NOISE IMPACT ASSESSMENT
CHILDCARE CENTRE
PREPARED FOR MONTESSORI ACADEMY GROUP
427 BURWOOD ROAD, BELMORE NSW 2192

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Report No: 221050_NIA_Rev4
November 2022
(Released: 09 November 2022)

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Engineering a Sustainable Future for Our Environment

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DOCUMENT REVISION RECORD

Revision	Date	Description	Checked	Approved
1	13-5-2022	Draft / Rev 1	E Hansma	R T Benbow
2	7-6-2022	Rev 2	E Hansma	R T Benbow
3	13-9-2022	Rev 3	L Zanotto	R T Benbow
4	9-11-2022	Rev 4	R T Benbow	R T Benbow

DOCUMENT DISTRIBUTION

Revision	Issue Date	Issued To	Issued By
1	13-5-2022	Montessori Academy Group	Benbow Environmental
2	7-6-2022	Montessori Academy Group	Benbow Environmental
3	13-9-2022	Montessori Academy Group	Benbow Environmental
4	9-11-2022	Montessori Academy Group	Benbow Environmental

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1. INTRODUCTION

Benbow Environmental (BE) has been commissioned by Montessori Academy Group to provide a Noise Impact Assessment (NIA) for the proposed childcare centre located at 427 Burwood Road, Belmore. The development involves adaptive reuse of Club Belmore RSL conversion into a two storey childcare centre with car parking and accommodating 120 children.

This Noise Impact Assessment has been carried out in accordance with the following guidelines and documents:

- NSW Noise Policy for Industry (EPA 2017);
- AAAC Technical Guideline: Childcare Centre Noise Assessment;
- Department of Environment, Climate Change and Water NSW, Road Noise Policy (DECCW 2011); and
- NSW Interim Construction Noise Guideline (DECC, 2009).

The assessment has been undertaken to ensure that the proposed activities would not generate adverse noise impacts on the nearest sensitive receivers and the health of the occupants of the proposed Childcare Centre, including the children, would not be impacted upon by major roads within proximity to the proposed Childcare Centre. Additionally, the impact of the development as a whole on road traffic noise has been assessed.

The Childcare Centre is proposed to operate from 7.00am to 6.00pm Monday to Friday. The centre would function primarily as a long-day care facility catering for up to 120 children ranging in age from 0–6 years. The development has provision for twenty-three (23) car parking spaces.

Existing ambient noise levels have been measured near the site location. Both operator attended short term noise monitoring and long term unattended noise monitoring have been carried out in accordance with the methodologies outlined in the NSW Noise Policy for Industry and relevant Australian Standards.

Long term unattended noise monitoring data have been utilised to derive the project specific noise levels (noise criteria) for all the considered nearest sensitive receivers.

Noise predictions were undertaken considering several receivers and utilising the noise modelling software Sound Plan v8.2. The sources of noise that present the primary potential for off-site impacts are the dedicated outside play areas, the air conditioning units and the proposed car park.

This report details the results of ambient noise measurements, the establishment of the noise criteria and the assessment of potential noise emissions from the proposed Childcare Centre. An assessment of the potential external noise intrusion and its consequent impact on the occupants of the proposed Childcare Centre has also been undertaken.

1.1 SCOPE OF WORKS

The scope of works of this noise impact assessment is as follows:

- Provide a brief description of the proposed development;
- Measure existing ambient noise levels at proposed site location;
- Determine all potential noise sources associated with the proposed operations;
- Predict potential noise impacts from the development at the nearest affected existing receivers;
- Assess potential noise impacts against relevant legislation and guidelines;
- Compare measured levels against relevant noise criteria, with emphasis on children's exposure to road traffic noise;
- Recommend noise mitigation measures, where required; and
- The compilation of this report containing concise statements of potential noise impact.

2. PROJECT INFORMATION

A brief description of the subject site and lands surrounding the study area has been outlined within this section of the report.

2.1 SITE LOCALITY AND SURROUNDING LAND USE

The proposal is for a childcare facility located at 427 Burwood Road, Belmore. (Lot 9, DP 11289 and Lot 2 DP816386). Site identification information and land use is summarised in Table 2 1. An aerial photograph displaying the site location is provided in Figure 2-1.

Land zoning for the site and the surrounding area is displayed in Figure 2-2. As per the *Canterbury Local Environmental Plan 2012*, the proposed development is located on B2 – Local Centre.

The LEP states that an objective of the B2 zoned land is "to provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area." Centre-based childcare facilities may be permitted with consent in B2 zoned land, as they are considered "other development not specified in item 2 or 4" of the permitted without consent or prohibited developments of this zone.

Immediately surrounding land use zoning includes additional B2 zoning north and south of the development. R3 (Medium Density Residential) and R4 (High Density Residential) zoned land is immediately east and further west of the development, respectively. RE1 (Public Recreation) and SP2 (Infrastructure) zoned land are located further from the development site.

Table 2-1: Site Identification

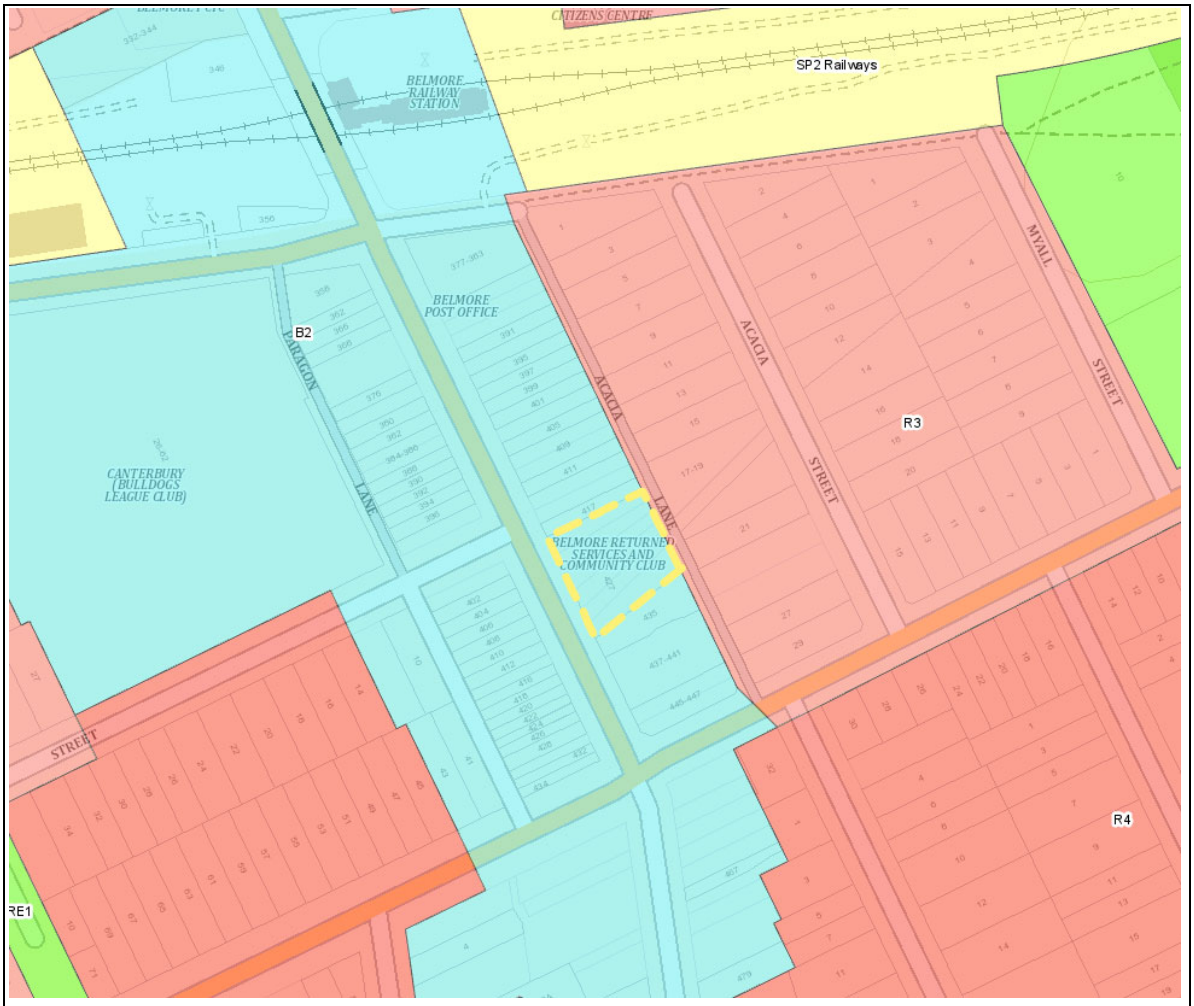
Lot and DP Number	Lot 9, DP 11289 & Lot 2 DP816386
Approximate Site Area (m^2)	2,406
Local Government Area	City of Canterbury Bankstown Council
Current Land Zoning	B2 – Local Centre

Figure 2-1: Site Location Aerial Photograph

Source: Six Maps 2018

↑N Not to scale	**LEGEND:** Site Boundaries	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

Figure 2-2: Land Use Zoning Map



Source: NSW ePlanning Spatial Viewer 2022

N

Not to scale

LEGEND:

Site Boundaries

B1	Neighbourhood Centre	R1	General Residential
B2	Local Centre	R2	Low Density Residential
B4	Mixed Use	R3	Medium Density Residential
B5	Business Development	R4	High Density Residential
B6	Enterprise Corridor	RE1	Public Recreation
B7	Business Park	RE2	Private Recreation
E2	Environmental Conservation	RU6	Transition
E3	Environmental Management	SP2	Infrastructure
E4	Environmental Living		
IN1	General Industrial		
IN2	Light Industrial		

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2.2 NEAREST SENSITIVE RECEIVERS

Table 2-2 lists and Figure 2-3displays the location of potentially affected sensitive receivers that are considered in the NIA.

As per the NSW EPA *Noise Policy for Industry* (2017), sensitive receivers are defined as those land uses that are sensitive to noise and include residences, schools, places of worship and recreation areas. Commercial premises such as cafes and restaurants that offer outdoor seating areas where people congregate for extended periods of time are also sensitive receivers.

Table 2-2: Nearest Sensitive Receivers (List)

Receiver ID	Lot & DP	Address	Distance from Site Boundary (m)	Direction from Site Boundary	Type of Receiver
R1	Lot 39 DP 11289	11 Acacia Street Belmore	35 m	NNE	Residential
R2	Lot 40 DP 11289	13 Acacia Street Belmore	30 m	NNE	Residential
R3	Lot 41 DP 11289	15 Acacia Street Belmore	15 m	NNE	Residential
R4	Lot 44 DP 11289	21 Acacia Street, Belmore	10 m	E	Residential
R5*	Lot 45 DP 11289	23 Acacia Street, Belmore	35 m	E	Residential
R6	Lot 45 DP 11289	23A Acacia Street, Belmore	10 m	E	Residential
R7	Lot 46 DP 11289	25A Acacia Street, Belmore	10 m	ESE	Residential
R8	Lot 47 DP 11289	27 Acacia Street, Belmore	20 m	SE	Residential
R9	Lot 48 DP 11289	29 Acacia Street, Belmore	30 m	SSE	Residential
R10	Lot 10 DP 1218442	12 Acacia Street, Belmore	80 m	NE	Residential
R11	Lot 1 DP 1173336	14 Acacia Street, Belmore	80 m	ENE	Residential
R12	Lot 73 DP 11289	16 Acacia Street, Belmore	80 m	ENE	Residential
R13	Lot 74 DP 11289	18 Acacia Street, Belmore	80 m	E	Residential
R14*	Lot A DP 312475	30 Leylands Parade, Belmore	70 m	SE	Residential
R15	Lot Y DP 389541	32 Leylands Parade, Belmore	60 m	SSE	Residential
R16	Lot 1 DP 170446	41 Leylands Parade Belmore	65 m	SW	Residential
R17	Lot 2 DP 8140	12 Collins Street, Belmore	80 m	W	Residential
R18	Lot 34 DP 11289	1 Acacia Street, Belmore	105 m	NNE	Residential
R19	Lot 1 DP 8140	400 Burwood Road, Belmore	20 m	W	Commercial
R20	Lot 3 DP 8140	404 Burwood Road, Belmore	20 m	W	Commercial
R21	Lot 1 DP 221488	410 Burwood Road, Belmore	20 m	W	Commercial
R22	Lot 1 DP 307430	414 Burwood Road, Belmore	20 m	W	Commercial
R23	Lot 1 DP 816386	437-441 Burwood Road, Belmore	Adjacent	S	Commercial

Table 2-2: Nearest Sensitive Receivers (List)

Receiver ID	Lot & DP	Address	Distance from Site Boundary (m)	Direction from Site Boundary	Type of Receiver
R24	Lot 13 DP 11289	417 Burwood Road, Belmore	Adjacent	N	Commercial
R25	Lot 42 DP 11289	17-19 Acacia Street, Belmore	10 m	E	Commercial

***indicates the receiver has two storeys.**

Figure 2-3: Nearest Sensitive Receivers (Aerial Photograph)

↑N

LEGEND:

Site Location

\+ Sensitive Receiver

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2.3 PROPOSED DEVELOPMENT

The proposed operations of the subject development are detailed as follows.

2.3.1 Operations Overview

The proposed facility will be an adaptive reuse of Club Belmore RSL into a two-storey day care centre catering for up to 120 children. A parking facility for 23 cars will be located adjacent to the child care centre. The facility will have playrooms, cot rooms, offices and amenities located on the ground and first floors. Outdoor play areas will be on both the ground and first floor.

The distribution of children between age groups will be the following:

- 0-2 years: 32 children
- 2-3 years: 45 children
- 3-6 years: 43 children

The ground floor and first floor site plans for the proposed childcare facility are displayed in Figure 2-4 and Figure 2-5 respectively.

Figure 2-4: Proposed Childcare Facility Ground Floor Site Plan

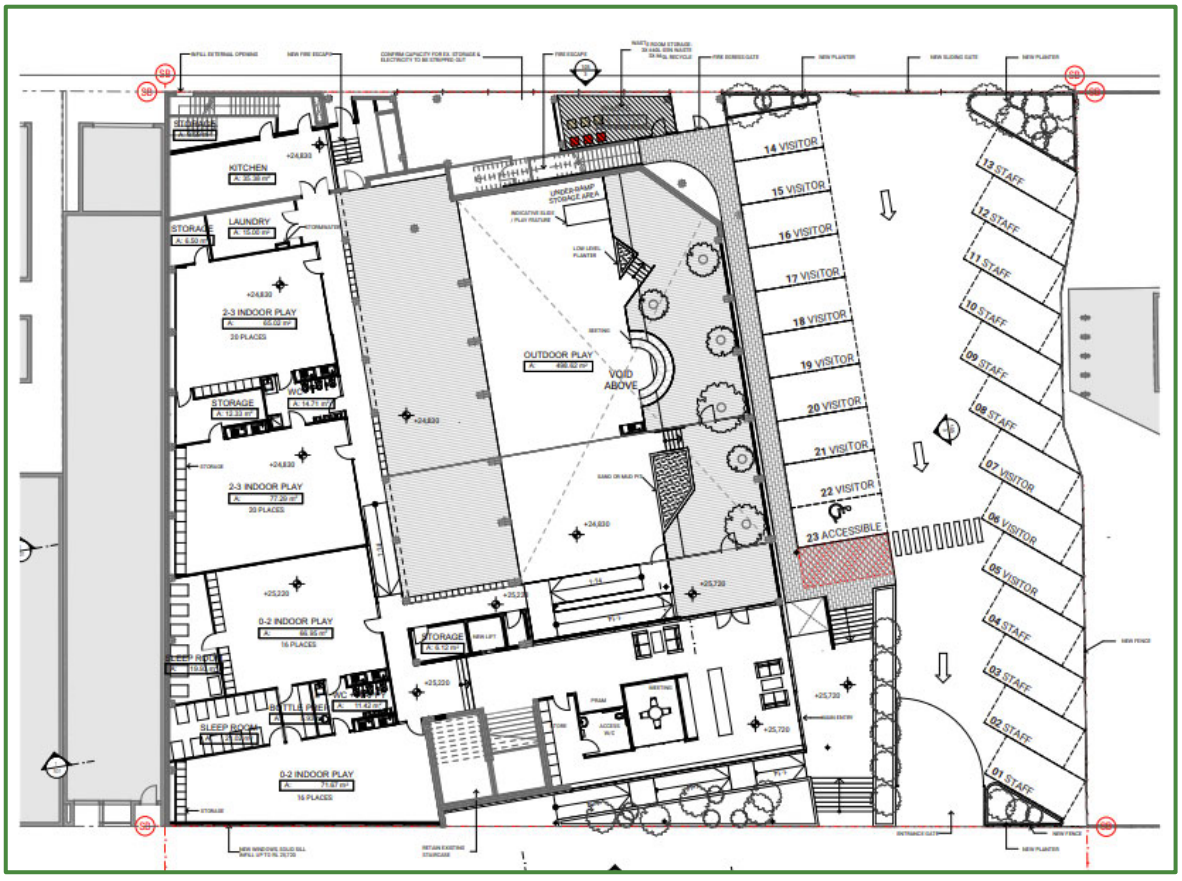
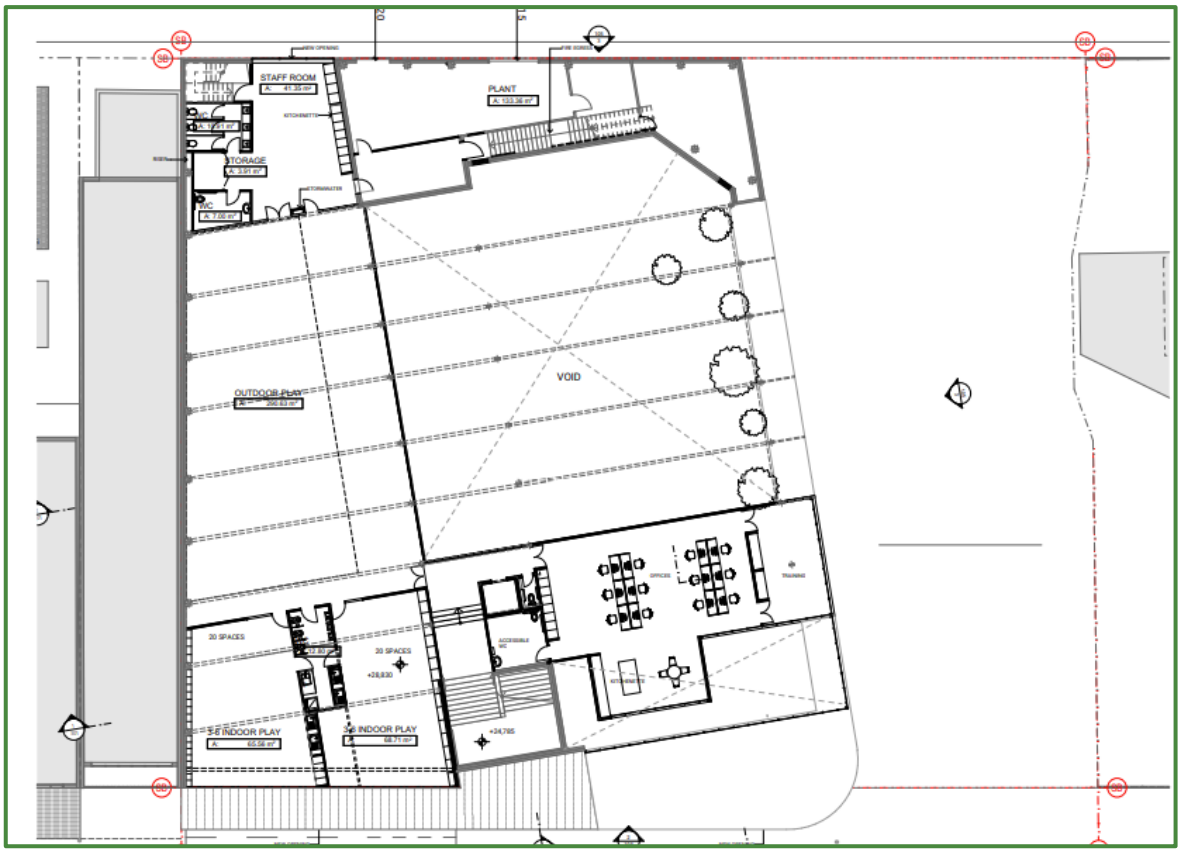


Figure 2-5: Proposed Childcare Facility First Floor Site Plan



2.3.2 Hours of Operation

The Childcare Centre is proposed to operate Monday to Friday from 7.00am to 6.00pm.

