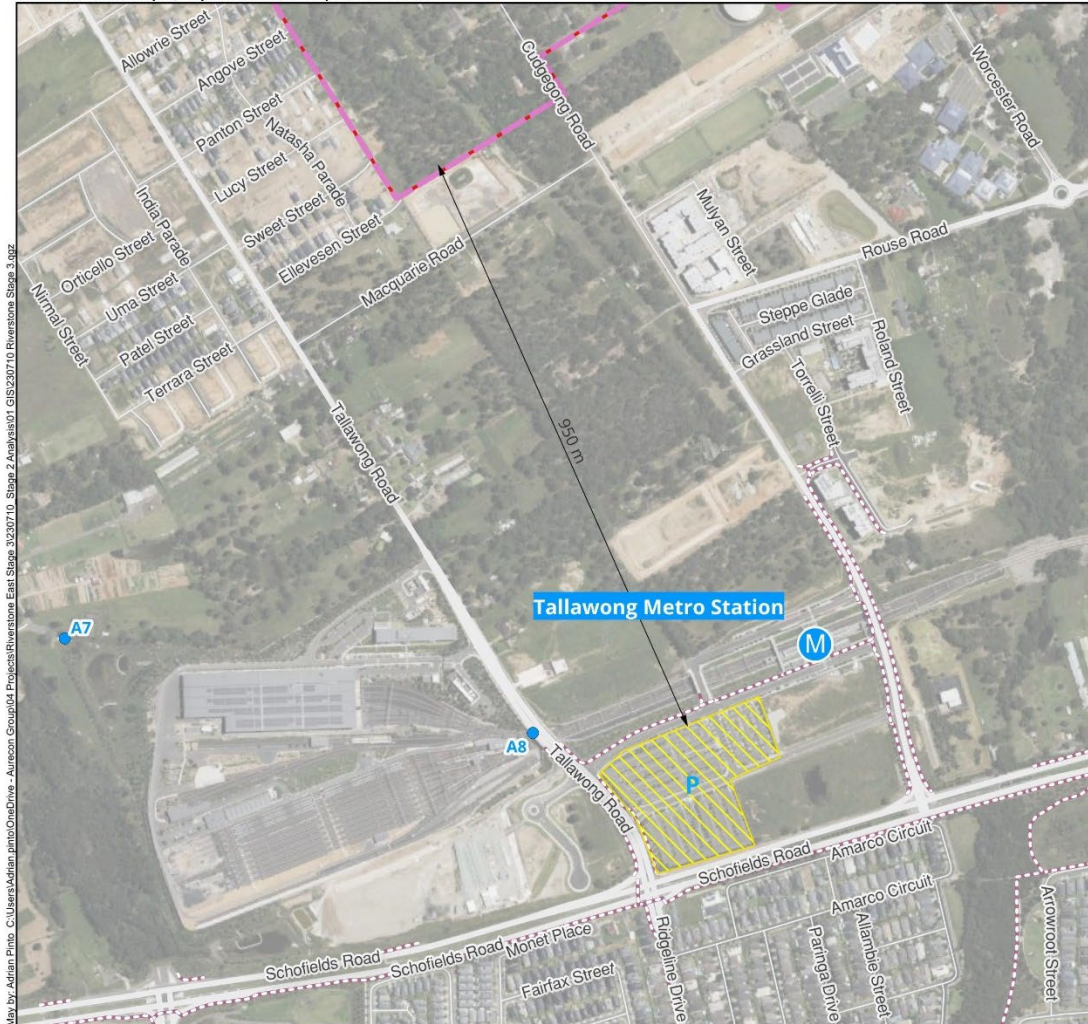
#### Source Noise Levels

The derived source noise level (Sound Power Level) for the carpark is 105 dBA. The predicted noise impact from the operation of the carpark is less than the daytime and evening shoulder period intrusiveness noise level of 42 dB(A) $L_{eq(15min)}$  and 41 dB(A) $L_{eq(15min)}$  respectively. The propagation of the carpark noise to nearby sensitive receivers would not exceed the NPfl noise criterion.

Table 6-5: Tallawong Station carpark noise impact

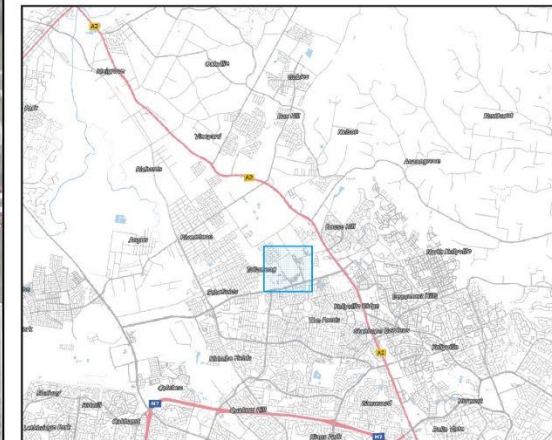
Number	Carpark Sound Power Level dBA	Predicted noise at NCA R1	Shoulder period intrusiveness criteria $L_{Aeq}$ dBA <sup>22</sup>	Compliance
1	105	37 dBA	42 (6am – 8am)	Yes
2	105	37 dBA	41 (4:30pm – 6:30pm)	Yes

<sup>22</sup> The lowest 10th percentile of  $L_{AF90, 15min}$  dB measurements for the equivalent of one weeks worth of valid data taken over the shoulder period (that is, all days included in a single data set of shoulder period)



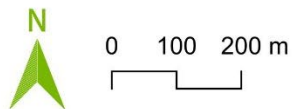
**Legend**

- Attended monitoring location
- Riverstone East Stage 3 Boundary
- Roads**
- Primary, Secondary or Tertiary
- Local roads
- Cycleway, footpath etc.
- NCA's**
- NCA - R1
- M Tallawong Metro station
- P Tallawong Metro station car park



Date: 09/08/2023

Version: 1



Job No.: P523561

Co-ordinate system: GDA2020 / MGA zone 56 ( EPSG:7856)

**Riverstone East Stage 3 Precinct Noise**

**Tallawong Metro station car park**

Figure 6-3: Tallawong Station carpark noise impacts (Aurecon, August 2023)

## 6.3 Road traffic

The precinct is strategically located but faces significant challenges due to its proximity to major roadways, namely Windsor Road, Garfield Road East, and Schofields Road. These thoroughfares are vital arteries that connect various parts of the region, making them essential for transportation and commerce. However, the substantial traffic volumes on these roads, both currently and in the foreseeable future, pose notable concerns for the surrounding area.

### Current and Future Traffic Volumes:

Table 6-6 offers a concise overview of the Average Annual Daily Traffic (AADT) on these three major roads. Notably, it reveals that both Windsor Road and Schofields Road are already experiencing traffic volumes exceeding 20,000 AADT at present, and these numbers are projected to persist in future scenarios. Furthermore, Garfield Road East, though not currently surpassing the 20,000 AADT threshold, is expected to do so in future projections. These statistics signify the heavy reliance on these roads for daily commuting and freight transportation, emphasizing their significance in the local transportation network.

### Implications for Future Residential Properties:

Figure 6-4 brings to light another critical aspect of this situation – the potential adverse effects of high traffic noise on residential properties in the vicinity. The map clearly delineates the areas predominantly within the zoning categories of NCA R2, NCA R3, NCA R4, and NCA R5, which will be susceptible to elevated noise levels emanating from Windsor Road and Garfield Road East. The noise generated by such busy roadways can have a considerable impact on the quality of life for residents in these zones.

### Challenges and Considerations:

**Traffic congestion:** The consistently high traffic volumes on these major roads can lead to congestion, affecting not only the flow of vehicles but also the accessibility of the precinct itself. This congestion may necessitate infrastructure improvements and traffic management strategies to maintain smooth transportation.

**Noise pollution:** The future residential areas facing these major roads are at risk of experiencing significant noise pollution, which can lead to health concerns, reduced property values, and overall discomfort for residents. Mitigation measures such as noise barriers and sound insulation in buildings may need to be considered (refer to Section 6.3.1).

**Urban planning:** Careful urban planning is essential to strike a balance between the necessity of these strategic residential development near the major roads and the well-being of residents. This could involve creating green buffers or pedestrian-friendly zones to mitigate the impact of traffic.

**Transportation infrastructure:** As the area continues to grow and the roadways become more congested, there might be a need for expanded public transportation options or improved road infrastructure to accommodate the increasing traffic.

**Community engagement:** It is crucial to involve the community in decision-making processes regarding traffic management and noise abatement strategies. Residents concerns and suggestions should be taken into account when planning for the precinct's future.

**Detailed traffic noise assessment:** The T&I SEPP 2021 requires a detailed traffic noise assessment for residential properties that are on land adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW). This would be undertaken at the Development Application stage. Refer to Figure 5-1 for TfNSW Map showing traffic volumes near busy roads such as Windsor Road and Garfield East Road. Windsor Road is subject to traffic with more than 20,000

vehicles (year 2036), so in accordance with the current T&I SEPP, it will warrant a detailed traffic noise assessment.

In conclusion, while the precinct's location near major roads provides valuable connectivity, it also presents substantial challenges related to traffic volumes and noise pollution. Effective urban planning and infrastructure development, along with community engagement, will be essential to ensure that the area can thrive despite these challenges and offer a feasible outcome for its residents.

Table 6-6: Traffic volumes on the major roads around the Precinct

Road section	Direction	Existing Traffic			10 Year Future Traffic			20 Year Future Traffic		
		AADT			AADT			AADT		
		LV	HV	Total	LV	HV	Total	LV	HV	Total
Windsor Road	Southbound	17150	540	17690	20252	638	20890	22851	719	23570
	Northbound	21590	770	22360	27480	980	28460	28639	1021	29660
	Grand Total			<b>40050</b>			<b>49350</b>			<b>53230</b>
Schofields Road	Eastbound	15660	340	16000	16394	356	16750	18567	403	18970
	Westbound	15690	750	16440	16425	785	17210	19212	918	20130
	Grand Total			<b>32440</b>			<b>33960</b>			<b>39100</b>
Garfield Road	Eastbound	5320	260	5580	8504	416	8920	10487	513	11000
	Westbound	5790	370	6160	10800	690	11490	12990	830	13820
	Grand Total			<b>11740</b>			<b>20410</b>			<b>24820</b>

Detailed traffic noise assessments are to be prepared in accordance with the methodology pursuant to the RMS "Preparing an Operational Traffic and Construction Noise and Vibration Assessment Report", RMS "Road Noise Policy", TfNSW "Road noise model validation guideline" and DoP "Development near Rail corridors and busy roads – Interim Guideline". The traffic noise assessment ensures the noise from operating traffic at the façade of the existing and new residential users are within the stipulated criteria in accordance with RMS Noise Criteria Guideline and other guidelines. The noise modelling should consider a hierarchy of noise mitigation measures including future planned commercial activities to assess the cumulative effect of noise mitigation measures on the predicted impacts.

### 6.3.1 Mitigation measures

For receivers that qualify for consideration of additional noise mitigation measures, identify potential noise mitigation measures from the list below. Options for noise mitigation measures are listed below in the order of preference for application given in the RMS Road Noise Policy (RNP):

- Quieter pavement surfaces
- Noise mounds
- Noise walls
- At-property treatments.

Community views should be considered when evaluating and selecting noise treatments as should the wider community benefits arising from noise mitigation of the proposed road or road redevelopment. Community views may be identified through a range of community engagement activities including visits to individual affected receivers.

For it to be considered reasonable to provide quieter pavement surfaces, noise mounds and noise walls there needs to be four or more closely spaced receivers that benefit. Where there are four or more closely spaced receivers the specific combination of noise mitigation measures is subject to further evaluation.

## Quieter pavement

A quieter pavement surface is the preferred form of noise mitigation as it reduces source noise levels. This provides protection to both outside recreational areas and internal noise levels and has the least visual impact.

For traffic generally, road tyre noise appears to dominate at around 70 km/h. This means that in areas with posted speeds of 70 km/h or more, the reduction of road tyre noise can be a useful noise reduction treatment. A quieter pavement surface should be considered where there are groups of four or more receivers that exceed the criteria and before the use of noise barriers.

## Noise barrier and noise mounds

A noise mound or noise wall provides similar benefits to those provided by a quieter pavement surface through reducing both external and internal levels of noise.

In terms of visual impact, a noise wall has a higher visual impact than a quieter pavement or noise mound under most situations. However, a noise wall is often more feasible than a mound as the site footprint can be much smaller.

Often barriers comprise a mound with a wall on top. Combinations with both mounds and walls may be visually more appealing than a wall alone and cost less than a wall of equivalent total height. A detailed guideline on how to identify noise barrier height is described in Section 9 of RMS Road Noise Mitigation Guideline. Noise barriers should be considered where there are four or more closely-spaced receivers.

The benefit provided by existing noise barriers (walls and mounds) must be taken into account when determining if a residence qualifies for consideration of treatment (e.g. Windsor Road has noise mound stretching partially between Terry Road and Nelson Road).

## At-property treatment

At-property noise mitigation measures such as facade treatments and localised screens may replace at-road mitigation, subject to a reasonable and feasible assessment, only in the following circumstances:

- Isolated single residences or isolated groups of closely spaced residences.
- Where the affected community expresses a preference for at-property treatment and the cost is less than a combination of a barrier and at-property treatment.
- Where noise barriers cannot achieve the level of noise mitigation (insertion loss) required.
- Where the only applicable noise criteria are internal (e.g., places of worship, hospitals or schools and child care facilities where play areas meet external criteria).
- Where other noise mitigation measures have been shown not to be feasible or reasonable.

These treatments are generally limited to acoustic treatment of the building elements and the installation of acoustic screen walls close to the receiver where they also protect outdoor living spaces.

The RNCG external noise level targets are the design guide for the level of noise reduction by external screen walls. Building element treatments are more effective when they are applied to masonry structures than lightly clad timber frame structures. Caution should be exercised before providing treatments for buildings in a poor state of repair, as they may be less effective in these cases and may not provide any appreciable noise reduction benefit.



## 6.4 Aircraft noise

Riverstone East precinct is located in the region which is less than 20 ANEF as per Richmond RAAF Airport 2014 ANEF Map (refer to Figure 5-2). The buildings within the precinct are therefore deemed “Acceptable” and no further assessment is required for the precinct with respect to AS 2021-2015.

## 6.5 Vibration impacts

There are no major vibration inducing activities or equipment within the precinct that can impact adversely on any of the sensitive receivers. No further mitigation measures are required.

The vibration impacts during construction stage may warrant consideration. Typically, vibration impacts from the construction phase would be mainly due to vibration intensive construction equipment such as compactor, excavator with a rock breaker attachment etc. While the impacts will be occurring for a temporary duration, the effects from these vibration impacts will be temporary, negligible and minor as the construction area is located beyond the safe working buffer distance. This can be adequately addressed at the Development Application stage, post-rezoning.

# 7 Conclusion

The Department is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct of the NWGA, nominally identified as Stage 3, in collaboration with Blacktown City Council.

This noise assessment thoroughly examined and summarises the primary sources of noise and vibration within the precinct. It has meticulously documented both the current and future designated areas susceptible to noise sensitivity, as per the draft Integrated Land Use Plan (ILP). Additionally, the assessment offers an estimated range of noise and vibration impacts linked to the current land uses and the planned transformation of the precinct into a residential zone. Comprehensive evaluations have been made, considering land development prerequisites, proposed transportation pathways, and the anticipated volume of heavy vehicle traffic stemming from both existing and forthcoming developments. Furthermore, the assessment presents a set of recommendations and noise management strategies aimed at addressing these impacts, adhering to the highest standards of noise reduction practices.



