Norman Disney & Young
A TETRA TECH COMPANY

SSDA Report

School Infrastructure NSW

New Primary School at Gregory Hills
Noise and Vibration Impact Assessment

CONFIDENTIAL

Revision: 6.0 – SSDA Lodgement **Issued**: 27 October 2022

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1 EXECUTIVE SUMMARY

1.1 Introduction

This Noise and Vibration Impact Assessment report accompanies an Environmental Impact Statement (EIS) pursuant to part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in support of an application for State Significant Development Application (SSDA) for the construction and operation of a new primary school at Gregory Hills (SSD – 41306367).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

Item	SEARs Requirements	Document Reference/Response
11	*Provide a noise and vibration impact assessment that:*	-
	Prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines.	Refer to Section 1.6
	The assessment must detail operational noise impacts (including any public – address system, events and out of hours use of school facilities) on nearby sensitive receivers considering noise intrusion.	Refer to Section 4
	The assessment must detail construction noise and vibration impacts on nearby sensitive receivers and structures.	Refer to Section 5
	Outline the proposed management and mitigation measures that would be implemented for operational and construction noise/vibration	Refer to Section 4 for mitigation measures discussion for each noise impact assessment and Section 5.4 for construction noise and vibration mitigation and management measures

This revision further addresses DPE Review of SSDA comments, which is clarified in Consultant Advice Notice J-001 - Acoustics – Responses to DPE comments.

1.2 Proposal

The proposal is for a new primary school at Gregory Hills that generally comprises the following:

- 44 General Learning Spaces.
- 4 Support Learning Spaces.
- Administration, staff hub, amenity and building service areas.
- Library, communal hall and canteen.
- Outside School Hours Care (OSHC) services.
- Sport courts, outdoor play space, a Covered Outdoor Learning Area (COLA) and site landscaping.
- Dedicated bicycle and scooter parking.
- Three (3) kiss and drop spaces for Supported Learning Students (SLS) located on Wallarah Circuit.
- On-site car parking.
- Signage.
- Footpath widening on Wallarah Circuit.

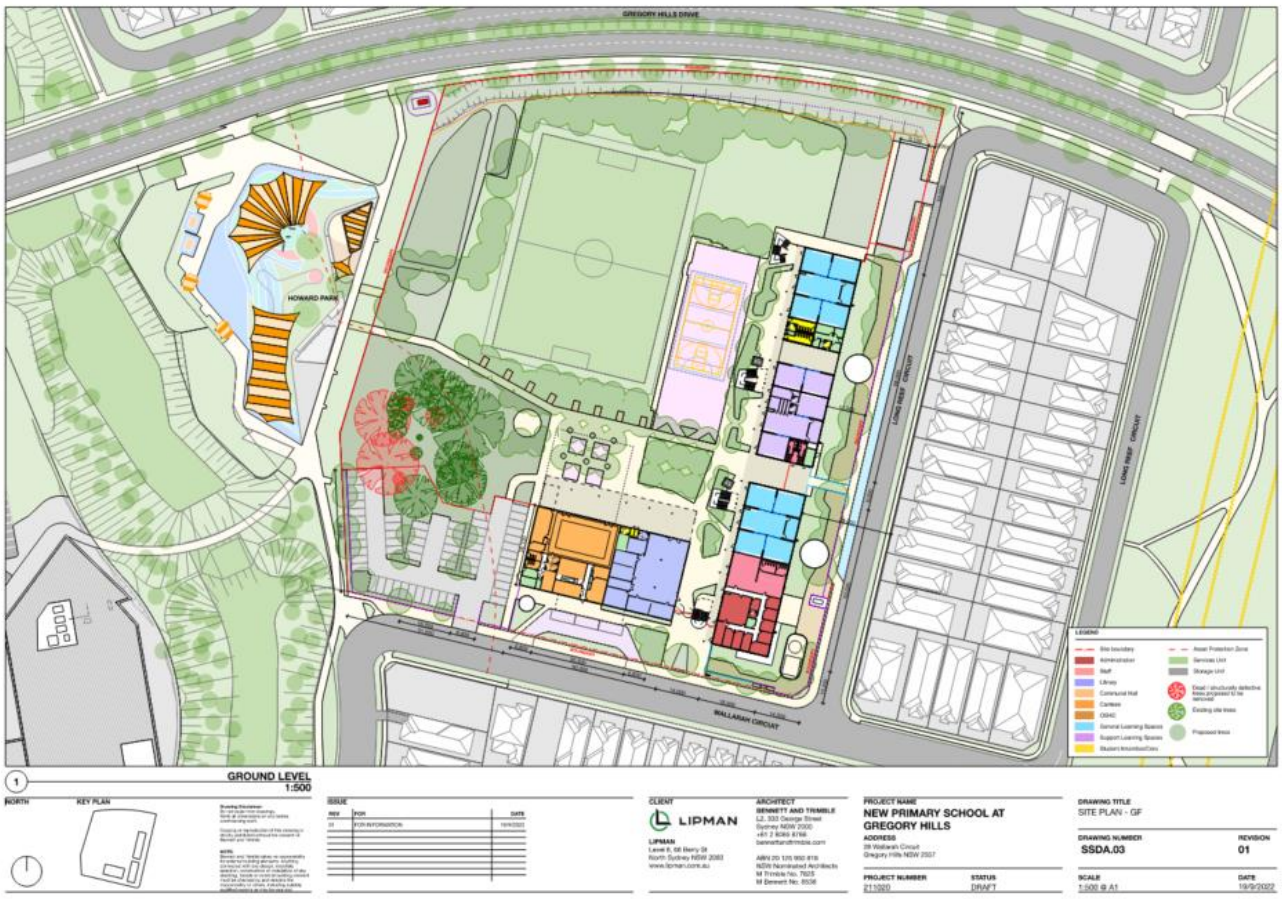


Figure 1 – Architectural Site Plan

1.3 Site Location and Description

The subject site is located in Dharawal Country at 28 Wallarah Circuit, Gregory Hills NSW 2557 and is legally described as Lot 3257 DP1243285.

The site is located within the Camden Local Government Area and is within the Turner Road Precinct of the South-West Growth Centre.

The site has an area of approximately 2.926ha (by Deposited Plan) and falls from the south-east corner (RL116.5) to the north- west corner (RL113).

The site has three (3) street frontages:

- Wallarah Circuit (southern boundary)
- Gregory Hills Drive (northern boundary)
- Long Reef Circuit (eastern Boundary)

The site is primarily vacant land, with the exception of an existing group of trees that have been retained in the southwest corner of the site that pre – date the subdivision and development of the precinct. There is also an existing electrical substation located on the south – eastern boundary.

There are easements of varying widths located to the northern boundary identified for drainage.

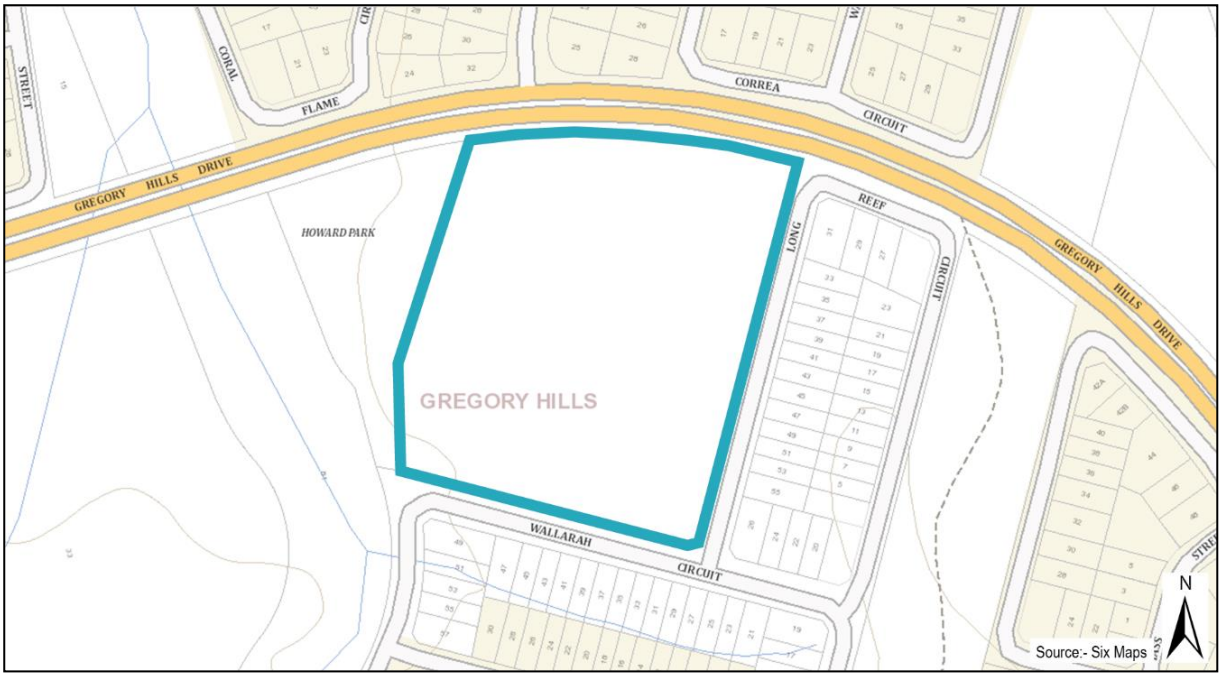


Figure 2 – Locality Map (Source: Sixmap)

Figure 3 – Site Aerial Map, (Source: Bennet and Trimble)

1.4 Surrounding Development

To the north, east and south of the site is emerging and recently completed residential development.

To the east of the residential area fronting Long Reef Circuit are high voltage power lines within an easement which include pedestrian paths and cycleways.

To the west of the site, beyond Sykes Creek and Howard Park, is the Gregory Hills town centre. A pedestrian bridge links Wallarah Circuit with the town centre across Sykes Creek.

Figure 4 – Surrounding Development (Source: Nearmap)

1.5 Authority

Authority to undertake this report was provided by Nick Marcovich of Jacobs.

1.6 Information Sources

The report is based upon the following information:

- NSW Noise Policy for Industry (NPfI) 2017
- NSW Interim Construction Noise Guideline 2009
- NSW Road Noise Policy (RNP) 2011
- AAAC Guideline for Child Care Centre Acoustic Assessment v3.0 2020
- NSW EPA Assessing Vibration: A Technical Guideline 2006
- German DIN 4150: Part 3 – 1999 "Effect of Vibration on Structure" (DIN 1999)
- Australian Standard AS 2670.2 1990 – Evaluation of Human Exposure to Whole Body Vibration – Part 2: Continuous and Shock Induced Vibration in Building (1 Hz to 80 Hz)
- British Standard BS 6472 – 2008 – Evaluation of Human Exposure Vibration in Buildings (1 Hz to 80 Hz)
- Bennett and Trimble "New Primary School" Site Plan dated 19/09/2022
- Transport and Accessibility Impact Assessment by Ason Group Rev 04, dated 23/09/2022

1.7 Revision History

Revision	Date Issued	Comment
1.0	9th September 2022	For Submission
2.0	16th September 2022	For Submission – Amended per PKA's Comment
3.0	21st September 2022	For Submission – Amended per DFP Comment
4.0	4th October 2022	For Submission – Amended per DFP, SB and PKA Comment
5.0	26th October 2022	For Submission – Final Draft
6.0	27th October 2022	For SSDA Lodgement

2 ACOUSTIC SURVEY OF THE EXISTING ENVIRONMENT

2.1 Methodology

Noise surveys and site inspection were conducted to determine the existing background/ambient noise levels at the nearest sensitive receivers. Logger locations and results are described in section 2.5, section 3.1 and shown in **APPENDIX A: Measured Noise Levels**.

2.2 Instrumentation

Noise levels were measured using noise loggers. **Table 1** provides information relating to each noise loggers/sound level meter.

Table 1 – Noise Logger and Sound Level Meter information

Noise Logger/Sound Level Meter	Type	Serial Number	Date of last calibration
ARL Rion NL - 42	Class 1	00597172	01/08/2022
ARL Rion NL - 42	Class 1	00184109	01/08/2022
B&K 2250	Class 1	2644676	22/06/2022

The equipment calibration was checked prior to, and after the noise survey using a 94 dB external calibration tone at 1 kHz.

The noise loggers were configured to record all relevant noise parameters including background noise (L_{A90}) and equivalent continuous noise levels L_{Aeq}. Samples were recorded at 15-minute A-weighted continuous intervals. The noise monitor responses were set to fast response. The analysers are Class 1 and comply with AS IEC 61672.2-2004.

2.3 Meteorological Data

In order to verify that the noise data was obtained during suitable meteorological conditions, weather data such as rain and wind speed were obtained from the Bureau of Meteorology Campbelltown (Mount Annan) weather station (Station ID 068257) as a representative site.

Noise data is excluded (as per the NSW NPfI methodology) from the results in case of:

- Rain observed during any 15-minute noise measurement period and/or
- Wind speeds exceeded 5 m/s during any 15-minute noise measuring period

The highlighted blue section interpreted in **APPENDIX A: Measured Noise Levels** shows background noise data that has been excluded for the background noise assessment.

2.4 Sensitive Receivers

Table 2 shows the assessed sensitive receivers in close proximity to the site, please also refer to **Figure 5** for a mark-up of the receiver locations.

Table 2- Sensitive receivers location

Item	Receivers	Representative property for assessment	Distance from site frontages (approximate)
R1	Residential properties around the site	Houses facing Gregory Hills Drive (Coral Flame Circuit)	69 m
R2	Residential properties around the site	Houses on Wallarah Circuit	21 m
R3	Residential properties around the site	Houses on Long Reef Circuit	18 m
R4	Active Recreational area adjacent to the site	Howard Park	30 m

Figure 5 – Proposed site and Sensitive Receivers Location

2.5 Noise Logger Location

The noise logger locations are as follows, which were selected as derived locations to represent the most affected sensitive receivers:

- 38 Oakland Circuit - This logger location is a similar distance away from Gregory Hills Drive to the sensitive receivers along Long Reef Circuit which will represent similar noise environments in terms of traffic noise and background noise levels to residences along Long Reef Circuit and Gregory Hills Drive.
- 49 Minnamura Dr - This logger location at Minnamurra Drive is located in a similar suburban residential environment to Wallarah Circuit. Whilst slightly further away from Gregory Hills Drive, it will provide a conservative representation of the background noise levels for residences along Wallarah Circuit.

In addition to the long term noise monitoring, short term measurements were conducted at the site frontage facing Gregory Hills Drive for the purpose of assessing noise intrusion onto the site.

Below is a layout of the noise logger and measurement location, which based on our assessment is appropriate in representing noise levels of sensitive receivers surrounding the site. Furthermore, our results (in section 3.1) show that both logger locations are not too dissimilar in background noise.

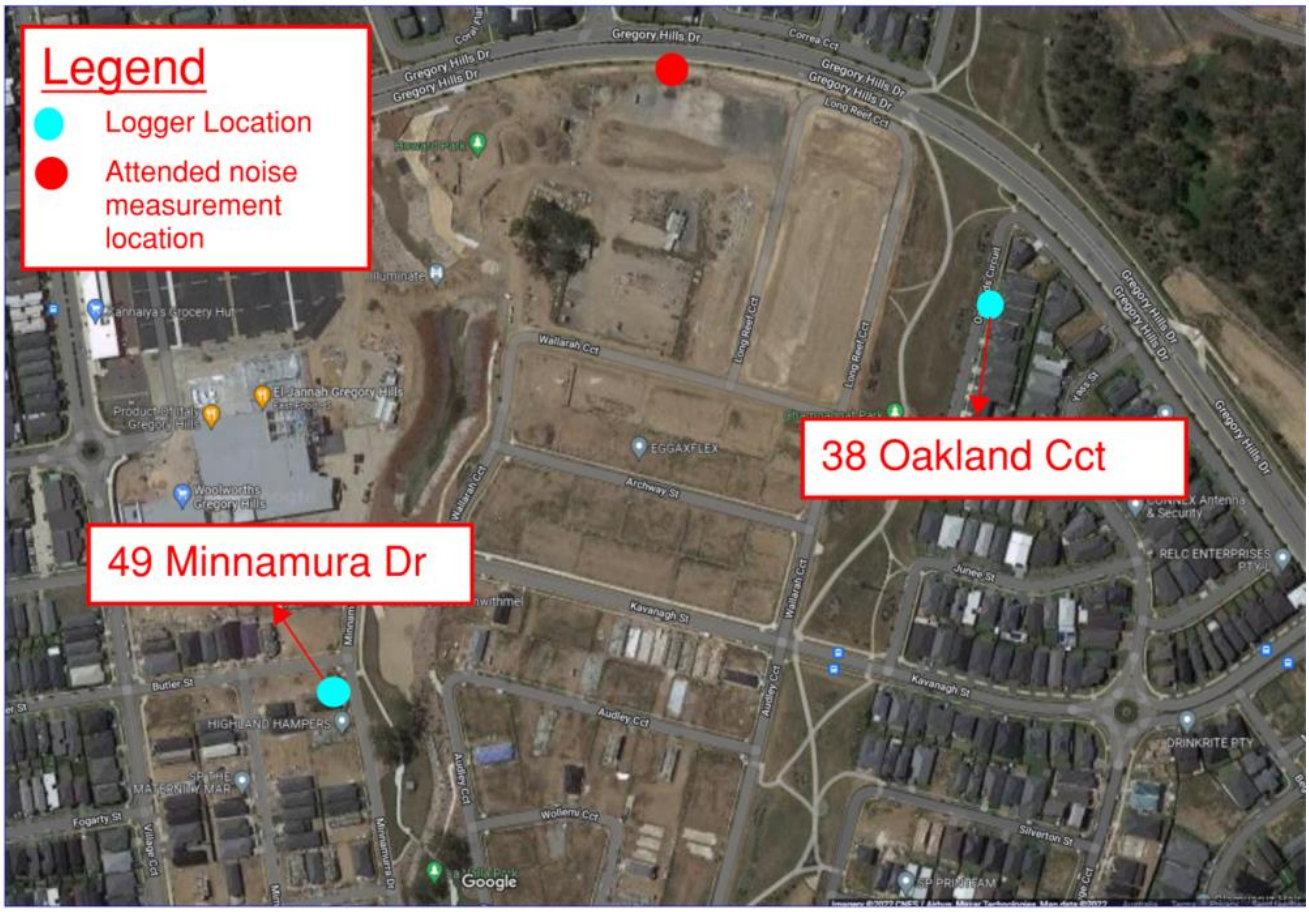


Figure 6 – Noise logger and Attended measurement location

3 NOISE AND VIBRATION CRITERIA

3.1 NSW Noise Policy for Industry (NPfI) 2017

For the purpose of the assessment, the measured noise data was processed into the following time periods:

- Daytime: 0700 to 1800 hrs.
- Evening: 1800 to 2200 hrs.
- Night-time: 2200 to 0700 hrs.