2.3.3 Vehicle Movements

Twenty-three (23) car parking spaces have been provided for staff and visitors of the childcare facility. During peak AM hours 96 car movements are expected per hour, this will equate to approximately 48 inbound and 48 outbound facility trips.

3. EXISTING ACOUSTIC ENVIRONMENT

The level of background and ambient noise is assessed separately for the daytime, evening and night time assessment periods. The NSW Noise Policy for Industry (EPA, 2017) defines these periods as follows:

- **Day** is defined as 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays;
- **Evening** is defined as 6.00pm to 10.00pm, Monday to Sunday and Public Holidays; and
- **Night** is defined as 10.00pm to 7.00am, Monday to Saturday and 10.00pm to 8.00am Sundays and Public Holidays.

Unattended long-term noise monitoring was undertaken from 21st March to 5th April 2022.

3.1 METHODOLOGY

The background noise level measurements were carried out using a Svantek SVAN 957 Precision Sound Level Meter (attended noise monitoring), and one (1) Acoustic Research Laboratories statistical Environmental Noise Logger, type EL-215 (unattended noise monitoring). The instrument sets complied with AS IEC 61672.1–2019 and was calibrated by a NATA accredited laboratory within two years of the measurement period. Calibration certificates have been included in Attachment 2.

Measurements of background and ambient noise levels were carried out in accordance with the Australian Standard AS 1055:2018 *Acoustics – Description and measurements of environmental noise* and the NSW EPA Noise Policy for Industry 2017.

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with an acoustic calibrator. There were no excessive variances observed in the reference signal between the pre-measurement and post-measurement calibration. The instruments were set on A-weighted Fast response and noise levels were measured over 15-minute statistical intervals. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in Attachment 3. The microphones were fitted with windsocks and were positioned between 1.2 and 1.5 meters above ground level.

Details of the instrumentation and setting utilised are provided in Table 3-1.

Table 3-1: Instrumentation and Setup Details

Type of Monitoring	Equipment	Serial Number	Setup Details
Long-term Unattended	ARL-215	194552	A-weighted Fast Response 15 minute integration period
Short-term Attended	Svantek SVAN957 Type 1 Integrating Sound and Vibration analyser	15336	Three channels: A-weighted Fast Response C-weighted Fast Response A-weighted Impulse Response 15 minute integration period 1/3 octave band recorded every 100 ms Logger file Recorded at steps of 100 ms

3.2 NOISE MONITORING LOCATIONS

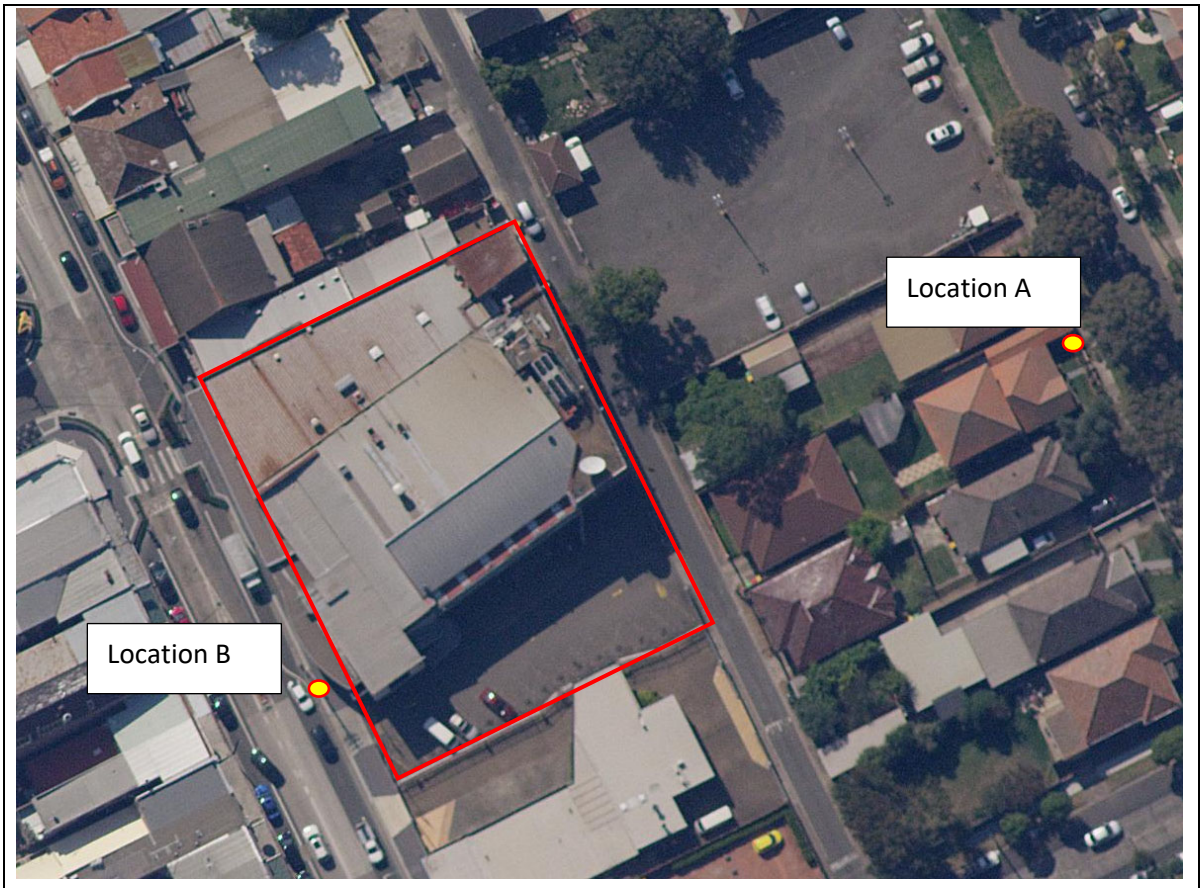
The environmental noise logger was utilised to measure the existing ambient and background noise levels. Unattended long-term noise monitoring was undertaken from 21st March to 5th April 2022 at 23 Acacia Street, Belmore. An attended noise measurement was conducted on 21st March 2022 at the location of the logger and at location B on the 12th September 2022 to monitor road traffic noise.

The noise logger location is shown in Figure 3-1 and listed in Table 3-2. Noise logger charts are presented in Attachment 4.

Table 3-2: Noise Monitoring Location

Monitoring Location	Methodology	Address
A	Attended monitoring and unattended monitoring	23 Acacia Street, Belmore
B	Attended monitoring	427 Burwood Road, Belmore

Figure 3-1: Logger Location



↑N	LEGEND: Logger Location Site Location	Benbow Environmental 25 Sherwood Street, Northmead NSW 2152

3.3 MEASURED NOISE LEVELS

3.3.1 Short Term Operator Attended Noise Monitoring Results

Attended noise monitoring was conducted on Monday 21st March 2022 in order to gain an understanding of the background noise sources of the area. Noise contributions were obtained from ambient noise sources such as local fauna, road traffic and surrounding resident noise. The results of the short-term attended noise monitoring are displayed in Table 3-3.

The attended measurements showed that the background noise levels were dominated by road traffic.

Table 3-3: Attended monitoring

Date/Time	L_{Aeq}	L_{A90}	L_{A10}	Comments
Monitoring location A Monday 21/03/2022 12:12 pm Daytime Period	52	42	59	Van passing <69 dB(A) Car passing <69 dB(A) Bird <65 dB(A) Truck on adjacent road – Leylands Parade <61 dB(A) Garbage truck <58 dB(A) Bus <58 dB(A) Adjacent road traffic <57 dB(A) Car door slam <57 dB(A) Engine start <52 dB(A) Resident noise <50 dB(A) Wind gust <46 dB(A)

3.3.2 Long-Term Unattended Noise Monitoring Results

The data was analysed to determine a single assessment background level (ABL) for each day, evening and night time period, in accordance with the NSW EPA Noise Policy for Industry. That is, the ABL is established by determining the lowest tenth-percentile level of the L_{A90} noise data over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night assessment periods is based on the median of individual ABL's determined over the entire monitoring period. The results of the long-term unattended noise monitoring are displayed in Table 3-4. Daily noise logger graphs have been included in Attachment 3.

Due to higher than usual rainfall as a result of the La Niña weather event and days of higher wind, 7 inclement free days were not achievable. When these weather affected days were included in overall noise levels, the weather conditions made little impact therefore, the 4 inclement free days are representative of the usual background noise levels.

Table 3-4: Unattended Noise Monitoring Results at 23 Acacia Street, Belmore dB(A)

Date	Average L_1			Average L_{10}			ABL (L_{90})			L_{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
21/03/2022	-	59	54	-	52	47	-	41	36	-	51	44
22/03/2022	62	59	55	55	53	47	40	42	34	55	52	49
23/03/2022	-	-	53	-	-	46	-	-	35	-	-	45
24/03/2022	-	-	-	-	-	-	-	-	-	-	-	-
25/03/2022	-	56	-	-	52	-	-	41	-	-	49	-
26/03/2022	-	61	-	-	55	-	-	40	-	-	54	-
27/03/2022	-	-	54	-	-	46	-	-	35	-	-	45
28/03/2022	65	62	-	58	55	-	41	40	-	58	57	-
29/03/2022	-	-	-	-	-	-	-	-	-	-	-	-
30/03/2022	-	-	54	-	-	47	-	-	36	-	-	48
31/03/2022	-	-	-	-	-	-	-	-	-	-	-	-
1/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
2/04/2022	-	56	55	-	51	48	-	38	36	-	49	46
3/04/2022	64	57	54	57	52	46	40	40	33	57	49	45
4/04/2022	63	57	54	56	52	46	42	40	35	55	49	46
5/04/2022	-	-	53	-	-	44	-	-	33	-	-	49
Average	**63**	**58**	**54**	**56**	**53**	**46**	*	*	*	*	*	*
Median (RBL)	*	*	*	*	*	*	**41**	**40**	**35**	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	**56**	**52**	**47**

Note: - Indicates values that has not been considered due to adverse weather conditions.
* Indicates values that are not relevant to that noise descriptor.
Value in bold indicates relevant noise descriptor.
A) Value removed as an outlier in total logarithmic average

3.4 EXISTING ROAD TRAFFIC NOISE

Attended noise monitoring was conducted on Monday 12th September 2022 at location B during peak traffic in order to determine the existing road traffic noise.

Table 3-5: Existing Road Traffic Noise Data

Measurement	L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	Notes
Monday 12/09/2022 08:10 Daytime Period	70	79	73	61	Small truck <80 dB(A) Car movements <64 – 82 dB(A) Bus movement <79 dB(A) Bus accelerating <90 dB(A) Loud car exhaust <80 dB(A) Car parking nearby <83 dB(A)
Monday 12/09/2022 08:27 Daytime Period	69	79	72	60	Large trucks <87 dB(A) Car movements <63-84 dB(A)

Based on the results of the attended monitoring undertaken, the road traffic noise levels measured on Burwood Road L_{AEq} are 70 dB(A) during the daytime.

4. METEOROLOGICAL CONDITIONS

Wind and temperature inversions may affect the noise impact at the receptors. Therefore, noise enhancing weather conditions should be assessed when wind and temperature inversions are considered to be a feature of the area.

A site-representative meteorological data file was obtained from the Bureau of Meteorology (BOM) for the Cantebury Racecourse weather station. In this Section, an analysis of the 2021 weather data has been conducted to establish whether significant winds are characteristic of the area.

4.1 WIND EFFECTS

Wind is considered to be a feature where source-to-receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30% or more of the time in any assessment period in any season.

4.1.1 Wind Rose Plots

Wind rose plots show the direction that the wind is coming from, with triangles known as “petals”. The petals of the plots in the figures summarise wind direction data into 8 compass directions i.e. north, north-east, east, south-east, etc. The length of the triangles, or “petals”, indicates the frequency that the wind blows from that direction. Longer petals for a given direction indicate a higher frequency of wind from that direction. Each petal is divided into segments, with each segment representing one of the six wind speed classes.

Thus, the segments of a petal show what proportion of wind for a given direction falls into each class. The proportion of time for which wind speed is less than 0.5 m/s, when speed is negligible, is referred to as calm hours or “calms”. Calms are not shown on a wind rose as they have no direction, but the proportion of time consisting of the period under consideration is noted under each wind rose.

The concentric circles in each wind rose are the axis, which denote frequencies. In comparing the plots it should be noted that the axis varies between wind roses, although all wind roses are similar in size. The frequencies denoted on the axes are indicated beneath each wind rose.

4.1.2 Local Wind Trends

Seasonal wind rose plots for this site utilising the Canterbury Racecourse AWS data have been included in Figure 4-1 to Figure 4-3.

Figure 4-1: Wind Rose Plots – BOM Canterbury Racecourse ID 066194 – 2021 – Day time

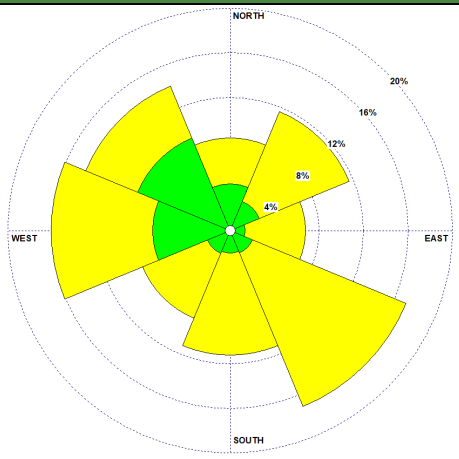
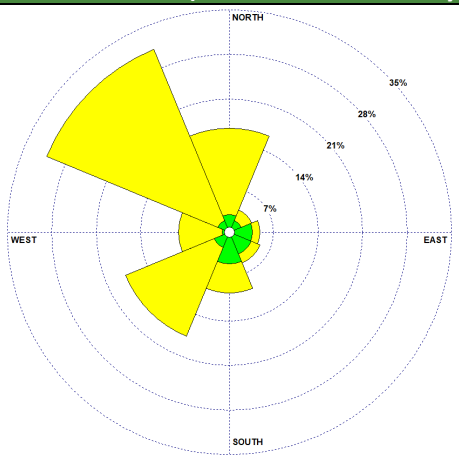
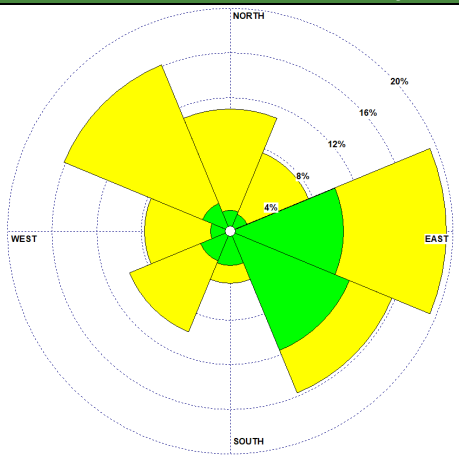
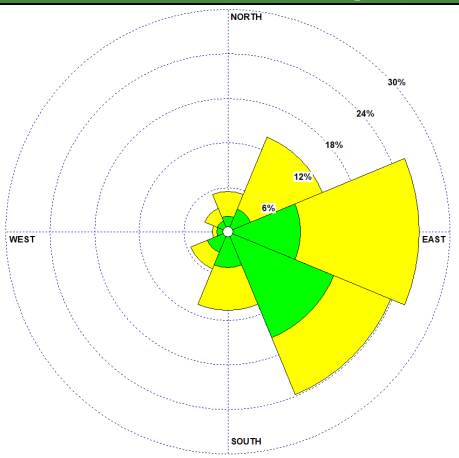
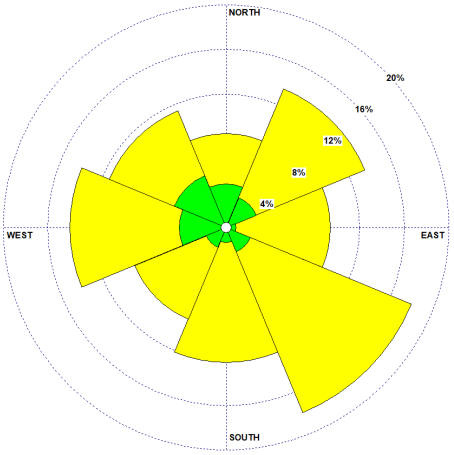
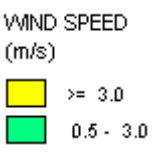
All Seasons	Summer Season (December – February)
	
Average Wind Speed: 3.78 m/s Calms Frequencies: 5.80% Axis Frequencies: 4%, 8%, 12%, 16%, 20%	Average Wind Speed: 4.36 m/s Calms Frequencies: 3.33% Axis Frequencies: 7%, 14%, 21%, 28%, 35%
Autumn Season (March – May)	**Winter Season (June – August)**
	
Average Wind Speed: 3.34 m/s Calms Frequencies: 7.88% Axis Frequencies: 4%, 8%, 12%, 16%, 20%	Average Wind Speed: 3.15 m/s Calms Frequencies: 7.52% Axis Frequencies: 6%, 12%, 18%, 24%, 30%
Spring Season (September – November)	**Legend**
	
Average Wind Speed: 4.29 m/s Calms Frequencies: 4.40% Axis Frequencies: 4%, 8%, 12%, 16%, 20%	

Figure 4-2: Wind Rose Plots – BOM Canterbury Racecourse ID 066194– 2021 – Evening time