# Attachment A – Glossary of terms

Term	Meaning
A-weighted decibels [dB(A)]	The A-weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Airborne sound	Airborne sound is sound transmitted through the air/atmosphere, e.g. conversation between people.
Ambient noise	The prevailing noise level at a location due to all noise sources but excluding the noise from the specific noise source under consideration. Generally measured as a dB(A) noise level.
Background noise	The noise level exceeded for 90% of the measurement period ( $L_{A90}$ ) i.e. the underlying level of noise present and does not include transient noise such as intermittent traffic or dogs barking.
Community	A group of people living in a specific geographical area or with mutual interests that could be affected by the Project.
Decibel [dB]	The measurement unit of sound.
Decibel scale	The decibel scale is logarithmic. Sound pressure levels are expressed in decibels as a ratio between the measured sound pressure level and the reference pressure. A 3dB increase in the sound pressure level corresponds to a doubling in the sound energy.
Equivalent continuous sound pressure level [ $L_{eq,T}$ ] and A-weighted equivalent continuous sound pressure level [ $L_{Aeq,T}$ ]	The equivalent continuous A-weighted sound pressure level is the value of the A-weighted sound pressure level of a continuous steady sound that has the same acoustic energy as a time-varying A-weighted sound pressure level when determined over the same measurement period, T. The ICNG defines $L_{Aeq(15min)}$ as ‘the A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as industry, road, rail and the community.
Feasible	Feasible relates to engineering considerations such as constructability, reliability, maintenance and safety.
Ground-borne vibration	Ground-borne vibration is vibration transmitted from source to receiver via the medium of the ground.
$L_{A90}$ (Time)	The A-weighted sound pressure level that is exceeded for 90% of the measurement period. This is considered to represent the background noise.
$L_{AFmax}$	The maximum sound pressure level measured over the measurement period.
Peak Particle Velocity (PPV)	The maximum vector vibration velocity that occurs in any of the individual x, y or z orthogonal directions. Current practices for assessments of the risk of structural damage to buildings use measurements of PPV in millimetres per second.
Rating Background Level [RBL]	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
RMS	Root mean square
Sound Power Level (SWL)	The total sound power emitted by a source.
Sound Pressure Level (SPL)	20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level of 20 micro Pascals.
Vibration	The variation in magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, acceleration or velocity. Common units include mm/s (or m/s) and $mm/s^2$ (or $m/s^2$ ).



Vibration dose value (VDV)	Vibration dose value is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration (British Standard 6472 – 2008).
Vibration intensive works	Works which use vibration intensive equipment such as jack hammers, piling rigs and rock breakers.

# Attachment B – Noise survey summary

<b>Location ID</b>	L1			<b>Aerial Image</b> 
<b>Address</b>	1034 Windsor Rd, Riverstone NSW 2155			
<b>Logger Model Name</b>	Rion NL-21	<b>Latest calibration date</b>	08/07/2022	
<b>Logger Serial No.</b>	00709 528	<b>Time weighting</b>	Fast	
<b>Start Date</b>	19/07/2023	<b>Frequency Weighting</b>	A	
<b>Finish Date</b>	2/08/2023	<b>Location</b>	Free Field	
<b>Logger Notes</b> Noise measurements are dominated by road traffic noise on Windsor Road mainly from light and heavy vehicles. Logger was placed in free field and free from acoustic obstacles.				
<b>Ambient noise monitoring results - NPfl &amp; ICNG time periods</b>				<b>Logger Photo</b> 
<b>Period</b>	Day 11 hr	Evening 4hr	Night 9 hr	
<b>RBLs LA90, period dB</b>	67	62	57	
<b>Ambient noise monitoring results - RNP time periods</b>				
<b>Period</b>	Day 15hr		Night 9 hr	
<b>LAeq period dB</b>	75		70	
<b>LAeq, 1hr dB</b>	77		75	
<b>Time periods for NPfl &amp; ICNG</b>				
Day	7 am to 6 pm Monday to Saturday 8 am to 6 pm Sundays and Public Holidays			
Evening	6 pm to 10 pm			
Night	remaining periods			

**Time periods for RNP**

Day 7am to 10 pm

Night 10 pm to 7am



**Riverstone East Precinct – Stage 3**

**Noise logger L1**

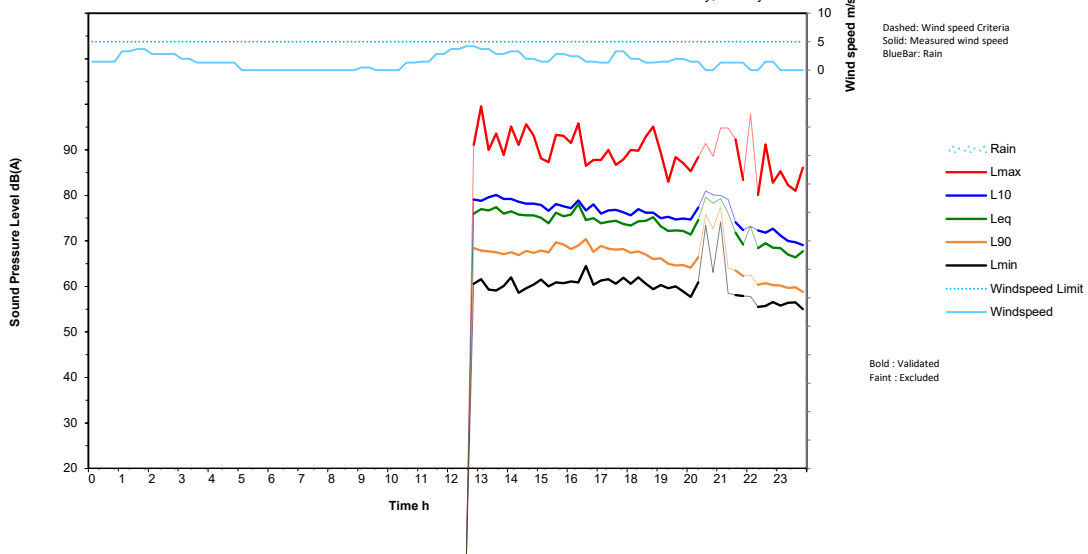
<b>Location ID:</b>	L1					
<b>Address:</b>	1034 Windsor Rd, Riverstone NSW 2155					
<b>NPfl based noise monitoring results</b>						
<b>Date</b>	<b>L<sub>A90</sub> Assessment Background Levels dB</b>			<b>L<sub>Aeq</sub> Ambient Noise Levels dB</b>		
	<b>Day</b>	<b>Evening</b>	<b>Night</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
Wednesday, 19 July 2023			58			71
Thursday, 20 July 2023	68	64	57	77	73	71
Friday, 21 July 2023	67	62	57	76	72	69
Saturday, 22 July 2023	65	62	51	74	71	67
Sunday, 23 July 2023	63	58		73	70	
Monday, 24 July 2023	66	62	57	76	71	70
Tuesday, 25 July 2023	66	62	56	76	72	71
Wednesday, 26 July 2023	67	62		76	72	
Thursday, 27 July 2023	67	64	55	76	73	71
Friday, 28 July 2023		64	57		72	68
Saturday, 29 July 2023	65	62	52	74	71	67
Sunday, 30 July 2023		61	50		72	71
Monday, 31 July 2023	67	62	57	76	71	71
Tuesday, 1 August 2023	67	62	57	76	72	71
	<b>RBL per period</b>			<b>Logarithmic average L<sub>Aeq, period</sub> dB</b>		
	<b>67</b>	<b>62</b>	<b>57</b>	<b>76</b>	<b>72</b>	<b>70</b>

*Note: No data has been presented for weather excluded data or data with extraneous noise*

Logger ID: L1

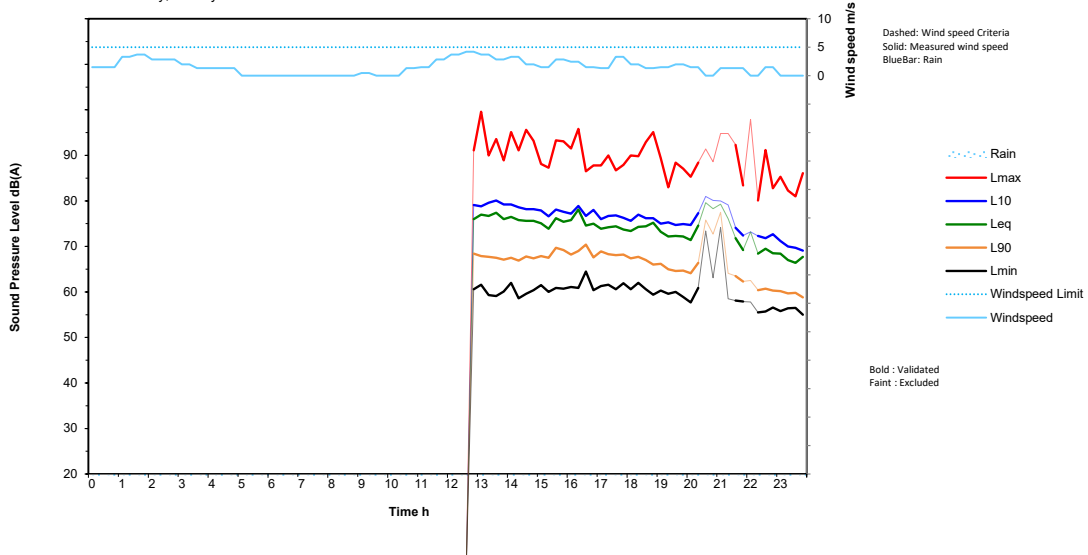
Location: 1034 Windsor Rd, Riverstone NSW 2155

Wednesday, 19 July 2023



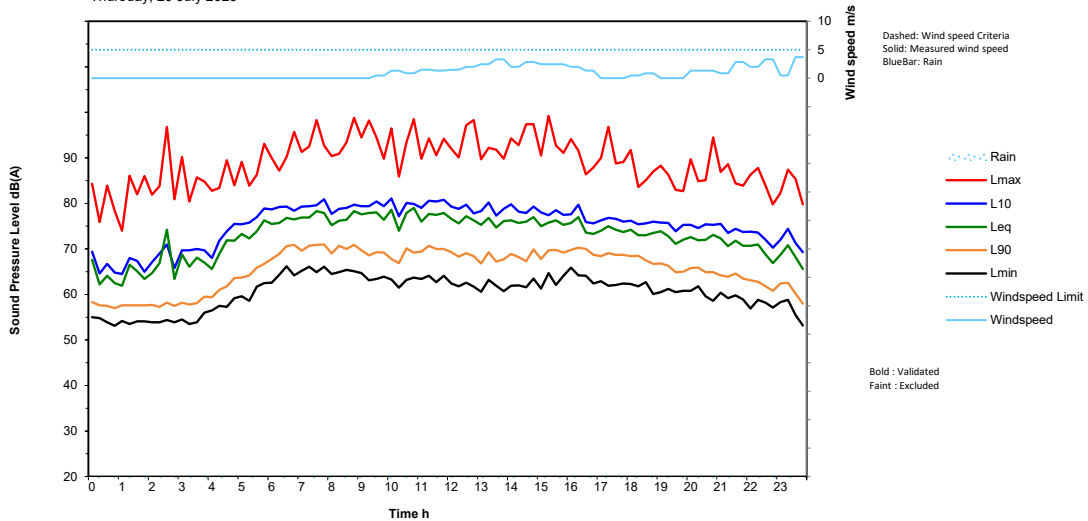
Location: 1034 Windsor Rd, Riverstone NSW 2155

Wednesday, 19 July 2023



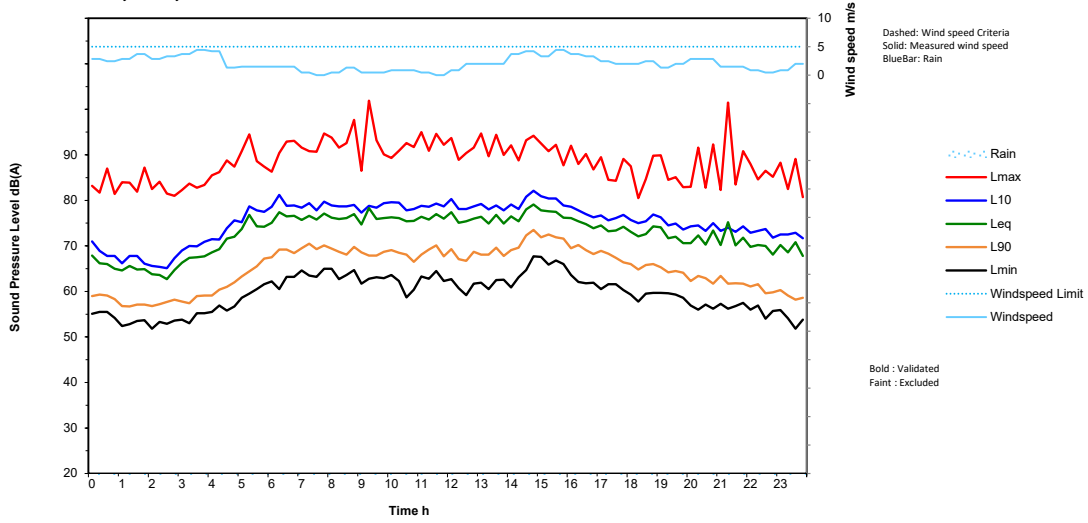
Location: 1034 Windsor Rd, Riverstone NSW 2155

Thursday, 20 July 2023



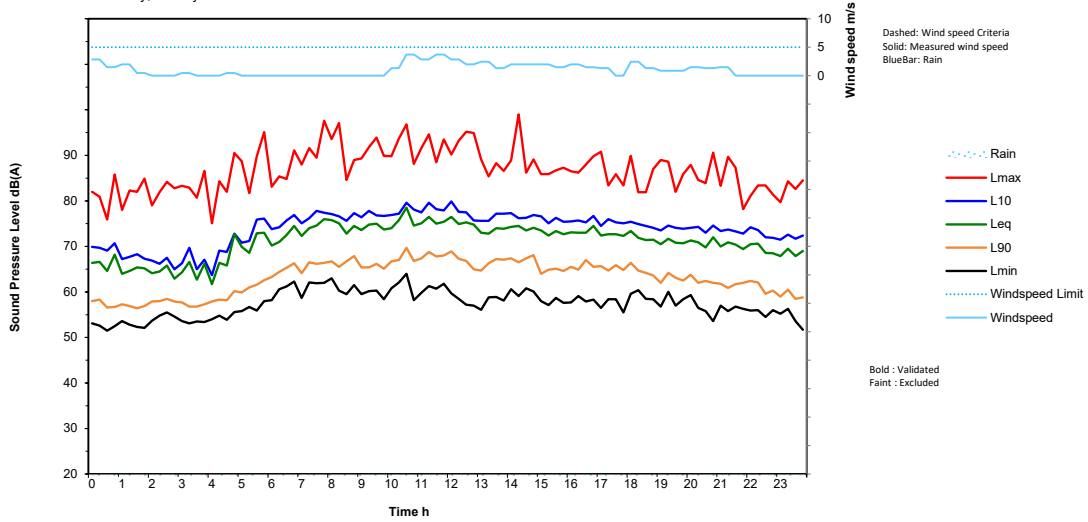
Location: 1034 Windsor Rd, Riverstone NSW 2155

Friday, 21 July 2023



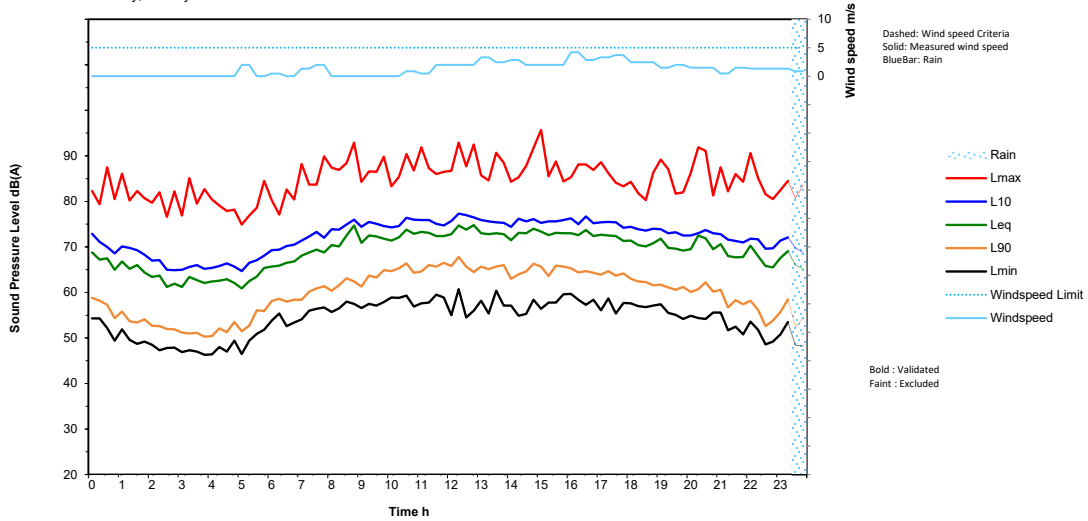
Location: 1034 Windsor Rd, Riverstone NSW 2155