The measured background (L_{A90}) and equivalent continuous (L_{Aeq}) noise levels during these defined time periods. The L_{A90} noise levels presented are *Rating Background Levels* (RBLs), being the median of the background L_{A90} (i.e. of the lowest 10th percentile of samples) in each daytime, evening and night-time measurement period, for each 24-hour period during the noise survey.

The L_{Aeq} noise levels presented are the logarithmic average of all the L_{Aeq} samples taken in each of the daytime, evening and night-time periods.

Table 3 shows a summary of our results, representing the existing ambient and background noise levels at the each of residential boundary listed below.

Table 3 Existing Noise Levels (Unattended), dBA

Location	Noise Index	Noise Level, dB re 20 µPa		
		Daytime 0700 to 1800	Evening 1800 to 2200	Night - time 2200 to 0700
38 Oakland Circuit	L_{A90} (RBL)	39	38	32
	$L_{Aeq,period}$	56	50	47
49 Minnamura Dr	L_{A90} (RBL)	38	37	32
	$L_{Aeq,period}$	55	48	44

In addition to the long – term noise monitoring, four attended 15 – minutes short term measurements (13.6 m from the road to the measurement location) were conducted at the site frontage facing Gregory Hills Drive shown in **Table 4**. The purpose of these measurements was to assess noise intrusion onto the site.

Table 4 Existing Noise Levels (Attended), dBA

Short term monitoring location	Date and time	Short term attended measurement	
		LAeq	L90
Site frontage facing Gregory Hills Dr	01/08/22, 11:08 – 11:23	63	49
	01/08/22, 11:25 – 11:40	63	49
	01/08/22, 11:41 – 11:59	63	48
	01/08/22, 11:59 – 12:14	64	51

3.1.1 Amenity and Intrusiveness Criteria

The NSW NPfI provides assessment methodologies, criteria and detailed information on the assessment of environmental noise emissions in NSW. The NSW NPfI criteria for noise sources consider two (2) components:

- Controlling **intrusive** noise impacts for residential receivers. Assessing intrusiveness generally requires noise measurements to quantify background (L_{A90}) noise levels at a location considered representative of the most potentially affected residential receiver(s). The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source(s) under consideration should be controlled to not exceed background noise levels by more than 5 dB(A).
- Maintaining noise **amenity** for various categories of land use (including residential receivers and other sensitive receivers). The amenity criterion is based on the sensitivity of a particular land use to industrial-type noise. The recommended amenity noise levels detailed in Table 2.2 of NSW NPfI represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. This is to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area. The project amenity criteria for each new source of industrial noise is equalled to recommended amenity noise level minus 5dB(A).
- A +3dB(A) to be added to project amenity noise level for conversion from a period level to a 15-minutes level. Where the resultant project amenity noise level is 10dB or more below the existing industrial noise level, the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

Table 5 NSW NPfI Amenity Criteria

Type of receiver	Indicative Noise Amenity Area	Period of Time	Recommended L_{Aeq} Noise Level, dB
Residence	Suburban	Day 7:00 to 18:00	55
		Evening 18:00 to 22:00	45
		Night 22:00 to 7:00	40
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65

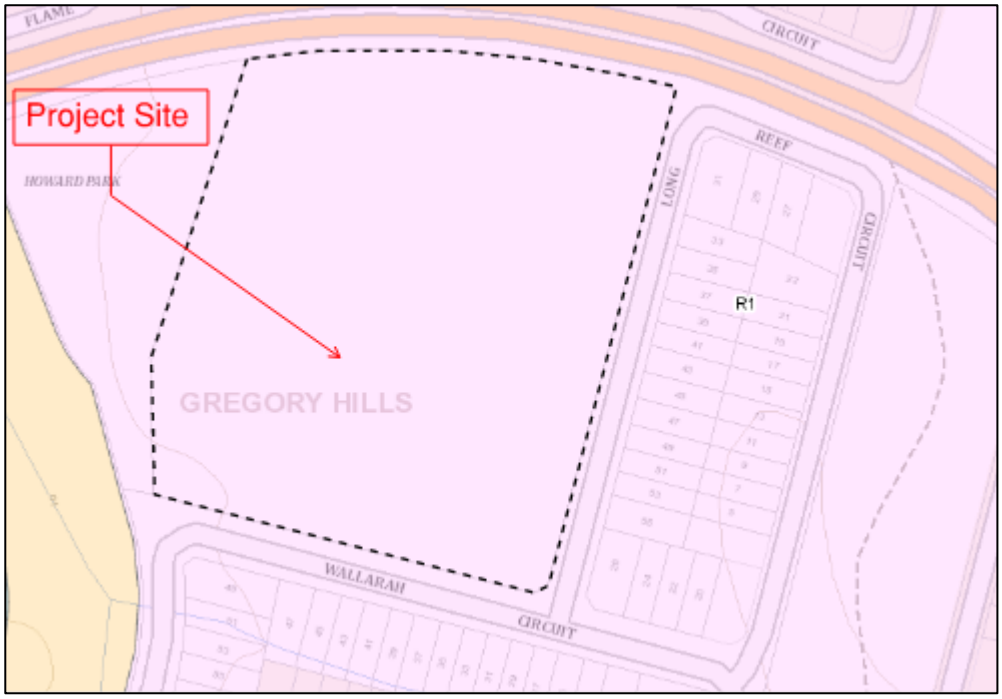


Figure 7 – NSW ePlanning Spatial Viewer

The NSW NPfI characterise the "Suburban Residential" noise environment as an area that has the following characteristics:

An acoustical environment that:

- An area that has local traffic with characteristically intermittent traffic flows or with some limited commercial industry.
- This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.

Figure 7 is obtained from the NSW ePlanning Spatial Viewer and shows the land zoning map of the proposed site and the nearest sensitive receivers.

As shown above, the site and its surrounding receivers are within an area made up of R1 (residential). Based on classification of R1, using table 2.3 of the NPfI in **Figure 8**, The amenity category would be an urban receiver. However, using the measured onsite levels, we believe the most appropriate classification for the surrounding residential receivers is suburban.

Table 2.3: Determining which of the residential receiver categories applies.

Receiver category	Typical planning zoning – standard instrument*	Typical existing background noise levels	Description
Rural residential	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime RBL <40 dB(A) Evening RBL <35 dB(A) Night RBL <30 dB(A)	**Rural** – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime RBL<45 dB(A) Evening RBL<40 dB(A) Night RBL <35dB(A)	**Suburban** – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL> 45 dB(A) Evening RBL> 40 dB(A) Night RBL >35 dB(A)	**Urban** – an area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above.

Notes: *As cited in Standard Instrument – Principal Local Environmental Plan, New South Wales Government, Version 15 August 2014. RBL = rating background noise level.

Figure 8 – NPfI Extract – Table 2.3 *Determining which of the residential receiver categories applies.*

The closest residential receivers are located on 24 Coral Flame Circuit (residential), Long Reef Circuit (residential) and Wallarah Circuit (residential) which has been assessed based on the Suburban noise criteria given in the NPfI. The NPfI recommends "Intrusive noise levels are only applied to residential receivers (residences)". For other receiver types identified in Table 2.2, only the amenity levels apply. The project amenity and intrusive noise levels are be listed in **Table 6.**

Table 6 NPfI Project Intrusiveness and Amenity Noise Criteria

Type of Receiver	Noise Level, $L_{eq,15mins}$ [dBA]		
	Daytime 0700 to 1800	Evening 1800 to 2200	Night - time 2200 to 0700
Residential Premises (38 Oakland Circuit)	**Project Amenity Assessment, $L_{Aeq, 15min}$**		
	53	43	38
	Project Intrusiveness Assessment, $L_{Aeq, 15min}$		
	44	43	37
Residential Premises (49 Minnamura Dr)	**Project Amenity Assessment, $L_{Aeq, 15min}$**		
	53	43	38
	Project Intrusiveness Assessment, $L_{Aeq, 15min}$		
	43	42	37

3.1.1.1 'Modifying factor' Adjustments

Penalties may be applied if the noise from the development "... contains certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level."

To take into account the potential annoying character of the noise an adjustment of +2dB(A) or +5 dB(A) for each annoying character aspect and cumulative of up to a total of 10 dB(A), may be added to the measured value to penalise the noise for its potential greater annoyance aspect.

Table C1 of the NSW NPfI provides procedures for determining whether an adjustment should be applied for greater annoyance aspect.

3.2 Camden Council Environmental Noise Policy

Camden Council issued their Environmental Noise Policy in 2008. Section 2.6 addresses noise emission from schools and acknowledges "schools have the potential to generate significant levels of noise, the restricted hours of operation generally serve to limit noise impact to neighbours."

The following is extracted from Section 2.6:

> *As a guide the LAeq(15 minutes) noise level from children in the outdoor areas of the site should not exceed the background LA90 (15minutes) sound level by more than 10dB(A) when measured at the boundary of the nearest or most affected residential premises, or if the boundary is more than 30 metres from a residential dwelling, at the most affected point within 30 metres of a residence.*
>
> *All other noise on the site, including children inside the buildings, woodwork/metalwork/music rooms, public address systems, bells / alarms, mechanical plant, children's external play areas, and cars within the carpark must comply with Part B - Section 4 of this document.*
>
> *Noise increases due to increased traffic flow on surrounding roads (due to vehicle flow from the site) shall be assessed in accordance with Part B - Section 5 of this document where applicable.*
>
> *Assessment of the noise from the school shall be conducted as outlined in Part C - Section 2.8 – Acoustic Assessment Report.*

Part B – Section 4 requires noise assessment in accordance with the NSW Industrial Noise Policy. The NSW Industrial Noise Policy has since been superseded by the NSW Noise Policy for Industry (NPfI) 2017.

Part B – Section 4 also provides guidance on construction noise, however appears to be based on Chapter 171 of the Environmental Noise Control Manual published in 1985. In this situation, we recommend following the more recent Interim Construction Noise Guideline in July 2009 as detailed in Section 4.4.1.

3.3 EPA NSW Road Noise Policy (RNP) 2011

Noise from the vehicles associated with the school will be assessed using NSW Road Noise Policy. **Table 7** presents the noise assessment criteria for the land use developments with potential to create additional traffic on existing local roads.

Table 7: Noise criteria from RNP

Road Category	Type of project/Land use	Assessment criteria, dB(A)	
		Day	Night
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use development	$L_{Aeq,\ 1hr}$ 55 (External)	$L_{Aeq,\ 1hr}$ 50 (External)

RNP recommends that "Where feasible, existing noise levels should be mitigated to meet the noise criteria. In this regard, the RNP states that for existing roads there is limited potential for noise control as the development is not linked to road improvements. It does however advise that applicable strategies include appropriate location of private access roads, regulating time of use, using clustering, and using barriers and acoustic treatments."

Section 3.4.1 of the RNP specifies a limit of 2 dB for vehicular noise level increase over the existing noise level of local roads for such developments/projects.

3.4 AAAC Acceptable Noise Level for Outdoor Play Areas

In May 2008, The Association of Australasian Acoustical Consultants (AAAC) first published the *Technical Guideline for Child Care Centre Noise Assessment.* The guideline was updated in 2020 to assist both AAAC members and local councils to assess the noise impact from proposed child care centres both accurately and fairly.

Although the proposed development is a new primary school, The criteria on the guideline can be used to assess the impact of traffic noise onto children at the outdoor playground areas.

"*The noise level $L_{Aeq,1\ hour}$ from road, rail traffic or industry at any location within the outdoor play or activity area during the hours when the Centre is operating shall not exceed 55 dB(A).*"

"*The noise level $L_{Aeq,1\ hour}$ from road, rail traffic or industry at any location within the indoor play or sleeping areas of the Centre during the hours when the centre is operating shall not exceed 40 dB(A).*"

3.5 Determination of Project Specific Noise Trigger Level

As discussed with client, total of 2 loggers were deployed to obtain the statistical background noise level pre – construction and assess the potential project noise trigger level (PNTL).

The project trigger noise levels are the most stringent noise levels of the NSW NPfI project intrusiveness and project amenity noise levels for day, evening and night-time periods and are project specific.

Following a review of the data, the following site-specific noise levels were adopted for this study, as shown in **Table 8** below.

Table 8: External Project Noise Trigger Level (PNTL) for operation noise

Location	Time	Descriptor	External PNTL [dBA]
38 Oakland Circuit	0700 to 1800	$L_{Aeq, Day}$	44
	1800 to 2200	$L_{Aeq, Evening}$	43
	2200 to 0700	$L_{Aeq, Night}$	37
49 Minnamura Dr	0700 to 1800	$L_{Aeq, Day}$	43
	1800 to 2200	$L_{Aeq, Evening}$	42
	2200 to 0700	$L_{Aeq, Night}$	37
Howard Park	When in Use	$L_{Aeq, 15mins}$	55
Outdoor Playground	When in Use	$L_{Aeq, 15mins}$	55

3.5.1.1 Sleep Disturbance Noise Limits

In accordance with NSW NPfI 2017, the potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is both awakenings and disturbance to sleep stages.

"Where the subject development/premises night-time noise levels at a residential location exceed:

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

a detailed maximum noise level event assessment should be undertaken."

Table 9 detailed the sleep disturbance noise limits for the nearest residential receivers adjacent to the proposed development.

Table 9: Sleep Disturbance Noise Limits

Location	Descriptor	Given Noise Limits [dBA]	Limits based on RBL [dBA]	Project Noise Levels [dBA]
Residential properties (38 Oakland Circuit)	$L_{eq,15mins, night}$	40	37	40
	$L_{Fmax, night}$	52	47	52
Residential properties (49 Minnamura Dr)	$L_{eq,15mins, night}$	40	37	40
	$L_{Fmax, night}$	52	47	52

3.6 Construction Noise and Vibration Criteria

3.6.1 Interim Construction Noise Guideline

The NSW Interim Construction Noise Guideline was developed by the NSW-Department of Environment & Climate Change DECC, NSW which incorporates the EPA. The Guideline contains detailed procedures for the assessment and management of construction noise impacts.

The guideline presents two ways of assessing construction noise impacts – the quantitative method, which is generally suited to longer term construction works and the qualitative method, which is generally suited to short term works (usually not more than 3 weeks) such as infrastructure maintenance.

It is expected that the length of the construction works associated with the development would be more than 3 weeks and therefore a quantitative method has been used for this assessment.

Table 10 set out the management levels for noise at residence and sensitive land uses, respectively. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected management level' which is >75dBA. Affected properties above 75 dBA might require community consultation and a Construction Noise & Vibration Management Plan (CNVMP). Based on the RBL of 38 – 39 dBA in the daytime, the recommended noise management level during all aspects of the construction program are summarised in **Table 11** below.

Table 10: Noise at Residences using Quantitative Assessment

Recommended Hours	External Management Level $L_{eq,15min}$ [dBA]	How to Apply
Recommended standard hours Monday – Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise Affected RBL + 10	The noise affected level represents the point above which there may be some community reaction to noise. ■ Where the predicted or measured $L_{Aeq\ (15\ minutes)}$ noise level is greater than the 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 75 dB(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 period by restricting hours that the very noisy activities can occur, taking into account: 1. 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);

Recommended Hours	External Management Level $L_{eq,15min}$ [dBA]	How to Apply
		2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended standard hours	37 dBA (32 + 5)	■ 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. ■ For guidance on negotiating agreements see section 7.22

*Section 6, 'work practices' of the *Interim Construction Noise Guideline*, states: "*there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts*.

This approach gives construction site managers and construction workers the greatest flexibility to manage noise".

Definitions of the terms feasible and reasonable are given in Section 1.4 of the Guideline.

The Interim Construction Noise Guideline recommends the following noise levels for land uses other than residential, as shown in **Table 12** below. The external noise levels should be assessed at the most affected occupied point on the premises. A conservative estimate of 10 dB is generally applied as the difference between the external and internal level for noise sensitive uses that require internal noise measurement.

3.6.2 Noise Management Levels

Noise Management Levels (NML) associated with the construction works on the project site are presented in **Table 11**.

Table 11: Construction Noise Management Levels, $L_{eq\ 15min}$

Receivers	Recommended Hours	Period	RBL $L_{A90,15mins}$ [dBA]	External Noise Management Level [dBA]
38 Oakland Circuit	Day time (standard construction hours)	When in use	39 dB(A)	(39 + 10) = 49 dB(A) (Noise affected) 75 dB(A) (highly noise affected)
49 Minnamura Dr			38 dB(A)	(38 + 10) = 48 dB(A) (Noise affected) 75 dB(A) (highly noise affected)

Table 12: Noise at Sensitive Land Use (public recreation area)

Land Use	External Management Level, $L_{eq,15min}$ [dBA] (applies when properties are being used)
Passive Recreation area	60
Commercial Premises	70

3.6.3 Construction Vibration Criteria

The effects of construction vibration upon buildings can be separated into three main categories:

- Perceptibility of the occupants to the vibration and the possibility of them being disturbed or annoyed.
- Vulnerability of the building structures to vibration induced damaged.
- Vulnerability of the contents of the building that includes types of equipment, activities and processes.

3.6.3.1 Human Response to Vibration

Humans are very sensitive to vibration, and they can be disturbed, annoyed and have their work activities interfered with if the levels are too high. The Interim Construction Noise Guideline references *"Assessing Vibration: a technical guideline*" (Vibration Guideline) issued by the Department of Environment and Conservation NSW for measurement and assessment of vibration. The Vibration Guideline provides vibration criteria for continuous, impulsive and intermittent vibration

Continuous vibration	Impulsive vibration	Intermittent vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990).	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer this would be assessed against impulsive vibration criteria.

The criteria are discussed in more detail in the following sections.

3.6.3.2 Continuous and impulsive vibration (1-80 Hz)

According to the Vibration Guideline for continuous and impulsive vibration, assessment of impact should be considered on the basis of weighted root-mean-square acceleration values and results are to be compared against the following preferred and maximum values given for each orthogonal axis. The frequency weightings as per BS6841:1987 (reproduced in Appendix B3 of the guideline) are to be applied to the RMS measurement values (1-80Hz).

The criteria in the Vibration Guideline are derived from the limiting values of the assessment curves and multiplying factors from BS 6472:1992 (the curves are no longer referenced in the superseded version of the standard BS 6472:2008). We have assumed hotels will be assessed as per the criteria for residences.

Table 2.2 Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration (m/s^2) 1–80 Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration					
Critical areas[2]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration					
Critical areas[2]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of this policy, and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472–1992

The Vibration Guideline notes "*Activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community. Situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short-term duration. An example is a construction or excavation project.*"

3.6.3.3 Intermittent vibration (1-80 Hz)

According to the Vibration Guideline for intermittent vibration, assessment of impact should be considered on the basis of vibration dose values (VDV). Acceptable values of vibration dose are given as follows. We have assumed hotels will be assessed as per the criteria for residences.