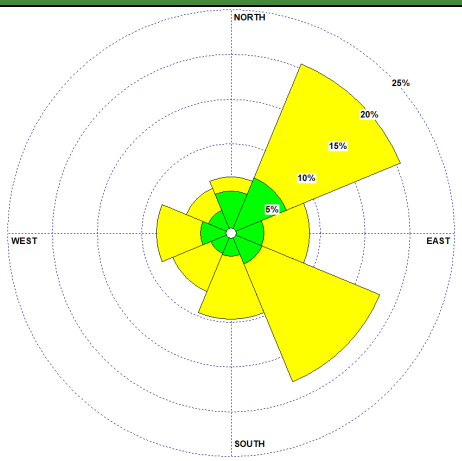
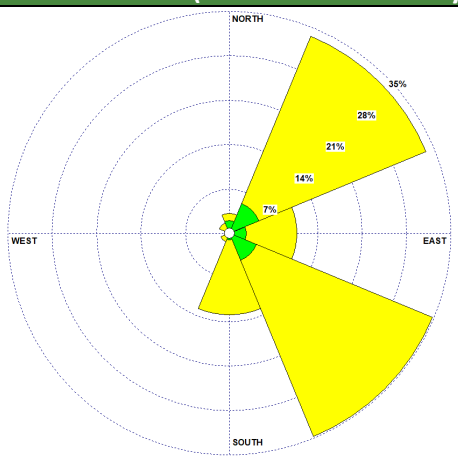
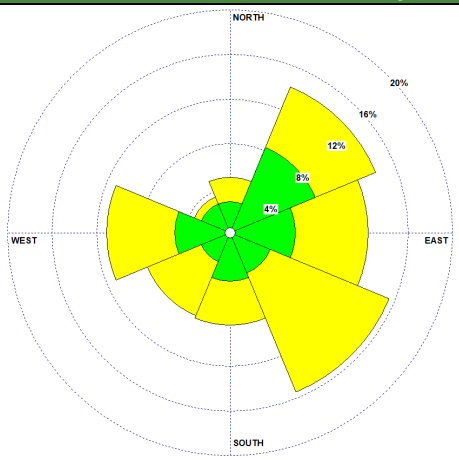
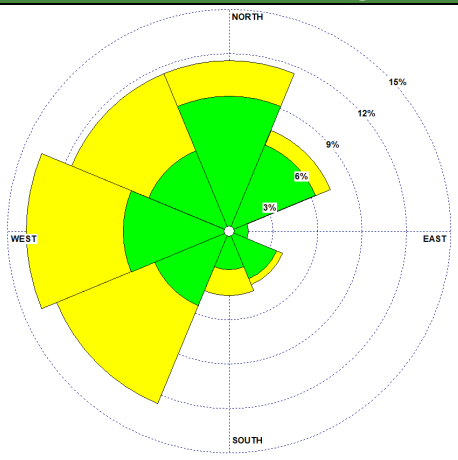
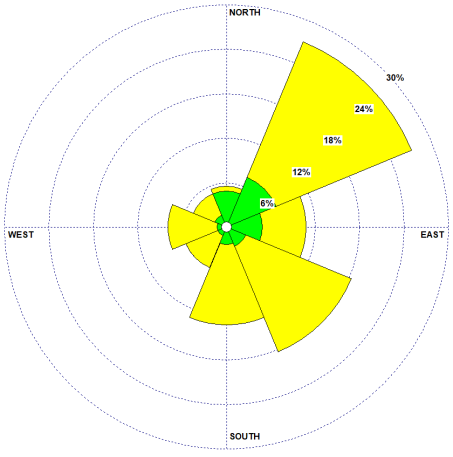
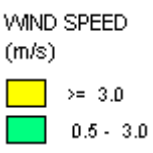
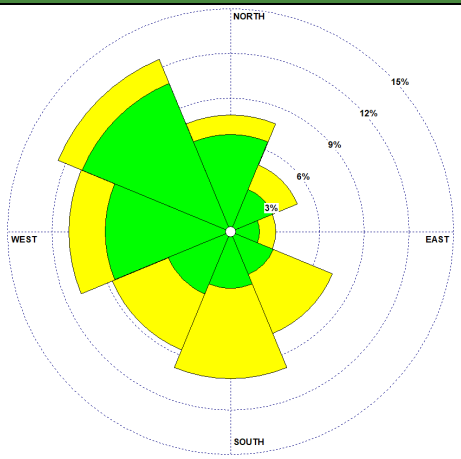
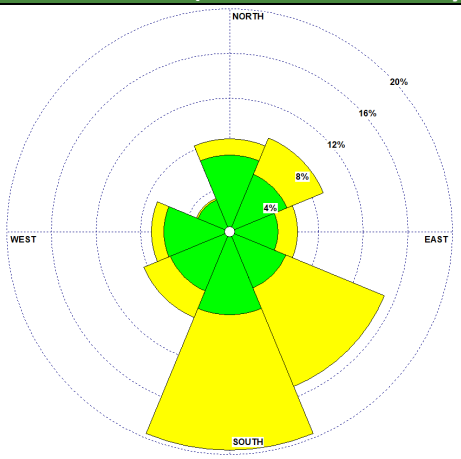
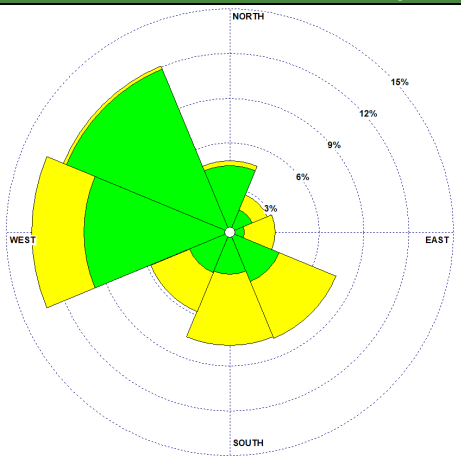
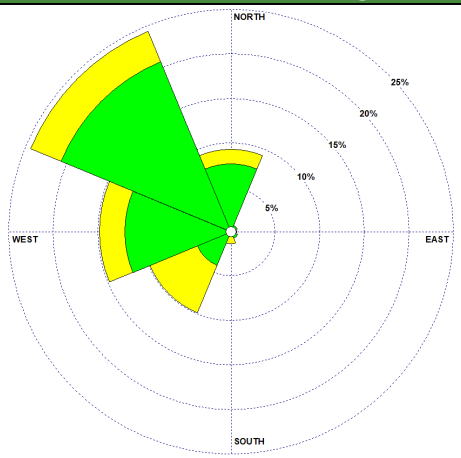
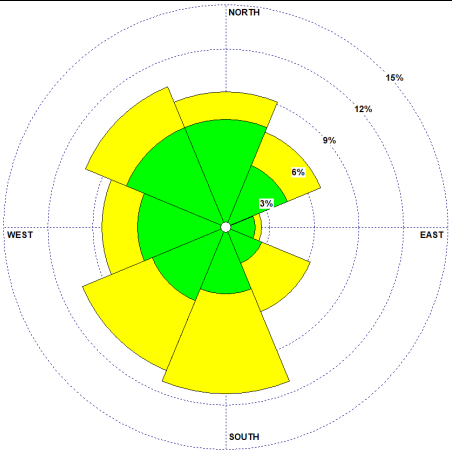
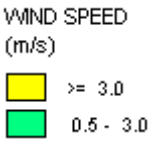
All Seasons	Summer Season (December – February)
	
Average Wind Speed: 3.13 m/s Calms Frequencies: 15.34% Axis Frequencies: 5%, 10%, 15%, 20%, 25%	Average Wind Speed: 4.37 m/s Calms Frequencies: 1.33% Axis Frequencies: 7%, 14%, 21%, 28%, 35%
Autumn Season (March – May)	**Winter Season (June – August)**
	
Average Wind Speed: 2.47 m/s Calms Frequencies: 22.17% Axis Frequencies: 4%, 8%, 12%, 16%, 20%	Average Wind Speed: 1.93 m/s Calms Frequencies: 30.87% Axis Frequencies: 6%, 12%, 18%, 24%, 30%
Spring Season (September – November)	**Legend**
	
Average Wind Speed: 3.76 m/s Calms Frequencies: 6.59% Axis Frequencies: 6%, 12%, 18%, 24%, 30%	

Figure 4-3: Wind Rose Plots – BOM Canterbury Racecourse ID 066194– 2021 – Night time

All Seasons	Summer Season (December – February)
	
Average Wind Speed: 1.66 m/s Calms Frequencies: 34.12% Axis Frequencies: 3%, 6%, 9%, 12%, 15%	Average Wind Speed: 2.17 m/s Calms Frequencies: 23.25% Axis Frequencies: 4%, 8%, 12%, 16%, 20%
Autumn Season (March – May)	**Winter Season (June – August)**
	
Average Wind Speed: 1.36 m/s Calms Frequencies: 43.11% Axis Frequencies: 3%, 6%, 9%, 12%, 15%	Average Wind Speed: 1.41 m/s Calms Frequencies: 34.78% Axis Frequencies: 5%, 10%, 15%, 20%, 25%
Spring Season (September – November)	**Legend**
	
Average Wind Speed: 1.69 m/s Calms Frequencies: 35.09% Axis Frequencies: 3%, 6%, 9%, 12%, 15%	

Appendix D2 of the Noise Policy for Industry (EPA, 2017), refers to utilising the Noise Enhancing Wind Analysis (NEWA) program on the NSW EPA website to determine the significance of source-to-receiver winds.

Table 4-1 below contains the noise wind component analysis from the NEWA software. Wind speeds are taken up to 3 m/s and wind direction is taken from source-to-receiver, plus and minus 45 degrees, as per appendix D2 of the Noise Policy for Industry.

It can be seen from Table 4-1 that there are no instances, where more than 30% of wind speeds are less than 3 m/s in the plus and minus 45 degree arc from source to receiver. Therefore, worst case 3 m/s source-to-receiver winds have not been included in the assessment.

Table 4-1: Noise Wind Component Analysis 2021 Canterbury AWS

Receiver	Day				Evening				Night			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
R1	4.9	4.7	1.9	2.7	7.5	6.5	3.5	5.5	9.2	3.3	0.6	3.5
R2	6.6	6.8	5	5	7.8	9	7.3	5.5	13.2	5.5	3.1	7.5
R3	5.8	6.7	6.6	6	5	8.4	7.6	3.6	13	6.6	4.3	10.5
R4	4.9	13.7	16.8	8.3	1.1	8.7	13	3	11.3	12.9	16.2	11
R5	5.4	15.3	19	10.1	1.4	9	15.5	3.6	11.5	14.6	19.4	12.2
R6	6.5	18.5	25.4	11.2	1.4	8.7	14.7	2.5	11.5	18.6	25.1	11.2
R7	6.5	17.6	25.4	9.6	1.1	9.2	12	2.2	8.4	18.8	25.7	9.8
R8	6.9	17.6	25.4	9.3	1.1	7.1	10.9	2.5	8.2	18.9	26.1	9.9
R9	6.6	18.3	24.7	9.9	1.9	6.3	9.2	2.5	7.4	18.8	26.4	9.8
R10	4.5	9.4	9.4	6.3	3.3	8.2	13	3.6	12.1	9.8	8.7	9.9
R11	4.6	9.6	10.2	6.4	1.9	8.7	13	1.9	11.3	9.7	9.2	9.9
R12	4.9	9.8	10.9	6.6	1.4	9	13.3	1.9	11.3	10.4	10.3	9.8
R13	5.3	12.1	13.2	7.7	1.1	7.9	12.2	2.5	11.6	11.7	11.6	9.7
R14	6.7	18.3	25	9.7	1.4	6.8	10.3	2.5	8.2	18.7	26.4	9.5
R15	7.5	16.1	24.8	10.6	2.2	5.4	9.8	3.6	8.3	15.9	26.8	11.7
R16	7.9	7.2	6.7	7.3	11.1	12.8	14.1	11.3	10	3.7	7	10
R17	5.2	6.8	3.9	5.6	14.4	14.4	7.1	13.2	8.4	3.3	1.8	6.7
R18	5.1	4.3	2.3	2.6	5.8	7.9	3.3	5.2	8.8	3.9	0.6	4.2
R19	4.9	6.4	3.4	5.1	14.2	12.2	4.1	10.4	9.9	4.3	0.8	5.7
R20	4.9	7.1	3.9	5.3	14.2	13.9	6	12.6	8.5	3.3	1.6	6.6
R21	6.7	7	5.1	6.5	13.9	15.2	10.3	11.5	8.5	2.5	4.5	7.7
R22	8	6.9	7.3	7.2	11.7	12.5	14.4	11.5	10.1	4.1	7.1	10.8

Table 4-1: Noise Wind Component Analysis 2021 Canterbury AWS

Receiver	Day				Evening				Night			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
R23	7.9	12.9	22.3	10.2	3.6	7.1	11.7	5.5	8.4	13.4	23.7	13
R24	6.3	6.5	5.5	5.6	5.3	7.9	7.3	4.4	12.7	5.8	3.6	8.9
R25	4.7	8.1	8.6	5.3	3.6	10.3	12.8	4.4	13	7.8	7.7	10.5

Noise enhancing meteorological conditions occur for 30% or more of the period and season

4.2 TEMPERATURE INVERSIONS

Temperature inversion is considered a feature where this occurs more than 30% of the nights in winter.

Temperature inversion conditions would be best associated with F-class stability conditions – generally associated with still/light winds and clear skies during the night time or early morning period (these are referred to as stable atmospheric conditions).

The facility will not operate during the night time period, therefore these effects have not been included in the noise impact assessment.

4.2.1 Weather Conditions Considered in the Assessment

The following conditions will be considered in this noise impact assessment considered:

- Neutral Weather Conditions.

Details of the considered meteorological conditions have been displayed in Table 4-2.

Table 4-2: Meteorological Conditions Assessed in Noise Propagation Modelling

Classification	Ambient Temp.	Ambient Humidity	Wind Speed	Wind Direction (blowing from)	Temperature Inversion	Affected Receiver	Applicability
Neutral	10 °C	70%	0 m/s	-	No	All	All periods

5. CURRENT LEGISLATION AND GUIDELINES

5.1 THE ASSOCIATION OF AUSTRALIAN ACOUSTICAL CONSULTANTS GUIDELINE FOR CHILD CARE CENTRE ACOUSTIC ASSESSMENT

Criteria – Residential Receptors

Outdoor Play Area
The noise impact from children at play in a child care centre differs from the domestic situation in that it is a business carried out for commercial gain, the number of children can be far greater than in a domestic situation and the age range of the children at the centre does not significantly vary over time as it would in a domestic situation. However, the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play, in some circumstances, can be pleasant, with noise emission generally only audible during the times the children play outside. Night time, weekend or public holiday activity is not typical and child care centres have considerable social and community benefit.

Base Criteria *– With the development of child care centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed* $L_{eq,15min}$ *45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).*

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

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

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

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:
- *1.5 m above ground level;*
- *On a balcony at 1.5 m above floor level;*
- *Outside a window on the ground or higher floors.*

Other Noise Emission

The cumulative $L_{eq,15\ minute}$ noise emission level resulting from the use and operation of the child care centre, with the exception of noise emission from outdoor play discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above. This includes the noise emission resulting from:

- *Indoor play;*
- *Mechanical plant;*
- *Drop off and pick up;*
- *Other activities/operations (not including outdoor play).*

Indoor Play

Noise emission from indoor play and activities should be considered, including scenarios with windows and doors both open and closed. Some child care centres may need to close their windows and doors during active indoor play or music.

Mechanical Plant

Child care centres may include air-conditioning plant and equipment, kitchen and wet area exhaust fans, car park and garbage room ventilation fans. Depending on the requirements of the state or territory where the centre is located, any such mechanical equipment should be assessed in accordance with this section and should not be audible outside the premises between 6pm and 7am.

Pick up and Drop off

Depending on the requirements of the state or territory where the centre is located, noise emission from vehicles on site should be considered.

Other Activities/Operations

Other activities which should be considered include deliveries, cooking, cleaning and laundry activities.

Sleep Disturbance

The noise impact of staff arrivals, setup, cleaning or other on-site activities prior to 7am or during night-time hours should be assessed at nearby residential premises. The L_{Amax} noise level emitted from vehicles arriving and parking, depending on the requirements of the state or territory where the centre is located shall not exceed the background noise level by more than 15 dB outside the nearest habitable room window.

Commercial Receptors

The cumulative $L_{eq,15min}$ noise level emitted from the use and operation of the child care centre shall not exceed 65 dB(A), from all activities (including outdoor play), when assessed at the most affected point on or within any commercial property boundary.

Other Sensitive Receivers

Where appropriate, assessment should include consideration of noise emission to other sensitive uses including schools, hospitals, places of worship and parks (active and passive). Depending on the requirements of the state or territory where the centre is located, in the absence of applicable noise criteria for such a sensitive use, the cumulative Leq,15min noise level emitted from the use and operation of the child care centre shall not exceed 65 dB(A), from all activities (including outdoor play), when assessed at the most affected point on or

within the sensitive property boundary, and shall not exceed 45 dB(A) internally, with windows or doors of the sensitive receiver open.

5.1.1 Outdoor Play

The noise criterion for outdoor play activities is presented in Table 5-1.

Table 5-1: Outdoor Play Areas Noise Criterion – dB(A)

Receiver Location	Receiver type	Period	RBL L_{A90}	Noise Criterion $L_{Aeq,15minute}$
R1-R18	Residential	Day	41	**46**[1]
R19-R25	Commercial	When in use	-	65

1 Where outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15min noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

5.2 NSW EPA Noise Policy for Industry

The NSW Noise Policy for Industry was developed by the NSW EPA primarily for the assessment of noise emissions from industrial sites regulated by the NSW EPA.

The policy sets out two components that are used to assess potential site-related noise impacts. The intrusiveness noise level aims at controlling intrusive noise impacts in the short-term for residences. The amenity noise level aims at maintaining a suitable amenity for particular land uses including residences in the long-term. The more stringent of the intrusiveness or amenity level becomes the project noise trigger levels for the project.

5.2.1 Project Intrusiveness Noise Level

The project intrusiveness noise level is determined as follows:

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

Where the $L_{Aeq,(15minute)}$ is the predicted or measured L_{Aeq} from noise generated within the project site over a fifteen minute interval at the receptor.

This is to be assessed at the most affected point on or within the residential property boundary or if that is more than 30 m from the residence, at the most affected point within 30 m of the residential dwelling.

5.2.2 Amenity Noise Level

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW Noise Policy for Industry 2017. The relevant recommended noise levels applicable are reproduced in Table 5-2.

Table 5-2: Amenity noise levels.

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} dB(A) Recommended amenity noise level
Residential	Suburban	Day	55
		Evening	45
		Night	40
Active Recreation	All	When in use	55
School Classroom	All	Noisiest 1-hour period when in use	Internal: 40[1]
			External: 50[2]
Industrial Premises	All	When in use	70
Place of worship	All	When in use	Internal: 40
			External: 50[2]
Commercial premises	All	When in use	65

Note: 1) In the case where existing schools are affected by noise from existing sources, the acceptable L_{Aeq} noise level may be increased to L_{Aeq} 1 hour.
2) Where internal amenity noise levels are specified, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided. In cases where gaining internal access for monitoring is difficult, then external noise levels 10 dB(A) above the internal levels apply.

Source: Table 2.2 and Section 2.6, NSW Noise Policy for Industry

The project amenity noise level for industrial developments = recommended amenity noise level minus 5 dB(A)

The following exceptions to the above method to derive the project amenity noise levels apply:

1. *In areas with high traffic noise levels*
2. *In proposed developments in major industrial clusters*
3. *Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case 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.*
4. *Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for development.*

This development is not considered to be captured by the above exceptions.