Saturday, 22 July 2023



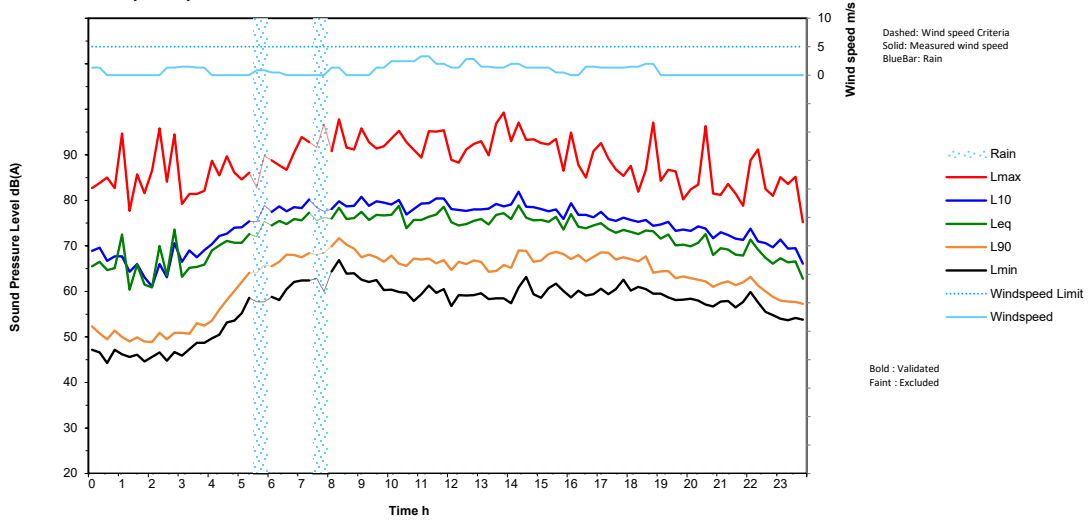
Location: 1034 Windsor Rd, Riverstone NSW 2155

Sunday, 23 July 2023



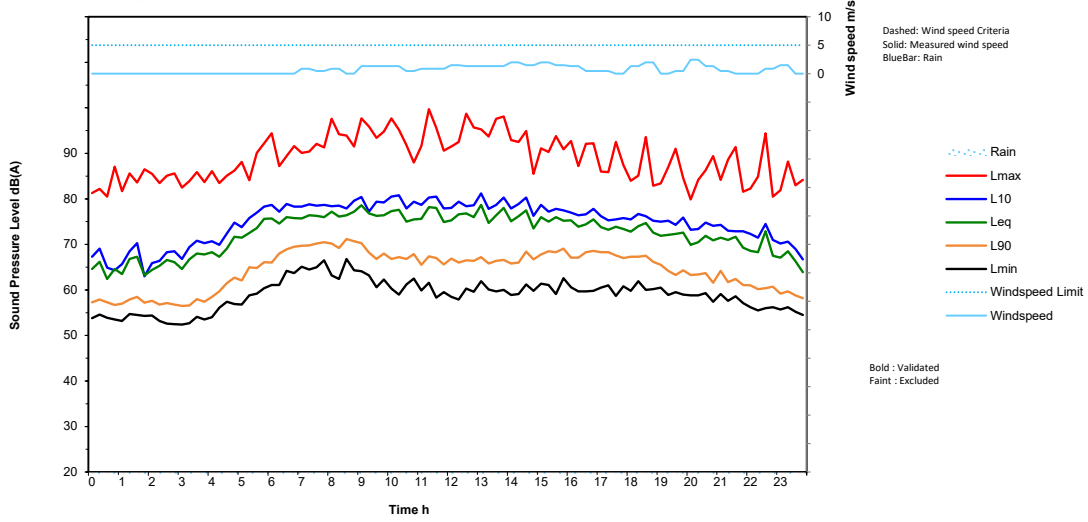
Location: 1034 Windsor Rd, Riverstone NSW 2155

Monday, 24 July 2023



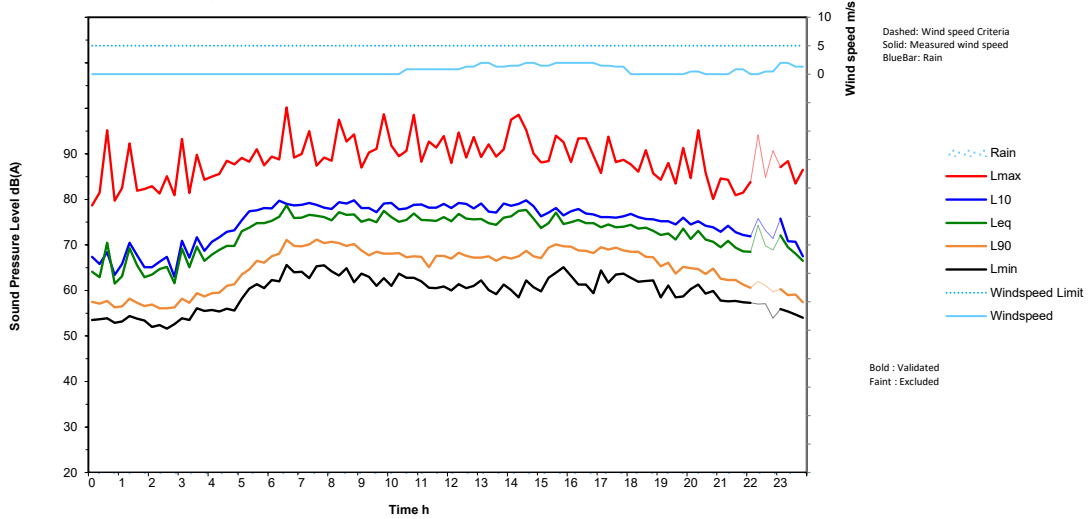
Location: 1034 Windsor Rd, Riverstone NSW 2155

Tuesday, 25 July 2023



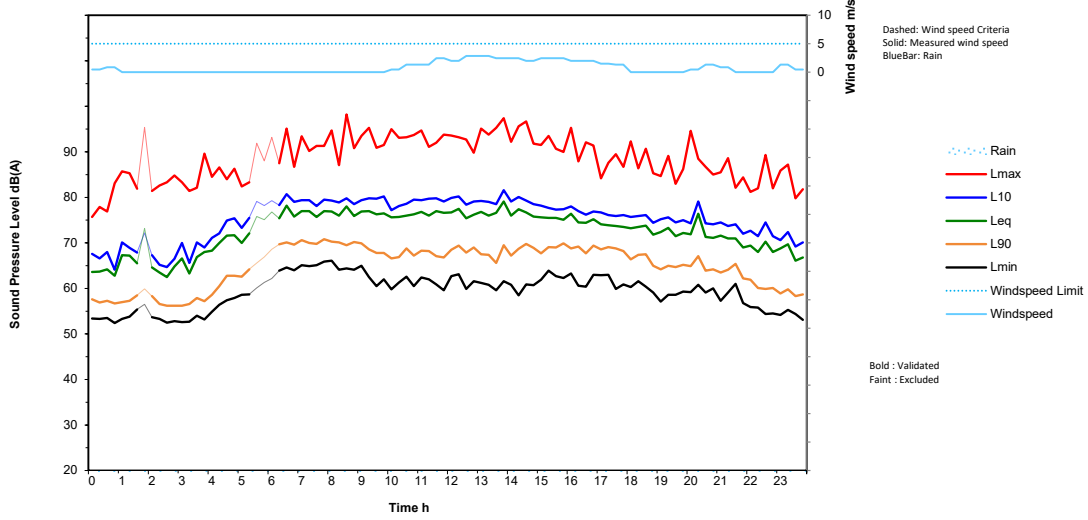
Location: 1034 Windsor Rd, Riverstone NSW 2155

Wednesday, 26 July 2023



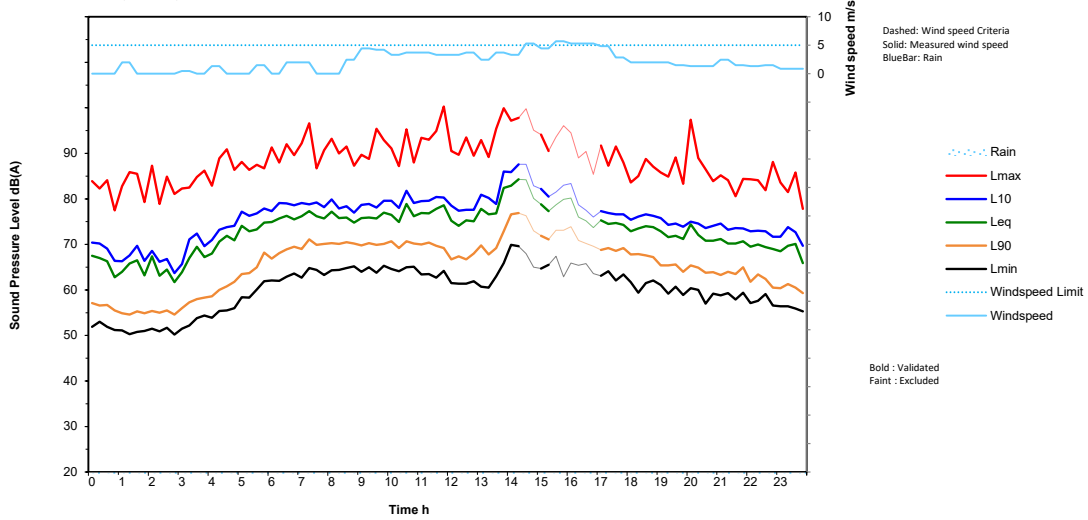
Location: 1034 Windsor Rd, Riverstone NSW 2155

Thursday, 27 July 2023



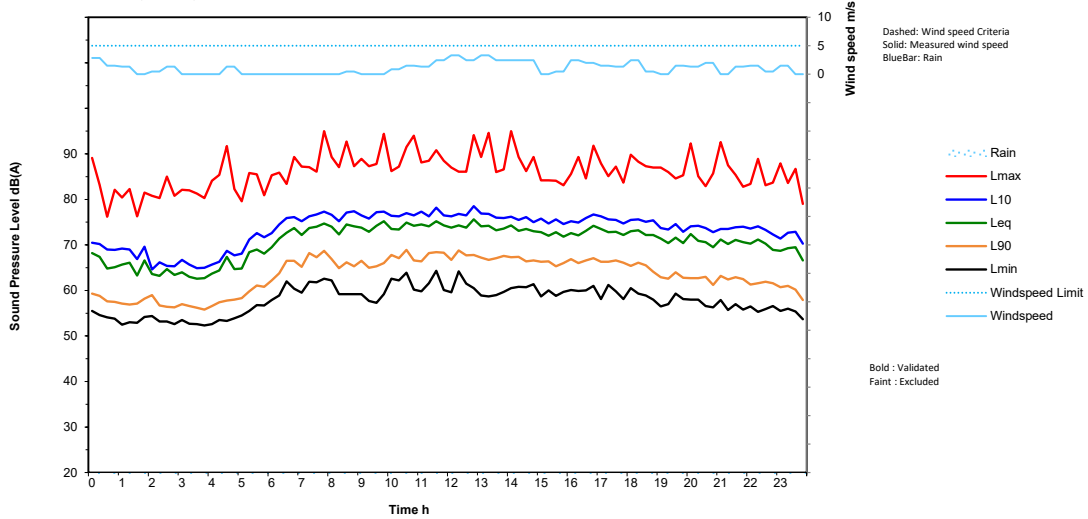
Location: 1034 Windsor Rd, Riverstone NSW 2155

Friday, 28 July 2023



Location: 1034 Windsor Rd, Riverstone NSW 2155

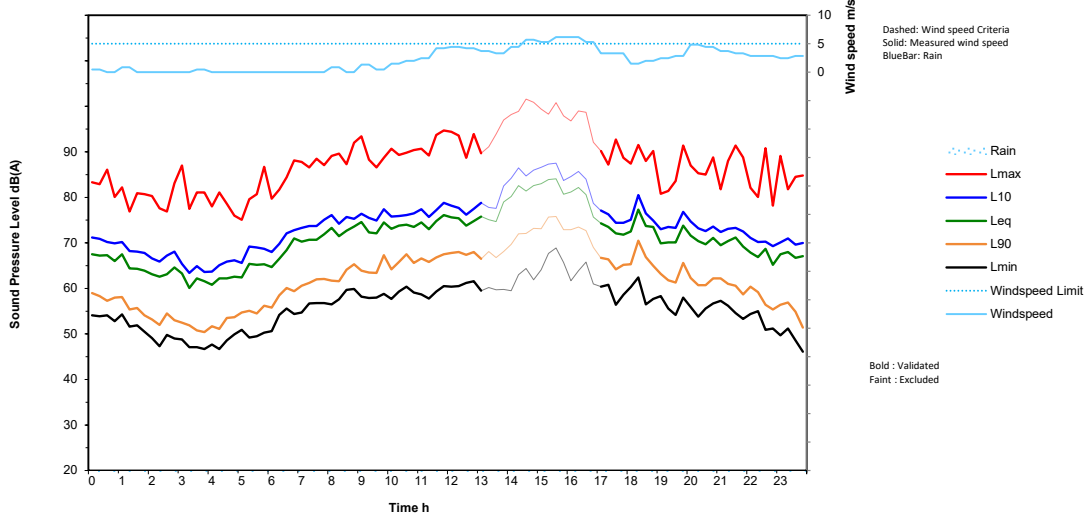
Saturday, 29 July 2023





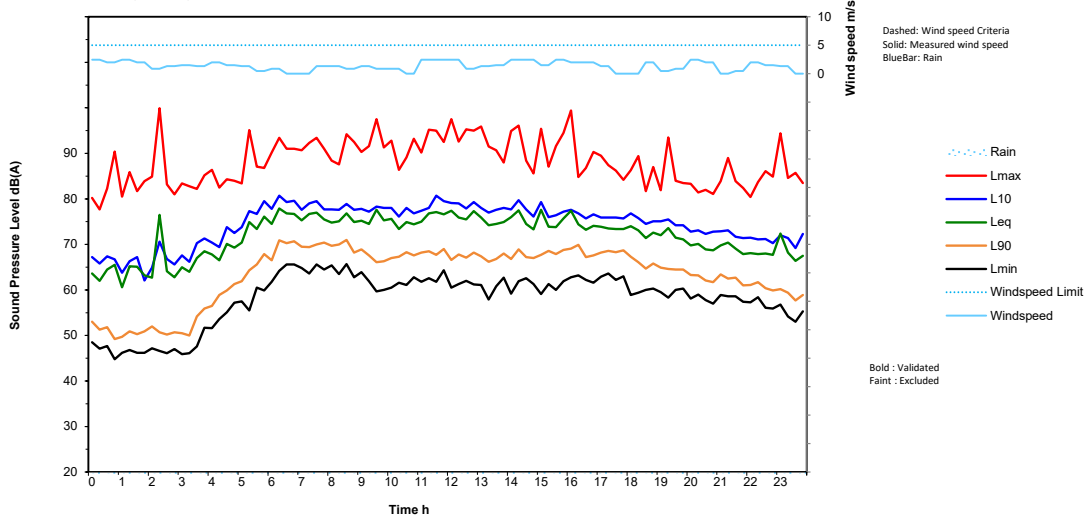
Location: 1034 Windsor Rd, Riverstone NSW 2155