Table 2.4 Acceptable vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.
Source: BS 6472–1992

3.6.3.4 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2 – 1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "Effects of Vibration on Structure" (DIN 1999).

3.6.3.5 Standard BS 7385 Part 2 – 1993

For transient vibration, as discussed in standard BS 7385 Part 2- 1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in **Table 13** and illustrated in **Figure 9**.

Table 13: Transient vibration criteria as per standard BS 7385 Part 2 – 1993

Line in	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	-
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the value in **Table 13** relate to transient vibration which does not cause resonant response in buildings.

Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in **Table 13** may need to be reduced by up to 50% (refer to Line 3 in **Figure 9**).

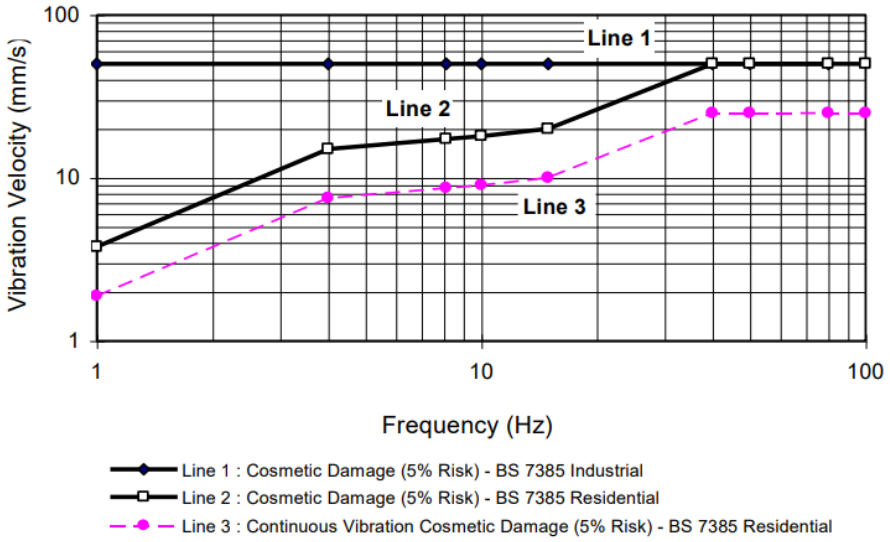


Figure 9 – BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damages

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 13**, and major damage to a building structure may occur at values greater than four times the tabulate values.

Fatigue considerations are also addressed in the standard and it is concluded that unless the calculation indicated that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in **Table 13** should not be reduced for fatigue considerations.

3.6.3.6 Structural Response to Vibration - German Standard DIN 4150-3:1999

The German Standard DIN 4150-3 Structural Vibration Part 3: Effects on building and structures is commonly used in Australia to evaluate the effects of vibration on structures primarily used for static loading.

The response of a building to vibration is affected by several factors that include its type of foundation, the underlying ground conditions, its construction and the state of the building. Please note the construction vibration limits are designed to ensure the structural integrity of nearby buildings and are not for human comfort. the limits are well above perceptibility.

According to DIN 4150 short term vibration refers to vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance in the structure being evaluated. Long-term vibration refers to all types of vibration not covered by the definition of 'short-term vibration'. The criteria for short-term and long-term vibration are listed in the following.

3.6.3.7 Guideline Values for evaluation of short-term vibration - DIN 4150-3:1999

The vibration limits of table 1 in DIN 4150-3:1999 (replicated in **Table 14** below refer to the evaluation of the effects of short-term vibration on structures.

It should however be noted that compliance with the vibration limits to avoid structural damage of buildings, cannot provide certainty. If damage occurs despite compliance with the standard, it is to be assumed that other

causes are responsible, however, further investigations are necessary. And on the other hand, exceeding the limits does not necessarily lead to damage.

Table 14: DIN 4150-3 Construction Vibration Limits – Short Term

Type of Structures	Guideline values for vibration velocity (mm/s)			
	Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor at all frequencies
	1Hz to 10Hz	10 to 50 Hz	50 to 100Hz (and above)	
Buildings for commercial purposes, **Industrial building** and building of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
Structures that because of their particular sensitivity to vibration, cannot be classified as above and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

3.6.3.8 Guideline Values for evaluation of long-term vibration - DIN 4150-3:1999

The vibration limits of Table 3 in DIN 4150-3:1999 refer to the evaluation of the effects of long-term vibration on structures.

The criteria are the peak particle velocities measured on the uppermost full storey of any building not related to the site and are listed in **Table 15.**

According to the standard, *exceeding the values listed below does not necessarily lead to damage*.

If a building is subject to harmonic vibration, then maximum values can occur in floors other than the top floor, or in the foundation. The values given also apply in these cases.

Table 15: DIN 4150-3 Construction Vibration Limits – Long Term

Type of Structures	Guideline values for velocity, vi, in mm/s of vibration in horizontal plane of highest floor, at all frequencies
Buildings for commercial purposes, Industrial building and building of similar design	10
Dwellings and buildings of similar design and/or occupancy	5
Structures that because of their particular sensitivity to vibration, cannot be classified as above and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

In summary, we consider that for this project the vibration criteria will be as per DIN 4150 – 3:1999 construction vibration limits – long term. Residential receivers in the area will have a maximum vibration velocity criterion of 5 mm/s^2 and commercial buildings of 10 mm/s peak particle velocity criteria.

4 OPERATIONAL NOISE IMPACT ASSESSMENT

The following sections present our assessment of noise emission impacts. Predicted noise levels and associated mitigation measures are also provided according to the noise assessment and criteria.

4.1 Noise Emission from Engineering Services

At this stage, the following information is known regarding the mechanical conditioning/ventilation strategies:

- Preliminary locations of external plant areas are known and are provided on the architectural drawings
- Preliminary types and number of units are known
- Exact selections and their associated noise levels are not known at this stage.

However we understand the new primary school is to be served by VRV systems. We expect that with selections of typical outdoor units, the noise criteria will be achieved given the distances involved to the nearest receivers. In our experience, for this type of development the following mechanical systems would be installed, and their associated sound power levels are outlined below:

- Kitchen Exhaust Fan (KEF) – 67 dBA (SWL) per unit
- Air Conditioning Condensers – Office Areas, Learning Areas, Library etc – 84 dBA (SWL) per unit
- Toilet Exhaust Fans (TEF) – Bathrooms – 55 dBA (SWL) per unit

It is anticipated that KEF serving the canteen will vertically discharge through external roof located approximately 59m away from the nearest residential along Wallarah Circuit. From our modelling, the noise levels of 28 dBA can be achieved and compliant with project's noise trigger level on nearby neighbouring properties, therefore no acoustic treatment are necessary.

For toilet exhaust fans (TEF) located 46m away from nearest residence in Wallarah Circuit, it is anticipated that the noise level of 46 dBA is compliant at nearby neighbouring receivers and would not require acoustic treatment to the fans.

In regards to air conditioning condensers, There are (4) four dedicated plant areas according to the updated architectural plans adjacent to the dedicated buildings as shown in **Figure 10**. From our review of the proposed locations and distances, the noise levels from these 4 condensers will exceed with the daytime project trigger noise level, some acoustic treatment of the plant items would be required.

A detailed acoustic assessment must be carried out at later stages of the design once the equipment is selected. The following acoustic treatment will be considered:

- Selection of low noise equipment
- Acoustically lined ductwork
- Acoustic Louvers
- Attenuators
- Acoustic Barrier

The selection and design of mechanical plant and equipment are to comply with the relevant project operational noise criteria as presented in Section 3.

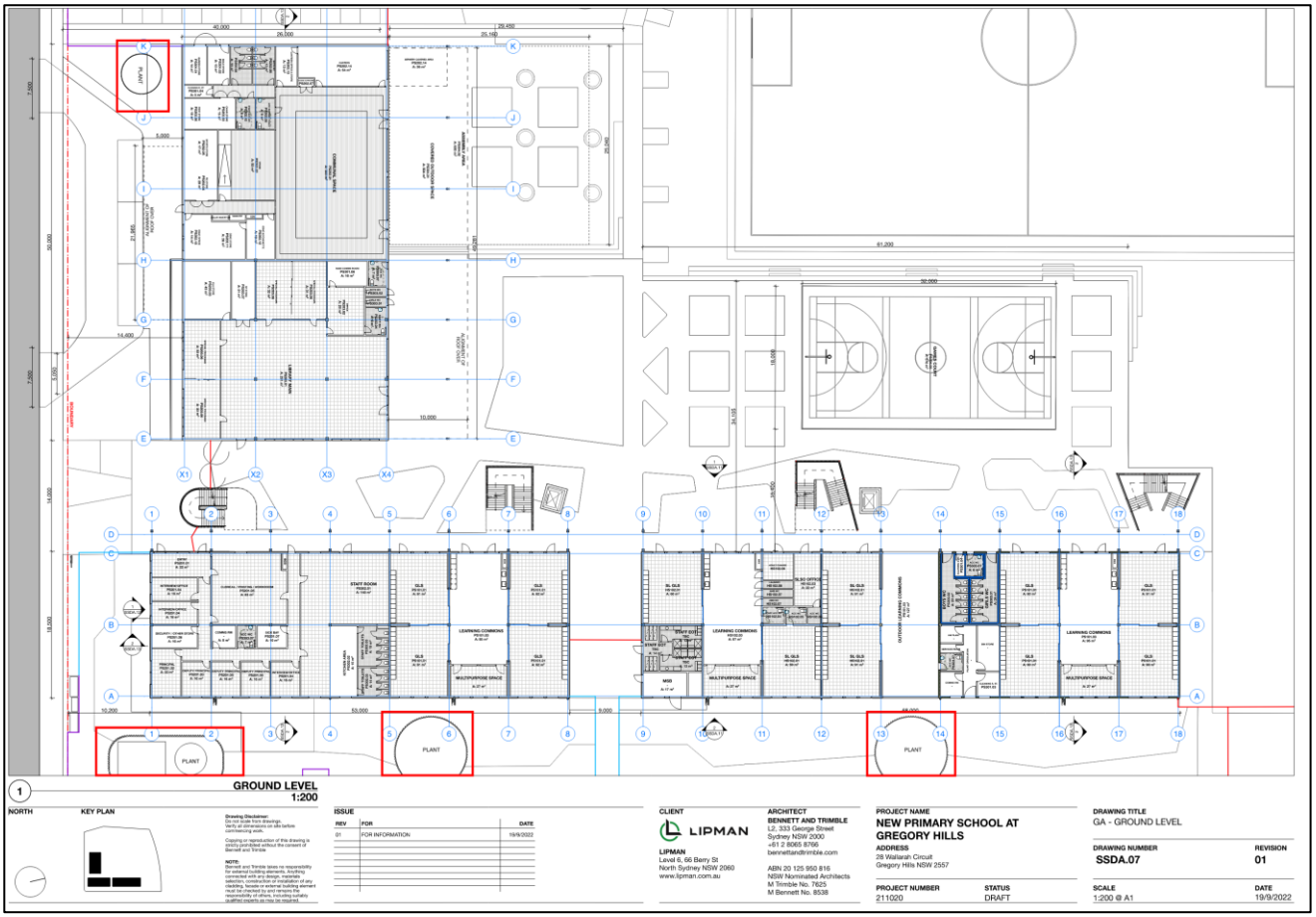


Figure 10 – Proposed Mechanical Plant Areas

4.2 Noise Emission from School Hall & Outside of School Hour (OOSH)

The school hall is proposed to be used for regular school activities during typical school hours as well as regular use of the hall for OOSH activities. Additionally, from time to time use of school hall will be used for out of hours community use. As such an assessment of the hall has been undertaken both during the daytime period, representing use by the Primary School, and the evening period, representing use from the external community of Gregory Hills. For both assessments amplified speech and music will be assessed. Regarding internal noise levels the following is assumed:

- Sound pressure level within the hall during amplified music or speech is 87 dBA previously measured in our database.
- During events which create these type of noise levels, we expect some glazing to be remain open to allow the use of natural ventilation, this allows the worst case calculation of noise breakout through ventilating gaps.
- Building fabric constructions for overall building envelope are assuming the façade rating of R_w 30.

Predicted noise levels from the day and evening time use of the community hall is presented below.

Table 16: Predicted Hall Noise Levels – $L_{Aeq(15\ minutes)}$

Receiver Location	Predicted Noise Level dBA $L_{Aeq(15\ minutes)}$	Criteria dBA $L_{Aeq(15\ minutes)}$	Compliance
49 Wallarah Circuit (55 m from the school Hall)	43	43	Yes
26 Long Reef Circuit (99m from the school hall)	38	43	Yes
Howard Park (108 m from the school hall)	37	55	Yes

4.3 Noise Emission from PA system & School Bells

It is recommended that Public Address (PA) system loudspeakers and electronic school bells for the new buildings are installed facing away and/or shielded from the neighbouring residences and are calibrated and set (with a power limiter) such that the Project Noise Trigger Level criteria at the nearest affected residence $L_{Aeq,15min}$ 43 dBA are not exceeded during their operation.

As a design principle, to minimise noise spill on surrounding receivers, more speakers operating a lower noise level is an effective way of controlling noise spill. Directional speakers located in the correct locations angled towards to the area requiring coverage will also reduce noise spill.

4.4 Noise Breakout from Outdoor Areas

The outdoor area is located to the north of the buildings and will be used for outdoor gatherings or classes, recess and as a play area. The new games court will be located to the west of the outdoor area.

The operational hours management of the school 6:00am – 6:00pm Monday – Friday (this includes before and after school care). NDY understands that school bell times are as follows, which indicates staggered recess and lunch times:

- 8:40am – morning playground duty begins (students in playground)
- 9:10am – classes begin
- 11:10am – K-2 recess starts
- 11:40am – K-2 recess ends, 3-6 recess begins
- 12:10pm – 3-6 recess begins
- 1:10pm – K-2 lunch begins
- 1:40pm – K-2 Lunch ends, 3-6 lunch begins
- 2:10pm – 3-6 lunch ends
- 3:10pm – classes end

The highest noise emissions will be during morning supervision, recess and lunch times where students gather outside as per the schedule above. To assess the noise impact from the outdoor area we have made a conservative noise model and made the following assumptions:

- It was assumed that only a half` of children playing outside in each of the outdoor schedule times listed above.
- Those playing will be on or around the field area.
- It was assumed that the noise source is an area source.

The school buildings to the south and east will provide shielding to the residences across Wallarah Circuit to the south and Long Reef Circuit but the residences on the North sides will be exposed to the outdoor play noise.

Based on the above assumptions we are predicting noise levels of 43 dBA at the nearest residential receiver at 24 Coral Flame Circuit, compliant with the Camden Council Environmental Noise Policy (Background +10 dBA) of 48 dBA during the daytime period.

This can be further justified with the recent NSW Land and Environment Court (LEC) proceeding outcomes (Meriden School v Pedavoll) on the 22nd October 2009 case NSW LEC 183, the court noted "All noise that emanated from the normal activities at a school is not offensive".

NDY is of the opinion that as the noise impact from outdoor play is acoustically acceptable and justified.

4.5 Noise Emission from Waste Collection

An assessment of the bin/waste collection has been made to take into consideration the potential noise emissions from commercial waste collection vehicles.

Using a sound power level of 86 dBA (typical commercial truck), it is predicted that noise emissions from waste collection vehicles will be compliant with the day time noise limits at the existing residences to the east and north at 43 dBA.

4.6 Noise Impact from Vehicular Movements

Noise impact from vehicular movements have been considered as follows:

4.6.1 External noise amenity on playground areas

Based on the short-term traffic noise measurement taken at a distance of 13.6m from measurement location conducted on Gregory Hills Dr during daytime, the external noise amenity in the outdoor playground areas 50 dBA, compliant with the required 55 dBA noise criterion, hence no mitigation measures would be required. A summary of calculations and results is presented in **Table 17**.

Table 17: Traffic noise emission levels to outdoor playground areas

Noise Data in dB	Octave Band Frequency (Hz)								Equivalent Sound pressure level in dBA
	63	125	250	500	1000	2000	4000	8000	
Measured $L_{Aeq,1\ hour}$	64	62	58	57	60	57	48	44	63
Distance Attenuation (65m to playground area)	14	14	14	14	14	14	14	14	
Incident sound pressure level (SPL) spectrum propagated to playground areas	50	48	44	43	46	43	34	30	50

4.6.2 Noise emission from the carpark

Table 22 and Figure 9 from Transport and Accessibility Impact Assessment report Rev 04 issued by Ason Group at 23/09/2022 as depicted in **Figure 11** indicate that the carpark will have 60 staff parking spaces with 1 accessible parking spaces included.

TABLE 22 CAR PARKING REQUIREMENT

User Type	Proposed Number	DCP Parking Rate	Number of Parking Spaces Required
Staff	60	1 car parking space per full-time equivalent staff member	60
Student/Parents	1012	1 car parking space per 100 students	11
Total Required		**71**	

Figure 11 – Ason Group, Number and Location of parking space

Noise emissions from the carpark were calculated to consider any possible noise impacts at the nearest sensitive receivers as shown in **Table 18**.

Table 18: Summary of Measured Sound Power Level by NDY

Vehicular Activity	Sound Power Level (dBA re 1 pW)
Light Vehicle Pass - By	91
Car Door Slamming	85
Engine Start	93

This was corrected for the car numbers, duration, and the distance to calculate the overall noise level. In the events of transient noise levels in **Table 18**, The noise levels will be assessed against the NPfI sleep disturbance criteria.

To calculate the noise levels, we have considered the existing carpark with a capacity of 60 parking spaces at an average distance of 57m to the residence in 49 Wallarah Circuit and 85m to the active recreation venues Howard Park. We have assumed car moving at 15 km/hr in the carpark area with 100% turnover rate within the 1 hour period. A summary of calculations and results is presented in **Table 19**.

Table 19: Carpark noise emission level

Receivers Location	Calculated Noise Levels (dBA)	LA_{max} (dBA)	Criteria, $L_{Aeq,15min}$ dBA	Sleep Disturbance criteria $L_{Fmax,\ night}$ (dBA)	Compliance
49 Wallarah Circuit (57 m from the carpark)	42	48	43 (daytime) 42 (evening)	52	Yes
Howard Park (85 m from the carpark)	40	-	55	-	Yes

The above summary results predict that noise emissions from the carpark will comply with criteria at the nearest residential boundary, hence all noise levels will comply with criteria, no mitigation measures will be required.

4.6.3 Noise from generated traffic

It is proposed that the construction traffic would access the site via Wallarah Circuit.

From the criteria discussed in Section 10.9 of the NSW RNP 2011, it is noted that vehicle numbers on surrounding roads would need to increase by around 60% from existing traffic flows, for a 2 dB increase in road traffic noise to occur. As noted previously, a 2dB increase in road traffic noise is not considered to be noticeable.

Based on the number of vehicles projected over each of the phases, it is concluded that noise impacts from construction traffic is unlikely to have an impact at the nearest affected properties. As a result, no further assessment is required.