5.2.3 Sleep Disturbance Criteria

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

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

- **$L_{Aeq,\ 15\ minute}$ 40 dB(A) or the prevailing RBL plus 5 dB, 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 assessment should be undertaken.

5.2.4 Project Noise Trigger Levels

The project noise trigger levels for the site have been established in accordance with the principles and methodologies of the NSW Noise Policy for Industry (EPA, 2017).

Table 5-3 below presents the minimum rating background levels, project intrusive noise level, recommended amenity noise level, and project amenity noise level. The project noise trigger level is the lowest value of intrusiveness or project amenity noise level after conversion to $L_{Aeq\ 15\ minute}$, dB(A) equivalent level.

Different time periods apply for the noise criteria as the intrusive criterion considers a 15 minute assessment period while the amenity criterion requires assessment over the total length of time that a site is operational within each day, evening or night period. In order to ensure compliance under all circumstances, a 15 minute period assessment has been considered for all receptors.

Table 5-3: Project Noise Trigger Levels NSW Noise Policy for Industry

Receiver	Type of Receptor	Time of day	Rating background noise level	Project intrusiveness noise level ($L_{eq(15\ minute)}$)	Recommended amenity noise level $L_{Aeq\ period}$	Project amenity noise level $L_{Aeq\ 15\ minute}$[1]	PNTL $L_{Aeq\ 15\ minute}$	Sleep Disturbance L_{Amax}
R1-R18	Residential - Suburban	Day	41	**46**	55	53	**46**	-
		Evening	40	45	45	**43**	**43**	-
		Night	35	40	40	**38**	**38**	**52**
R19-R25	Commercial	When in use	-	-	65	63	**63**	-

Notes:

1) These levels have been converted to $L_{Aeq\ 15\ minute}$ using the following: $L_{Aeq\ 15\ minute} = L_{Aeq\ period} + 3$ dB (NSW Noise Policy for Industry Section 2.2).

5.3 NSW EPA Road Noise Policy

The NSW Road Noise Policy (RNP) has been adopted to establish the noise criteria for the potential noise impact associated with additional traffic generated by the proposal. The RNP was developed by the NSW EPA primarily to identify the strategies that address the issue of road traffic noise from:

- Existing roads;
- New road projects;
- Road redevelopment projects; and
- New traffic-generating developments.

5.3.1 Road Category

Vehicles are proposed to access the site from the existing driveway adjacent to the site from Burwood Road. The closest residents are located along Burwood Road a 'local road'.

5.3.2 Noise Assessment Criteria

Section 2.3 of the RNP outlines the criteria for assessing road traffic noise. The relevant Section of Table 3 of the RNP is shown in Table 5-4.

Table 5-4: Road Traffic Noise Assessment Criteria For Residential Land Uses, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)*	
		Day (7am-10pm)	Night (10pm-7am)
Local roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq\ (1\ hour)}$ 55 dB (external)	$L_{Aeq\ (1\ hour)}$ 50 dB (external)

* measured at 1 m from a building façade.

5.3.3 Relative Increase Criteria

In addition to the assessment criteria outlined above, any increase in the total traffic noise level at a location due to a proposed project or traffic-generating development, must be considered. Residences experiencing increases in total traffic noise levels above the relative criteria should also be considered for mitigation as described in Section 3.4 of the RNP. For road projects where the main subject road is a local road, the relative increase criterion does not apply.

Table 6 of the RNP outlines the relative increase criteria for residential land uses, with the details applicable to this project shown in Table 5-5.

Table 5-5: Relative Increase Criteria For Residential Land Uses, dB(A)

Road Category	Type of Project/Land Use	Total Traffic Noise Level Increase, dB(A)	
		Day (7am-10pm)	Night (10pm-7am)
Sub-arterial roads	Land use development with potential to generate additional traffic on existing road	Existing traffic $L_{Aeq\ (15\ hour)}$ + 12 dB (external)	Existing traffic $L_{Aeq\ (9\ hour)}$ + 12 dB (external)

The assessment criteria provided in Table 5-4 and the relative increase criteria provided in Table 5-5 should both be considered when designing project specific noise levels. When existing traffic levels are below the criteria in Table 5-4, the lower of the relative increase criteria and the assessment criteria in Table 5-5 should be adopted. For example, if the assessment criteria is 60 dB(A) and the relative increase criteria is 42 dB(A), then a project specific noise level of 42 dB(A) should be adopted. Similarly, if the assessment criteria is 60 dB(A) and the relative increase criteria is 65 dB(A), a project specific noise level of 60 dB(A) should be adopted.

5.3.4 Exceedance of Criteria

If the criteria shown in both Table 5-4 and Table 5-5 cannot be achieved, justification should be provided that all feasible and reasonable mitigation measures have been applied.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

5.3.5 Assessment Locations for Existing Land Uses

Table 5-6: Assessment Locations for Existing Land Uses

Assessment Type	Assessment Location
External noise levels at residences	The noise level should be assessed at 1 metre from the façade and at a height of 1.5 metres from the floor. Separate noise criteria should be set and assessment carried out for each façade of a residence, except in straightforward situations where the residential façade most affected by road traffic noise can be readily identified. The residential noise level criterion includes an allowance for noise reflected from the façade ('façade correction'). Therefore, when taking a measurement in the free field where reflection during measurement is unlikely (as, for instance, when measuring open land before a residence is built), an appropriate correction – generally 2.5 dB – should be added to the measured value. The 'façade correction' should not be added to measurements taken 1 metre from the façade of an existing building. Free measurements should be taken at least 15 metres from any wall, building or other reflecting pavement surface on the opposite side of the roadway, and at least 3.5 metres from any wall, building or other pavement surface, behind or at the sides of the measurement point which would reflect the sound.
Noise levels at multi-level residential buildings	The external points of reference for measurement are the two floors of the building that are most exposed to traffic noise. On other floors, the internal noise level should be at least 10 dB less than the relevant external noise level on the basis of openable windows being opened sufficiently to provide adequate ventilation. (Refer to the Building Code of Australia (Australian Building Codes Board 2010) for additional information.)
Internal noise levels	Internal noise levels refer to the noise level at the centre of the habitable room that is most exposed to the traffic noise with openable windows being opened sufficiently to provide adequate ventilation. (Refer to the Building Code of Australia (Australian Building Codes Board 2010) for additional information.)
Open space – passive or active use	The noise level is to be assessed at the time(s) and location(s) regularly attended by people using the space. In this regard, 'regular' attendance at a location means at least once a week.

5.3.6 Road Traffic Noise Intrusion

The NSW Department of Environment, Climate Change and Water Road Noise Policy has been considered in this acoustic assessment for the purpose of assessing the road traffic noise impacts.

Table 4 of the NSW RNP establishes the road traffic noise assessment criteria for non-residential land uses affected by proposed road projects and traffic generating developments. This is shown in Table 5-7.

This is consistent with the Development near Rail Corridors and Busy Roads Interim guideline requirements.

Table 5-7: Extract of NSW EPA Road Noise Policy – Table 4

Existing sensitive land use	Assessment criteria – dB(A)		Additional considerations
	Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)	
8. Childcare facilities	Sleeping rooms $L_{Aeq,(1\ hour)}$ 35 (internal) Indoor play areas $L_{Aeq,(1\ hour)}$ 40 (internal) Outdoor play areas $L_{Aeq,(1\ hour)}$ 55 (external)	–	Multi-purpose spaces, e.g. shared indoor play/sleeping rooms should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility

5.4 CONSTRUCTION NOISE CRITERIA

Criteria for construction and demolition noise has been obtained from the NSW Interim Construction Noise Guideline (DECC, 2009). Guidance for construction vibration has been taken from British Standard BS7385-Part 2: 1993 '*Evaluation and measurement for vibration in buildings*' and other standards.

5.4.1 NSW Interim Construction Noise Guideline

Residential Criteria

Table 2 of the Interim Construction Noise Guideline (DECC, 2009), sets out construction noise management levels for noise at residences and how they are to be applied. The management noise levels are reproduced in Table 5-8 below. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

Table 5-8: Management Levels at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq(15\ minute)}$	How to Apply
Recommended standard hours: Monday to Friday 7am – 6pm Saturday 8am – 1pm No work on Sundays or Public Holidays	Noise Affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15\ minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. • The proponent should also inform all potentially affected 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 periods by restricting the 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, or mid-morning or mid-afternoon for works near residents. 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL + 5 dB	• 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 7.2.2 (RNP)

Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m from the residence.

Other Land Uses

Table 5-9 sets out management levels for construction noise at other land uses applicable to the surrounding area.

Table 5-9: Management Levels at Other Land Uses

Land use	Management Level $L_{Aeq(15\ minute)}$ (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A) External noise level 55 dB(A)[1]
Places of worship	Internal noise level 45 dB(A) External noise level 55 dB(A)[1]
Active recreation areas	External noise level 65 dB(A)
Offices, retail outlets	External Noise Level 70 dB(A)
Industrial premises	External noise level 75 dB(A)

1) Where internal noise levels are specified, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided. In cases where gaining internal access for monitoring is difficult, then external noise levels 10 dB(A) above the internal levels apply.

There are no other sensitive land uses in the area surrounding the site.

Noise Criterion

The noise criterion for construction noise is presented in Table 5-10.

Table 5-10: Construction Noise Criterion dB(A)

Receiver	Land Use	Period	RBL L_{A90}	Management Level $L_{Aeq(15\ minute)}$
R1-R18	Residential	Standard Hours	41	51
R19-R25	Offices, retail outlets	When in use	-	70

5.4.2 Vibration Criteria

Vibration criteria from construction works are outlined in this section, including guidelines to avoid cosmetic damage, structural damage or human discomfort. There is no specific vibration standard in NSW to assess cosmetic or structural damage to buildings. Usually the British Standard BS 7385–Part 2: 1993 '*Evaluation and measurement for vibration in buildings*' or the German standard DIN4150–Part 3: 1999 '*Structural Vibration Part 3 – effects of vibration on structures*' is referenced. The *Assessing Vibration – A Technical Guideline* (DEC, 2006) provides guidance on preferred levels for human exposure.

5.4.3 BS 7385-2:1993

The British Standard BS 7385–Part 2:1993 '*Evaluation and measurement for vibration in buildings*' provides vibration limits to avoid cosmetic damage on surrounding structures. Limits are set at the lowest limits where cosmetic damage has previously been shown.

Table 5-11: Vibration criteria for cosmetic damage (BS 7385:2 1993)

Type of building	Peak component particle velocity in frequency range of predominant pulse		
	4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above		
Unreinforced or light framed structures. Residential or light commercial type buildings	15 to 20 mm/s	20 to 50 mm/s	50 mm/s

5.4.4 DIN4150-3:1999

The German standard DIN4150-Part 3:1999 'Structural Vibration Part 3 – effects of vibration on structures' has also been considered. The German standard is considered more onerous than the British standard, and specifically includes more stringent limits to avoid structural damage to surrounding heritage buildings.

Table 5-12: Structural damage criteria heritage structures (DIN4150-3 1999)

Type of building	Peak component particle velocity (PPV) mm/s			
	Vibration at the foundation at a frequency of:			Vibration of horizontal plane of highest floor at all frequencies
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	
Buildings used for commercial purposes, industrial buildings or buildings of similar design	20	20 to 40	40 to 50	40
Residential dwellings and similar	5	5 to 15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, cannot be classified as the two categories above, and are of intrinsic value (for example heritage listed buildings).	3	3 to 8	8 to 10	8

5.4.5 Human Exposure

The guideline *Assessing Vibration – A Technical Guideline* (DEC, 2006) describes preferred criteria for human exposure. The limits describe values where occupants of buildings would be impacted by construction work.

Table 5-13: Preferred and maximum weighted rms z-axis values, 1-80 Hz

Location	Daytime		Night time	
	Preferred	Maximum	Preferred	Maximum
Continuous Vibration (weighted root mean square (rms) vibration levels for continuous acceleration (m/s^2) in the vertical direction)				
Residences	0.01	0.02	0.007	0.014
Offices, schools, educational institutions and places of worship	0.02	0.04	0.02	0.04
Workshops	0.04	0.08	0.04	0.08
Impulsive Vibration (weighted root mean square (rms) vibration levels for impulsive acceleration (m/s^2) in the vertical direction)				
Residences	0.3	0.6	0.1	0.2
Offices, schools, educational institutions and places of worship	0.64	1.28	0.64	1.28
Workshops	0.64	1.28	0.64	1.28
Intermittent Vibration (m/s)				
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6

6. NOISE IMPACT ASSESSMENT

An outline of the predictive noise modelling methodology and operating scenarios has been provided below.

6.1 NOISE SOURCES

The overall sound power levels for the identified noise sources have been referenced either from the *AAAC Technical Guideline: Childcare Centre Noise Assessment* or Benbow Environmental's extensive database. Additionally, the octave band centre frequency sound power levels have been obtained from on-site measurements of sound pressure levels undertaken by Acoustical Engineers from Benbow Environmental measured at similar facilities.

The primary noise sources associated with the facility would include:

- Children playing in the outdoor play area;
- Road traffic noise from vehicles going in and out of the carpark; and
- Air conditioning system and car park exhaust.

The noise associated with traffic will be highest at peak AM and PM periods. External noise sources such as air conditioning condenser units are to be located to minimise noise impacts on neighbouring residences. For example, external mechanical equipment can be located strategically to avoid direct line of sight to residences so that the noise emissions would be inconsequential at the residences.

The noise data utilised do not present tonal, impulsive, intermittent or low frequency characteristics; therefore, the correction penalty for the presence of these characteristics has not been applied.

The octave band centre frequency sound power levels are presented in Table 6-1 The data have been used in the model to represent the noise emissions from the site at the nearest potentially affected sensitive residential receiver.

Table 6-1: Sources: A-weighted Sound Power Levels, dB(A)

Noise Source	Total	Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
10 Children (0-2 years old) playing	78	54	60	66	72	74	71	67	64
10 Children (2-3 years old) playing	85	61	67	73	79	81	78	74	70
10 Children (3-6 years old) playing	87	64	70	75	81	83	80	76	72
Air-conditioner condenser unit (large)	78	77	70	65	60	60	56	51	47
Car Park Exhaust	85	84	77	72	67	64	63	58	54

Noise Source	Total	Third Octave Band Centre Frequency (Hz)									
		25	31	40	50	63	80	100	125	160	200
		250	315	400	500	630	800	1k	1.25k	1.6k	2k
		2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	
Car driving (car park)	**82**	27	30	31	39	57	47	51	52	55	60
		65	66	63	68	72	75	75	74	74	72
		67	64	61	58	56	57	50	46	42	
Car door closing	**95**	60	62	67	70	74	73	73	69	73	72
		73	79	82	86	85	83	86	88	86	79
		76	75	72	72	71	65	60	57	55	
Car ignition	**78**	29	32	36	39	40	45	48	43	46	53
		54	49	52	60	65	63	64	67	70	71
		69	68	65	65	65	64	57	52	47	

6.1.1 Construction Noise Sources

The following table shows the noise sources used in the construction scenarios.

Table 6-2: A-weighted Sound Power Levels Associated with Construction Noise, dB(A)

Noise Source	Total	Octave Band Centre Frequency (Hz)								
		31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Concrete Truck	**99**	-	58	76	87	92	95	92	90	79
Front end loader	**103**	56	87	93	91	98	98	95	87	77
Grinding	**111**	-	57	71	88	97	99	107	106	100
Welding	**97**	-	58	65	74	84	88	89	94	90
Excavator	**110**	-	108	101	100	100	96	94	91	86

6.2 MODELLING METHODOLOGY

6.2.1 Noise Model

Noise emissions from the proposed operations were modelled using the ISO9613-2 algorithm within SoundPLAN V8.2. This model is recognised by the NSW EPA for modelling environmental noise emissions and has been used by BE on many projects achieving highly accurate and repeatable results.

The noise sources as well as the topographical features of the subject area and receivers, were all input into the noise model to determine the noise emissions of the proposed development at the nearest potentially affected residences. On-site structures were included in the model to account for shielding provided by the building walls.

The modelling scenario has been carried out using the $L_{Aeq(15\ minute)}$ descriptor. Using this descriptor, noise emission levels were predicted at the receivers to determine the noise impact against the relevant noise criteria in accordance with the NSW Noise Policy for Industry (EPA 2017) and the AAAC Technical Guideline: Childcare Centre Noise Assessment. The summary of the relevant criteria is presented in Section 5.2.4.

6.2.2 Assumptions Made for Noise Modelling

In establishing configurations within a noise-modelling package, it is inherent that several reasonable assumptions be made. It should be noted that the relevant assessment period for on-site noise emissions is 15 minutes; therefore noise source durations detailed throughout the following assumptions section should be considered per 15 minute period in view of potential noise impacts under worst-case scenarios. Each assessment-specific assumption has been detailed below:

- The Childcare Centre has been modelled to be operating from 7:00am to 6:00pm;
- Off-site topographical information was obtained by combining data from Google Maps and a site survey plan obtained for the site;
- All receivers are modelled at 1.5 m above ground level;
- All ground areas at the nearest nominated occupancies have been modelled considering a ground absorption coefficient of 0.6. This represents hard ground such as asphalt and concrete resulting in 40% of the acoustic energy being reflected and 60% of the acoustic energy being absorbed; and
- The outdoor playscapes, carpark and the adjacent setbacks have been modelled as 0.1– hard.

6.2.2.1 Construction Noise

Construction activities are highly likely to be staged with minor demolition taking place first, followed by concreting activities, building construction and finishing works amongst other activities at other stages. To simplify the assessment and provide a worst case scenario, the major construction equipment utilised throughout the works including a concrete truck, welder, grinder, excavator and front end loader have been modelled to be simultaneously occurring in both noise generating scenarios. Assumptions on individual equipment is as follows:

- 1 Concrete truck has been modelled as a point source and is considered to operate throughout a 15 minute period for 30% of the time;
- 1 point source representing welding operations has been considered to operate throughout a 15 minute period for 100% of the time;
- 1 point source representing grinding operations has been considered to operate throughout a 15 minute period for 50% of the time;
- 1 front end loader has been modelled as a point source and is considered to constantly operate for 100% of the time over a 15 minute period;
- 1 excavator has been modelled as a point source and is considered to constantly operate for 100% of the time over a 15 minute period.

6.2.2.2 Outdoor Play Noise

- All children were modelled as point sources to last for 100% of the time over any 15 minute period within the designated outdoor play areas. Source heights were considered in the model. In particular, children playing have been modelled as point source at 1 metre height;
- The outdoor play scenario considers neutral weather and wind affected receivers.
- 120 children have been modelled to represent a conservative worst case scenario.

6.2.2.2.1 First Floor Outdoor Play Area

- A barrier surrounding the play area must be at least 1.2 m tall.

6.2.2.2.2 Ground Floor Outdoor Play Area

- The southern end of the ground floor play area must not be open to the car park and should have a barrier at least 2 m tall.