Sunday, 30 July 2023



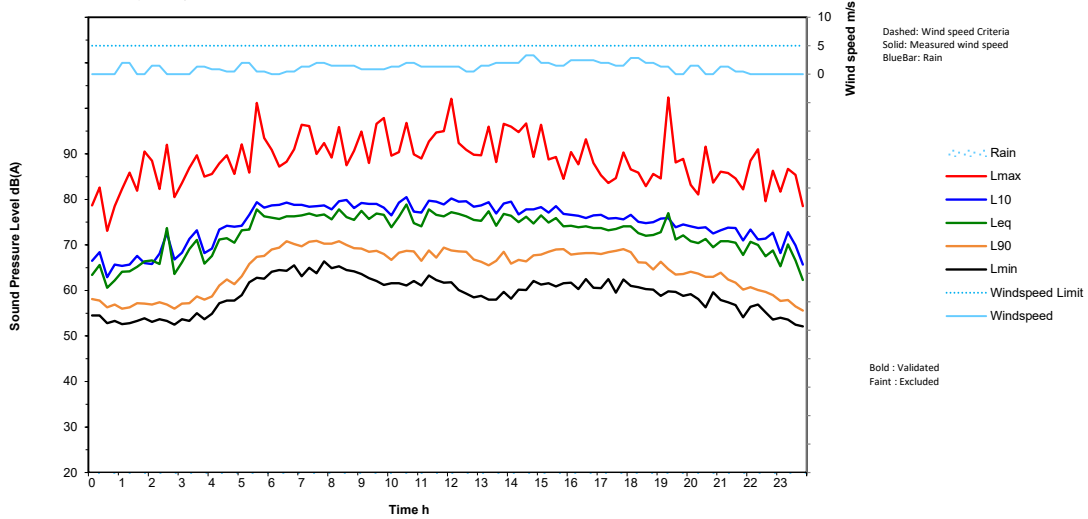
Location: 1034 Windsor Rd, Riverstone NSW 2155

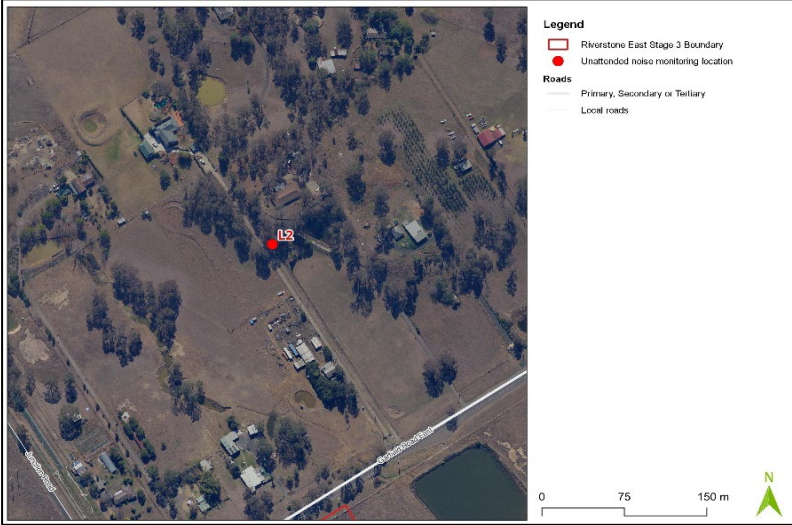

Monday, 31 July 2023



Location: 1034 Windsor Rd, Riverstone NSW 2155

Tuesday, 1 August 2023



<b>Location ID</b>	L2			<b>Aerial Image</b> 
<b>Address</b>	293 Garfield Road East, Riverstone NSW 2765			
<b>Logger Model Name</b>	Larson Davis LXT1	<b>Latest calibration date</b>	12/07/2022	
<b>Logger Serial No.</b>	0001719	<b>Time weighting</b>	Fast	
<b>Start Date</b>	19/07/2023	<b>Frequency Weighting</b>	A	
<b>Finish Date</b>	28/07/2023	<b>Location</b>	Free Field	
<b>Logger Notes</b>	<p>Noise measurements are dominated by road traffic noise on Garfield Road East mainly from light and heavy vehicles. Construction noise was observed on 19<sup>th</sup> July 2023 during the installation of the logger.</p> <p>No construction noise was audible or present during site visits on 23<sup>rd</sup> July and 2<sup>nd</sup> August 2023.</p>			
<b>Ambient noise monitoring results - NPfl &amp; ICNG time periods</b>				<b>Logger Photo</b> 
<b>Period</b>	Day 11 hr	Evening 4hr	Night 9 hr	
<b>RBLs LA90, period dB</b>	43	43	36	
<b>Ambient noise monitoring results - RNP time periods</b>				
<b>Period</b>	Day 15hr	Night 9 hr		
<b>LAeq period dB</b>	51	48		
<b>LAeq, 1hr dB</b>	53	52		
<b>Time periods for NPfl &amp; ICNG</b>				
Day	7 am to 6 pm Monday to Saturday 8 am to 6 pm Sundays and Public Holidays			
Evening	6 pm to 10 pm			
Night	remaining periods			
<b>Time periods for RNP</b>				
Day	7am to 10 pm			
Night	10 pm to 7am			



<b>Location ID:</b>	L2					
<b>Address:</b>	293 Garfield Road East, Riverstone NSW 2765					
<b>NPfl based noise monitoring results<sup>1</sup></b>						
Date	L <sub>A90</sub> Assessment Background Levels dB			L <sub>Aeq</sub> Ambient Noise Levels dB		
	Day	Evening	Night	Day	Evening	Night
Wednesday, 19 July 2023		43	36		50	49
Thursday, 20 July 2023	42	43	35	51	50	48
Friday, 21 July 2023	44	43	35	51	49	47
Saturday, 22 July 2023	43	44	34	51	49	46
Sunday, 23 July 2023	43	40		49	48	
Monday, 24 July 2023	44	44	37	52	49	47
Tuesday, 25 July 2023	42	44	36	50	50	48
Wednesday, 26 July 2023	42	45	37	51	50	50
Thursday, 27 July 2023 <sup>2</sup>						
Friday, 28 July 2023 <sup>2</sup>						
Saturday, 29 July 2023 <sup>2</sup>						
Sunday, 30 July 2023 <sup>2</sup>						
Monday, 31 July 2023 <sup>2</sup>						
Tuesday, 1 August 2023 <sup>2</sup>						
	<b>RBL per period</b>			<b>Logarithmic average L<sub>Aeq, period</sub> dB</b>		
	<b>43</b>	<b>43</b>	<b>36</b>	<b>51</b>	<b>50</b>	<b>48</b>

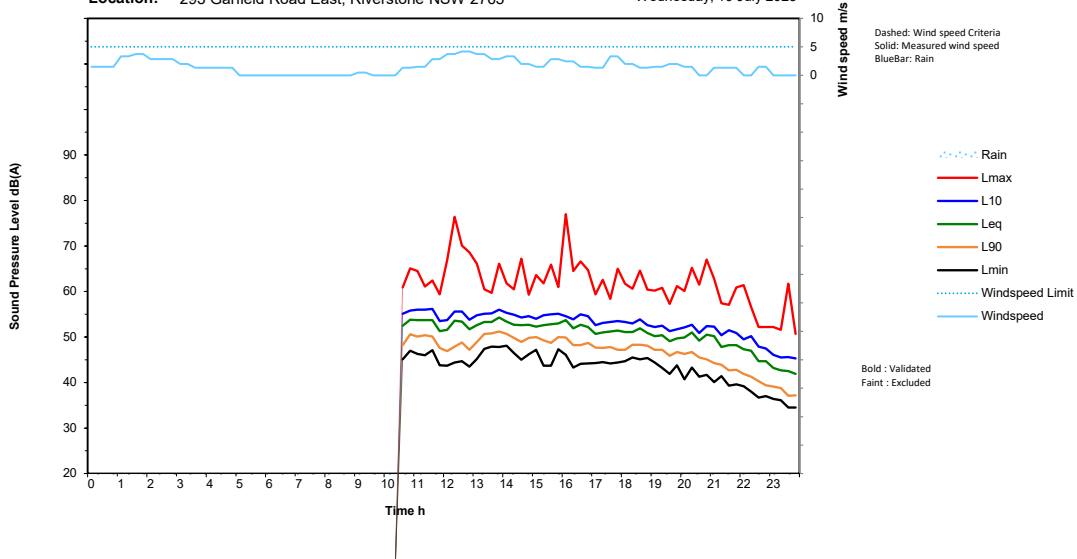
Note 1: No data has been presented for weather excluded data or data with extraneous noise.

Note 2: Noise logger failed to measure data after 27<sup>th</sup> July due to depletion of the battery.

Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

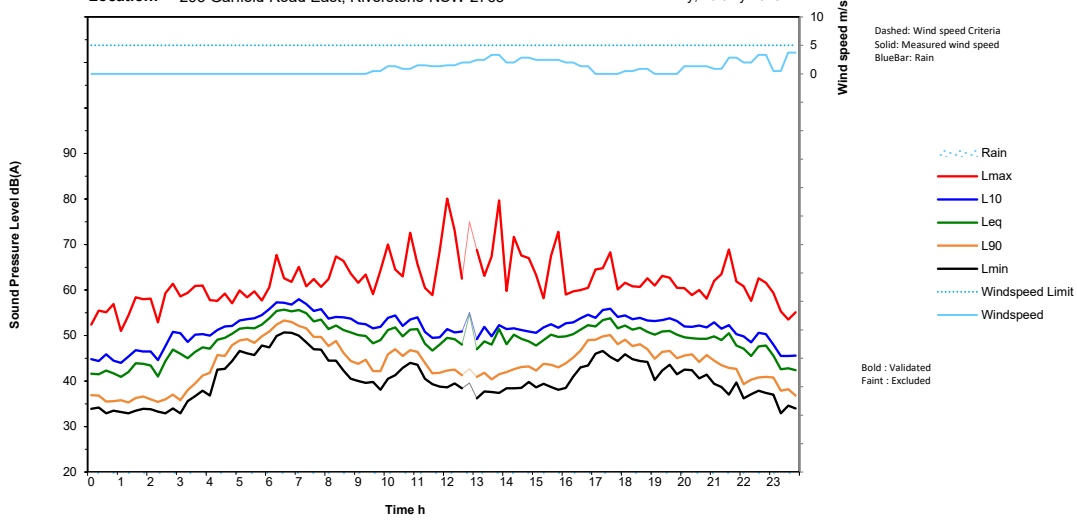
Wednesday, 19 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

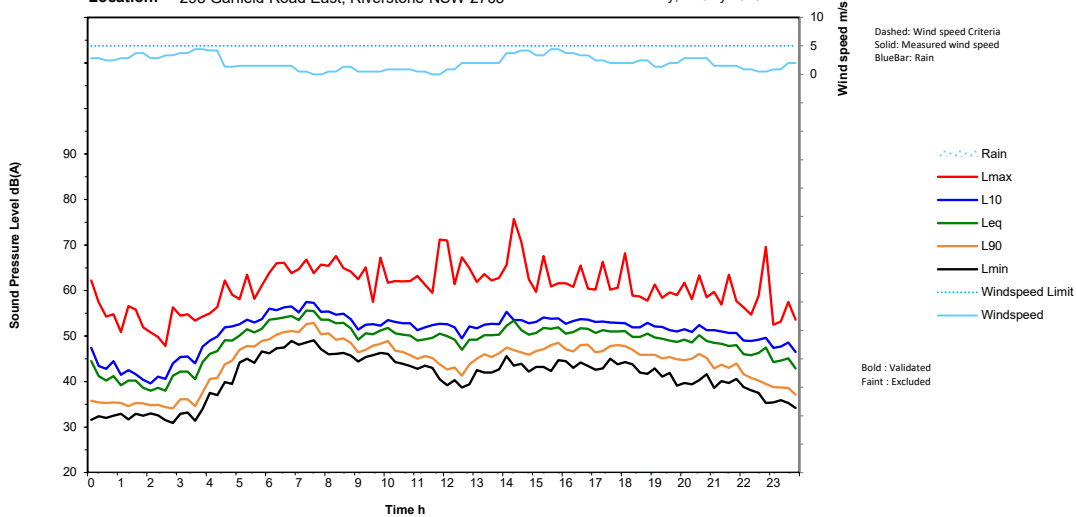
Thursday, 20 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

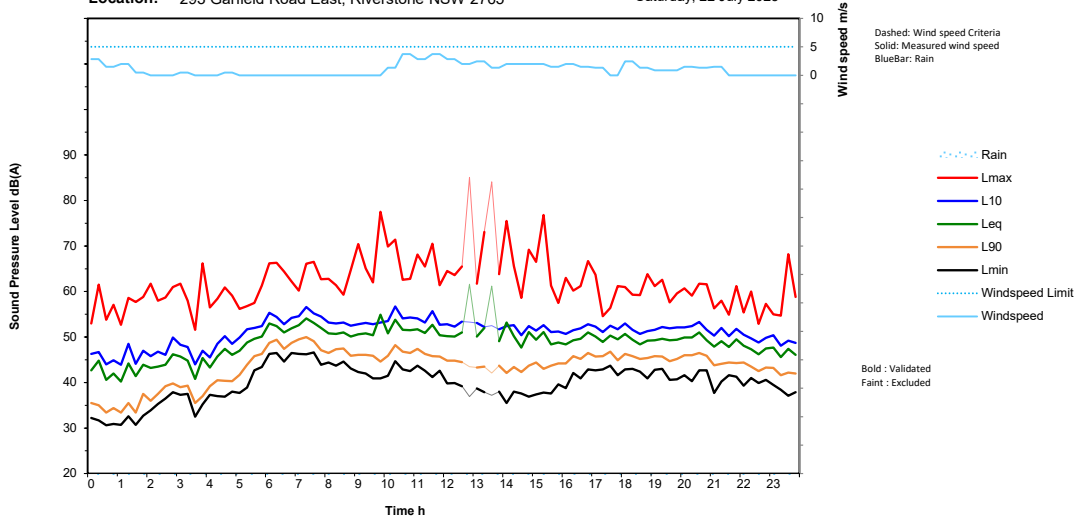
Friday, 21 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

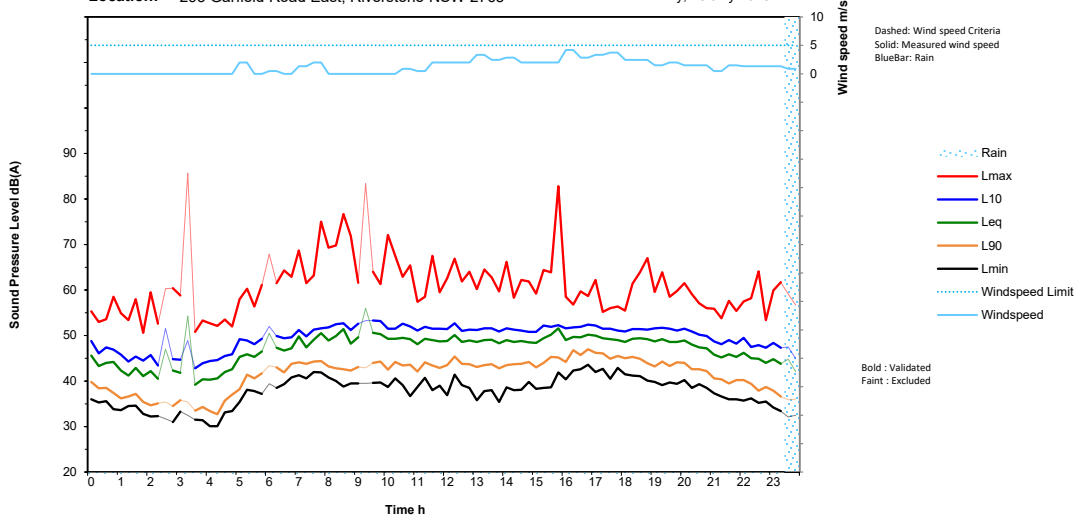
Saturday, 22 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