4.6.4 Noise emissions from the short stay parking area

Table 20 Ason Group, Predicted AM/PM Peak Traffic Movements

TABLE 15 TRIP GENERATION		
Land Use	Trip Generation	
	AM Peak	Network PM Peak
1012-space Primary School	638 total (332 in, 306 out)	527 total (243 in, 284 out)

User Type	Location	Number of Parking Spaces Provided
Student/Parents	Wallarah Circuit Support Learning Drop – off Area	3
	Long Reef Circuit Short Stay Parking Area	17

Two (2) dedicated short stay parking areas are proposed, firstly along Wallarah circuit near the support learning facilities and secondly along Long Reef Circuit. It has an exclusive lane close to the kerb allocated to drop offs in the morning and pick ups in the afternoon.

Noise impacts from the increase in vehicle movements around short stay parking area in the morning and afternoon along Wallarah Circuit and Long Reef Circuit are to be assessed in accordance with the NSW EPA Road Noise Policy (RNP) 2011.

In undertaking our noise modelling below, we have assumed the following from the information provided in **Table 20**:

- 3 spaces at Wallarah Circuit and 17 spaces at Long Reef Circuit are dedicated for short stay parking activities.
- 638 combined AM Peak movements along both Wallarah Circuit and Long Reef Circuit.
- 527 combined PM Peak movements along both Wallarah Circuit and Long Reef Circuit.

Apportioning the combined peak movements to Wallarah Circuit and Long Reef Circuit based on the number of spaces for each road, the following trips at each short stay parking location are assumed:

- AM Peak:
    - Wallarah Circuit: 96
    - Long Reef Circuit: 542
- PM Peak:
    - Wallarah Circuit: 80
    - Long Reef Circuit: 447

In the assessment of noise from the use of the short stay parking onto nearby residential has been undertaken using the EPA's Road Noise Policy for a Local Road as both Wallarah Circuit and Long Reef Circuit

are both defined as a local road. The results of the acoustic assessment as a result of short stay parking along Wallarah Circuit and Long Reef Circuit are detailed in **Table 21**.

Table 21: Noise emission from short stay parking

Residential Receivers	Time of the Day	Calculated Noise Level dBA ($L_{Aeq, 15\ Minutes}$)	EPA RNP 2011 Criteria ($L_{Aeq, 1\ hour}$)	Compliance
47 Wallarah Circuit (30 m from short stay parking)	AM Peak Period	43	55	Yes
	PM Peak Period	42	55	Yes
45 Long Reef Circuit (16 m from short stay parking)	AM Peak Period	55	55	Yes
	PM Peak Period	54	55	Yes

The table above predicted the noise impact from vehicular noise emission for short stay parking are within the criteria set in the NSW RNP 2011. Based on the limited daily frequency and the times of the day in which the activities will including the implementation of school management, we believe in our professional opinion the use of the short stay parking activities will not result in unacceptable acoustic impacts for the existing surrounding residences.

4.7 Summary of Acoustic Mitigation

The acoustic treatment and reasonable steps to follows based on the noise assessment above are required as follows:

Table 22: Summary of Acoustic Mitigation

Noise Assessment	Required Acoustic Mitigation and Controls
Engineering Services	NDY propose general acoustic treatment to be considered. Final requirements to be reviewed during detailed design when selections of the plant and equipment are available, and will be the responsibility of the design team to achieve set criteria as written in this acoustic report.
PA system/ School Bells	NDY propose general acoustic treatment to be considered. Final requirements to be reviewed during detailed design when selections and locations of the PA system/school bells are confirmed to meet the operational noise criteria as written in this acoustic report.
Outdoor Area	No further mitigation is expected, based on our assumptions.
School Hall	No further mitigation is expected, based on our assumptions.
Vehicular Movement	No further mitigation is expected, based on our assumptions.
Waste Collection	No further mitigation is expected, based on our assumptions.

5 CONSTRUCTION NOISE AND VIBRATION

5.1 Preliminary Noise Assessment

The following has been assumed in regards to noise intensive equipment/activities:

- Excavations may be undertaken.
- Rock breaking activities may be performed.
- Loading and unloading will be part of general construction activities.

For the assessment reference sound levels for representative equipment have been taken from the DEFRA, BS5228 and AS2436 databases. The documents include extensive databases of sound data covering trucks, excavators, hand tools and all manner of other construction equipment and activities. The ratings listed are for individual pieces of equipment at constant operation.

Table 23: Typical External Noise Levels of Demolition and Construction Machinery/Activity

Item #	Activity /Machinery	Source and reference number	L_{eq} Sound Pressure Level at 10m (dBA)
Earthworks			
0	14 ton tracked excavator	BS5228-2009 Table C2 Ref 25	69
Construction and Fit out Works			
1	Tracked mobile crane 132 Kw / 55 t	BS 5228 – 1:2009 Table C3 Ref 29	75
2	Handheld cordless nail gun (15 to 50 mm nails)	BS 5228 – 1:2009 Table C4 Ref 95	78
3	Diesel Generator	BS 5228 – 1:2009 Table C4 Ref 78	84
4	Angle grinder 2.3 Kw / 4.7 kg	BS 5228 – 1:2009 Table C4 Ref 93	70
Carpark construction			
5	Compactor	BS 5228 – 1:2009 Table C5 Ref 29	73
6	Vibratory Roller	BS 5228 – 1:2009 Table C4 Ref 78	66
7	Road Planner	BS 5228 – 1:2009 Table C5 Ref 9	76

Notes:

- NSW DECC 2009 Construction noise Guideline quotes on Appendix B Equipment Noise levels, the DEFRA 2005 database, which includes the above referenced BS 5228 – 1:2009 noise levels.

5.2 Predicted Construction Noise

Based upon the above plant sound power levels, predicted construction noise levels for the various works phases are presented below in **Table 24**. As shown construction noise levels during both excavation and structural works phases were predicted to exceed the noise affected level but not to exceed 75 dB(A). Under the ICNG, this means there is no requirement for a construction noise to be managed as part of a construction noise and vibration management plan.

However, 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.

Table 24: Predicted construction noise $L_{eq,15min}$

Receivers	Proposed Hours	Period	Predicted Construction Noise Level (dBA)	External Noise Management Level.	Compliance
Earthworks					
Long Reef Cct	Monday Friday 7am to 6pm Saturday 8am to 2pm No work on Sundays or Public Holidays	Day	57	49 dB(A) (Noise Affected)	No
28 Correa Cct			57	48 dB(A) (Noise Affected)	No
Wallarah Circuit			59 - 74	49 dB(A) (Noise Affected)	No
Construction and Fit out works					
Long Reef Cct	Monday Friday 7am to 6pm Saturday 8am to 2pm* No work on Sundays or Public Holidays	Day	55	49 dB(A) (Noise Affected)	No
28 Correa Cct			55	48 dB(A) (Noise Affected)	No
Wallarah Circuit			58 – 67	49 dB(A) (Noise Affected)	No

Receivers	Proposed Hours	Period	Predicted Construction Noise Level (dBA)	External Noise Management Level.	Compliance
Car park works					
Long Reef Cct	Monday Friday 7am to 6pm Saturday 8am to 2pm* No work on Sundays or Public Holidays	Day	57	49 dB(A) (Noise Affected)	No
28 Correa Cct			57	48 dB(A) (Noise Affected)	No
Wallarah Circuit			55	49 dB(A) (Noise Affected)	No
*Proposed extended hours on Saturday between 1-2pm for non noisy activities. Refer section 5.4.2.					

5.3 Preliminary Vibration Assessment

Based on the information available at this stage, the construction activities expected to occur on the site are likely to have little to no impact on the surrounding buildings on a vibration basis. Compliance with vibration limits is expected based on ensuring ground compacting equipment is selected to adherer to minimum safe working distances.

It is important to note that construction vibration levels depend on several factors. These include the activity, the machine, the geology of the ground and the distance between the building and the source. Surface works are expected to have a lower vibration impact than ground compacting/breaking works.

NSW RMS provides safe operating distances as per the CNVG for cosmetic damage to the building and for human response to vibration which has been used as a guideline at this stage. **Table 25** below lists minimum safe working distances for critical equipment.

Table 25: RMS Safe Operating Distances – *Construction Noise and Vibration Guideline 2016*

Plant Item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1 – 2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2 – 4 tonnes)	6 m	20 m
	< 200 kN (Typically 4 – 6 tonnes)	12 m	40 m
	< 300 kN (Typically 7 – 13 tonnes)	15 m	100 m
	> 300 kN (Typically 13 – 18 tonnes)	20 m	100 m
	> 300 kN (Typically >18 tonnes)	25 m	100 m

Plant Item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration Guideline)
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Jackhammer	Hand held	1 m (nominal)	2 m

5.4 Construction Activities and Mitigation

The following has been assumed in regards to vibration intensive equipment/activities:

- Ground rock breaking activities may be required.
- Drum roller are expected to be non – vibratory.
- Any excavations on the site are expected using conventional earthmoving equipment such as a hydraulic excavator with bucket attachment.

Construction noise and vibration are to be minimised as much as practical, with mitigation measures to be implemented by the contractor. It is responsibility of the contractor to commit some of these measures. The following are general construction noise source control measures that needs to be considered:

- During extended construction hours, less intrusive works will be scheduled to be carried out and/or works will be carried out away from sensitive receivers.
- Activities that approach the highly noise affected criteria for the residential receivers to be carried out during times where receivers are less sensitive to noise.
- Avoid unnecessary revving of engines and turn off plant that is not being used/required.
- Where possible organise the site so that delivery trucks and haulage trucks only drive forward to avoid the use of reversing alarms.
- Where possible, avoid using tonal reverse alarm outside standard construction hours.
- Organise and schedule the equipment operations to limit the noisiest machines operating simultaneously.
- Site set up/ movement of plant / delivery of material/ waste removal to site should generally be restricted to day period.
- Truck drivers are to be informed of site access routes, acceptable delivery hours and must minimise extended periods of engine idling.
- Ensure there is no unnecessary shouting or loud stereo/radios on site. There must be no dropping of metal from heights, throwing of metal items or slamming of doors.
- Use less noise intensive equipment where reasonable and feasible.
- Where practical fixed plant should be positioned as far as possible from the sensitive receivers.
- Use temporary site buildings and material stockpile as noise barrier.
- Employ the use of solid barrier plywood hoardings if required.
- Where practical, a partial enclosure shall be used to minimise noise levels.

Table 26: Construction Noise Mitigation Measures

Item #	Activity /Machinery	Typical Construction Noise Mitigation Measures
Earthworks		
0	Tracked excavator	Time limit use of excavator. When not in use switch excavator off to reduce idling noise
Construction and Fit out Works		
1	Electric tower crane, lifting	Location of crane to be as far away from sensitive receiver as practical, if crane needs to be set-up near the receiver noisy activities will need to be time managed, to be carried out during standard hours
2	Handheld cordless nail gun (15 to 50 mm nails)	To be set up away from the sensitive receiver, if required adjacent the boundary or a barrier to shield the noise emissions may be required (building façade may be used as a barrier during later stages of the construction)
3	Diesel Generator	To be set up away from the sensitive receiver, if required adjacent the boundary a barrier to shield the noise emissions may be required outside standard construction hours
4	Concrete mixer discharging with concrete Pump 26 Ton / 7 m3 + 22m boom	Site access for trucks to be away from sensitive receiver
5	Screw guns	Compliance expected if carried out within enclosed building
6	Tile Cutting	Compliance expected if carried out within enclosed building

5.4.1 General/Site Management Issues

- As the construction methodology of the proposed development is yet to be finalised, NDY has provided a general recommendation to manage the construction noise and vibration in the section below. A detailed construction noise and vibration management plan and a quantitative construction noise assessment will be developed in the later stage of the project with the consultant team and contractor and it will be finalised prior to issuing a construction certificate in accordance with AS2436-2010 and other relevant Australian Guidelines.
- All employees, contractors and subcontractors are to receive an environmental induction and should instruct all persons at the site with regard to all relevant project specific and standard noise mitigation measures, including but not limited to permissible hours or work, limitation of high noise generating activities, location of nearest affected noise receivers, construction employee parking areas, designated loading/unloading areas and procedures, site opening/closing times (including deliveries) and environmental incident procedures.
- A dedicated person will form a point of contact for dissemination of general information regarding site operations. Contact persons will also be defined to receive comment or complaints from the community.

5.4.2 Hours of Work/Respite Periods

The following construction hours are proposed as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 2pm.

- Sundays and Public Holidays: No excavation or construction works

It is proposed that less obtrusive construction activities will be undertaken between 1pm and 2pm Saturdays. Works not involving earthmoving equipment, power tools, etc., but instead including such activities as cleaning, tidying up the site, etc.

5.4.3 Consultation

Notification to residents of proposed works:

- A letter to be distributed to neighbouring sites/residents in advance of the works to notify them of the nature and estimated timescales for completion of the proposed works.

Project info – line and construction response line:

- A 24-hour contact point shall be provided for any complaints regarding the construction works and a project representative shall respond to all compliant as soon as possible.

5.4.4 Noise and Vibration Monitoring

Where required, the developer will engage a qualified Acoustical Consultant to assess noise and ground borne vibration levels at agreed sensitive locations at agreed intervals. Monitoring periods will need to be determined as required by the Council. It is proposed that the results of the monitoring program are prepared by the Acoustic Consultant and contractor into monitoring reports, summarising construction noise and vibration results over the subject period. These reports should:

- Include a representative sample of typical site activities likely to occur on a day to day basis, activities causing complaints and/or any activity nominated in writing by the Council.
- Outline activities, noise levels and remedial measures undertaken.
- Make recommendations on control measures available where noise or vibration levels are found to exceed the guideline prescribed limits and describe the methods to be employed to ensure ongoing compliance, such as:
    - Restricted times of operation of certain noisy activities (such as pile driving) including scheduling of noisy activities to less sensitive times.
    - The use of low noise techniques, such as Pressure or Bored Piling instead of the impact driven pre-cast pile techniques.
    - Provision of sound attenuating barriers, fences or acoustic enclosures.
- Define the permissible noise levels at all relevant sensitive zones.

6 CONCLUSION

A New Primary school will begin construction at 28 Wallarah Circuit, Gregory Hills. This report addresses operational and operational noise and vibration emissions as received at the most affected receivers, located around the subject site:

- 24 Coral Flame Circuit (residential)
- Long Reef Circuit (residential)
- Wallarah Circuit (residential)
- Howard Park (Active recreational areas)

Operational Noise

- Operational noise criteria were set in accordance with NSW NPfI.
- The main contributors of operational noise emission are expected to be building services equipment, vehicular noise from short stay parking, noise from amplified music and speech during outside of school hours event and the waste collection area.
- Building services equipment will be attenuated through the use of typical acoustic treatment items such as internally lined ductwork, attenuators, acoustic louvres, etc., as required.
- Noise impact from vehicular activities at short stay parking complaint with NSW RNP 2011. Some noise control mitigation action and works are provided to reduce the vehicular noise emission from short stay parking to meet the 55 dBA criteria.
- Waste collection activities will comply with project trigger noise levels provided activities have a sound power level not greater than 86 dBA.

Operational Vibration

- Operational vibration criteria have been set as per AS 2670.
- The main contributors of operational vibration emission are expected to be building services equipment.
- Building services equipment will incorporate vibration isolators according to the equipment operating parameters and the characteristics of the supporting structure.