6.2.2.3 Mechanical Plant Noise

- Four large air con condensers have been modelled as single fan condensers with individual sound power levels of 80 dB(A).
- The plant room is modelled to contain the four air con condensers evenly spaced apart with two large area sources on the north-eastern wall to represent louvres with an Rw of 10 dB(A).
- Noise sources representing all the mechanical noise sources were considered to last for 100% of the time over a 15 minute period and at a height of 0.5 m above the floor level.
- A total of 96 car movements over an hour were modelled as one moving point source, entering and leaving the childcare facility at a height of 1 m above ground level in order to account for the engine. These vehicles were modelled to travel at a speed of 10 km/h.
- 48 doors slamming over a 15 minute assessment period have been considered within the carpark across four different locations. Car door slams are assumed to last 1 second in duration, with two car door slams per car.
- Car ignition was also considered in the model. 24 car ignitions over a 15 minute period across four different locations have been considered in the assessment with each ignition lasting 3 seconds.

6.2.2.4 Road Noise Intrusion

- Road noise impacts from Burwood Road was modelled to assess impacts on the occupants of the childcare centre as two line sources were calibrated to generate the 70 dB(A) L_{Aeq} measured at location B.
- One receiver was modelled in Ground Floor Outdoor Play Area and one receiver in the First Floor Outdoor Play Area to assess impacts from road noise intrusion on the outdoor play areas.
- One receiver was modelled 1 m away from the Burwood Road facing façade of the Indoor Play Room adjacent to Burwood Road on the ground floor, another receiver was modelled 1 m away from the Burwood Road facing façade of the Indoor Play Room on the first floor and a third receiver was modelled 1m away from the southern façade of the WC & Nappy Change room to represent ground floor sleeping room to assess impacts from road noise intrusion on the indoor areas.
- It is noted the ground floor sleeping room only has one external wall which backs onto an adjacent building and the internal walls have no windows. The receiver has been placed adjacent to the WC & Nappy change room near the sleeping room as this location is the closest and most representative.
- Receivers were modelled at a height of 1 m above the floor level.

6.2.2.5 Offsite Road Traffic Noise

- The most likely routes for cars that have receivers along them would involve travelling along Burwood Road. The nearest residential receptor to the site along this route is identified as 483 Burwood Road, Belmore.
- 96 cars have been considered to pass the residences along local road, Burwood Road in a in a worst case 1 hour period in the day.
- The cars are assumed to travel at the posted speed of 50 km/h along Burwood Road.
- Cars have been modelled considering one moving point sources at heights of 1 m above ground level in order to account for the engine.
- It is noted that there are houses south of the child care centre that front Acacia Lane however traffic flow is one way through the child care centre and therefore would not directly pass theses residences.

6.2.3 Scenarios

Each scenario is detailed in Table 6-3. Each model configuration was used to calculate noise levels at the twenty-five (25) aforementioned receivers under the proposed maximum operations.

Table 6-3: Model Scenarios

Scenario	Description
Scenario 1 Construction	Concrete Truck + Front end loader + Grinding + Welding + Excavator
Scenario 2 Outdoor Play	120 children playing outdoors (30 x 0-2 year old children, 50 x 2-3 year old children, and 40 x 3-6 year old children)
Scenario 3 Mechanical Plant	On-site car parking activity + mechanical plant
Scenario 4 Road Noise Intrusion	Road Noise Intrusion on the Childcare Centre Noise Impact on children playing outdoors and on the indoor play areas and sleeping areas
Scenario 5 Road Traffic Noise Impact Assessment	Road Traffic Noise Assessment on residential receivers

The following figures show noise source locations for all of the modelled scenarios.