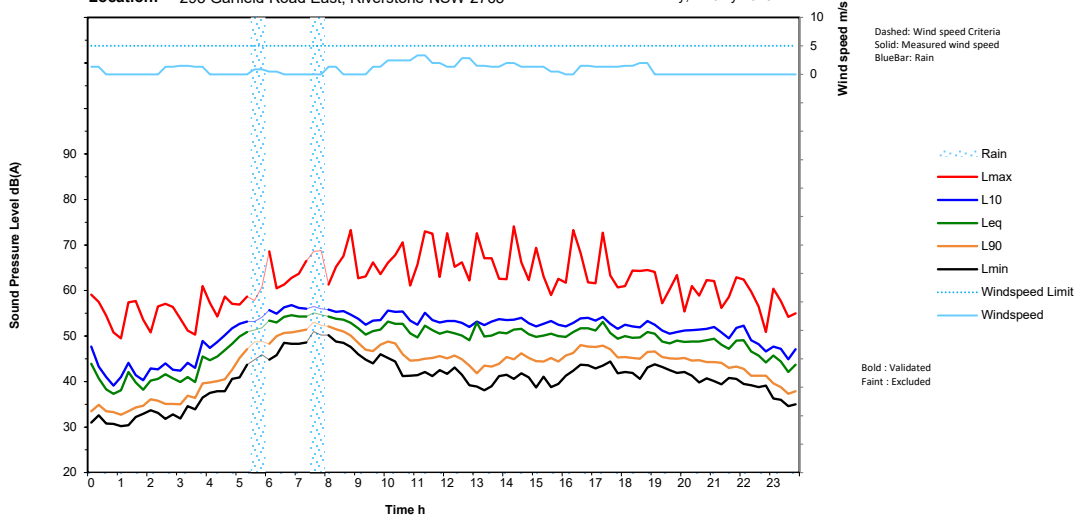
Sunday, 23 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

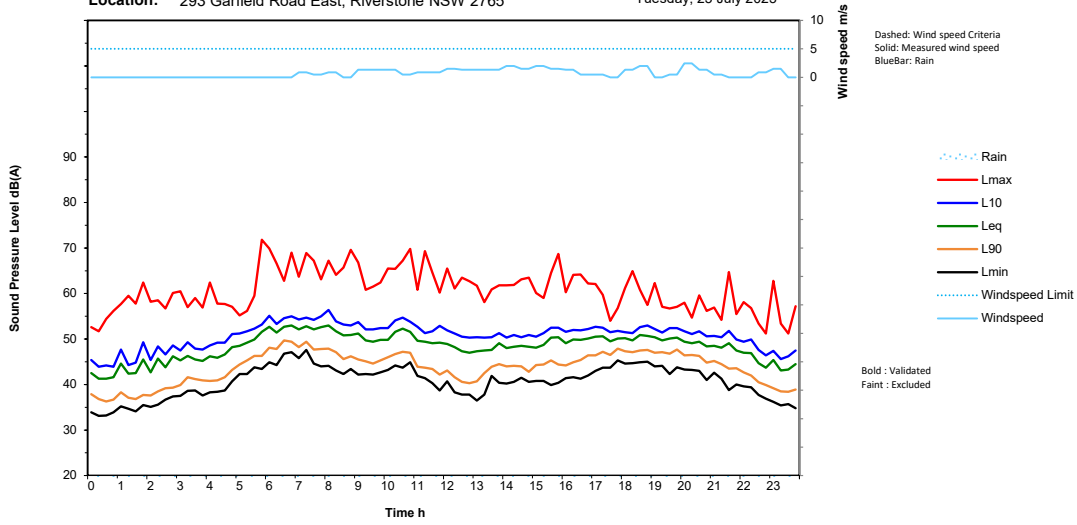
Monday, 24 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

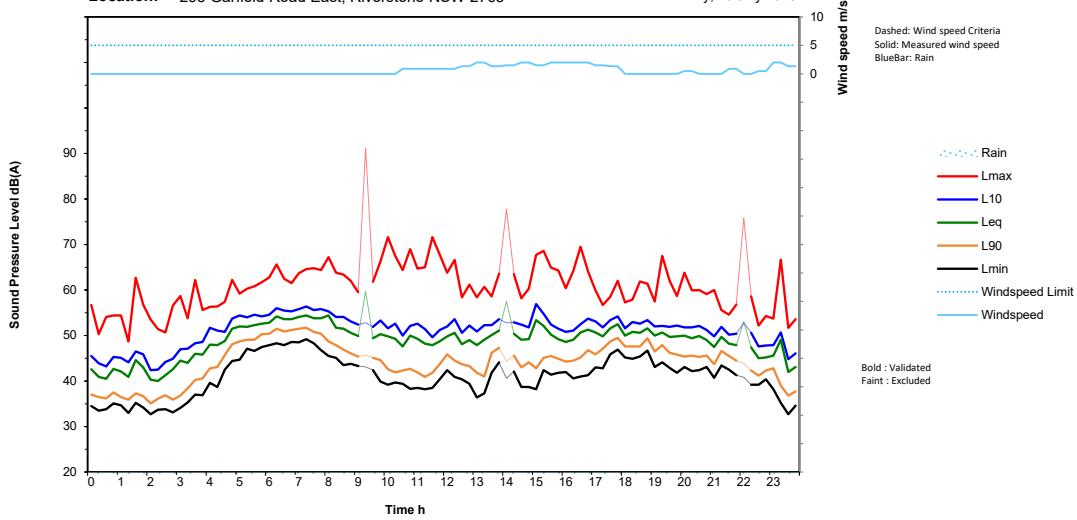
Tuesday, 25 July 2023



Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

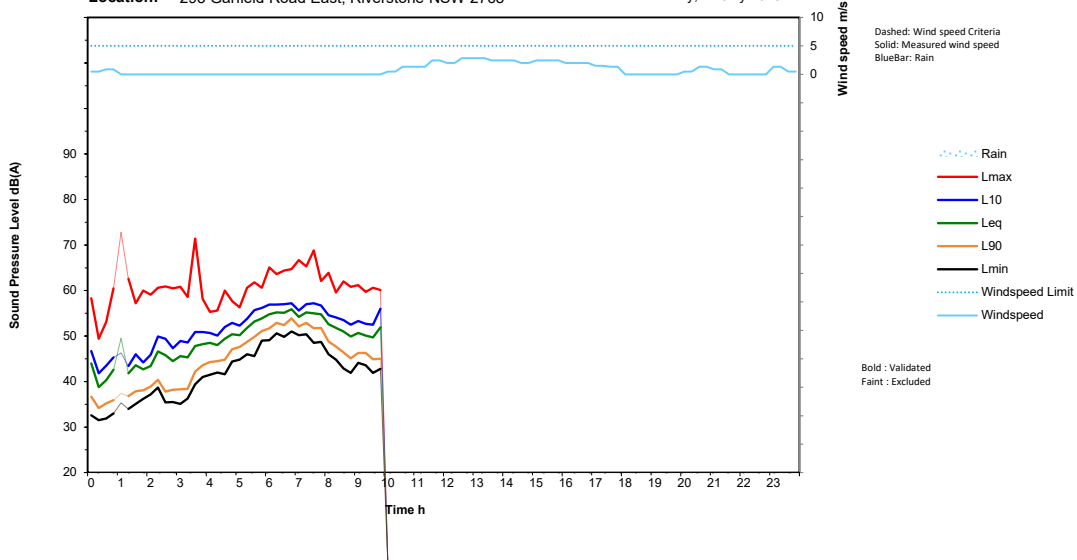
Wednesday, 26 July 2023




Logger ID: L2

Location: 293 Garfield Road East, Riverstone NSW 2765

Thursday, 27 July 2023



<b>Location ID</b>	L3			<b>Aerial Image</b>
<b>Address</b>	150 Cudgegong Road, Rouse Hill NSW 2155			
<b>Logger Model Name</b>	Rion NL-21	<b>Latest calibration date</b>	12/07/2022	
<b>Logger Serial No.</b>	00709529	<b>Time weighting</b>	Fast	
<b>Start Date</b>	19/07/2023	<b>Frequency Weighting</b>	A	
<b>Finish Date</b>	2/08/2023	<b>Location</b>	Free field	
<b>Logger Notes</b>	Noise measurements are dominated by local road traffic noise on Cudgegong Road mainly from light vehicles.			




**Legend**

- Riverstone East Stage 3 Boundary
- Unattended noise monitoring location

**Roads**

- Local roads

<b>Ambient noise monitoring results - NPfl &amp; ICNG time periods</b>				<b>Logger Photo</b>
<b>Period</b>	Day 11 hr	Evening 4hr	Night 9 hr	
<b>RBLs LA90, period dB</b>	38	38	34	
<b>Ambient noise monitoring results - RNP time periods</b>				
<b>Period</b>	Day 15hr	Night 9 hr		
<b>LAeq period dB</b>	54	48		
<b>LAeq, 1hr dB</b>	57	52		
<b>Time periods for NPfl &amp; ICNG</b>				
Day	7 am to 6 pm Monday to Saturday 8 am to 6 pm Sundays and Public Holidays			
Evening	6 pm to 10 pm			
Night	remaining periods			
<b>Time periods for RNP</b>				
Day	7am to 10 pm			
Night	10 pm to 7am			







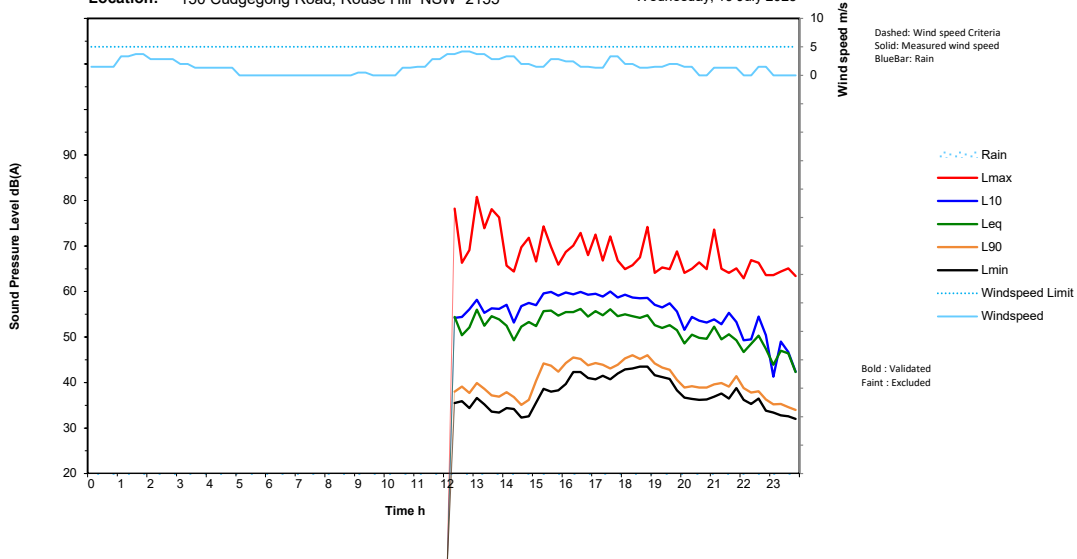
<b>Location ID:</b>	L3					
<b>Address:</b>	150 Cudgegong Road, Rouse Hill NSW 2155					
<b>NPfl based noise monitoring results<sup>1</sup></b>						
Date	L <sub>A90</sub> Assessment Background Levels dB			L <sub>Aeq</sub> Ambient Noise Levels dB		
	Day	Evening	Night	Day	Evening	Night
Wednesday, 19 July 2023		39	32		52	49
Thursday, 20 July 2023	41	38	36	55	52	49
Friday, 21 July 2023	40	37	31	56	52	46
Saturday, 22 July 2023	37	37	31	53	50	48
Sunday, 23 July 2023	37	37		52	49	
Monday, 24 July 2023	38	39	36	55	52	48
Tuesday, 25 July 2023	36	40	34	56	52	49
Wednesday, 26 July 2023	36	39	33	56	53	48
Thursday, 27 July 2023	39	40	38	55	53	49
Friday, 28 July 2023		40	37		52	48
Saturday, 29 July 2023	39	40	38	54	51	48
Sunday, 30 July 2023		39	36		49	48
Monday, 31 July 2023	38	38	34	55	51	48
Tuesday, 1 August 2023	37	36	33	54	52	48
	<b>RBL per period</b>			<b>Logarithmic average L<sub>Aeq, period</sub> dB</b>		
	<b>38</b>	<b>38</b>	<b>34</b>	<b>55</b>	<b>52</b>	<b>48</b>

Note 1: No data has been presented for weather excluded data or data with extraneous noise.

Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

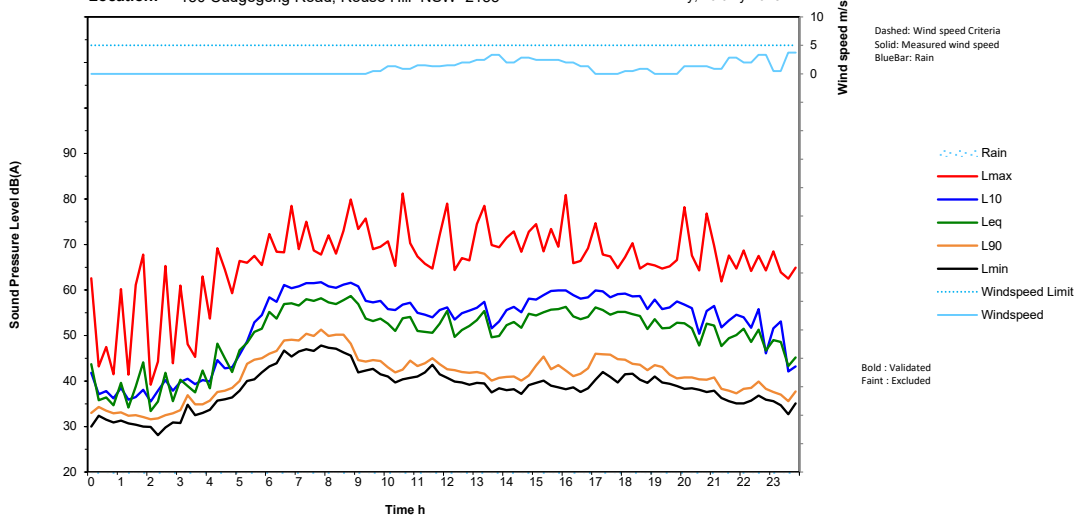
Wednesday, 19 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

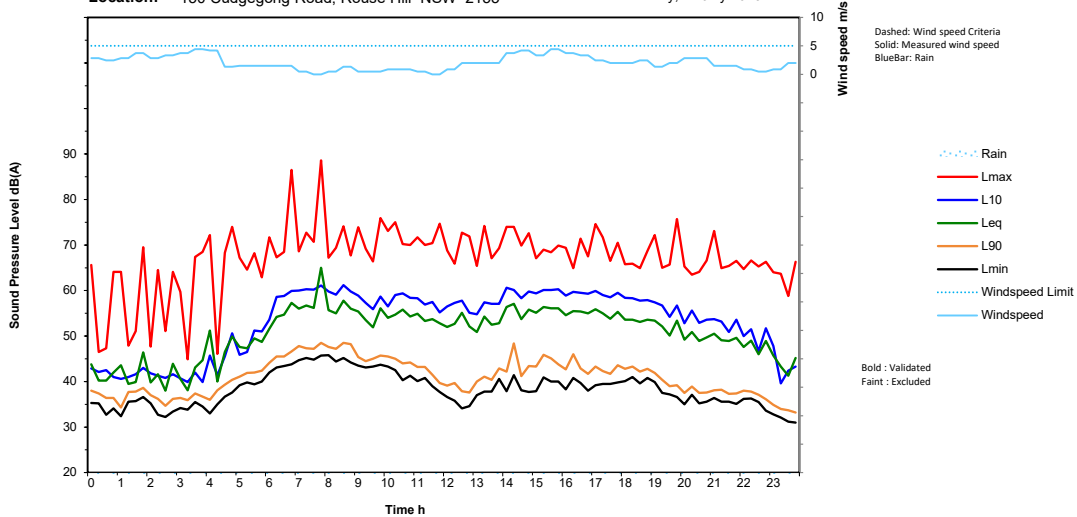
Thursday, 20 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