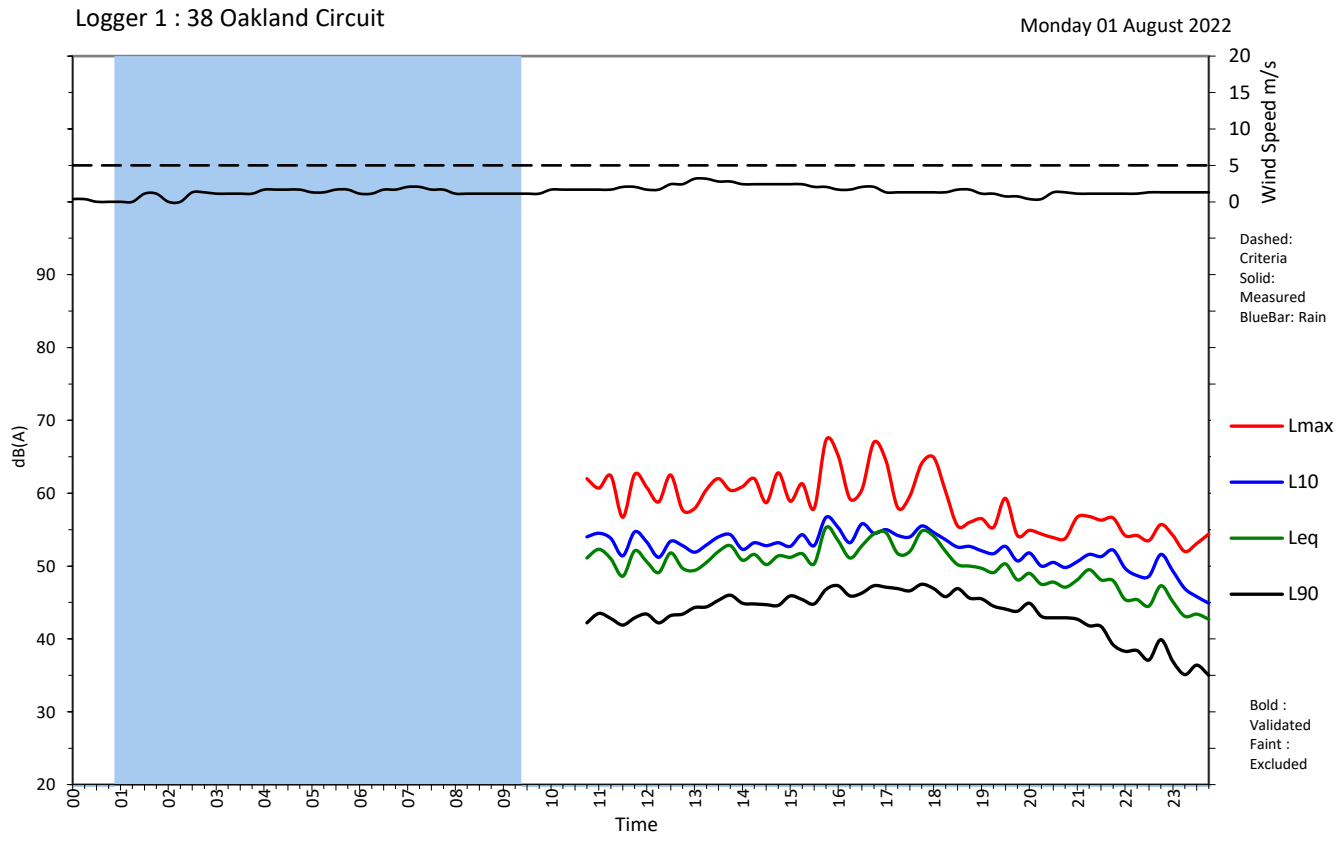
Construction Noise and Vibration

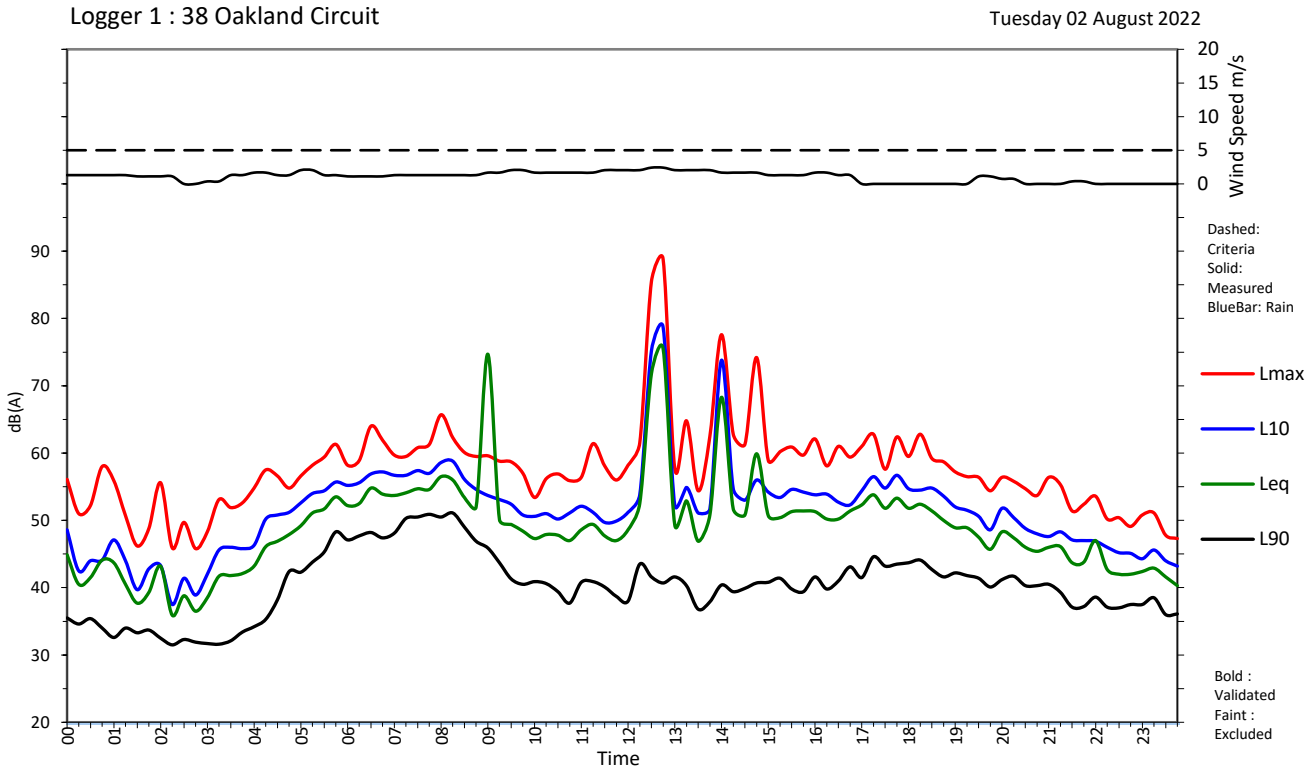
- Construction noise criteria have been set in accordance with NSW Interim Construction Noise Guideline.
- Construction noise is predicted to exceed the noise affected level, indicating reasonable steps to reduce noise should be taken, however does not exceed the highly noise affected level, indicating a construction noise and vibration management plan.
- Further investigation is likely to be required once the construction methodology has been developed.
- The proposed hours of construction period have been provided with all reasonable steps to reduce the noise emission during the period of hours worked.
- Construction vibration has been assessed against British Standard BS 7385:1993, NSW EPA Assessing Vibration: A Technical Guideline 2006, AS 2670.2 1990, and German DIN 4150: Part 3 – 1999.
- The main sources of construction vibration emission from the site are expected to be handheld jackhammers, rock breakers.
- Further investigation may be required once the construction methodology has been developed.

Based on the above conclusions, The assessment of noise and vibration impacts on the surrounding community from the proposed New Primary School at Gregory Hills will be compliant with noise and vibration regulations except with the construction noise assessment, Mitigation measures to reduce the construction noise impacts are recommended to be followed. As such NDY supports the applicable planning pathway for the proposed new primary school.