Figure 6-1: Scenario 1 Construction Noise Source Locations

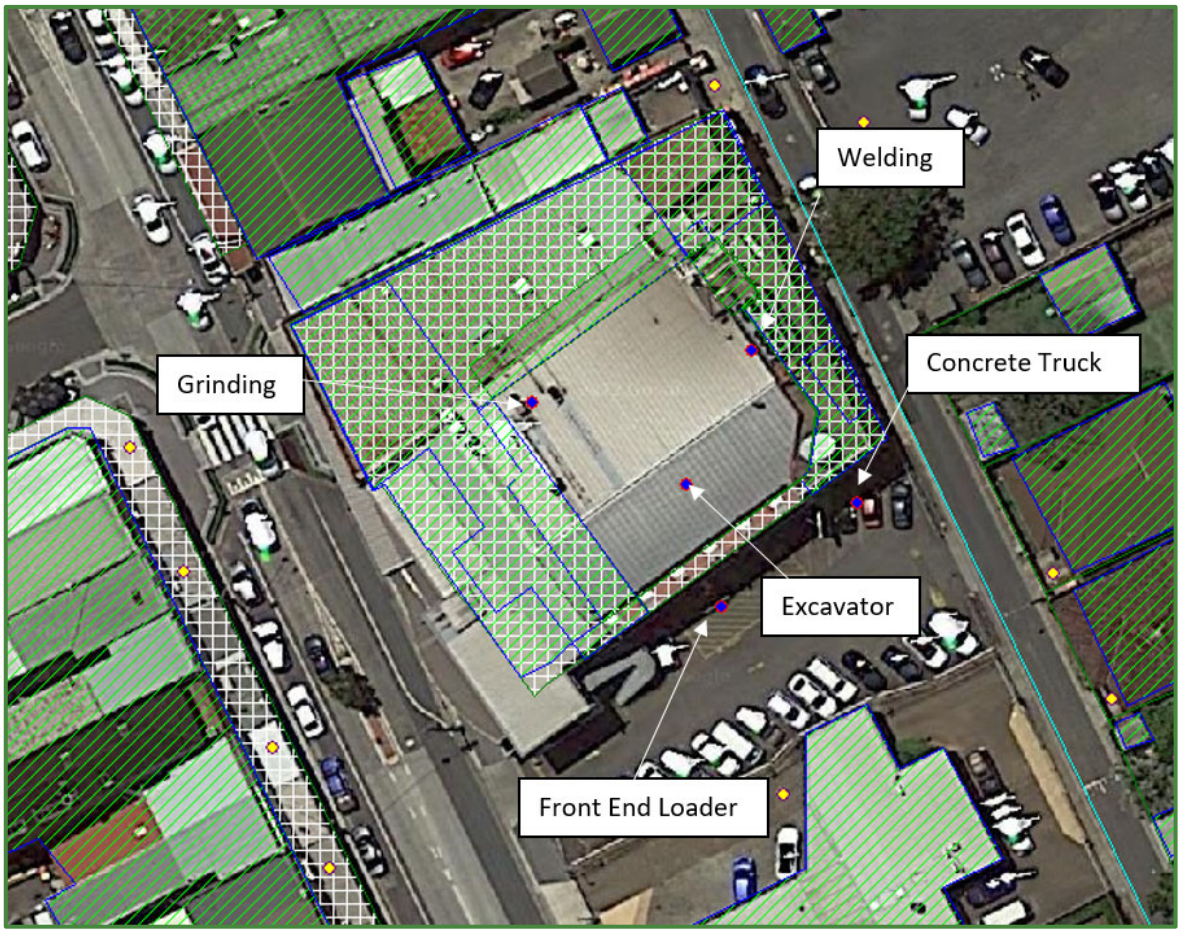


Figure 6-2: First Floor Play Area A Noise Controls

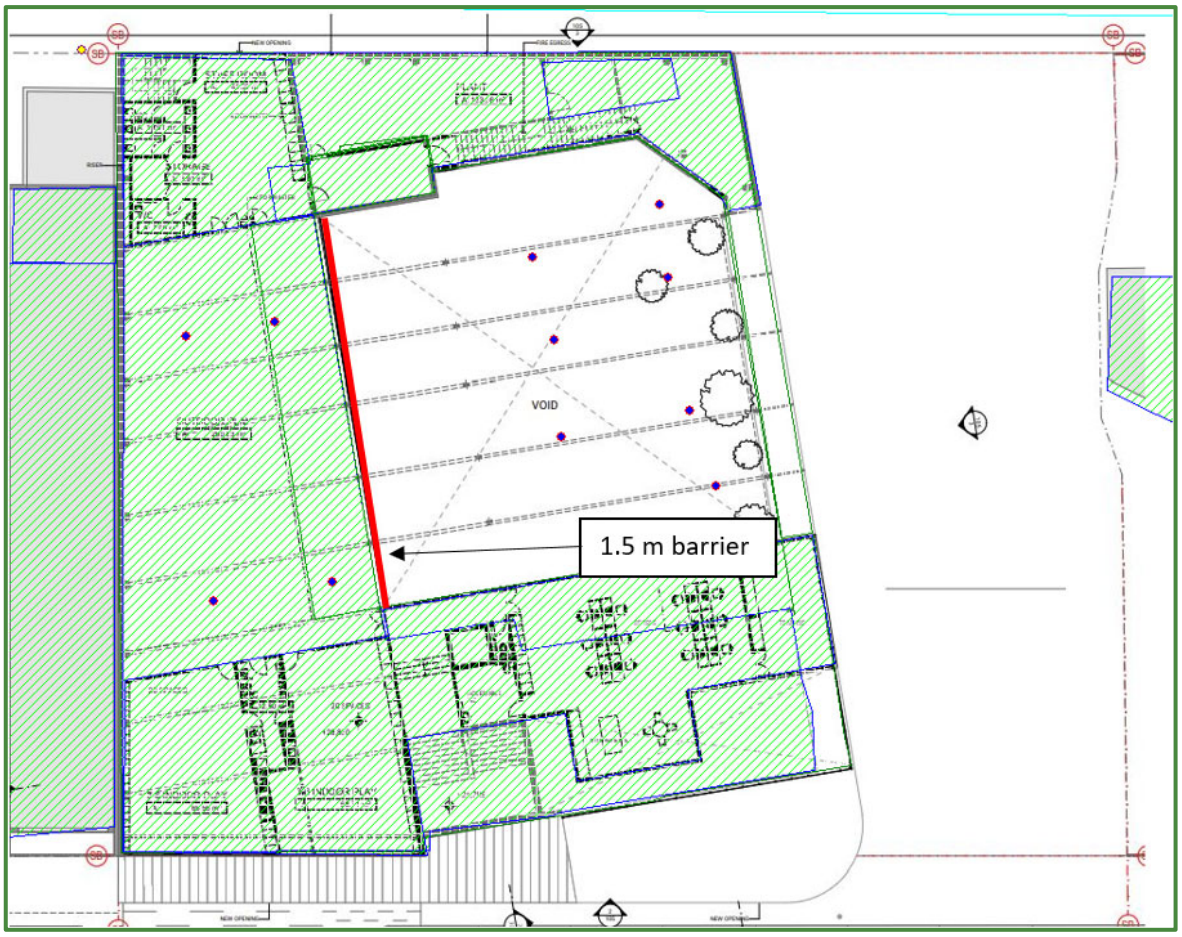


Figure 6-3: Ground Floor Outdoor Play Area Noise Controls

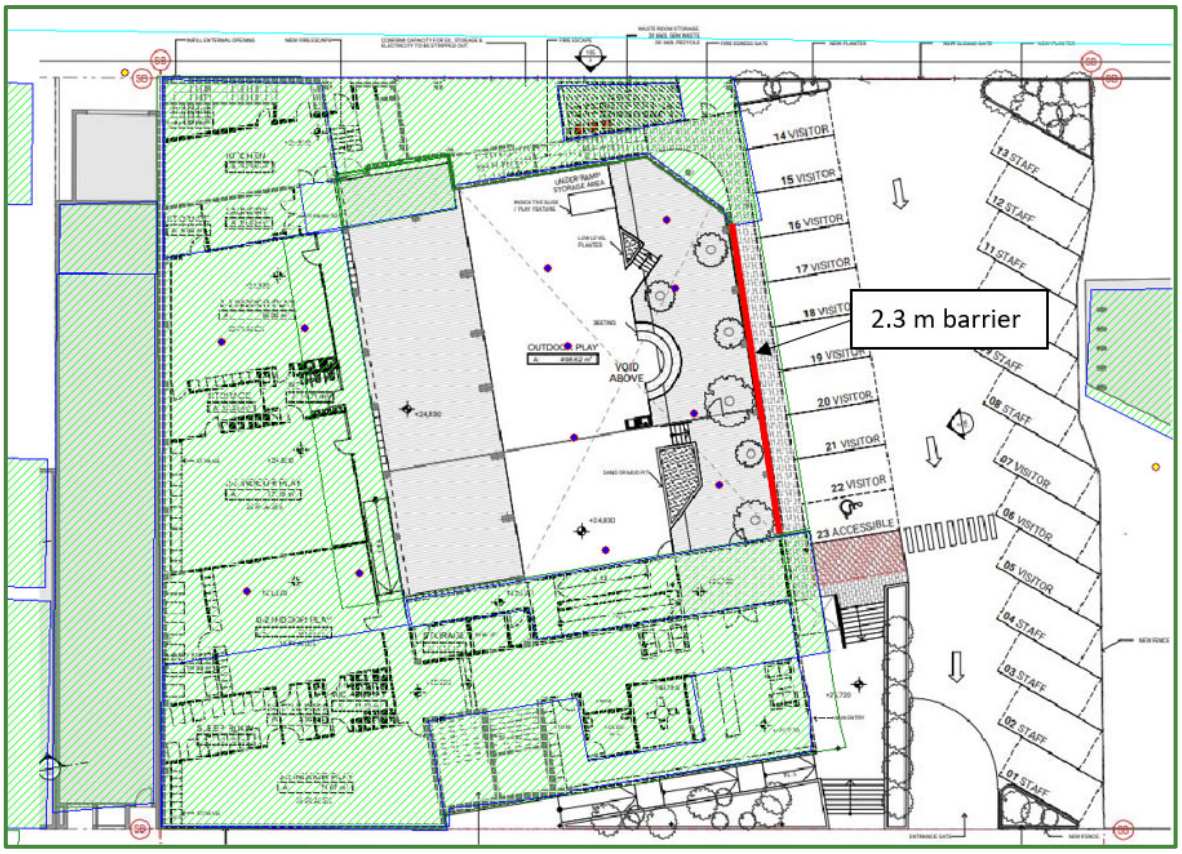


Figure 6-4: Scenario 2 Outdoor Play Noise Source Locations

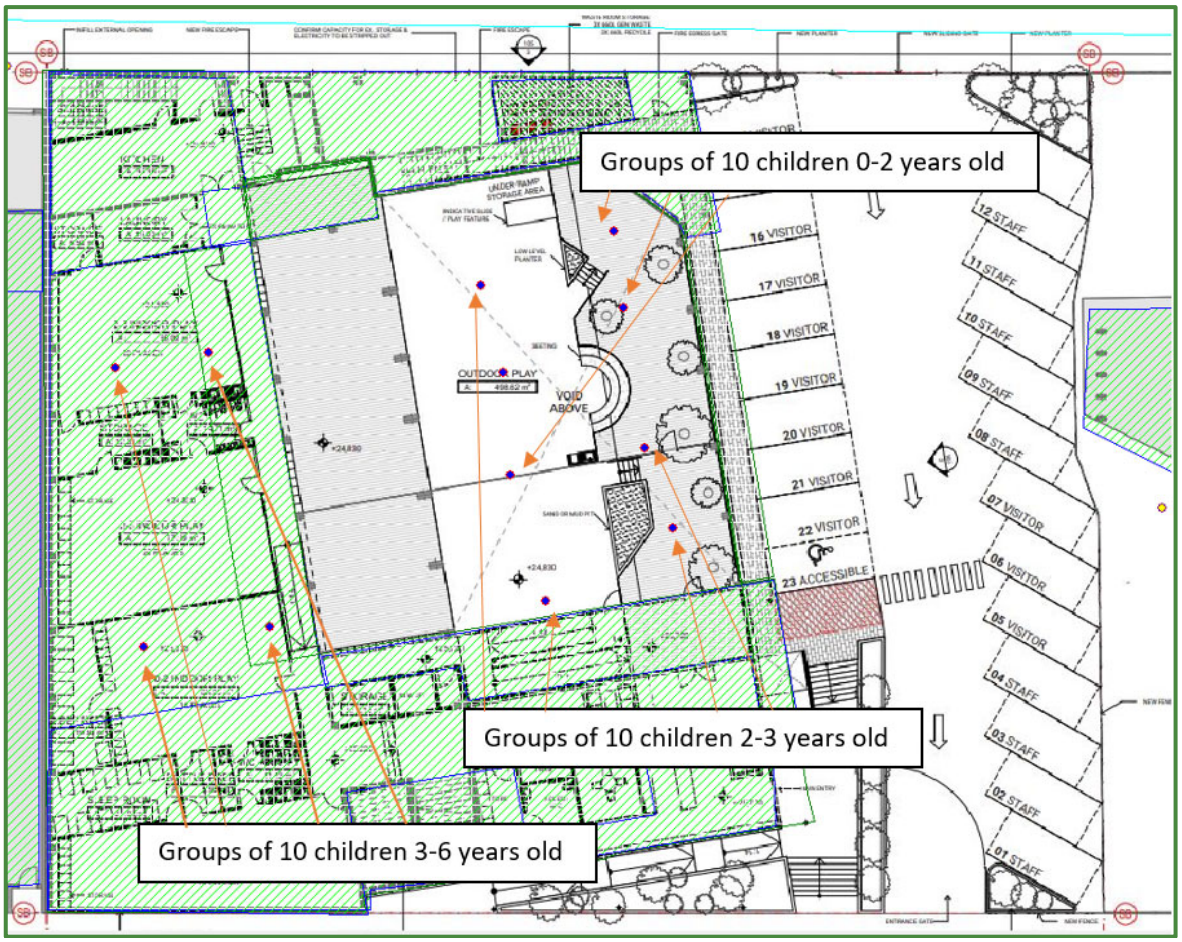


Figure 6-5: Scenario 2 Childcare Centre 3D Wire Frame View

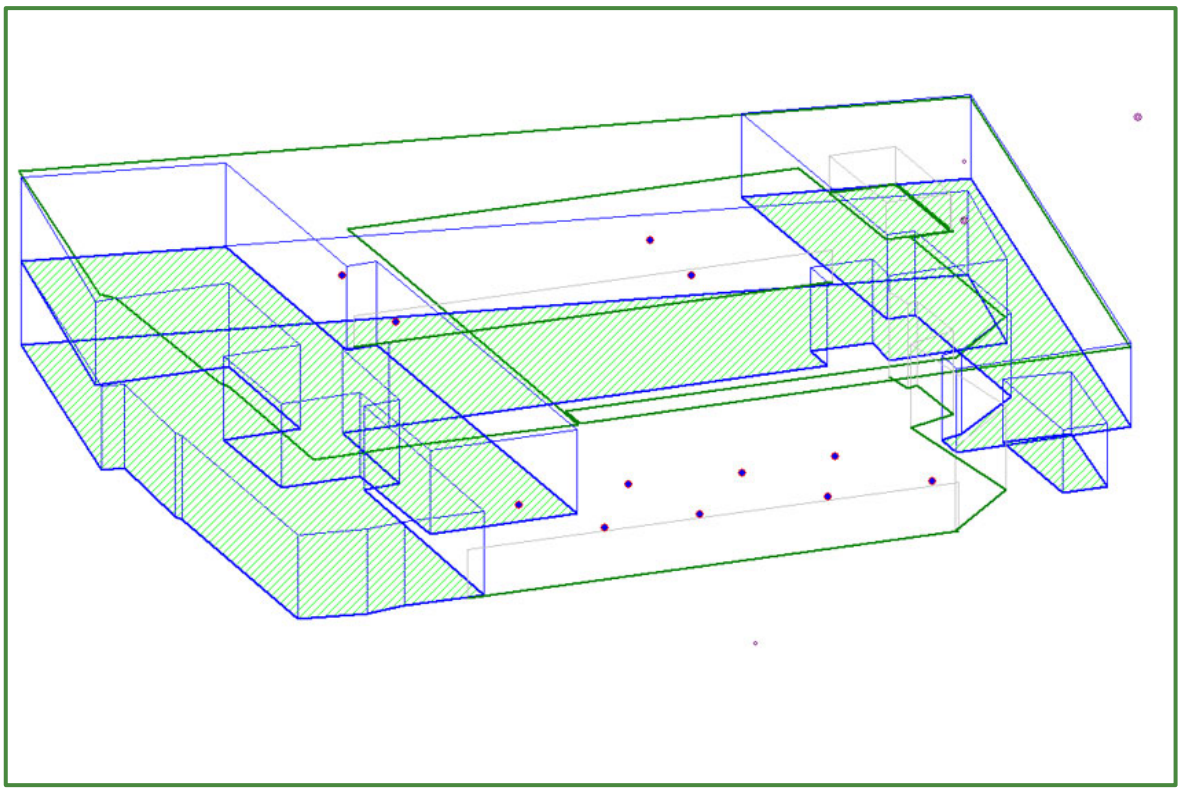


Figure 6-6: Scenario 3 Mechanical Plant Noise Source Locations

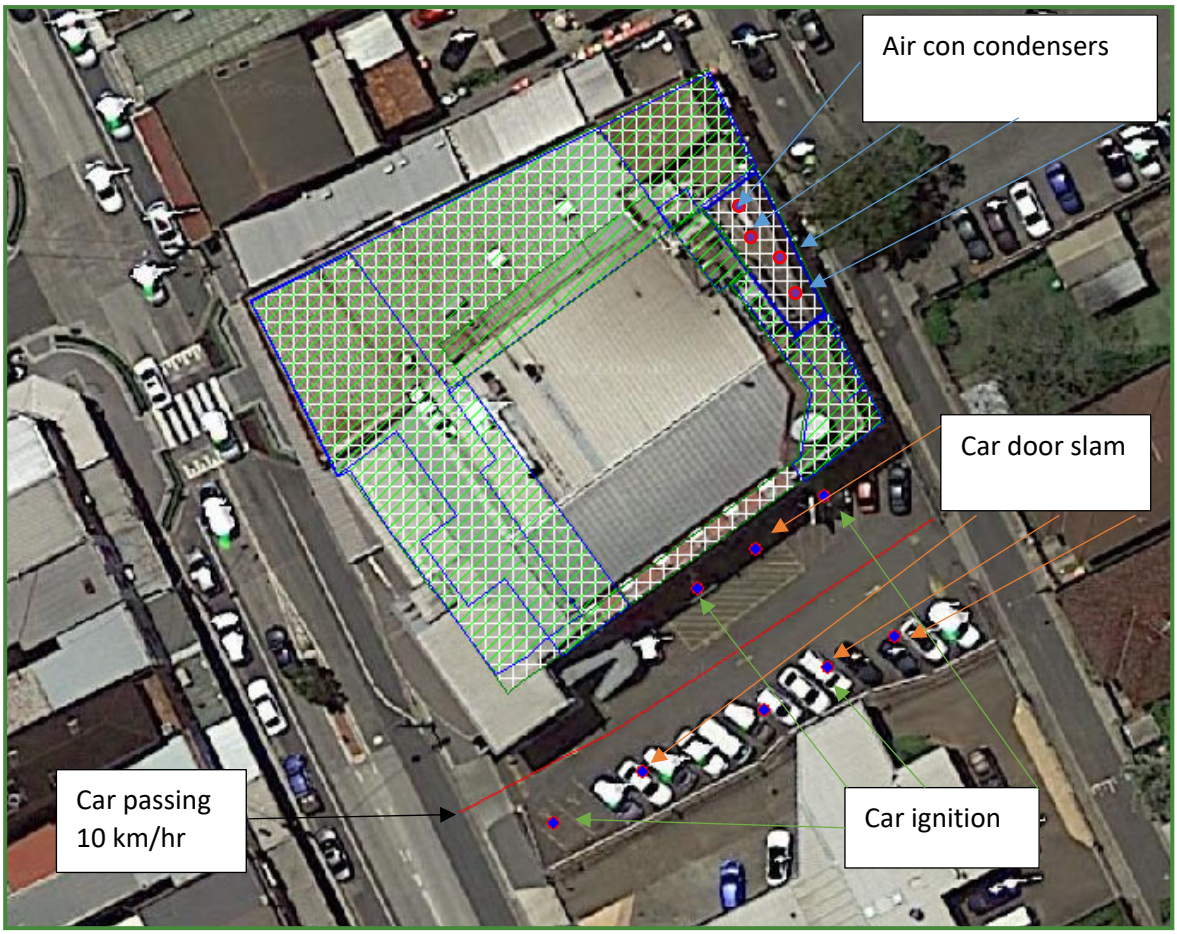


Figure 6-7: Scenario 3 Mechanical Plant 3D Wire Frame View

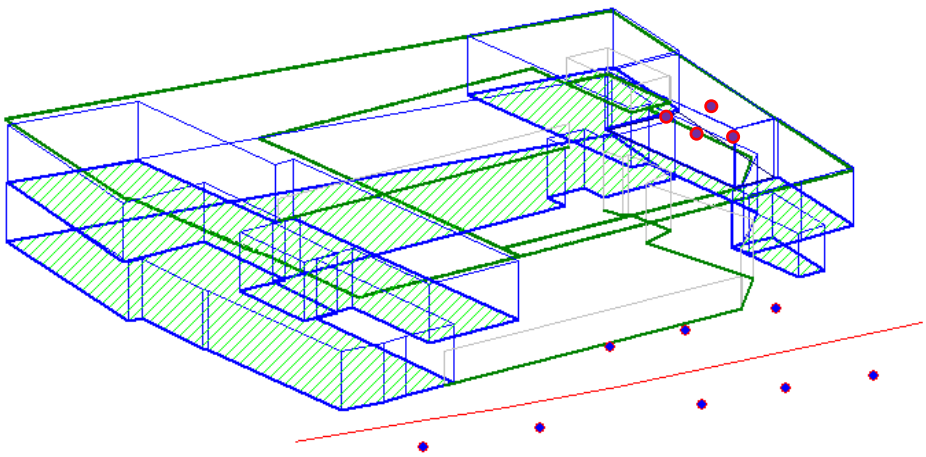


Figure 6-8: Scenario 4 – Road Noise Intrusion

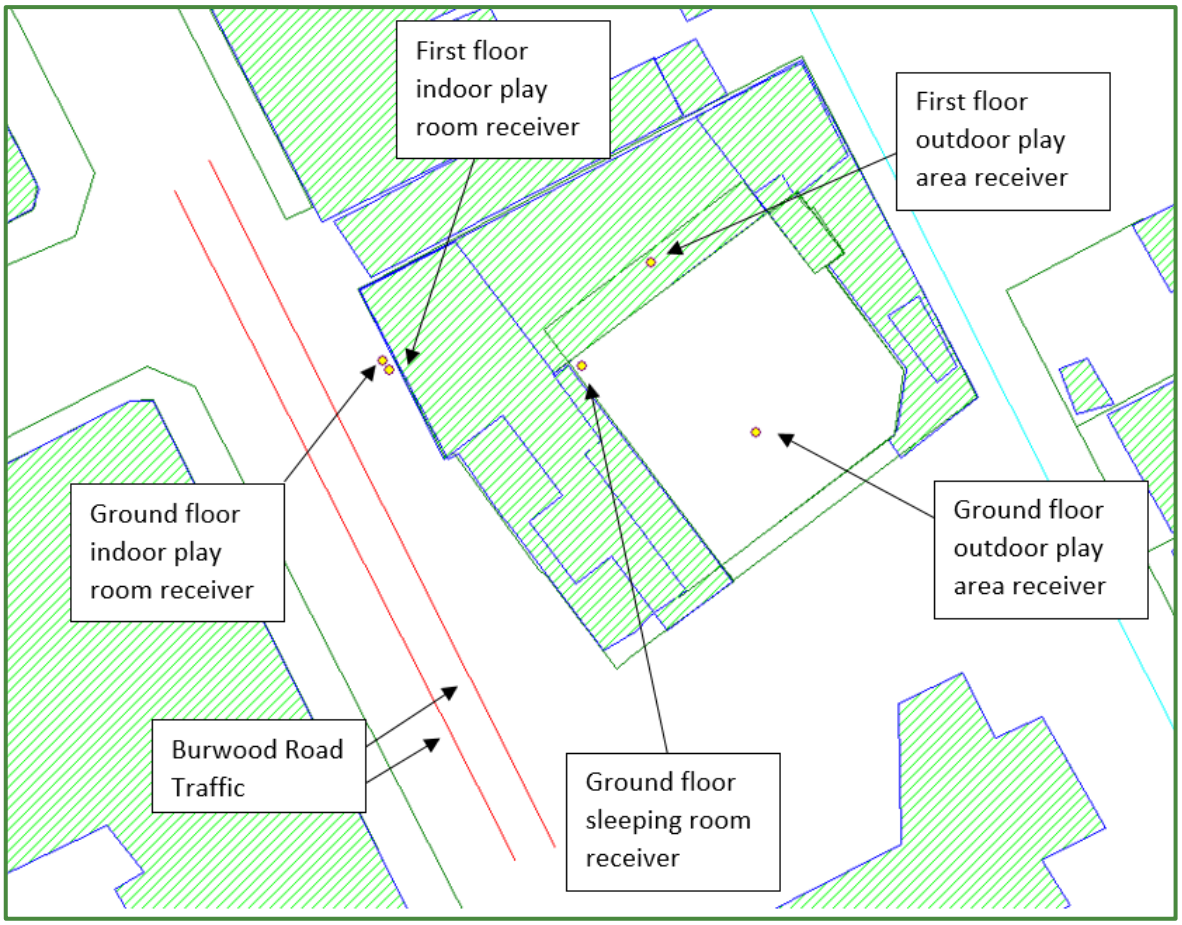


Figure 6-9: Scenario 4 Road Noise Intrusion with Childcare Centre Ground Floor Plan Overlay

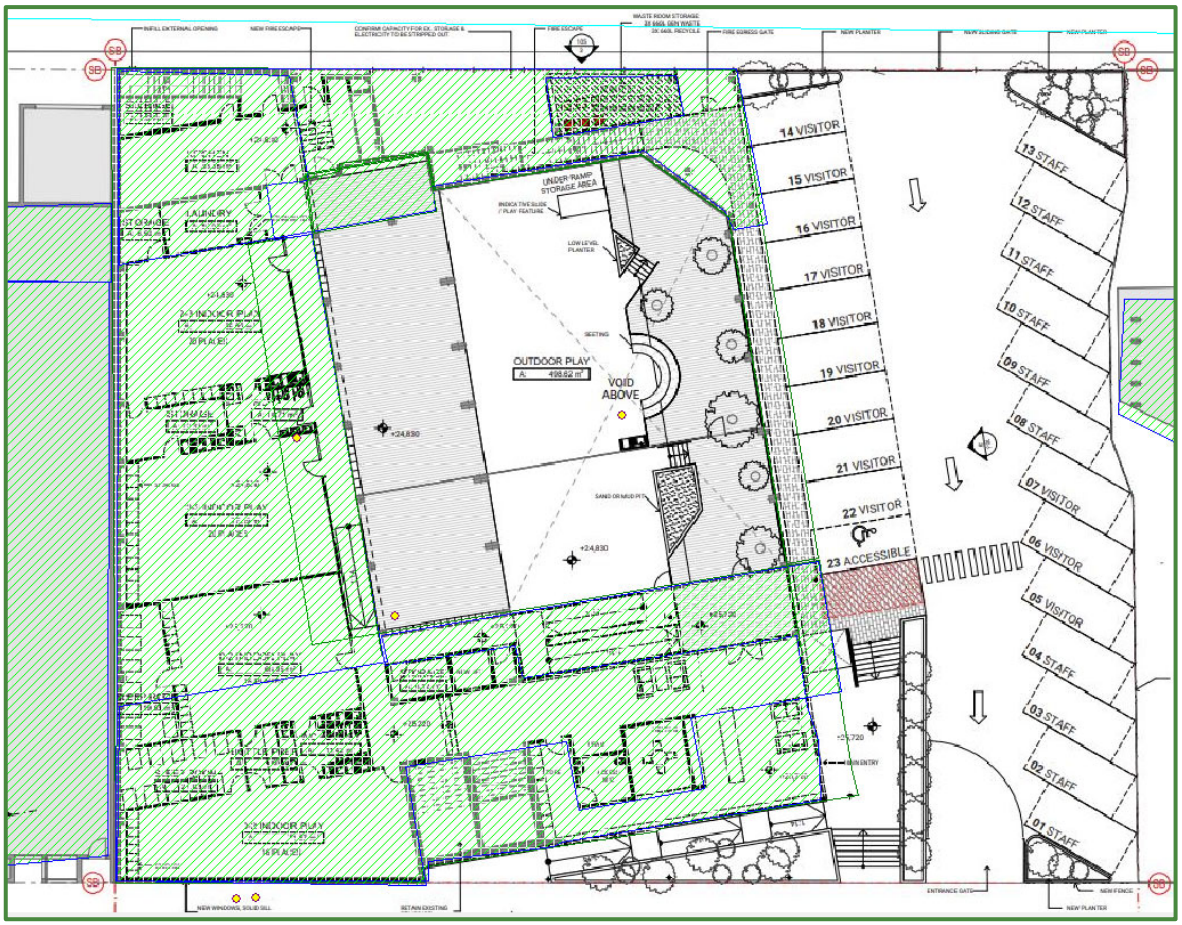


Figure 6-10: Scenario 4 Road Noise Intrusion with Childcare Centre First Floor Plan Overlay