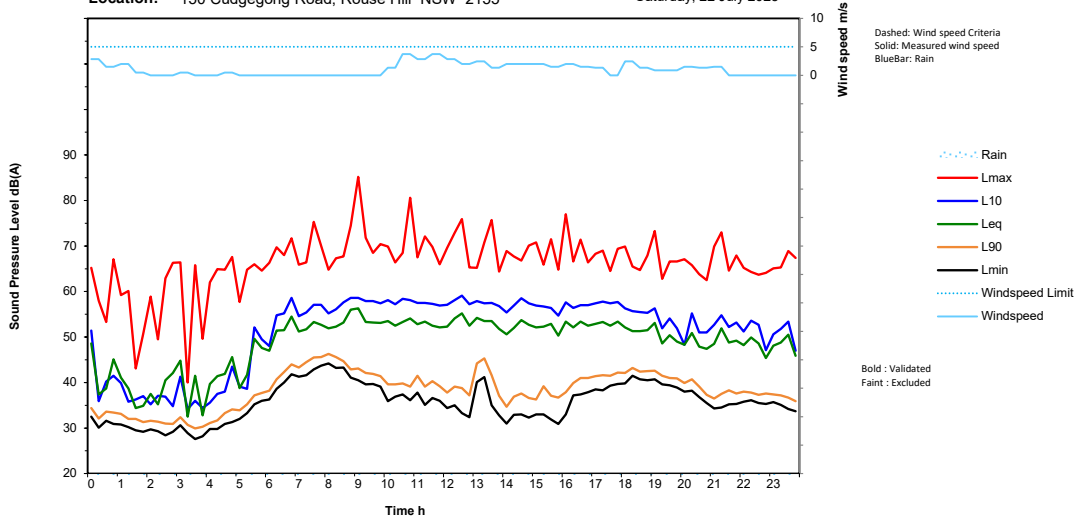
Friday, 21 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

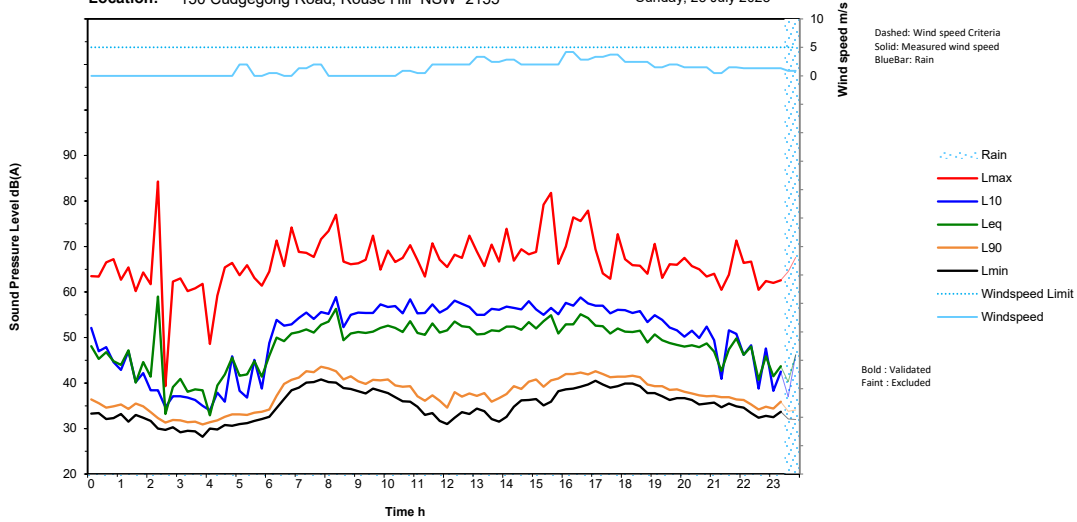
Saturday, 22 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

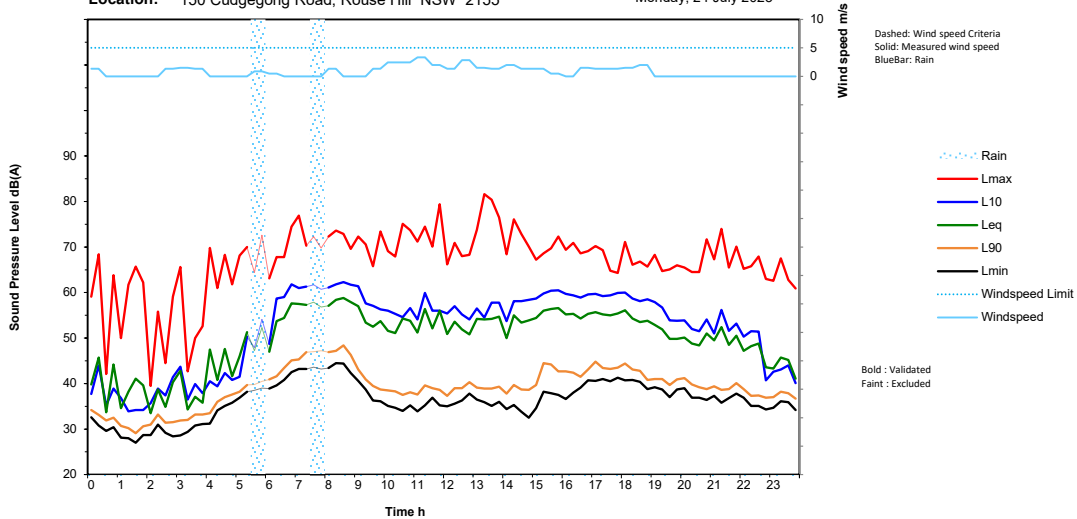
Sunday, 23 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

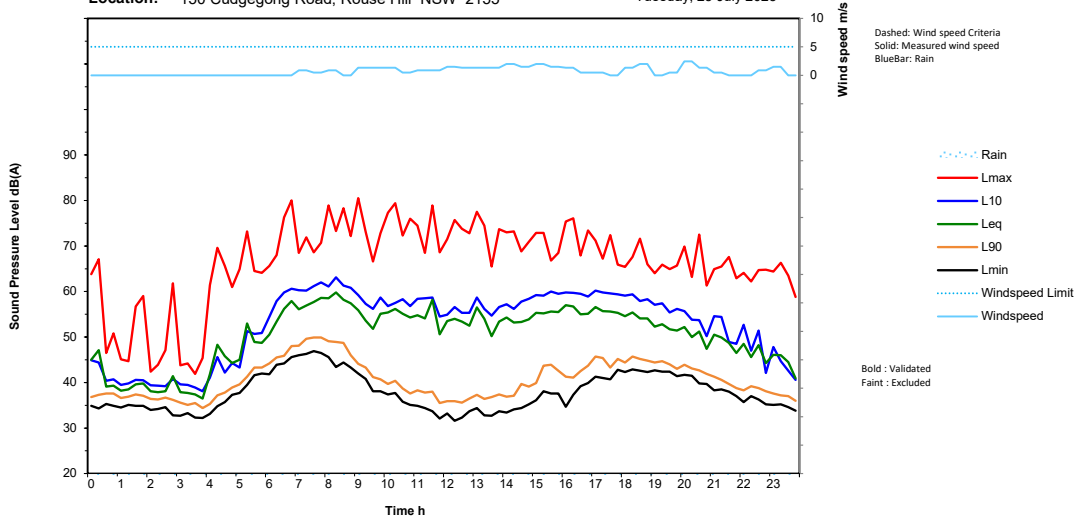
Monday, 24 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

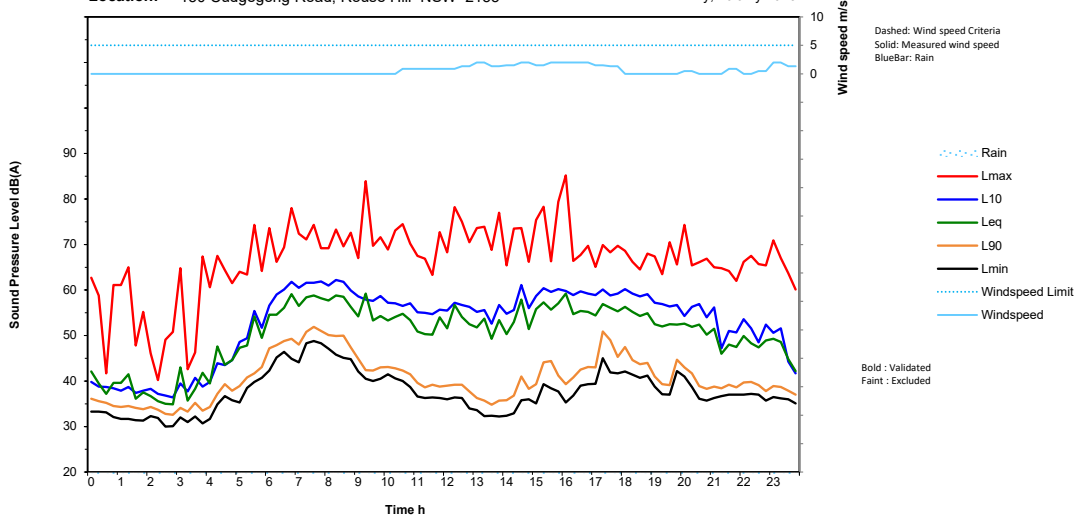
Tuesday, 25 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

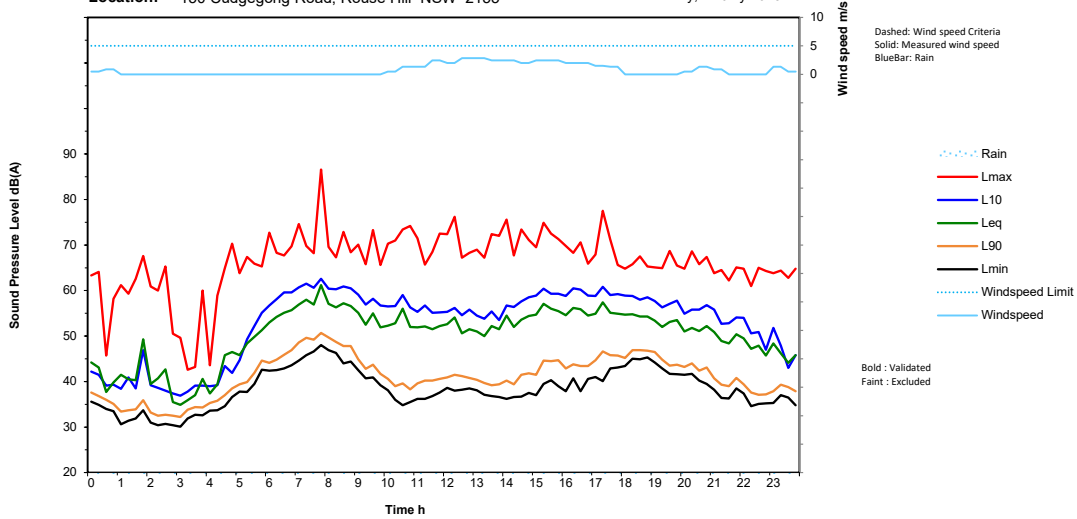
Wednesday, 26 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

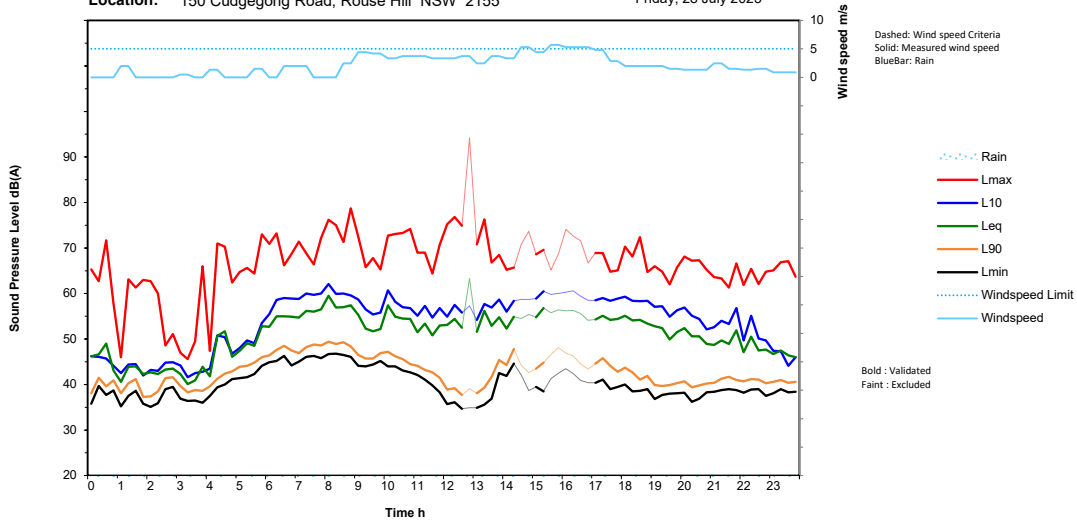
Thursday, 27 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

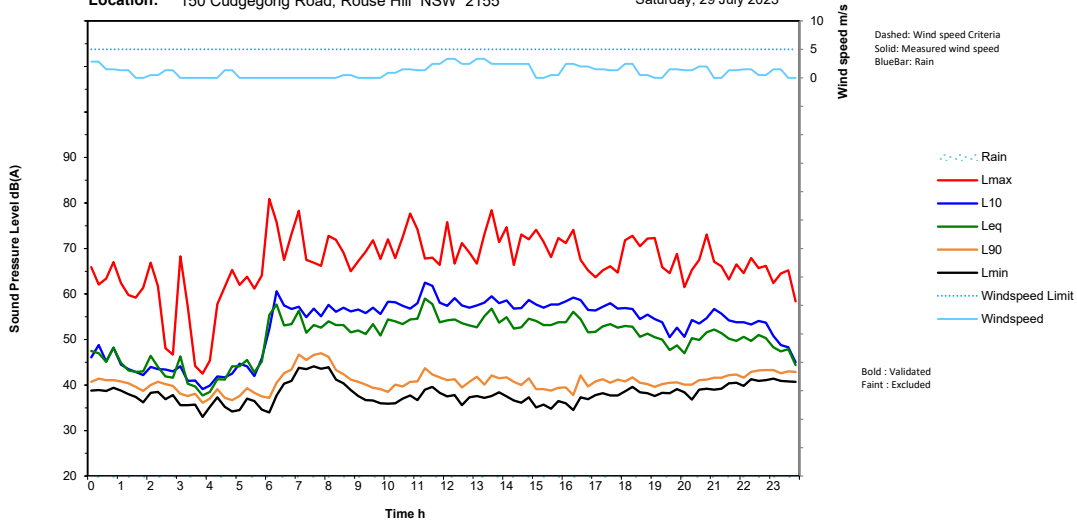
Friday, 28 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

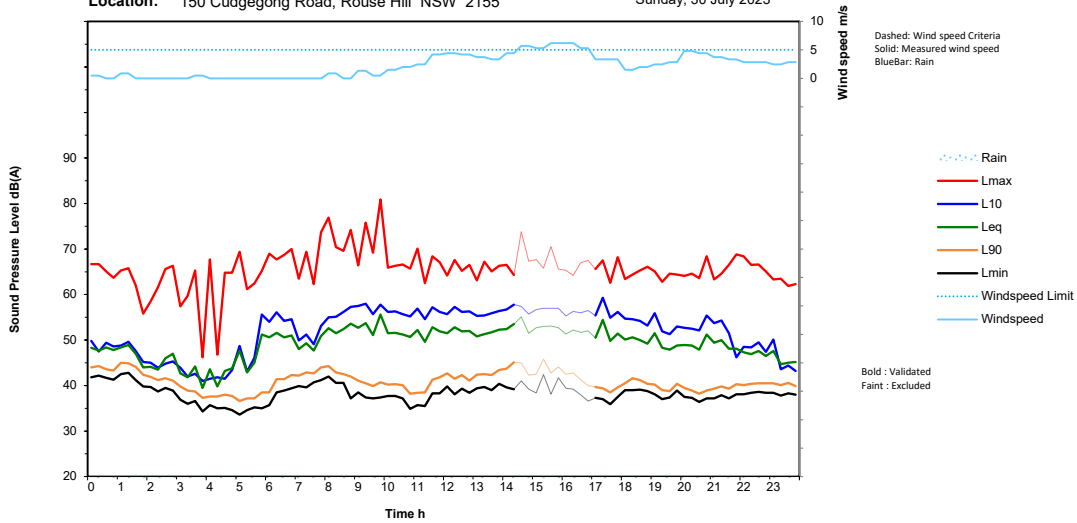
Saturday, 29 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