APPENDIX A: MEASURED NOISE LEVELS

Figure 12 – Rion ARL NL 42 logger in 38 Oakland Circuit

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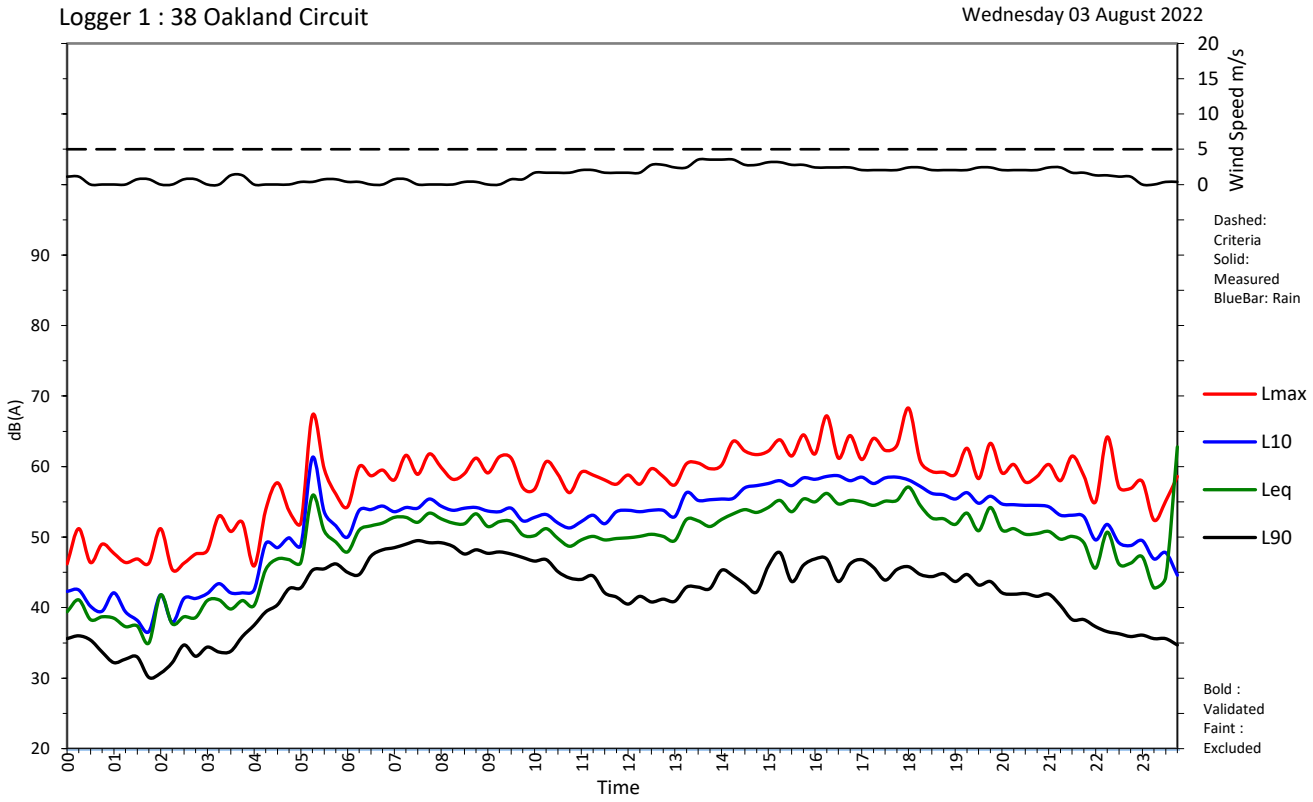
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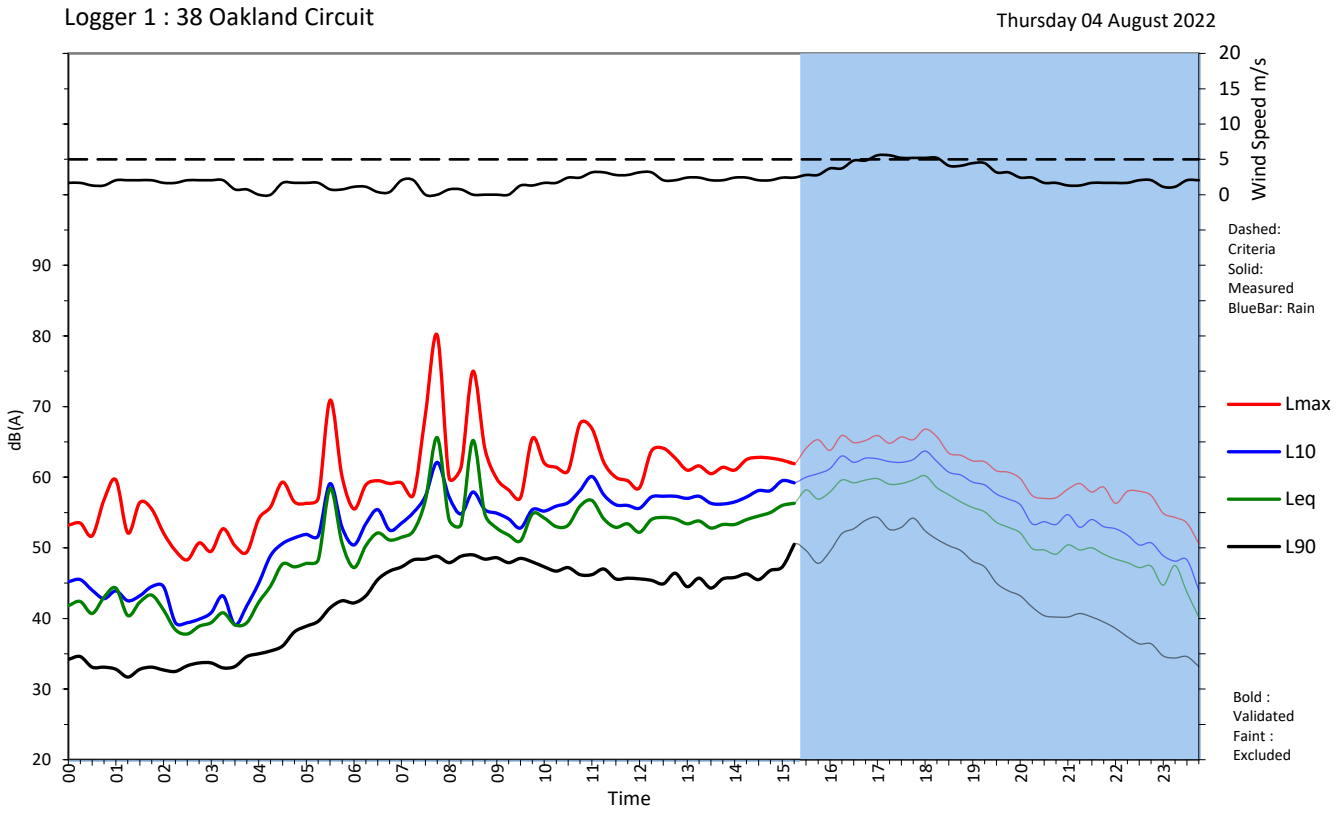
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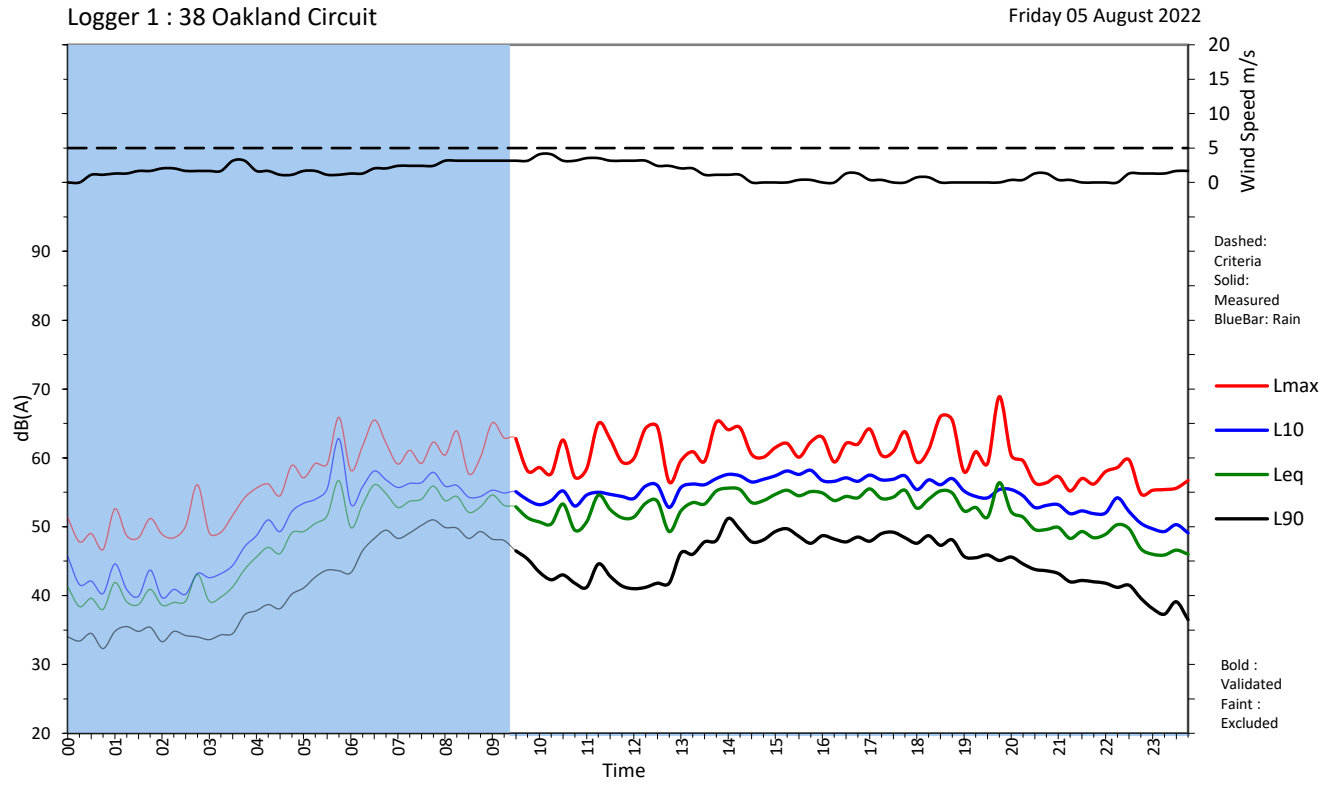
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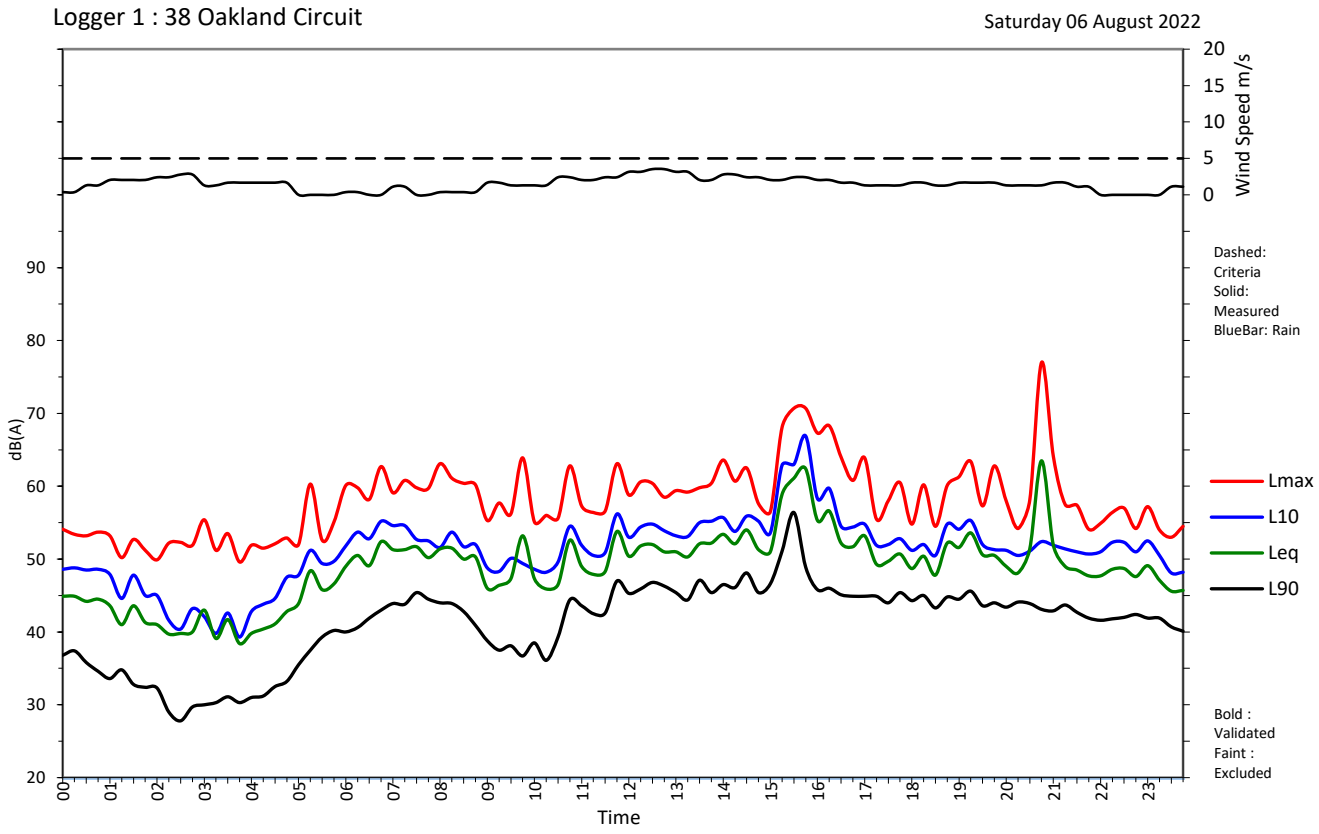
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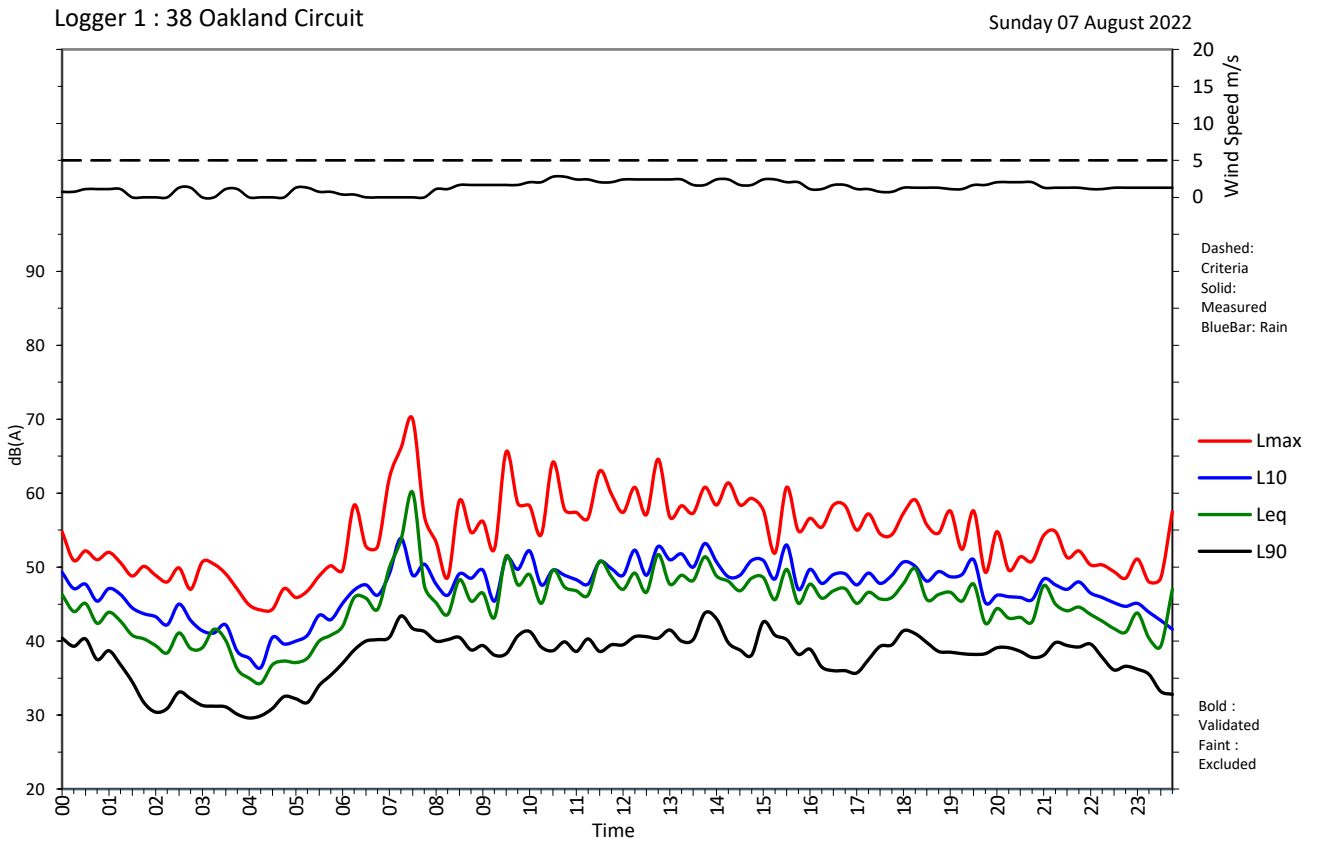