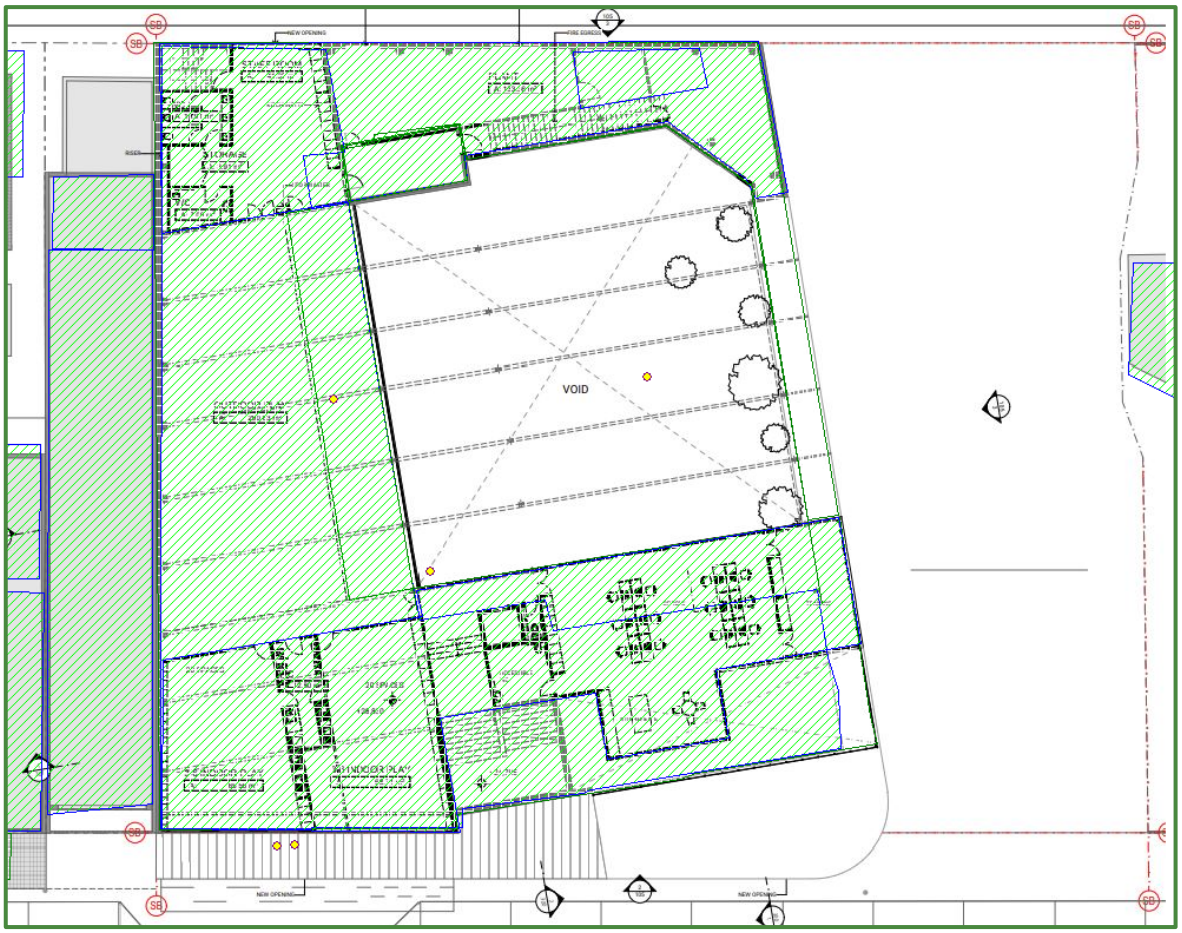


Figure 6-11: Scenario 4 Road Noise Intrusion 3D Wire Frame View

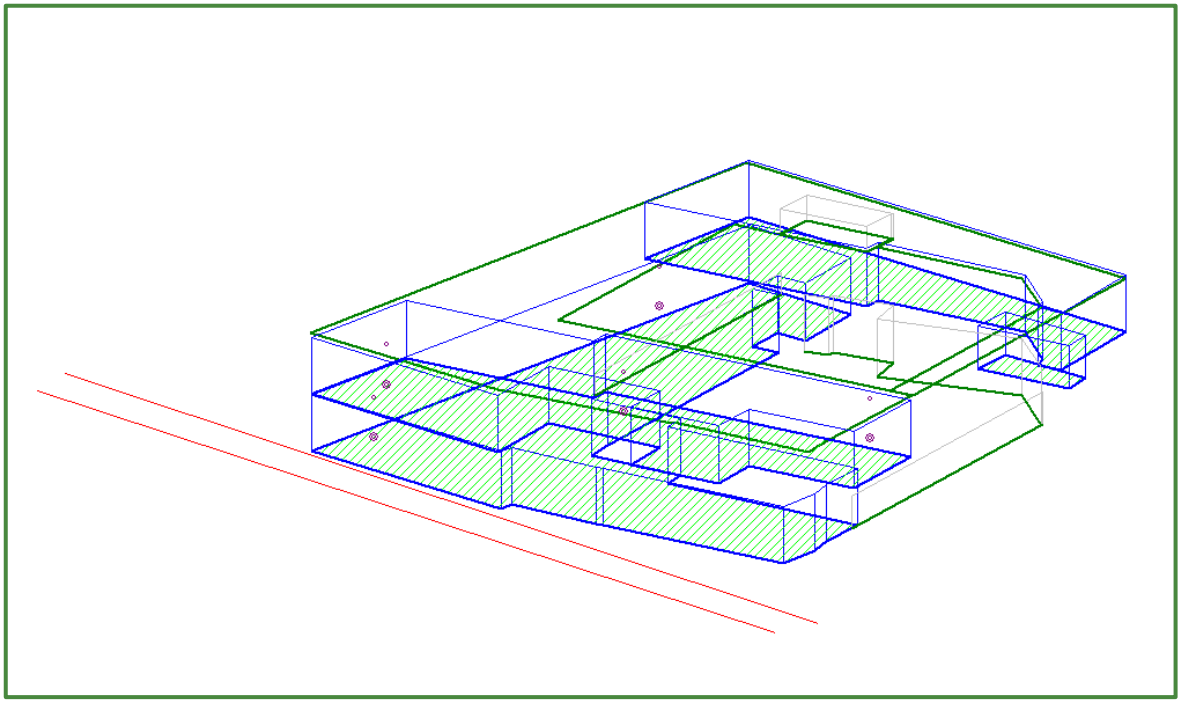
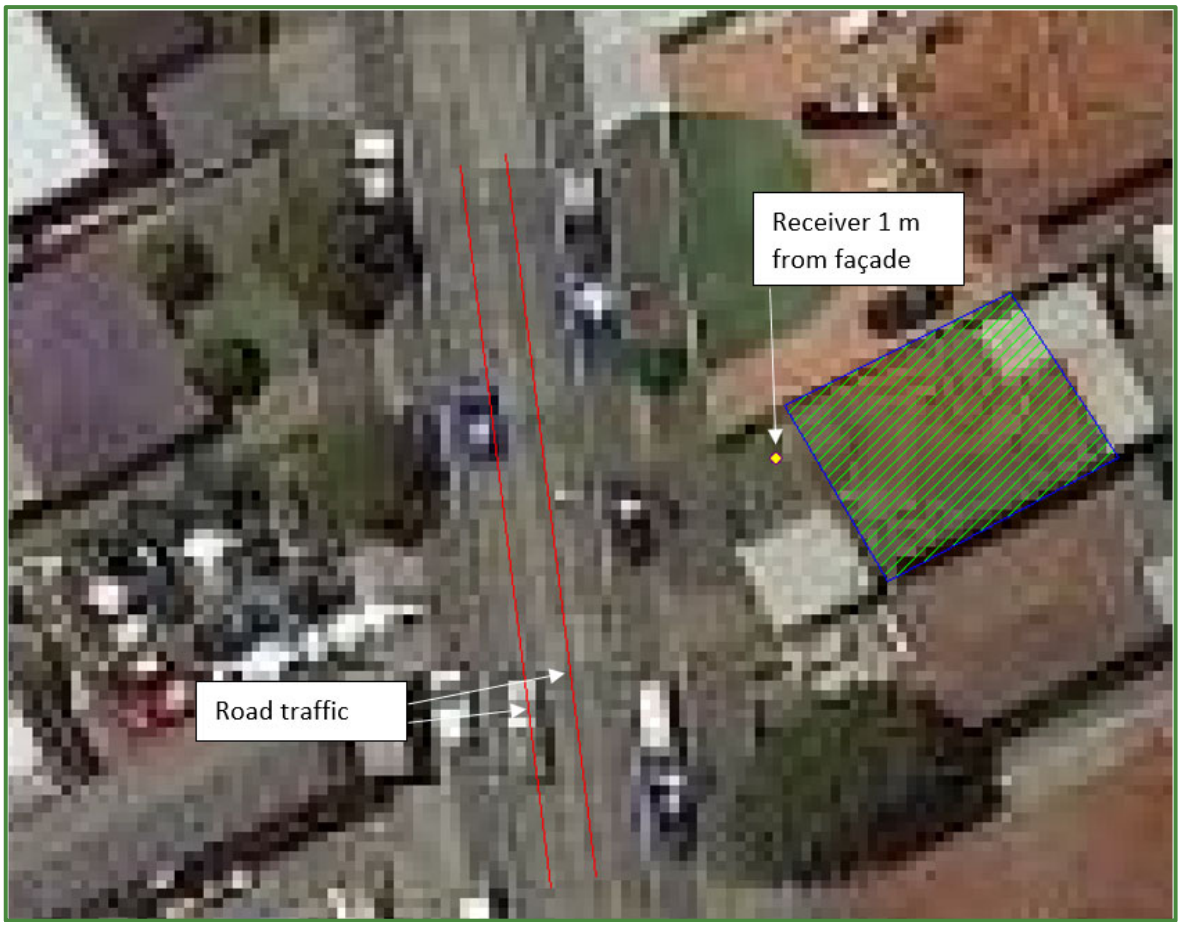


Figure 6-12: Scenario 5 Road Traffic Noise Impact Assessment Aerial



6.3 PREDICTED NOISE LEVELS AND RECOMMENDATIONS

Results of the predictive noise modelling are shown below.

6.3.1 Construction Scenario

Noise emission levels from the construction of the proposed facility have been predicted for each of the nearest potentially affected receivers with no noise controls in place. Table 6-4 shows the predicted results.

Table 6-4: Scenario 1– Noise Modelling Results – Construction Activities

Receiver	Scenario 1 Predicted Noise Level $L_{Aeq\ (15\ minute)}$	Noise Managment Level $L_{Aeq\ (15\ minute)}$
R1	47 ✓	51
R2	47 ✓	51
R3	47 ✓	51
R4	58 ✗	51
R5	53 ✗	51
R5 F1	59 ✗	51
R6	68 ✗	51
R7	67 ✗	51
R8	61 ✗	51
R9	56 ✗	51
R10	43 ✓	51
R11	45 ✓	51
R12	51 ✓	51
R13	48 ✓	51
R14	57 ✗	51
R14 F1	58 ✗	51
R15	55 ✗	51
R16	41 ✓	51
R17	40 ✓	51
R18	43 ✓	51
R19	55 ✓	70
R20	56 ✓	70
R21	58 ✓	70
R22	67 ✓	70
R23	75 ✗	70
R24	50 ✓	70
R25	50 ✓	70

Note: ✓ indicates compliance with the relevant noise criteria ✗ indicates non-compliance with the noise management level

In scenario 1 noise levels associated with construction are predicted to exceed the noise management level at several receivers. However, the predicted levels comply with the highly noise affected management level of 75 dB(A) at all receivers.

No significant vibration impacts are expected.

6.3.1.1 Construction Noise Mitigation Measures

As mentioned in section 6.2.2.1, the construction noise scenario represents a worst case scenario that may not occur in practice, and expected impacts on the surrounding receivers are predicted to be lower than the results presented in Table 6-4. None of the predicted noise levels exceed the highly noise affected management level of 75 dB(A).

As per the guidance from the NSW Interim Construction Noise Guidelines, the proponent should consider notifying the nearby receivers where applicable via letter box drops of the proposed construction works:

> *Where the predicted or measured $L_{Aeq(15\ minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. The proponent should also inform all potentially affected residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.*

Using Chapter 6 of the Interim Construction Noise Guideline, some reasonable and feasible work practises and mitigation measures that could be considered for adoption are as follows:

- Construct the boundary walls before commencing other construction operations;
- Where possible stagger the use of noisy equipment (front end loader, grinder, welder etc.) such that they do not operate simultaneously;
- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration;
- Regular identification of noisy activities and adoption of improvement techniques;
- Avoiding the use of portable radios, public address systems or other methods of site Communication that may unnecessarily impact upon nearby residents;
- Where possible, avoiding the use of equipment that generates impulsive noise;
- Minimising the need for vehicle reversing for example, by arranging for one-way site traffic routes;
- Use of broadband audible reverse alarms on vehicles and elevating work platforms used on site;
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact;
- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks;
- Regularly inspecting and maintaining plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively;
- Locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or
- Orientating the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise;
- Minimising truck movements; and
- Scheduling respite periods for intensive works.

Construction activities should only take place during standard **construction** hours as follows:

Monday to Friday:	7am to 6pm
Saturday:	8am to 1pm
Sunday and Public Holidays:	No works permitted

Adopting these work practices will significantly reduce the impact of the construction works at the nearest sensitive receivers.

The residents shown in the highlighted area in Figure 6-13 should be informed of the construction work to be carried out at the site and the period in which this will be done, as well as site contacts provided in case there are any issues.

Figure 6-13: Community Communication Map

Source: Google Maps 2022

↑N	LEGEND: Residents to be communicated within	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

6.3.2 Outdoor Play Activities

Noise emission levels from the operations of the proposed facility have been predicted for each of the nearest potentially affected receivers. Table 6-5 shows the predicted results for the modelled scenario.

Table 6-5: Scenario 2 - Noise Modelling Results - Outdoor Play Activities, dB(A)

Receiver	Predicted Noise Level $L_{Aeq\ (15\ minute)}$	Noise Criteria $L_{Aeq\ (15\ minute)}$
	Scenario 2 Outdoor Play	
R1	37 ✓	46
R2	35 ✓	46
R3	37 ✓	46
R4	36 ✓	46
R5	35 ✓	46
R5 F1	38 ✓	46
R6	43 ✓	46
R7	46 ✓	46
R8	42 ✓	46
R9	36 ✓	46
R10	27 ✓	46
R11	28 ✓	46
R12	28 ✓	46
R13	30 ✓	46
R14	39 ✓	46
R14 F1	40 ✓	46
R15	39 ✓	46
R16	27 ✓	46
R17	30 ✓	46
R18	30 ✓	46
R19	39 ✓	63
R20	39 ✓	63
R21	38 ✓	63
R22	37 ✓	63
R23	48 ✓	63
R24	38 ✓	63
R25	35 ✓	63

Note: ✓ indicates compliance with the relevant noise criteria
* indicates wind affected receptors

The noise levels associated with the children's outdoor play area are all predicted to achieve compliance with the established project specific noise levels.

6.3.2.1 Childcare Centre Noise Controls

In line with the assumptions in Section 6.2.2.2 the following controls must be applied to ensure compliance. All walls, barriers and awnings must be made of solid material with no gaps.

6.3.2.1.1 First Floor Outdoor Play Area

- A barrier surrounding the play area must be at least 1.5 m tall.

6.3.2.1.2 Ground Floor Outdoor Play Area

- The southern end of the ground floor play area must not be open to the car park and should have a barrier at least 2.3 m tall.

6.3.3 Mechanical Plant and Carpark

Table 6-6 shows the predicted results for Scenario 3 which includes the noise emissions from mechanical plants and carpark associated activities.

Table 6-6: Scenario 4 - Noise Modelling Results - Mechanical Plants and Carpark, dB(A)

Receiver	Predicted Noise Level	Noise Criteria $L_{Aeq\ (15\ minute)}$
	Scenario 3 Day Neutral Weather $L_{Aeq\ (15\ minute)}$	Day
R1	29 ✓	46
R2	28 ✓	46
R3	34 ✓	46
R4	43 ✓	46
R5	34 ✓	46
R5 F1	36 ✓	46
R6	43 ✓	46
R7	41 ✓	46
R8	35 ✓	46
R9	29 ✓	46
R10	29 ✓	46
R11	29 ✓	46
R12	30 ✓	46
R13	30 ✓	46
R14	29 ✓	46
R14 F1	30 ✓	46
R15	32 ✓	46
R16	<20 ✓	46
R17	<20 ✓	46
R18	21 ✓	46
R19	36 ✓	63
R20	38 ✓	63
R21	42 ✓	63
R22	43 ✓	63
R23	51 ✓	63
R24	40 ✓	63
R25	45 ✓	63

Note: ✓ indicates compliance with the relevant noise criteria

As can be seen from the above predicted results, noise levels would comply with the relevant acoustic criteria.

6.3.3.1 Mechanical Plant Controls

The following controls outlined in the assumptions in Section 6.2.2.3 must be applied:

- Individual air con condensers should not exceed a sound power level of 80 dB(A).
- The louvres installed need to have an Rw of 10 dB(A) or greater to achieve the same levels.

6.3.4 Noise Associated with On-Site Indoor Activities

Considering that the on-site outdoor activities comply with the noise criteria, noise generated within the Childcare Centre building is not expected to create any annoyance to the nearby residences as the structure's facades will substantially minimize the sound propagation.

The proposed Childcare Centre will be mechanically ventilated allowing windows to remain closed, if required.

6.3.5 Noise Impact on Children Playing Outdoor – Road Noise Intrusion

The unattended noise level for road traffic noise indicate that the highest average $L_{eq,1\ hr}$ for the day time during weekdays was measured to be 70 dB(A) at location B.

Table 6-7: Scenario 5 – Noise Modelling Results Road Noise Intrusion Outdoor Play, dB(A)

Receiver	Predicted Noise Level $L_{Aeq\ (15\ minute)}$	Noise Criteria $L_{Aeq\ (15\ minute)}$
Ground Floor - Outdoor Play Area	42 ✓	55
First Floor – Outdoor Play Area	47 ✓	55

Note: ✓ indicates compliance with the relevant noise criteria

The noise levels within the outdoor playground areas have been predicted at less than 50 dB(A), which is well below the criteria of 55 dB(A).

6.3.6 Noise Impact on Indoor Play Areas and Sleeping Areas

Indoor play areas and sleeping rooms closest to Burwood Road have been selected to provide a worst case scenario. It is important to note that the ground floor sleeping room only has one external wall which backs onto an adjacent building and the internal walls have no windows. The receiver has been placed adjacent to the WC & Nappy change room near the sleeping room.

Table 6-8: Scenario 6 – Noise Modelling Results Road Noise Intrusion for Indoors, dB(A)

Receiver	Predicted Noise Level Outdoors 1 m from Façade $L_{Aeq\ (15\ minute)}$
Ground Floor - Sleeping Room	41
Ground Floor –Indoor Play Room adjacent to Burwood Road	71
First Floor –Indoor Play Room adjacent to Burwood Road	70

The outdoor to indoor noise level losses for typical building constructions are provided in the RTA publication "Environmental Noise Management Manual", RTA 2001. This provides a preliminary assessment tool of the proposed building construction.

The noise reductions provided by typical building constructions are provided in Table 6-9.

Table 6-9: Indicative building noise reduction (FHWA 1995)

Building type	Window	Internal noise reduction
All	Open	10 dB(A)
Light frame	Single glazed (closed)	20 dB(A)
Masonry	Single glazed (closed)	25 dB(A)
	Double glazed (closed)	35 dB(A)

Source: RTA 2001

Table 6-10: Predicted noise levels from indoors

Room type	Window	Criteria	Noise Level
Ground Floor - Sleeping Room	Open	35	31 dB(A) ✓
	Masonry Single glazed (closed)		16 dB(A) ✓
	Masonry Double glazed (closed)		<15 dB(A) ✓
Ground Floor – Indoor Play Room adjacent to Burwood Road	Open	40	61 dB(A) ×
	Masonry Single glazed (closed)		46 dB(A) ×
	Masonry Double glazed (closed)		36 dB(A) ✓
First Floor –Indoor Play Room adjacent to Burwood Road	Open	40	60 dB(A) ×
	Masonry Single glazed (closed)		45 dB(A) ×
	Masonry Double glazed (closed)		35 dB(A) ✓

The indoor sleeping room will comply with the road noise intrusion criteria. Windows in the ground floor and first floor indoor play rooms adjacent to Burwood Road should be double glazed and remain closed. These rooms are to be provided with mechanical ventilation to avoid the need to open any windows.

6.3.7 Road Traffic Noise Impact Assessment

The $L_{Aeq,\ 1\ hour}$ noise descriptor has been calculated at the most affected residential receptor located along the closest local road. The predicted noise levels are displayed in Table 6-11.

Table 6-11: Predicted Levels for Road Traffic Noise dB(A)

Receptor	Local Roads Noise Criteria	Site Contribution	Existing Road Noise	Total Cumulative Noise
	Day - $L_{Aeq,\ 1\ hour}$	Day - $L_{Aeq,\ 1\ hour}$	Day - $L_{Aeq,\ 1\ hour}$	Day - $L_{Aeq,\ 1\ hour}$
483 Burwood Road, Belmore	55	37 ✓	70	70 ✓

From Table 6-11, it can be seen that the predicted road traffic noise contributions will comply with the road noise criteria. The proposed development will result in an increase of 0 dB(A) therefore also complying with the relative increase criteria of 2 dB(A).

Therefore, the proposed vehicle movements are predicted to comply with the NSW Road Noise Policy, and no additional mitigation strategies are recommended.

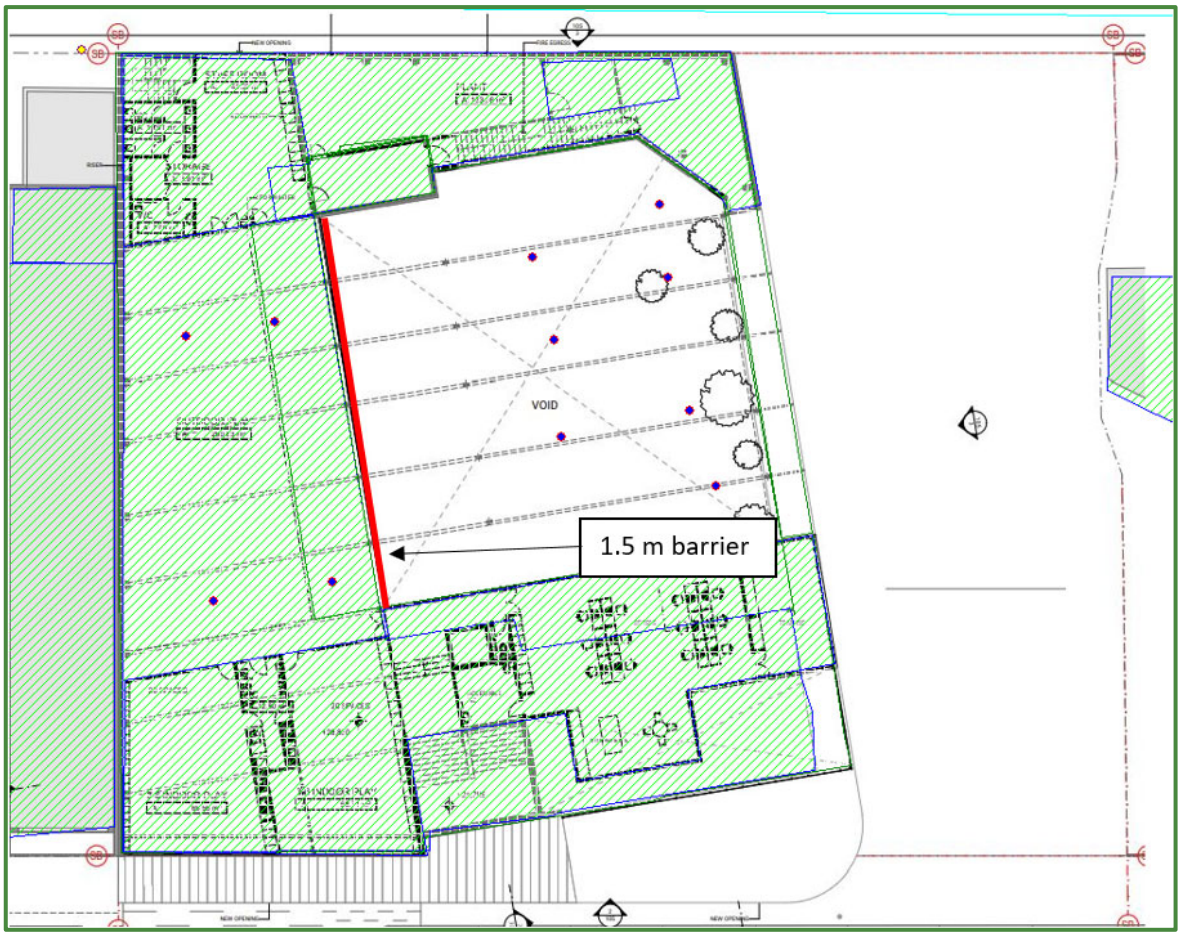
6.4 Summary of Operational Noise Controls

All walls, barriers and awnings must be made of solid material with no gaps.