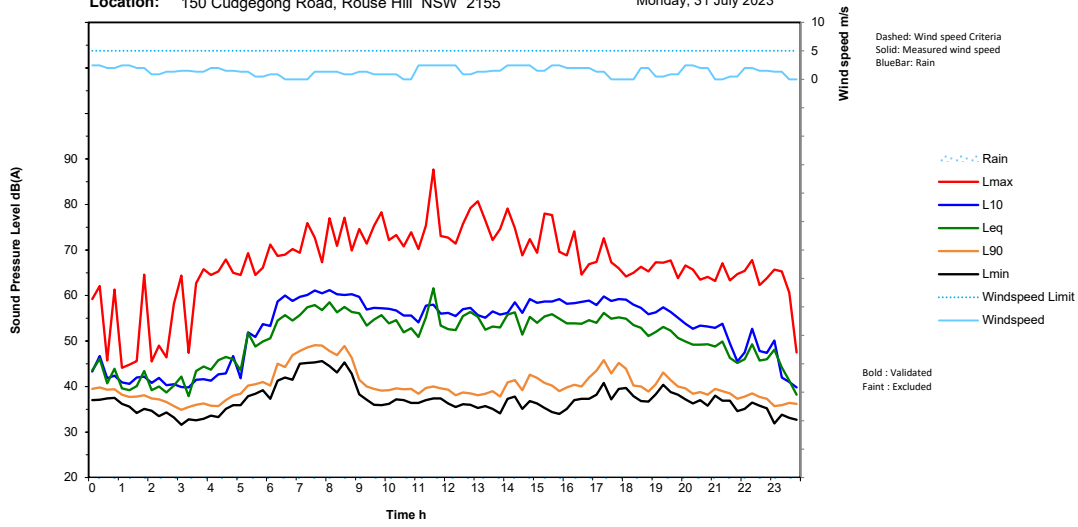
Sunday, 30 July 2023



Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

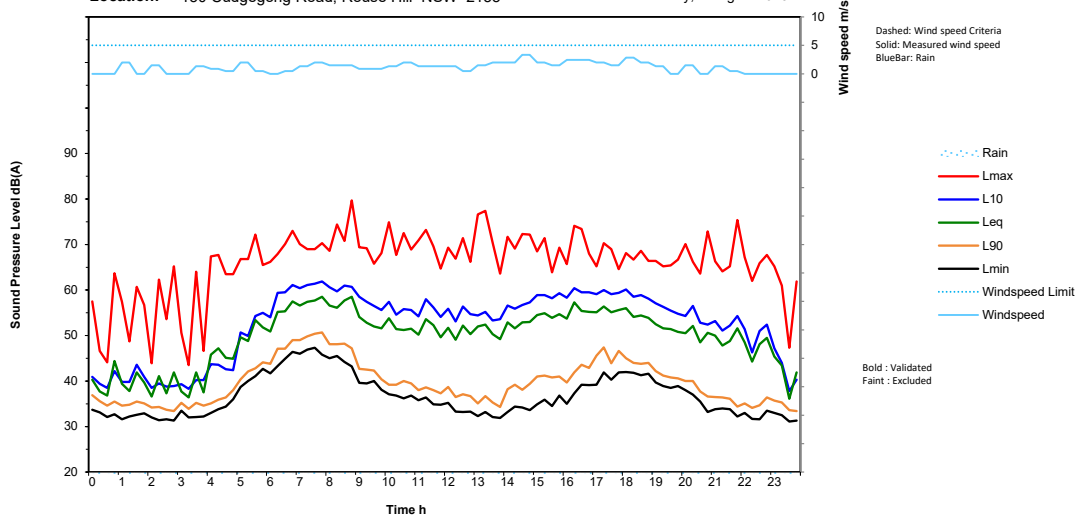
Monday, 31 July 2023





Logger ID: L3

Location: 150 Cudgegong Road, Rouse Hill NSW 2155

Tuesday, 1 August 2023



<b>Location ID</b>	L4			<b>Aerial Image</b> 
<b>Address</b>	328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)			
<b>Logger Model Name</b>	ARL NGARA	<b>Latest calibration date</b>	19/10/2022	
<b>Logger Serial No.</b>	878000	<b>Time weighting</b>	Fast	
<b>Start Date</b>	19/07/2023	<b>Frequency Weighting</b>	A	
<b>Finish Date</b>	2/08/2023	<b>Location</b>	Free Field	
<b>Logger Notes</b>	Noise measurements are dominated by local road traffic noise on Cudgegong Road mainly from light vehicles.			

<b>Ambient noise monitoring results - NPfl &amp; ICNG time periods</b>				<b>Logger Photo</b> 
<b>Period</b>	Day 11 hr	Evening 4hr	Night 9 hr	
<b>RBLs LA90, period dB</b>	43 (42)	43(42)	42(38)	
<b>Ambient noise monitoring results - RNP time periods</b>				
<b>Period</b>	Day 15hr	Night 9 hr		
<b>LAeq period dB</b>	53 (52)	52 (50)		
<b>LAeq, 1hr dB</b>	56 (54)	55 (53)		
<b>Time periods for NPfl &amp; ICNG</b>				
Day	7 am to 6 pm Monday to Saturday 8 am to 6 pm Sundays and Public Holidays			
Evening	6 pm to 10 pm			
Night	remaining periods			
<b>Time periods for RNP</b>				
Day	7am to 10 pm			
Night	10 pm to 7am			

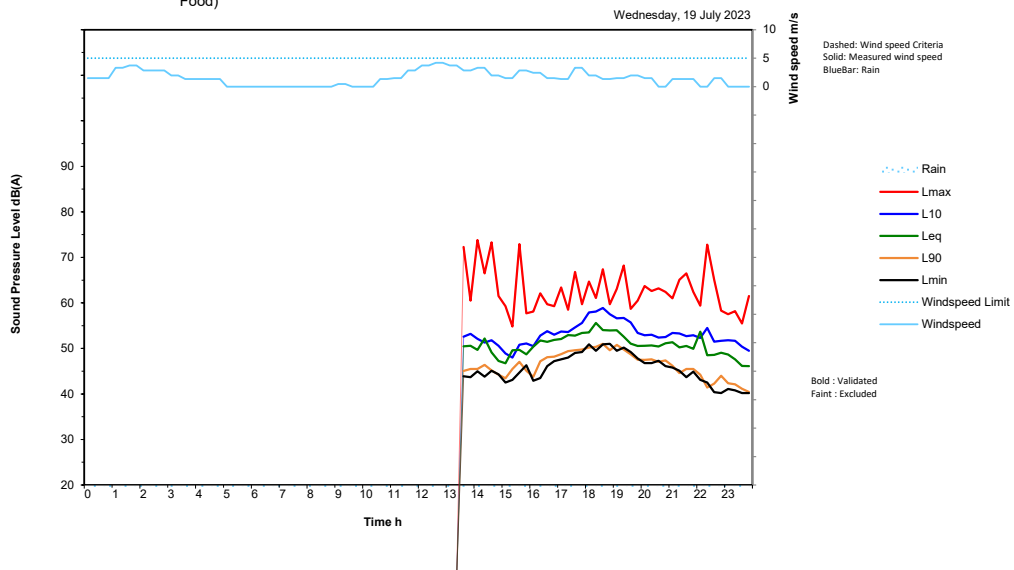




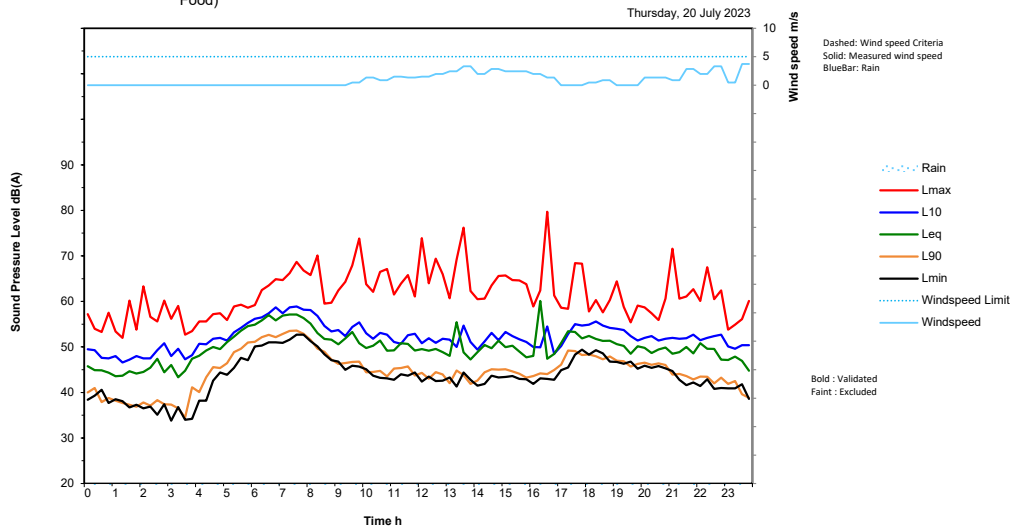
<b>Location ID:</b>	L4					
<b>Address:</b>	328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)					
<b>NPfl based noise monitoring results<sup>1</sup></b>						
<b>Date</b>	<b>L<sub>A90</sub> Assessment Background Levels dB<sup>2</sup></b>			<b>L<sub>Aeq</sub> Ambient Noise Levels dB<sup>2</sup></b>		
	<b>Day</b>	<b>Evening</b>	<b>Night</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
Wednesday, 19 July 2023		47 (45)	39 (37)		54 (52)	50 (50)
Thursday, 20 July 2023	45 (43)	46 (44)	36 (33)	53 (52)	51 (50)	48 (48)
Friday, 21 July 2023	43 (42)	46 (44)	40 (38)	52 (52)	51 (51)	47 (47)
Saturday, 22 July 2023	41 (39)	46 (44)	39 (36)	50 (50)	52 (51)	48 (48)
Sunday, 23 July 2023	42 (40)	43 (40)		49 (48)	50 (48)	
Monday, 24 July 2023	46 (44)	50 (46)	44 (38)	52 (51)	54 (52)	53 (49)
Tuesday, 25 July 2023	45 (44)	50 (45)	41 (36)	51 (51)	57 (52)	51 (50)
Wednesday, 26 July 2023	43 (41)	50 (47)	42 (38)	52 (51)	56 (53)	52 (51)
Thursday, 27 July 2023	44 (43)	49 (46)	44 (40)	52 (52)	55 (53)	51 (49)
Friday, 28 July 2023		52 (46)	46 (42)		56 (52)	55 (50)
Saturday, 29 July 2023	43 (41)	54 (48)	44 (36)	51 (51)	57 (53)	55 (50)
Sunday, 30 July 2023						
Monday, 31 July 2023	42 (40)	49 (45)	43 (38)	52 (52)	54 (51)	52 (51)
Tuesday, 1 August 2023	44 (42)	47 (45)	40 (40)	53 (53)	53 (51)	50 (48)
	<b>RBL per period</b>			<b>Logarithmic average L<sub>Aeq, period</sub> dB</b>		
	<b>43 (42)</b>	<b>43 (42)</b>	<b>42 (38)</b>	<b>52 (51)</b>	<b>54 (52)</b>	<b>52 (50)</b>

Note: Graphs for Logger L4 show the data after the filtering process.

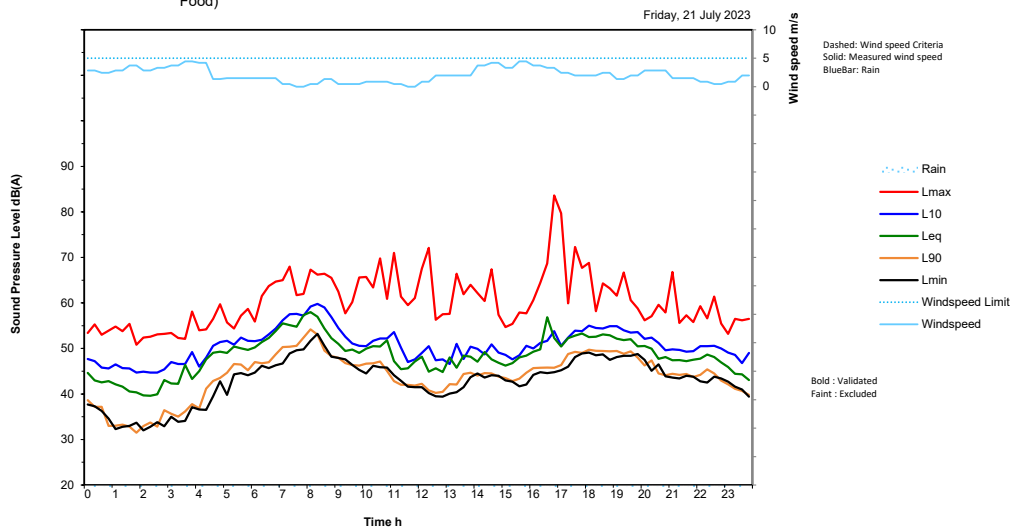
**Logger ID:** L4  
**Location:** 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)



**Logger ID:** L4  
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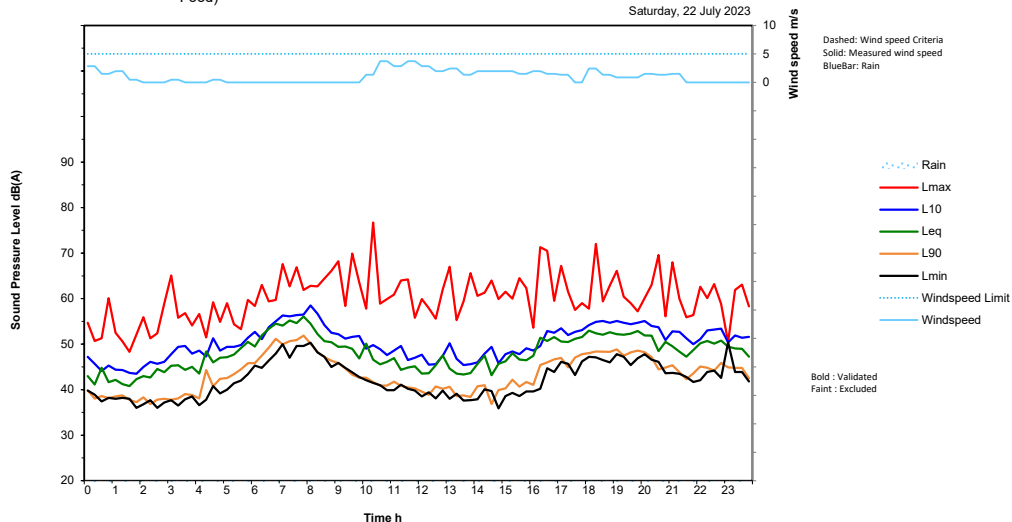


**Logger ID:** L4  
**Location:** 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)



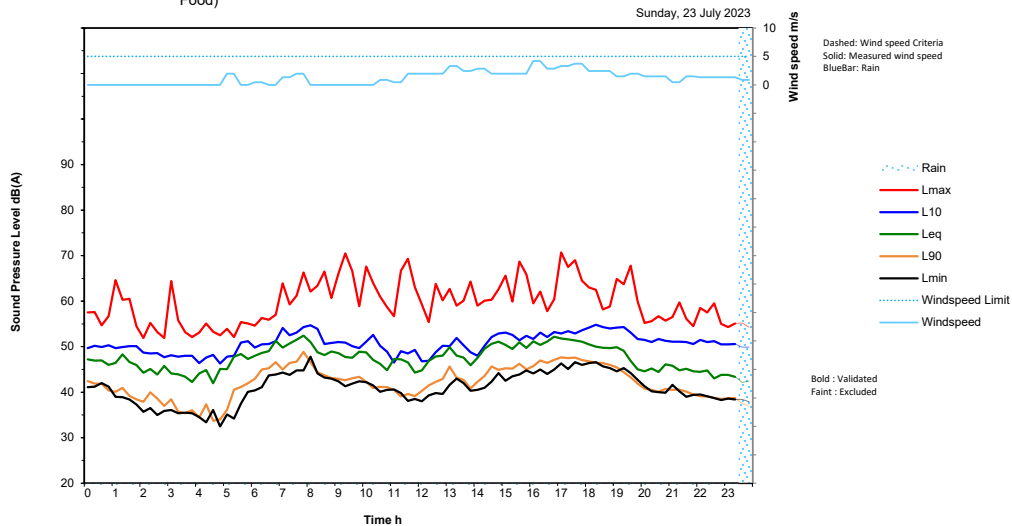
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Saturday, 22 July 2023