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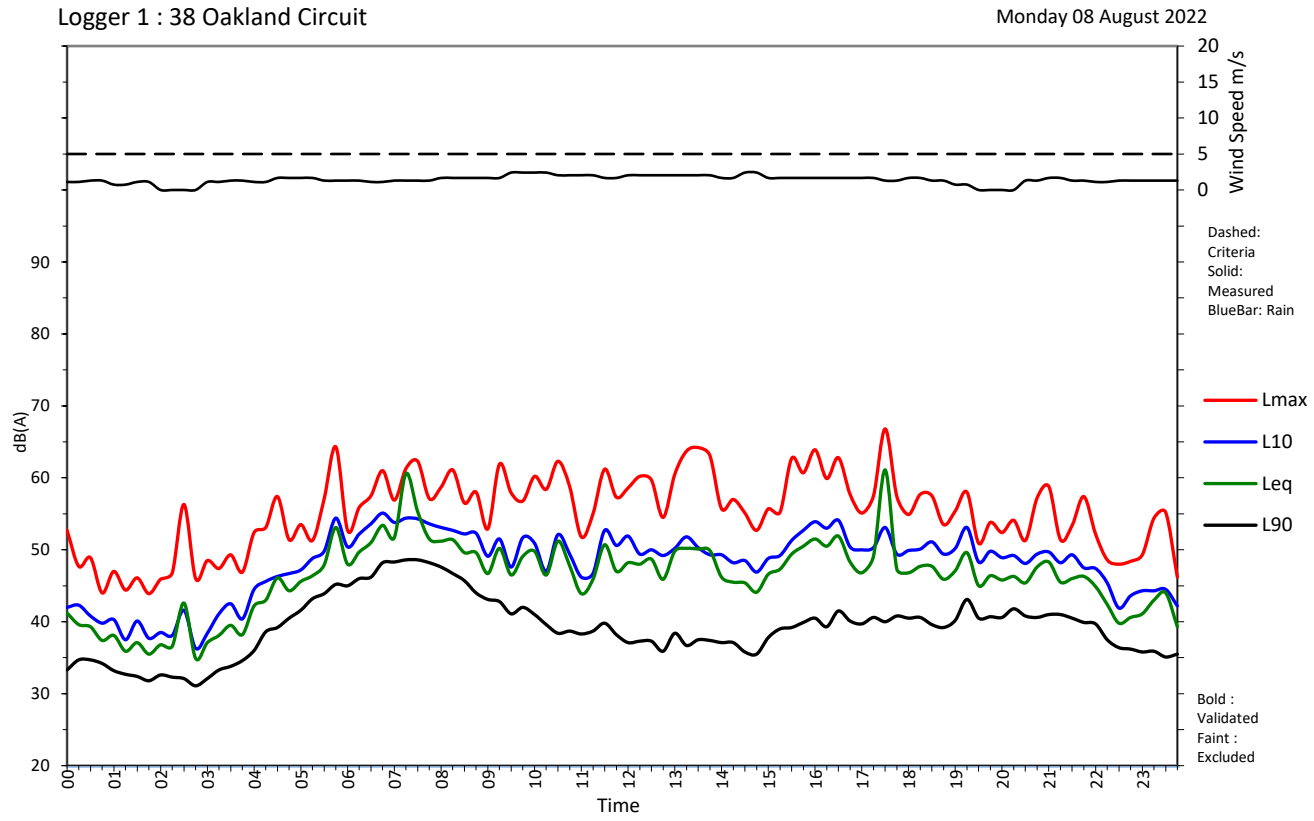
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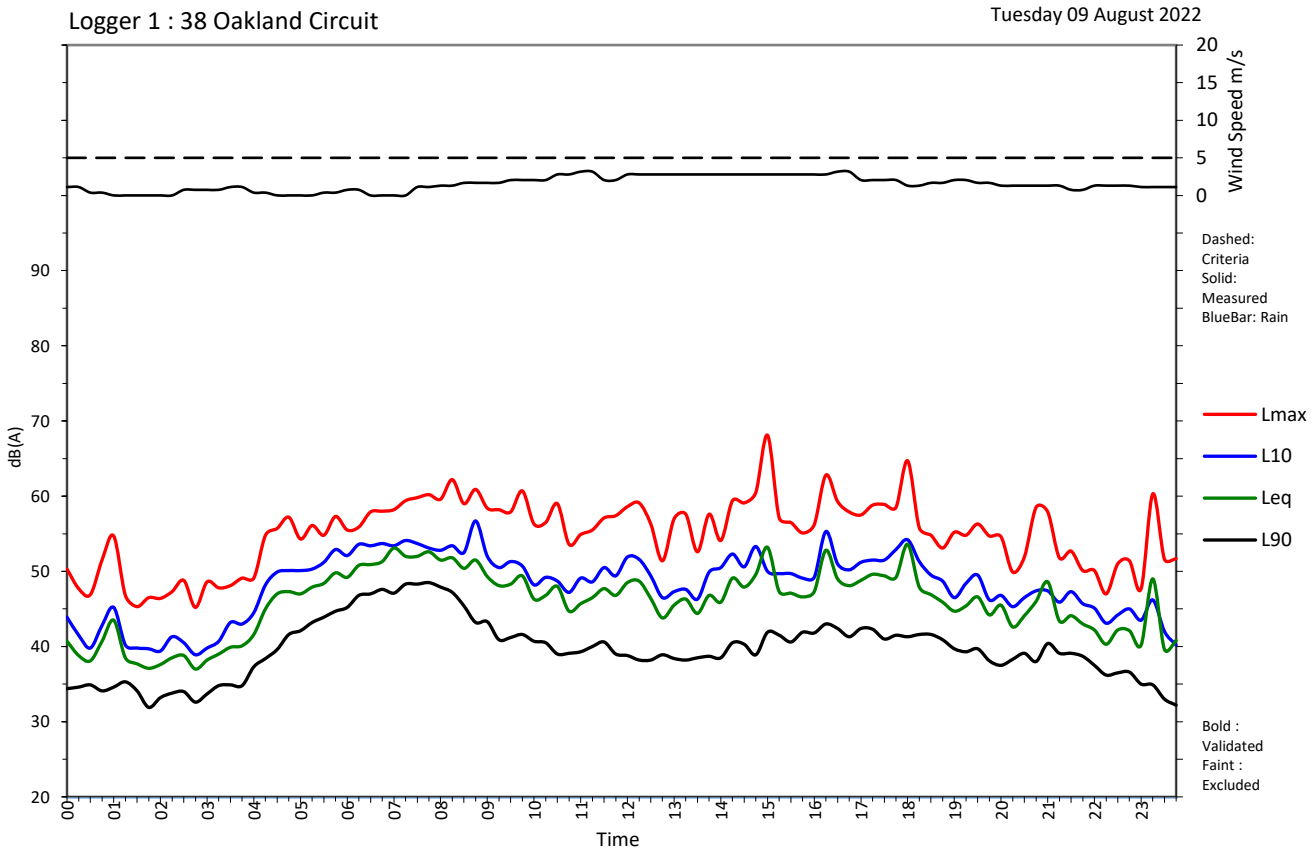
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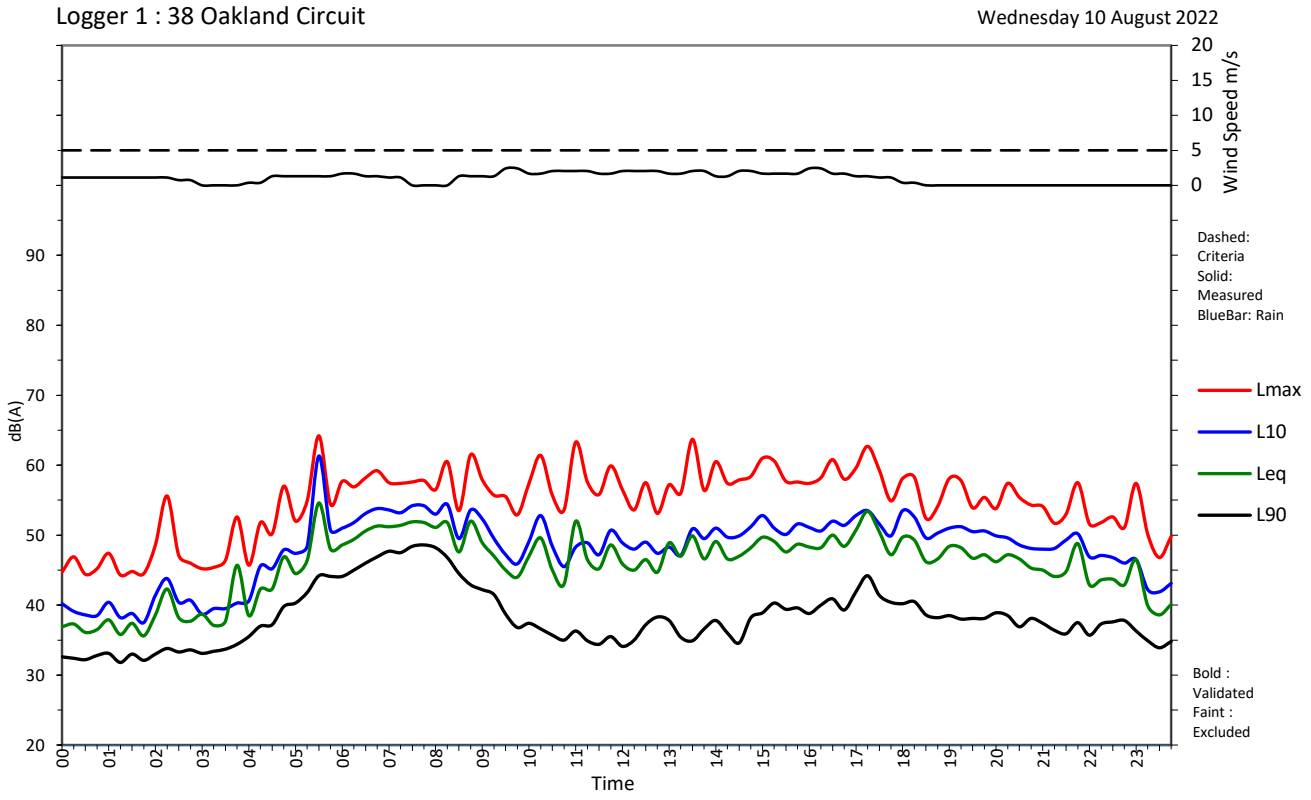
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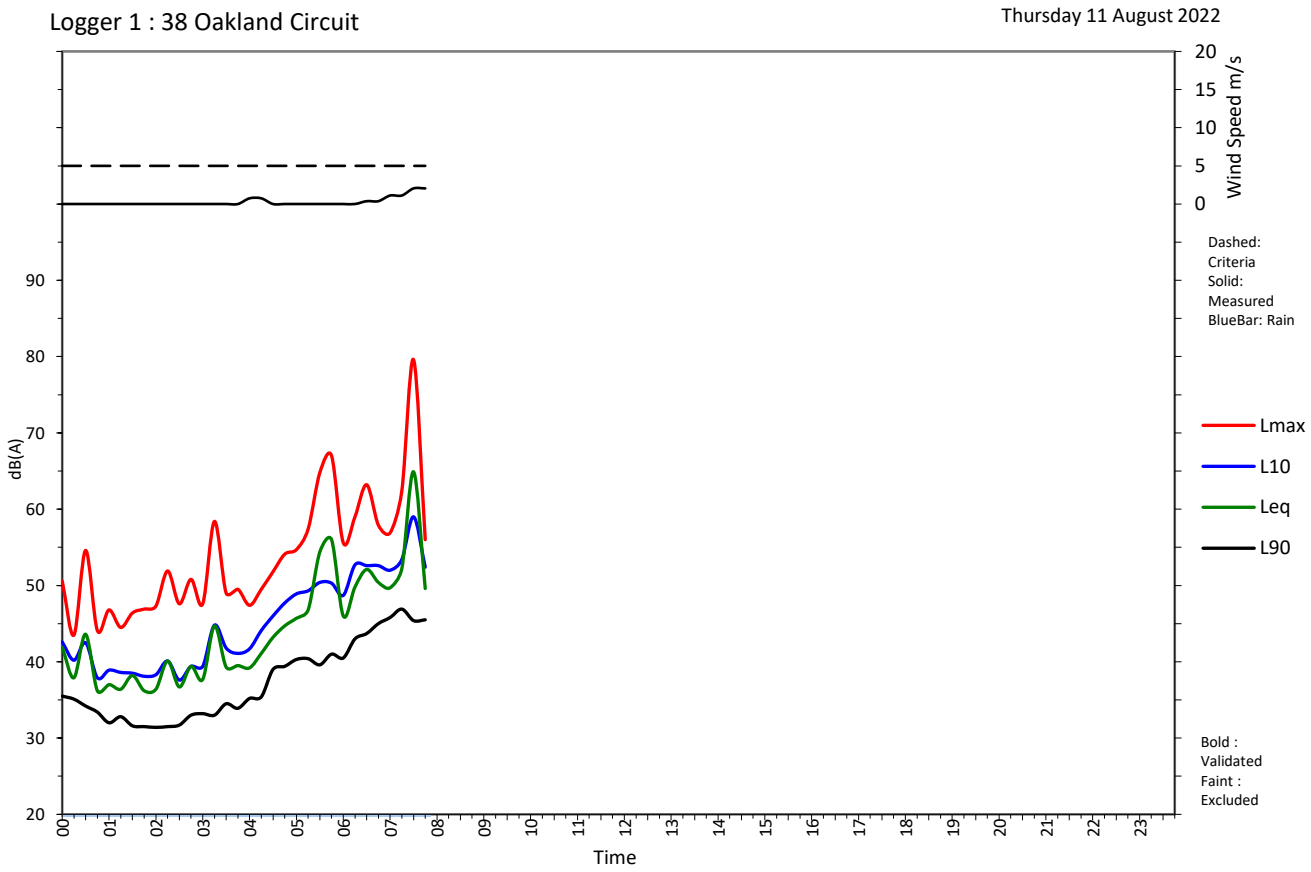
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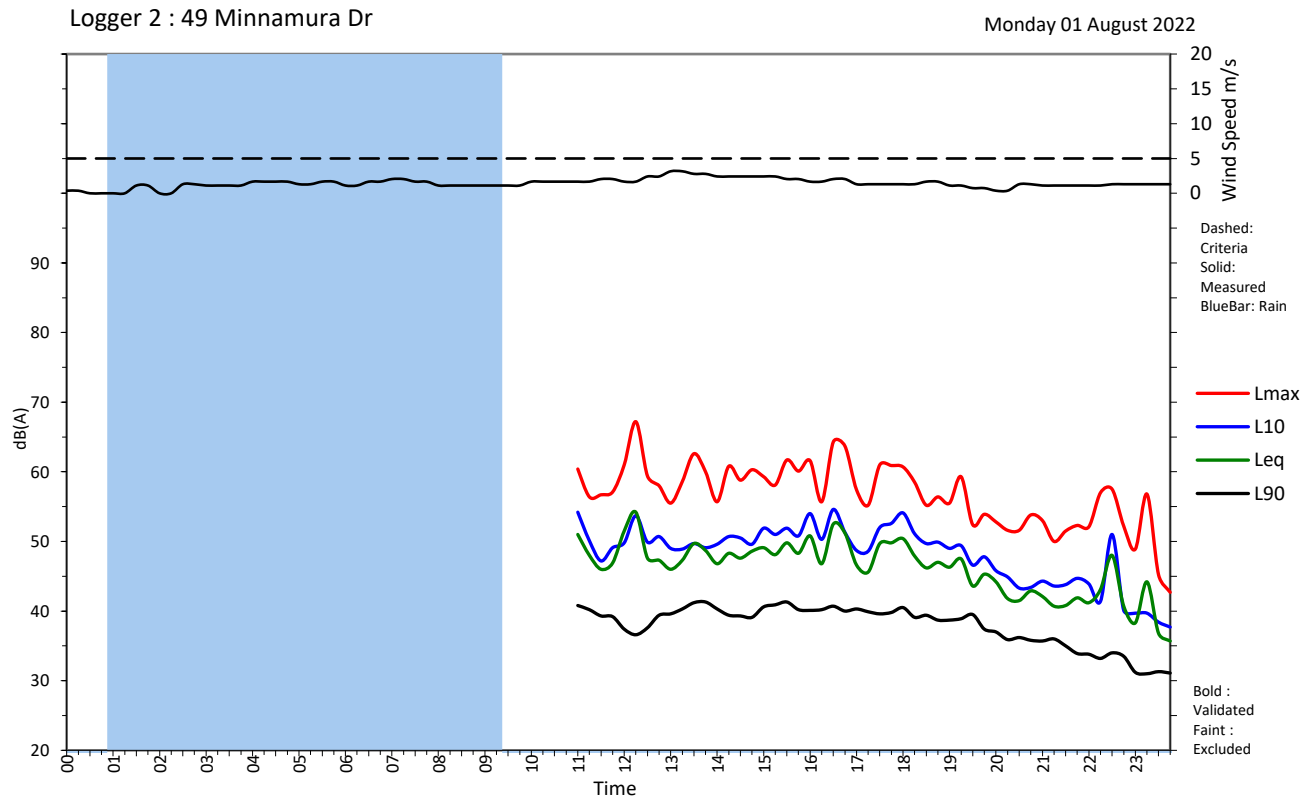
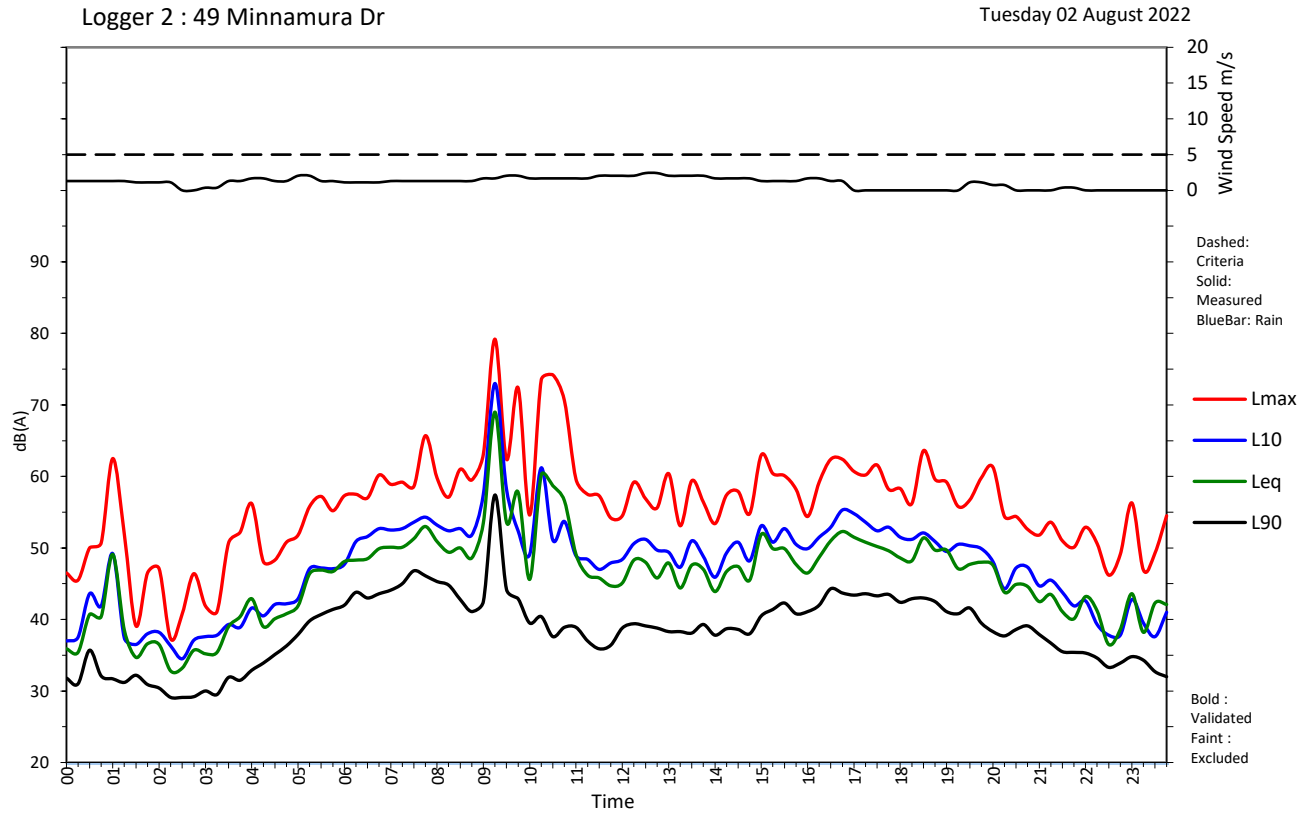
Figure 13 – Rion ARL NL 42 logger in 49 Minnamura Dr