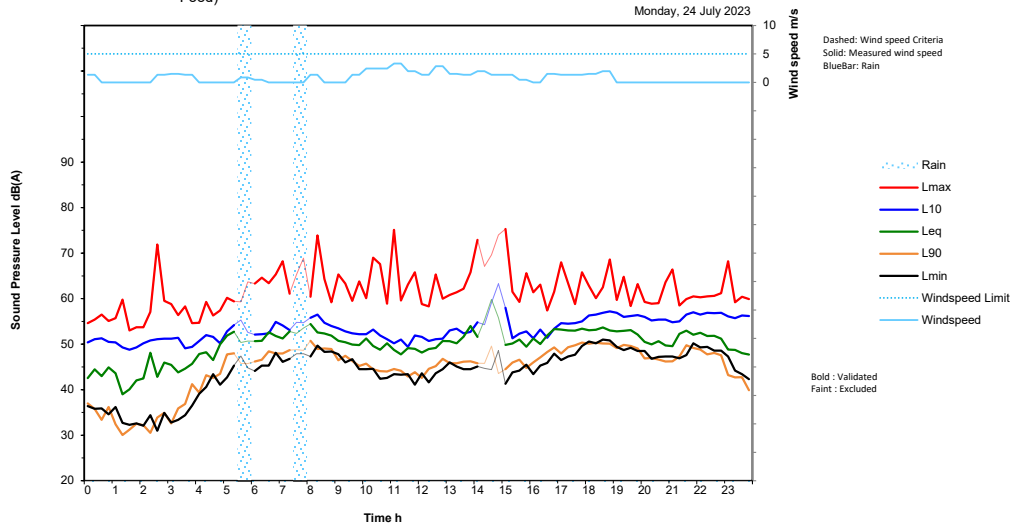
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Sunday, 23 July 2023



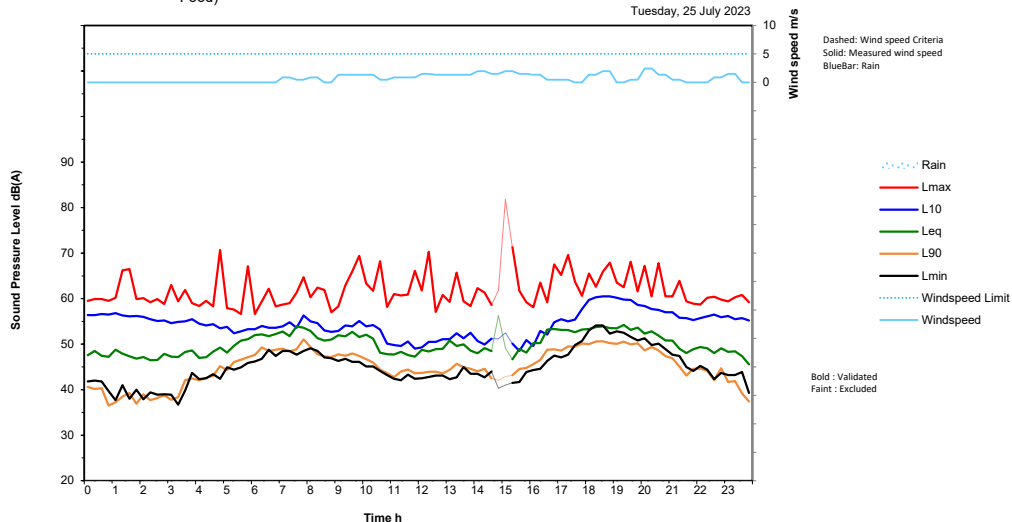
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Monday, 24 July 2023



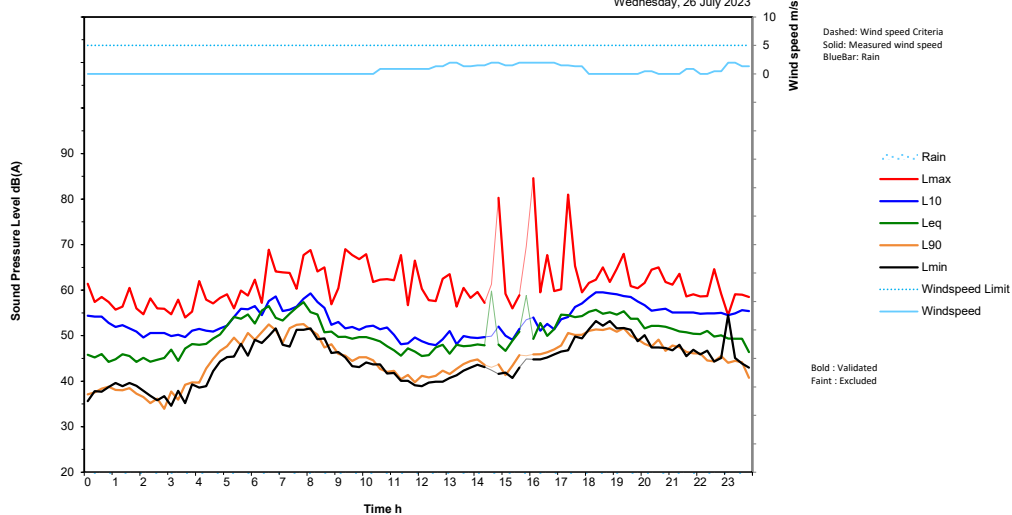
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Tuesday, 25 July 2023



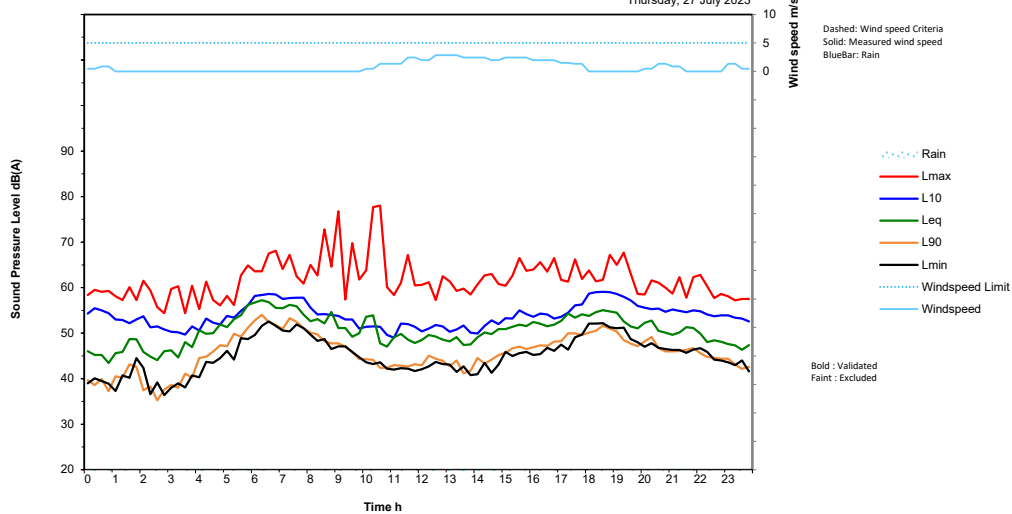
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Wednesday, 26 July 2023



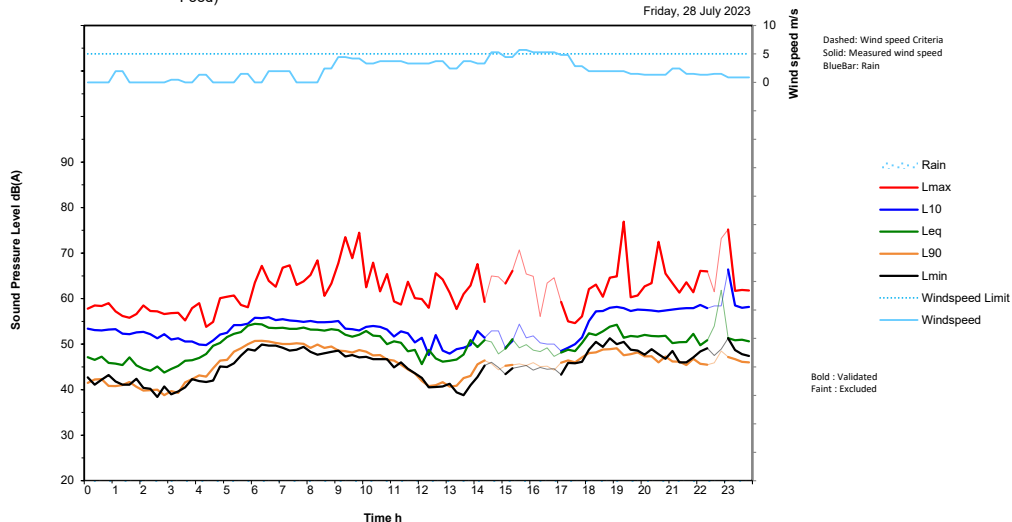
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Thursday, 27 July 2023



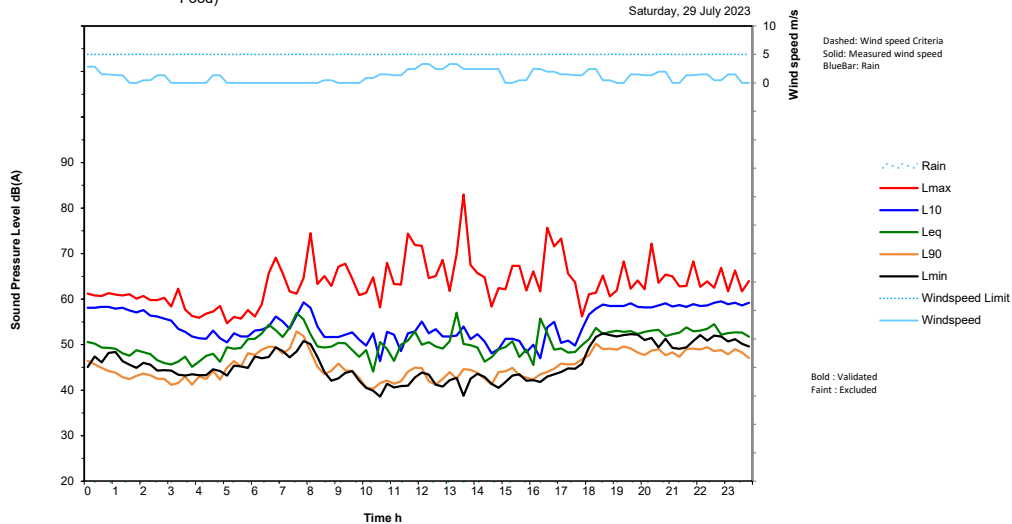
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Friday, 28 July 2023



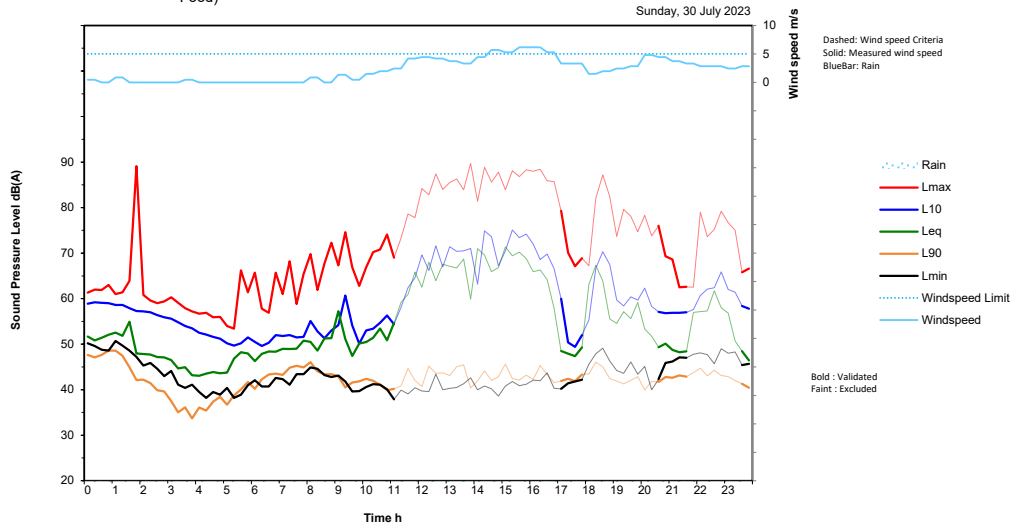
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Saturday, 29 July 2023



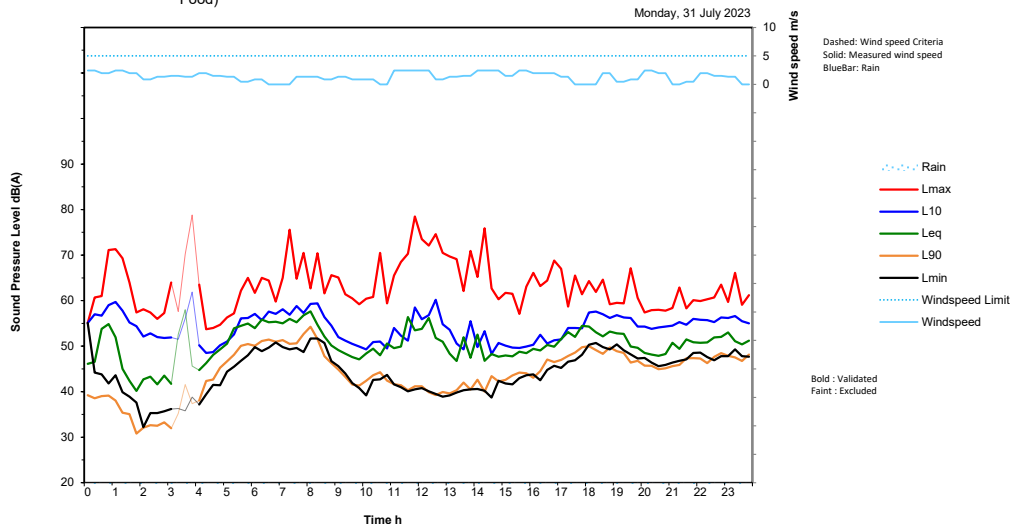
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Sunday, 30 July 2023



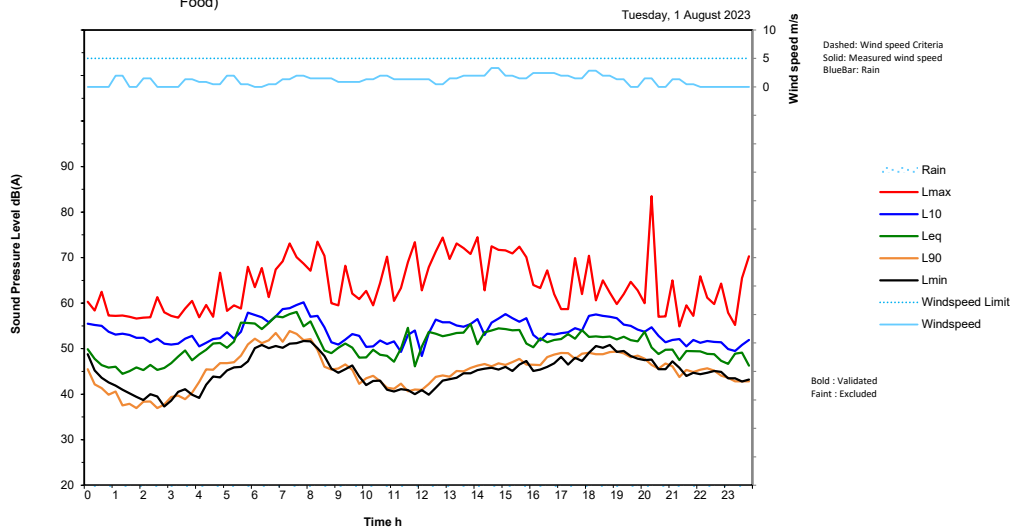
Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Monday, 31 July 2023



Logger ID: L4  
Location: 328 Garfield Road East, Riverstone NSW 2155 (Burns Pet Food)

Tuesday, 1 August 2023



**Document prepared by**

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