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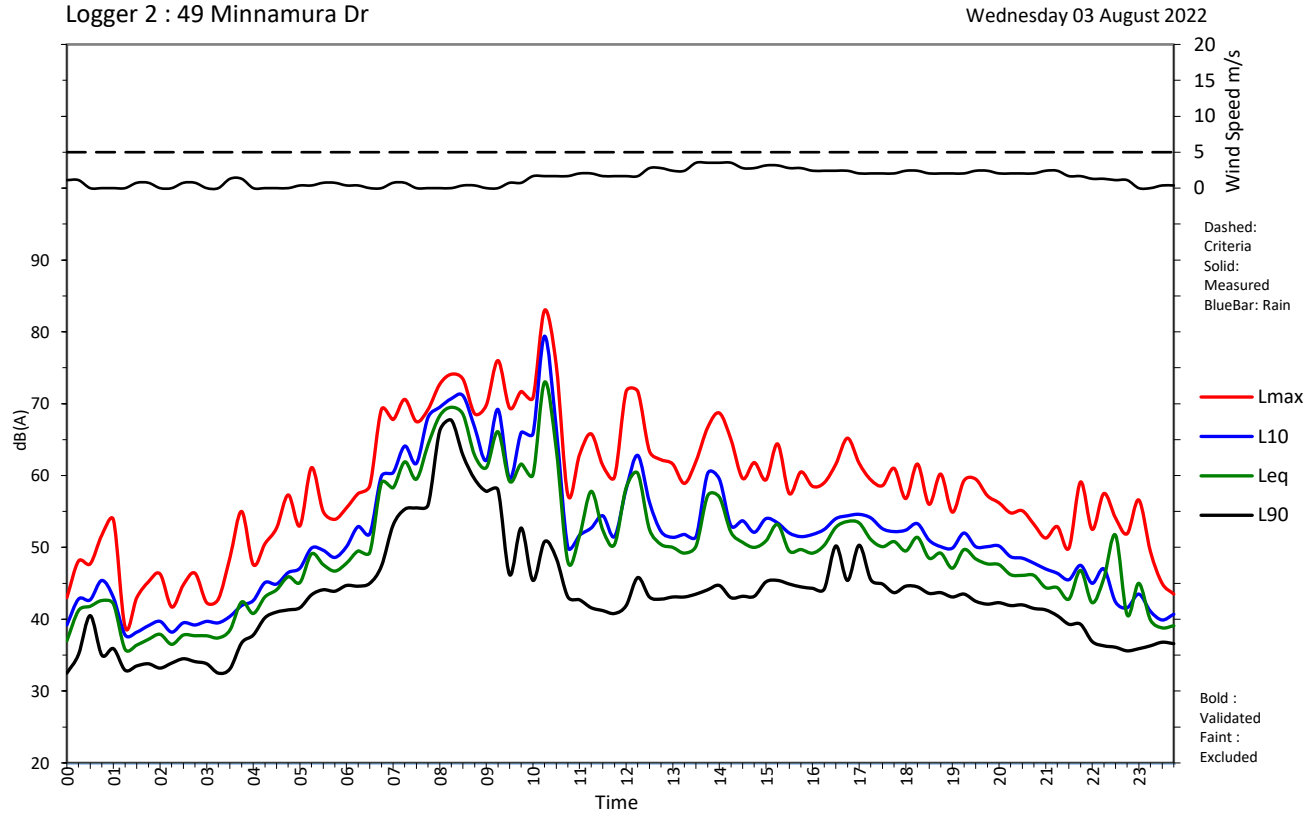
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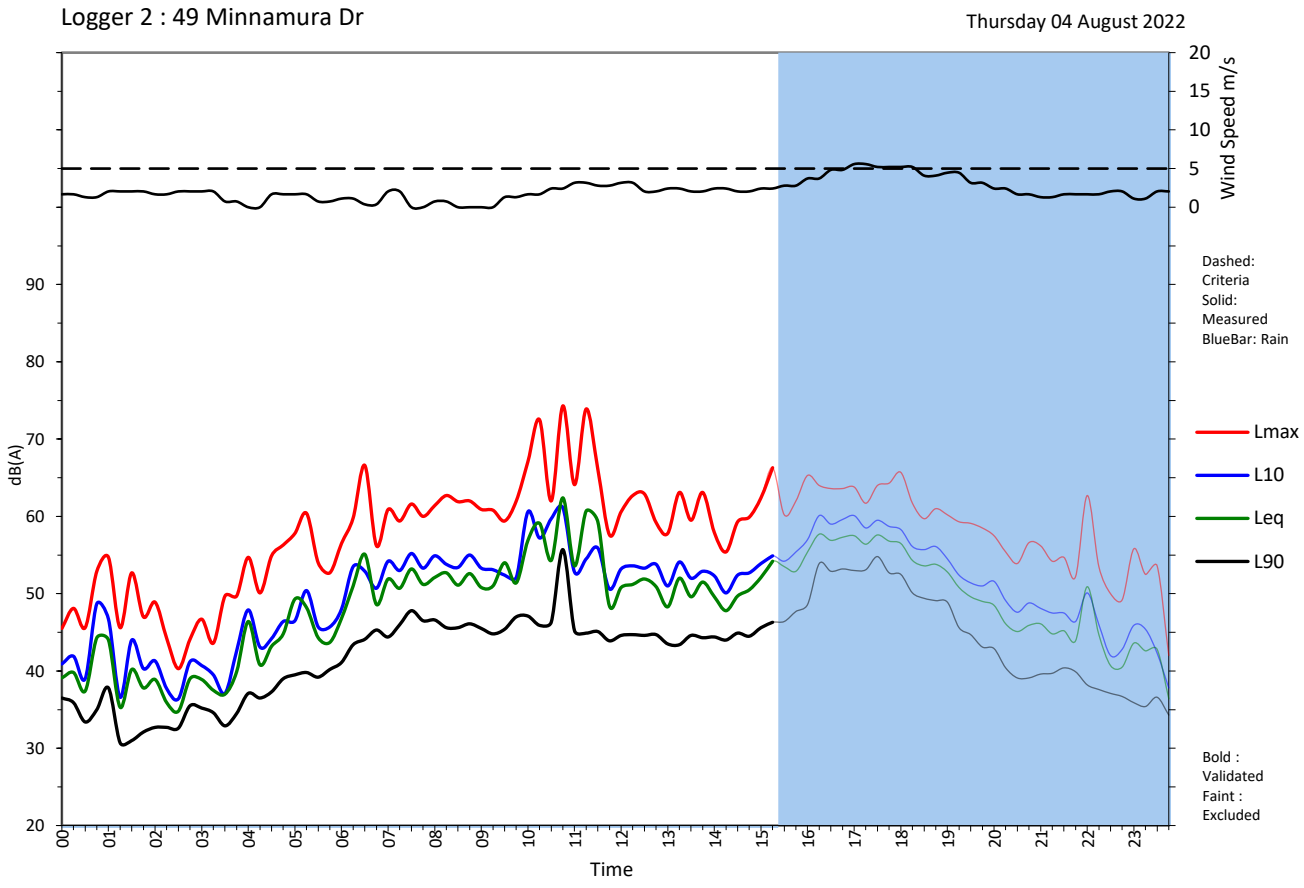
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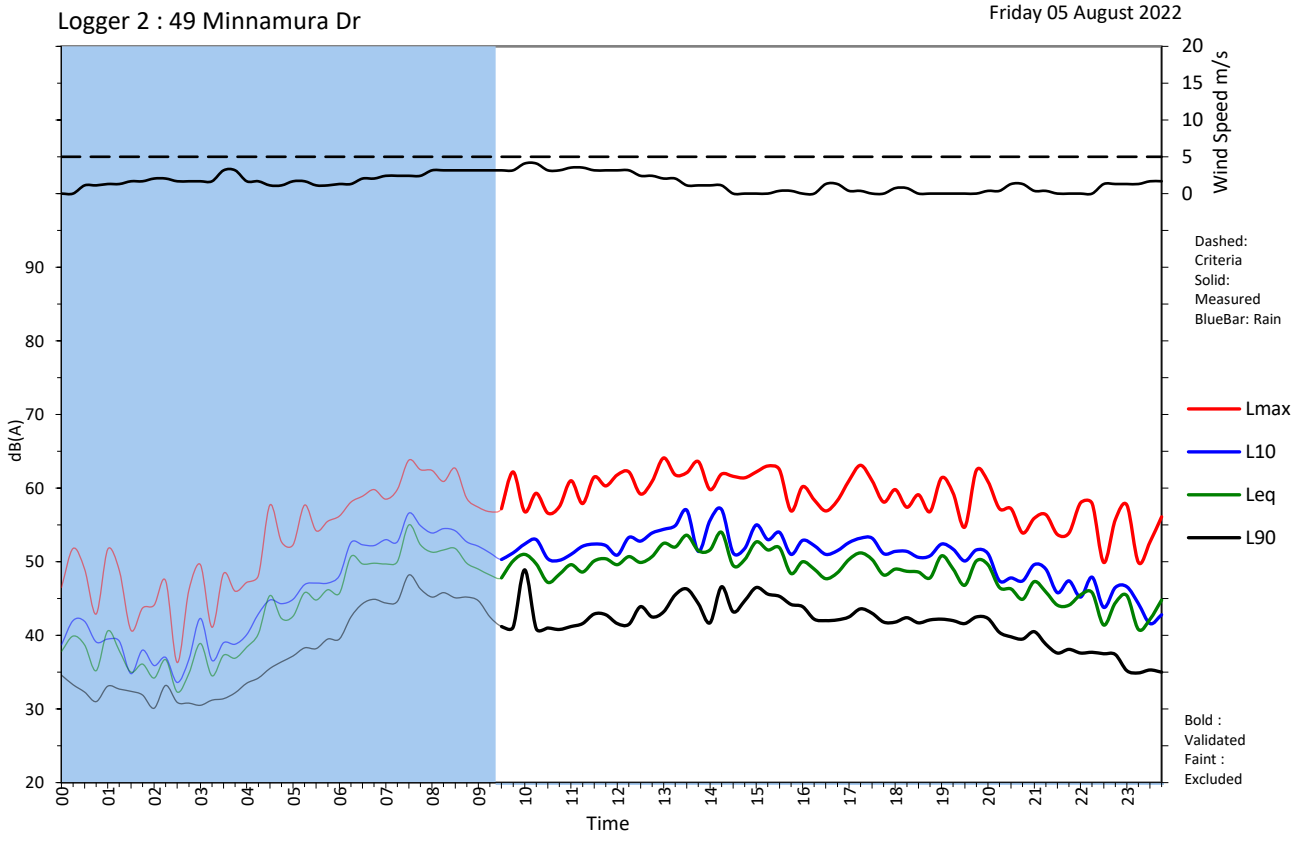
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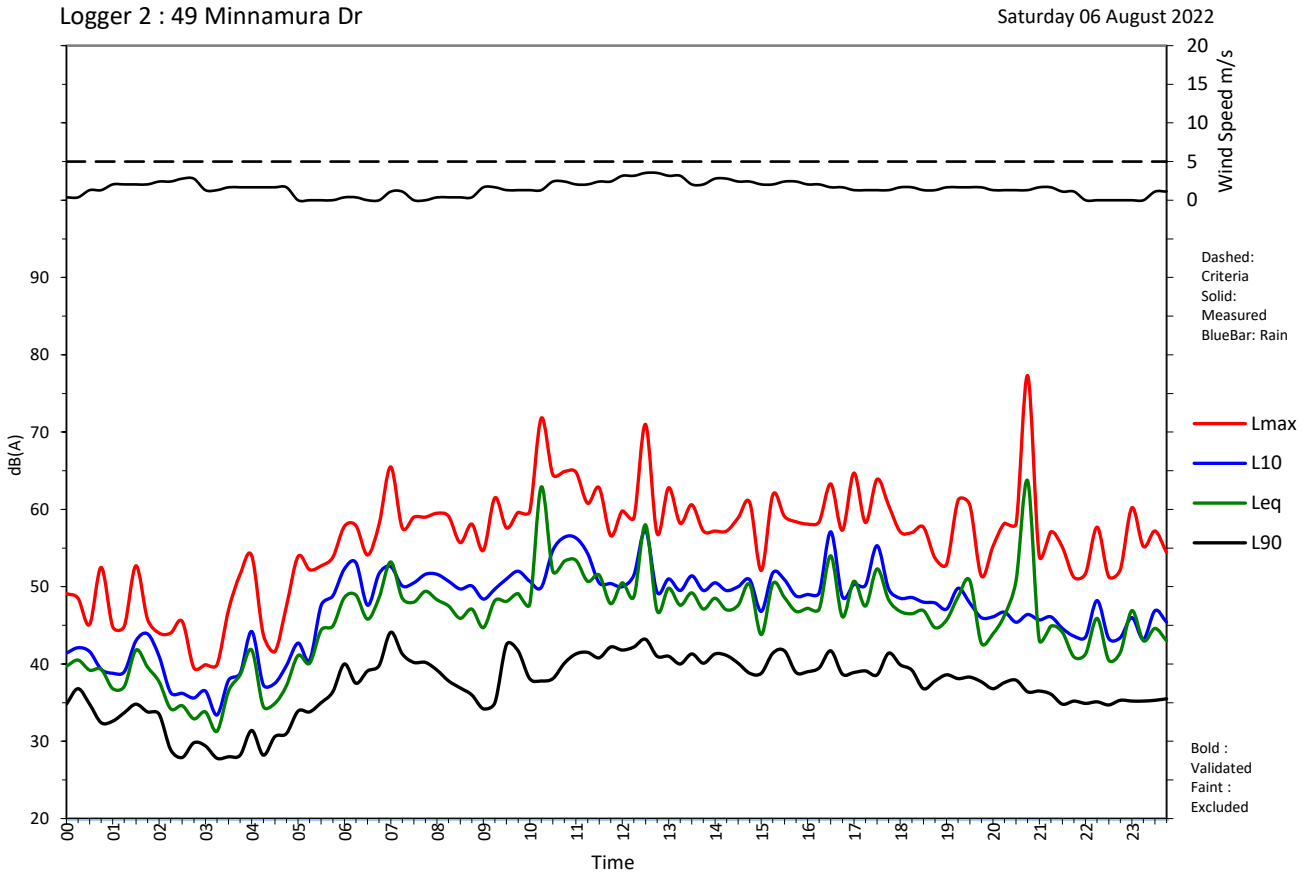
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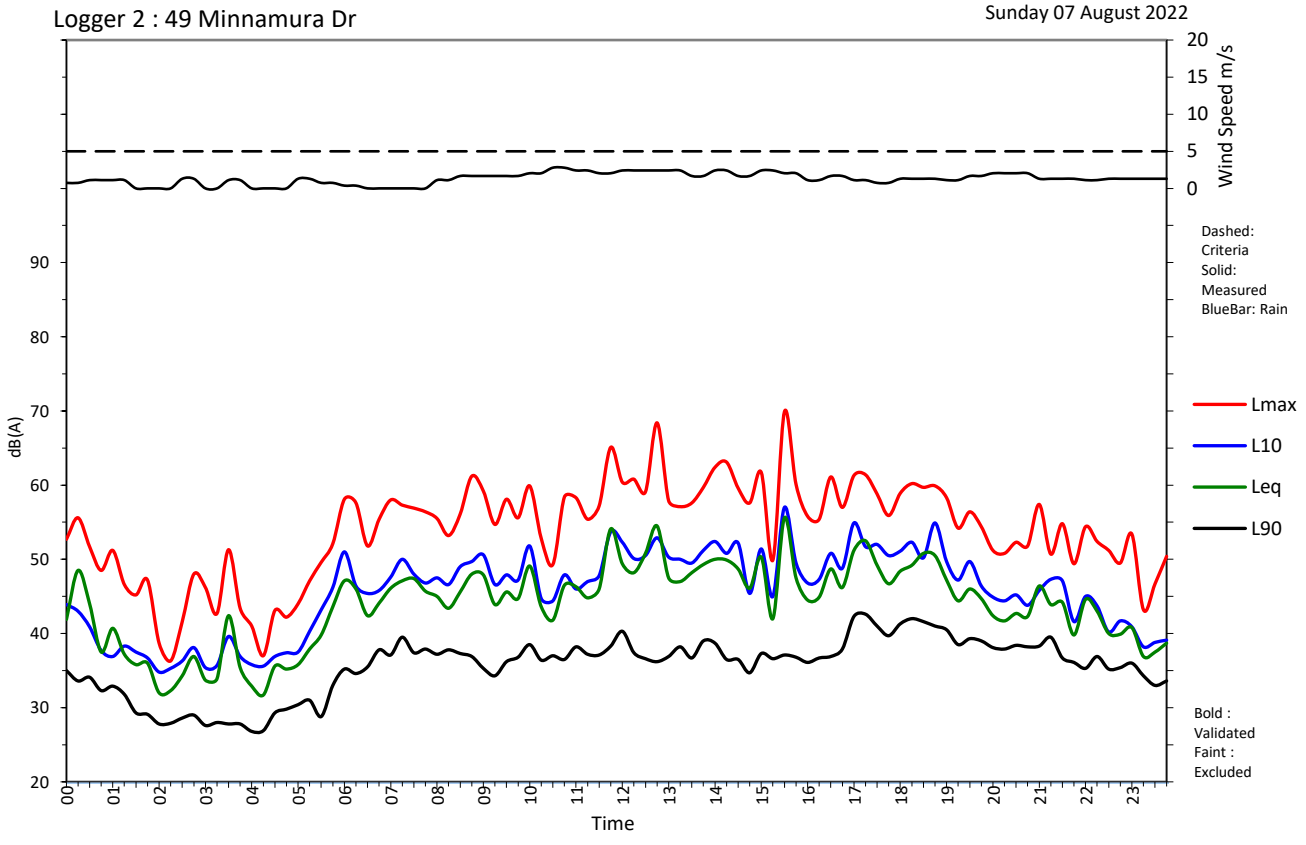
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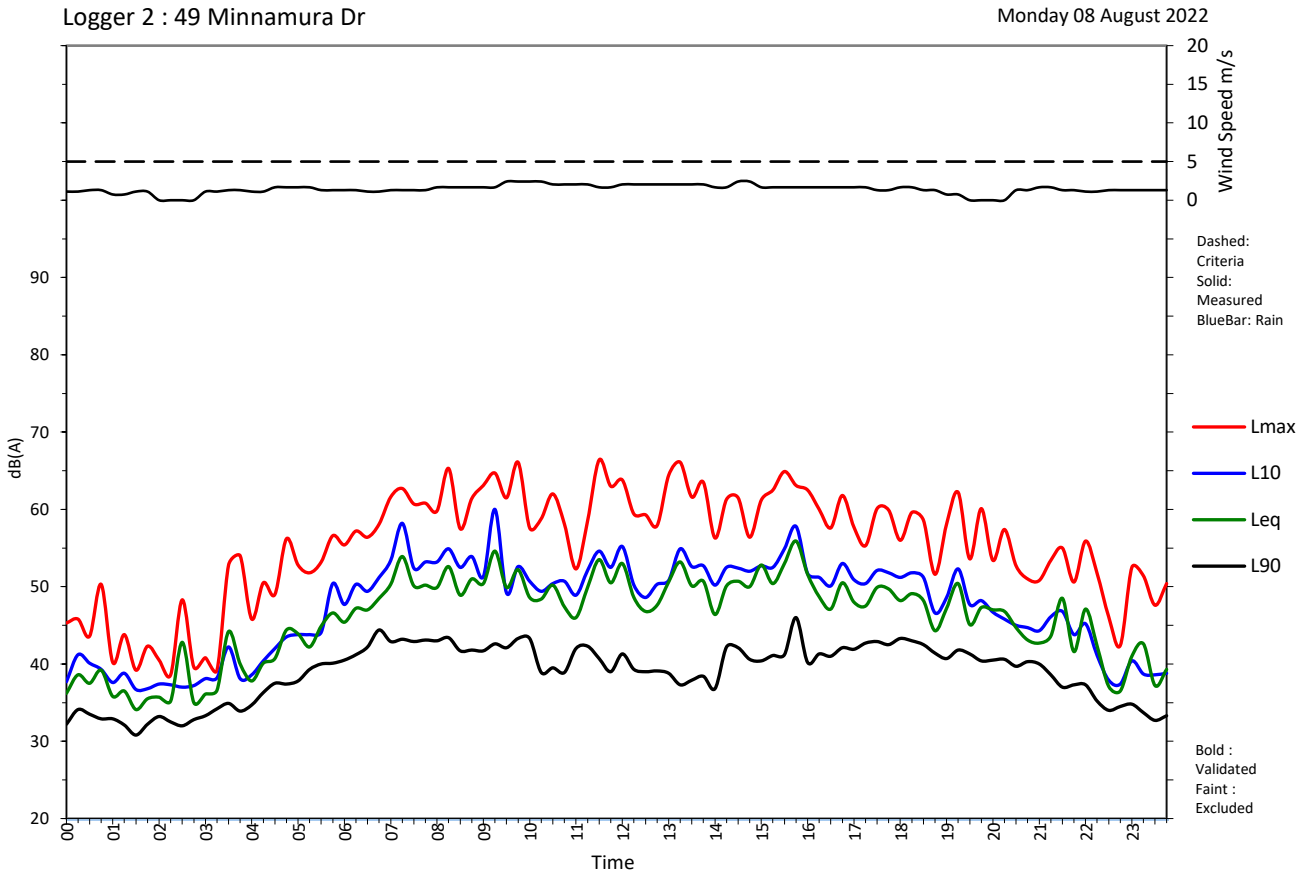
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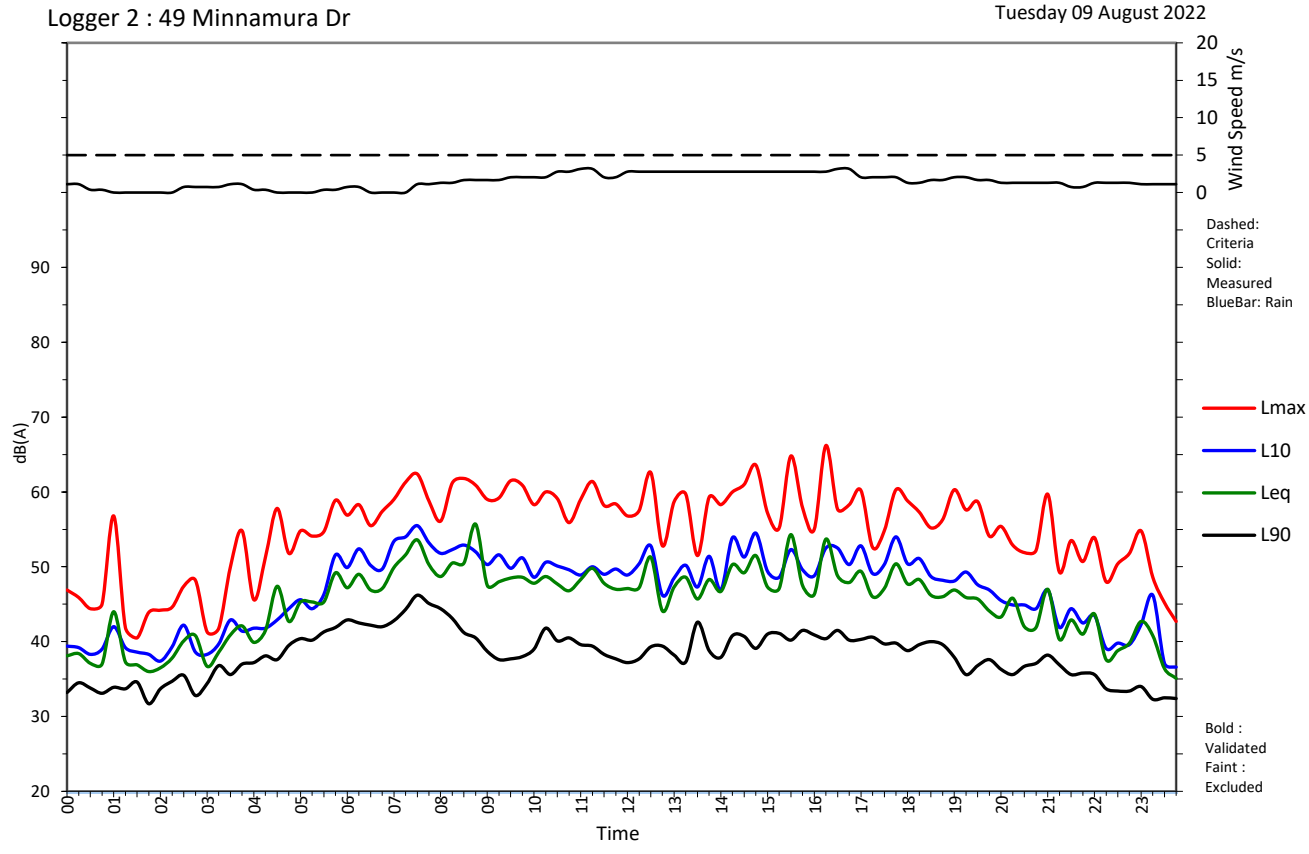
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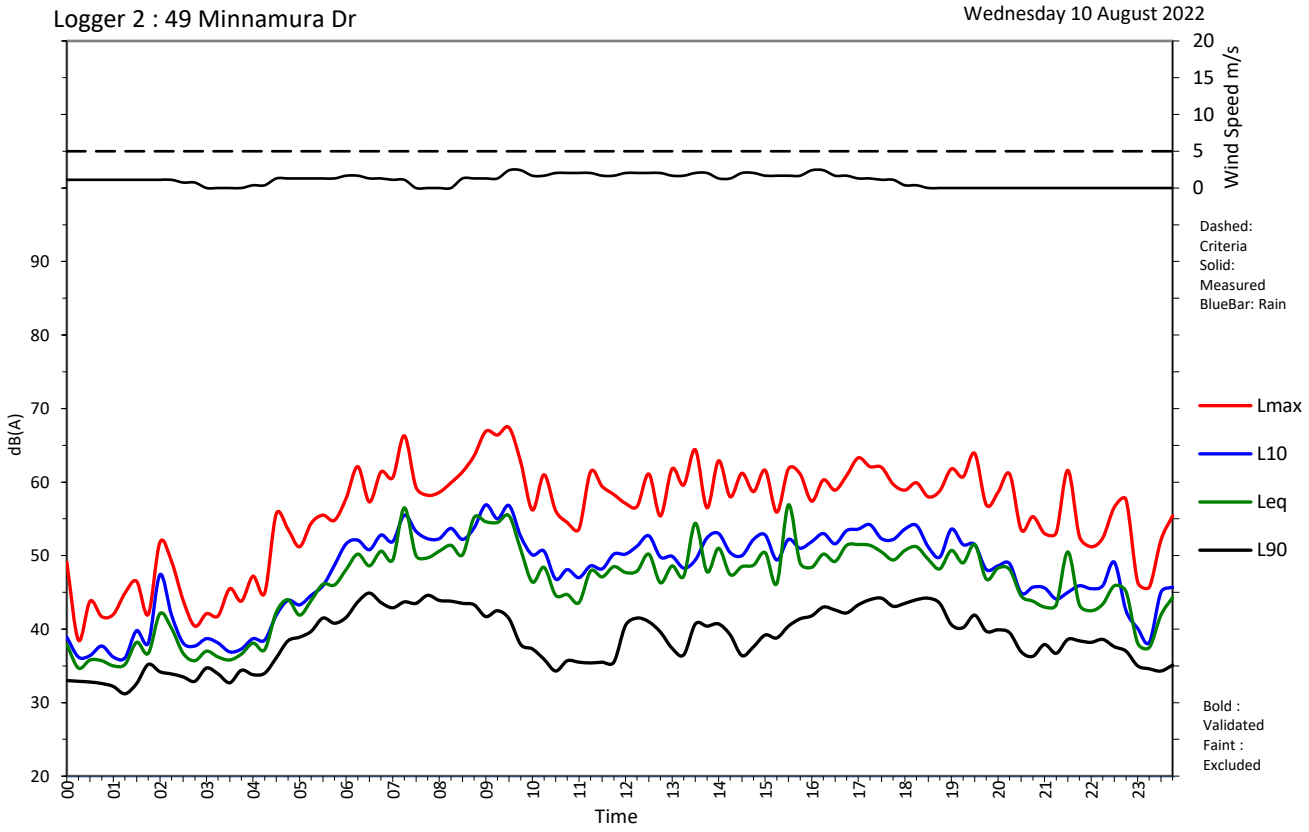
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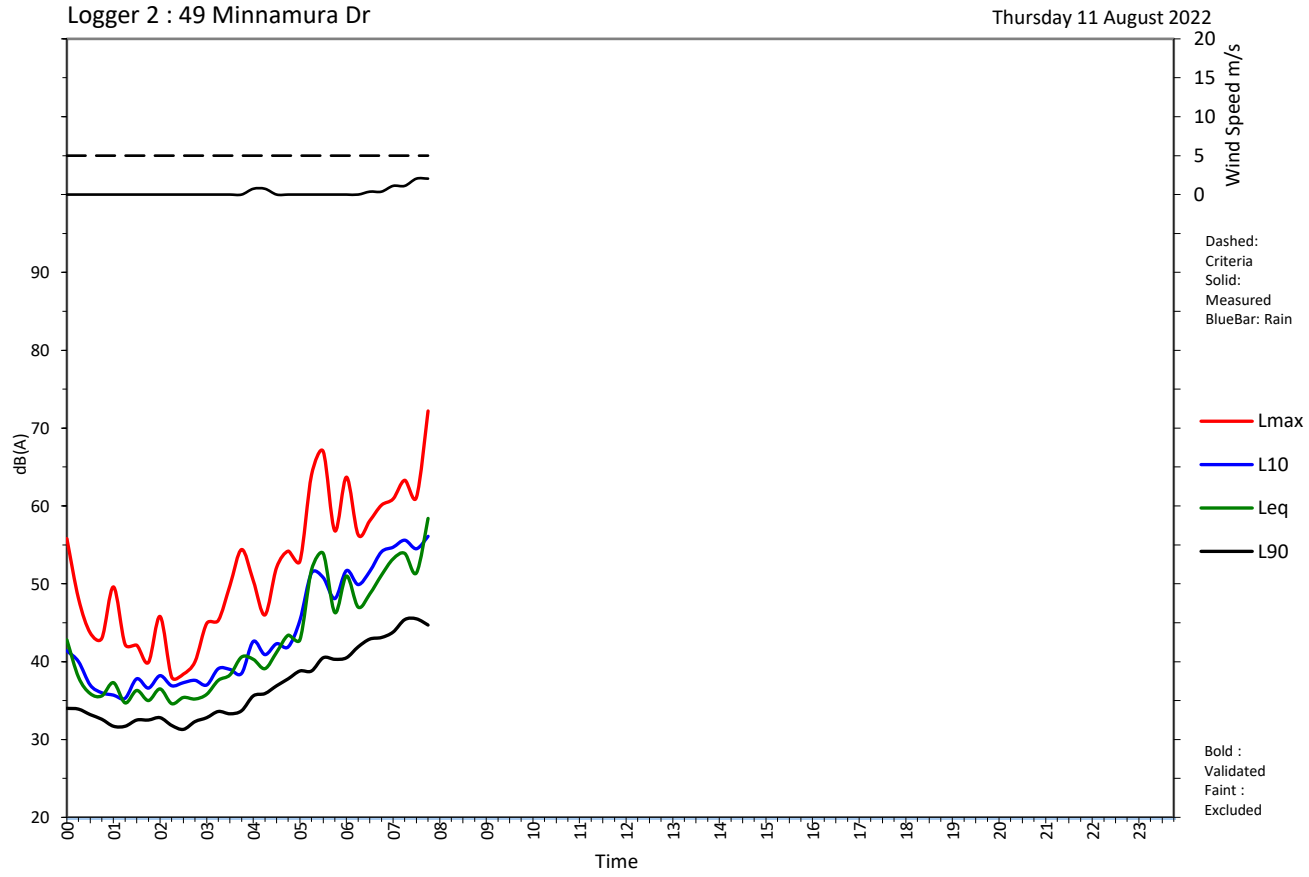
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NDY QA SYSTEM

Revision No:	6.0
Revision Date:	27 October 2022
Reason Description:	SSDA Lodgement

Authorisation By: Jarrad Underwood

Client Name:	School Infrastructure NSW
Client Contact:	Bill Kabbout
Project Leader:	Jarrad Underwood
Editor:	Ricky Sugianto Lai
Filename:	rp220905s0010
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Verification By: Cameron Walbran

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