6.4.1 First Floor Outdoor Play Area

- A barrier surrounding the play area must be at least 1.5 m tall.

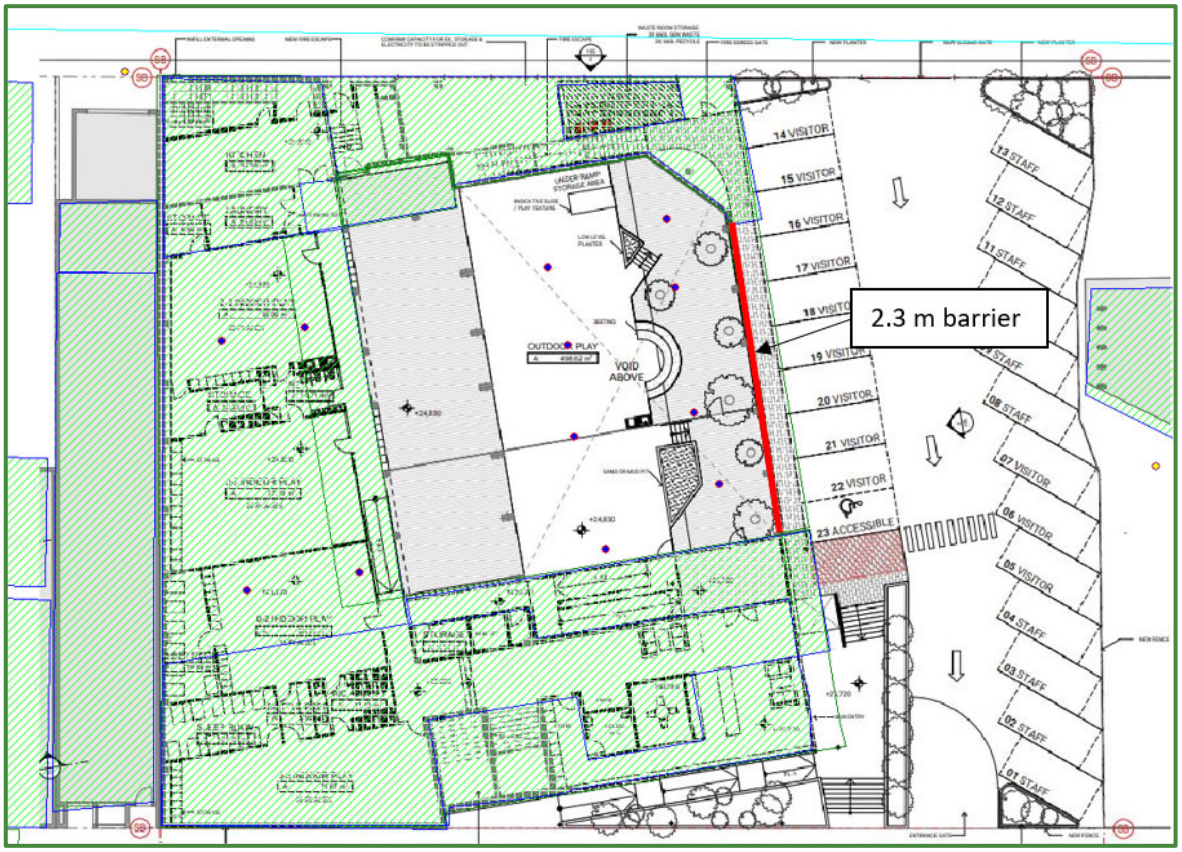
Figure 6-14: First Floor Outdoor Play Area Noise Controls



6.4.2 Ground Floor Outdoor Play Area

- The southern end of the ground floor play area must not be open to the car park and should have a barrier at least 2.3 m tall.

Figure 6-15: Ground Floor Outdoor Play Area Noise Controls



6.4.3 Mechanical Plant

- Individual air con condensers should not exceed a sound power level of 80 dB(A).
- The louvres installed need to have an Rw of 10 dB(A) or greater to achieve the same levels.

6.4.4 Road Noise Intrusion

Windows in the ground floor and first floor indoor play rooms adjacent to Burwood Road should be double glazed and remain closed. These rooms are to be provided with mechanical ventilation to avoid the need to open any windows.

7. STATEMENT OF POTENTIAL NOISE IMPACT

Benbow Environmental (BE) has conducted a detailed noise impact assessment for the proposed Childcare Centre located at 427 Burwood Road, Belmore NSW 2192.

This assessment has been carried out in accordance with the guidelines established by both the *NSW Environmental Protection Authority Noise Policy for Industry (2017),* the *AAAC Technical Guideline: Childcare Centre Noise Assessment* and the *Department of Environment, Climate Change and Water NSW, Road Noise Policy (DECCW 2011)* and *NSW Interim Construction Noise Guideline (DECC, 2009).*

Background noise levels of the area have been obtained in accordance with the methodologies outlined in the NSW EPA Noise Policy for Industry and relevant Australian Standards.

The nearest receivers and noise criteria were identified. The site operations were modelled using the predictive noise software, Sound Plan V8.2.

The activities proposed by the proponent were found to comply with the NSW EPA Noise Policy for Industry.

Construction noise exceeds the noise affected RBL + 10 dB set in Table 2 of the Interim Construction Noise Guideline (DECC, 2009) for several receivers, however the highly noise affected management level of 75 dB(A) is not exceeded. Recommended noise controls for construction works are listed in section 6.3.1.1.

As detailed within the body of this report, operational noise emissions generated by the proposed Childcare Centre are predicted to comply with the relevant acoustic criteria at all considered receiver locations. This includes the noise associated with the children's outdoor play activities, mechanical plant and carpark activities.

Acoustic barriers must be of at least the height and dimensions of that described in the assumptions and controls (section 6.3.2.1 and section 6.3.3.1) to ensure noise level compliance.

The existing road traffic noise levels are not expected to negatively impact the outdoor play areas, and the sleeping areas and comply with the relevant criteria in these areas. Windows in the ground floor and first floor indoor play rooms adjacent to Burwood Road should be double glazed and remain closed. These rooms are to be provided with mechanical ventilation to avoid the need to open any windows.

A summary of operational noise controls is provided in section 6.4.

This concludes the report.

Emma Hansma	Bethany Carlyon	Richard Benbow
Senior Engineer	Graduate Environmental Scientist	Principal Consultant

8. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Montessori Academy Group, as per our agreement for providing environmental services. Only Montessori Academy Group is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Montessori Academy Group for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

ATTACHMENTS

Glossary of Noise Terminology

'A' FREQUENCY WEIGHTING

The 'A' frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (L_{Aeq},T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc.. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (L_{A90}, T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days). For a 15 minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (h) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10} (10^{(50/10)} + 10^{(50/10)})$ and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FLETCHER–MUNSON EQUAL LOUDNESS CONTOUR CURVES

The Fletcher–Munson curves are one of many sets of equal loudness contours for the human ear, determined experimentally by Harvey Fletcher and Wilden A. Munson, and reported in a 1933 paper entitled "Loudness, its definition, measurement and calculation" in the Journal of the Acoustic Society of America.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

IMPACT ISOLATION CLASS (IIC)

The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation. Not commonly used in Australia.

'I' (IMPULSE) TIME WEIGHTING

Sound level meter time constant now not in general use. The 'I' (impulse) time weighting is not suitable for rating impulsive sounds with respect to their loudness. It is also not suitable for assessing the risk of hearing impairment or for determining the 'impulsiveness' of a sound.

IMPACT SOUND INSULATION ($L_{nT,w}$)

Australian Standard AS ISO 717.2—2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured 1/3 octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE

An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAFmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LASmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE RATING NUMBERS

A set of empirically developed equal loudness curves has been adopted as Australian Standard AS 1469—1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the 'A' frequency weighted dB level minus five.

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient"

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means noise:
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE

Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T60

The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α

Sound is absorbed in porous materials by the viscous conversion of sound energy to a small amount of heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2 kHz is termed the Noise Reduction Coefficient (NRC).

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure or some other devise. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (L_{Aeq}, T) by the formula L_{Aeq}, T = L_{AE} – 10 $\log_{10}$ T. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (L_{AE}).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m^2).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where L_P = 10 $\log_{10}$ $(Pa/Po)^2$ dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20 x 10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, Lw

The sound power level of a noise source is the inherent noise of the device. Therefore sound power level does not vary with distance from the noise source or with a different acoustic environment. Lw = Lp + 10 $\log_{10}$ 'a' dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION CLASS (STC)

An internationally standardised method of rating the sound transmission loss of partition walls to indicate the sound reduction from one side of a partition to the other in the frequency range of 125 Hz to 4000 kHz. (Refer: Australian Standard AS 1276—1979). Now not in general use in Australia see: weighted sound reduction index.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS 1191—2002.

STATISTICAL NOISE LEVELS, Ln.

Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors for example:-

- The noise level, in decibels, exceeded for 1 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF1}, T. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.
- The noise level, in decibels, exceeded for 10 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF10}, T. In most countries the LAF10, T is measured over periods of 15 minutes, and is used to describe the average maximum noise level.
- The noise level, in decibels, exceeded for 90 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF90}, T. In most countries the LAF90, T is measured over periods of 15 minutes, and is used to describe the average minim um or background noise level.

STEADY NOISE

Noise, which varies in level by 6 dB or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1—1997).

WEIGHTED SOUND REDUCTION INDEX, Rw

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall Rw + C ratings are frequency weighted to simulate insulation from human voice noise. The R_w + C is similar in value to the STC rating value. External walls, doors and windows may be R_w + C_{tr} rated to simulate insulation from road traffic noise. The spectrum adaptation term Ctr adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

WHITE NOISE

White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1—2019: '*Electroacoustics – Sound level meters – Specifications*'.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM29941

EQUIPMENT TESTED: Sound & Vibration Analyser

Manufacturer:	Svantek		
Type No:	Svan-957	**Serial No:**	15336
Mic. Type:	7052E	**Serial No:**	47869
Pre-Amp. Type:	SV12L	**Serial No:**	18743
Filter Type:	1/3 Octave	**Test No:**	FILT 6546

Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Tests Performed: IEC 61672-3:2013,
IEC 1260:1995, & AS/NZS 4476:1997

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1006	hPa ±1 hPa	**Date of Receipt :**	02/07/2021
Temperature	22	°C ±1° C	**Date of Calibration :**	05/07/2021
Relative Humidity	37	% ±5%	**Date of Issue :**	05/07/2021

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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www.acousticresearch.com.au

Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C21453

Client Details Benbow Environmental
25-27 Sherwood Street
Northmead NSW 2152

Equipment Tested/ Model Number : ARL EL-215
Instrument Serial Number : 194552
Microphone Serial Number : N/A
Pre-amplifier Serial Number : N/A

Atmospheric Conditions
Ambient Temperature : 23.6°C
Relative Humidity : 39.9%
Barometric Pressure : 100.9kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 8 Jul 2021
Secondary Check: Rhys Gravelle
Report Issue Date : 8 Jul 2021
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10.2.2: Absolute sensitivity	*Pass*	10.3.4: Inherent system noise level	*Pass*
10.2.3: Frequency weighting	*Pass*	10.4.2: Time weighting characteristic F and S	*Pass*
10.3.2: Overload indications	*Pass*	10.4.3: Time weighting characteristic I	*Pass*
10.3.3: Accuracy of level range control	*Pass*	10.4.5: R.M.S performance	*Pass*
8.9: Detector-indicator linearity	*Pass*	9.3.2: Time averaging	*Pass*
8.10: Differential level linearity	*Pass*	9.3.5: Overload indication	*Pass*

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.13dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.19dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.31dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.1dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

The sound level meter under test has been shown to conform to the type 2 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C29629

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 565912
Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level:	NA	N	93.82 dB	986.03 Hz	0.35 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure	1004	hPa ±1 hPa	**Date of Receipt :**	26/05/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	26/05/2021
Relative Humidity	49	% ±5%	**Date of Issue :**	26/05/2021

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

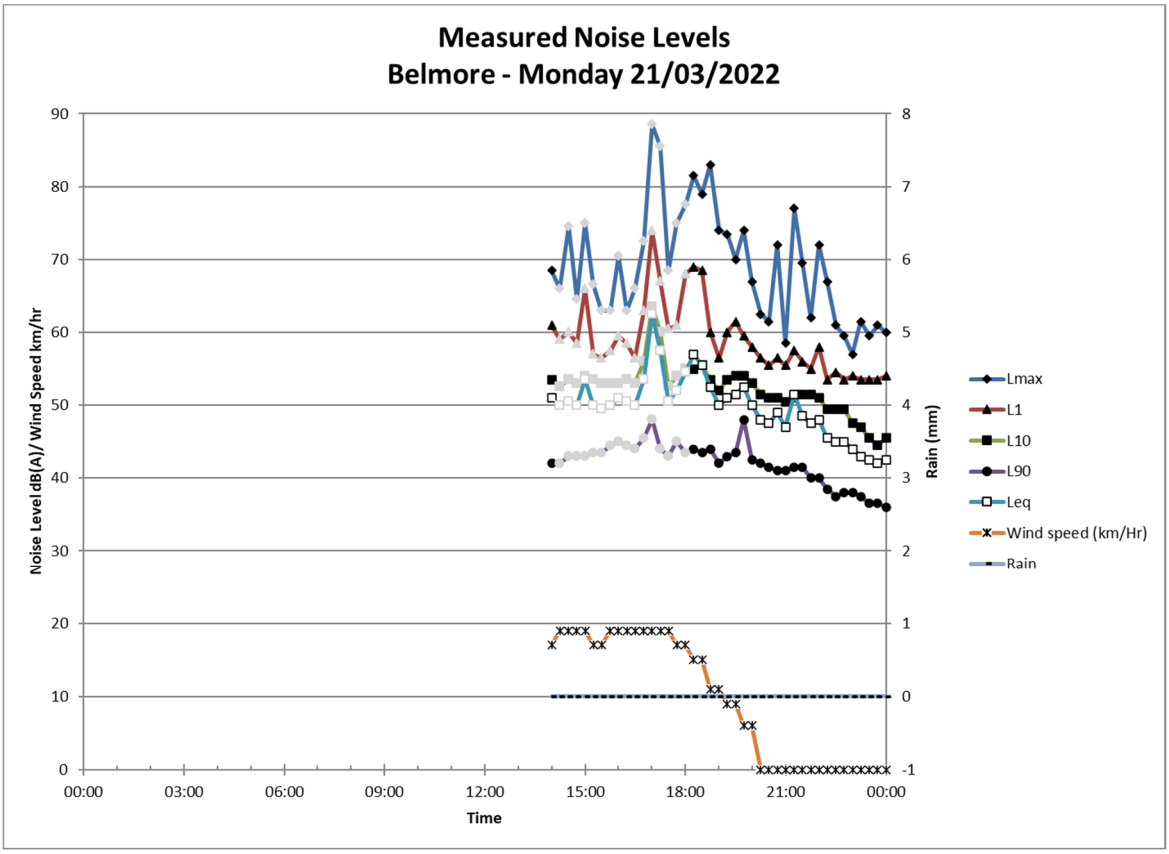
This report applies only to the item identified in the report and may not be reproduced in part.

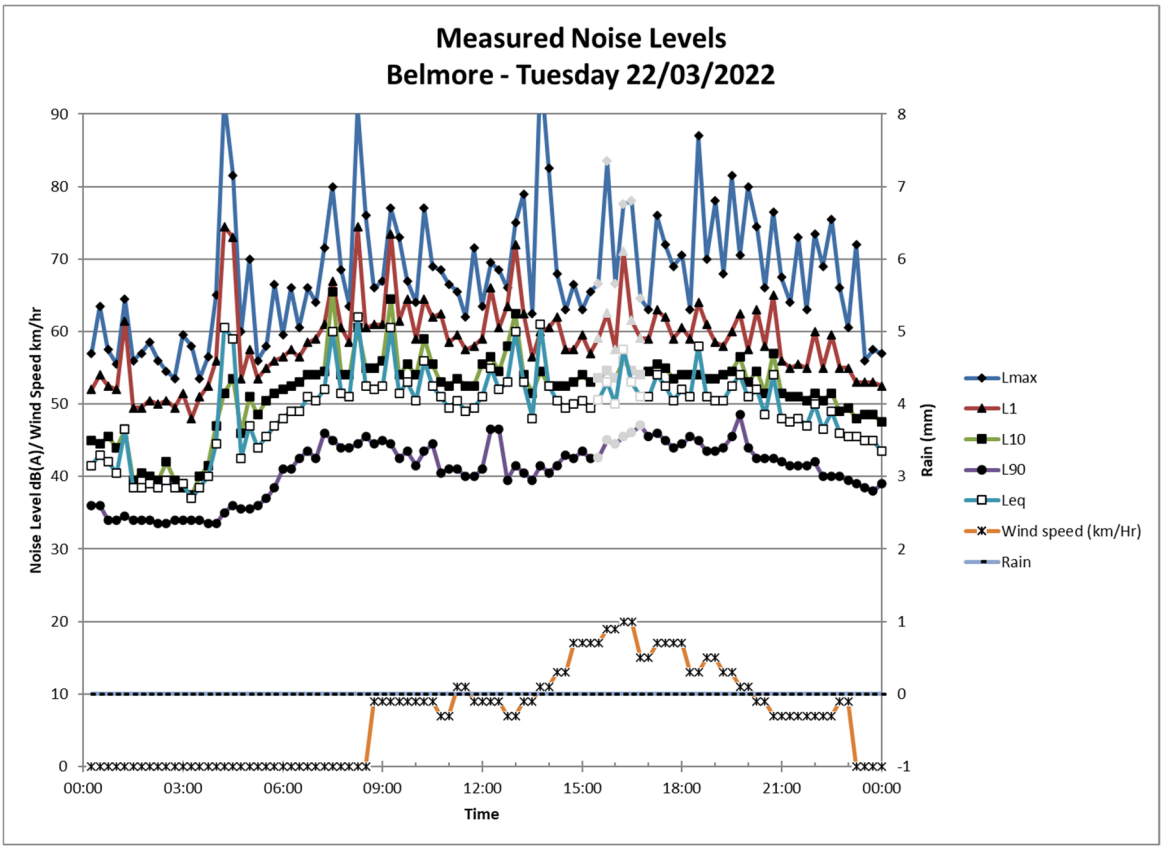
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

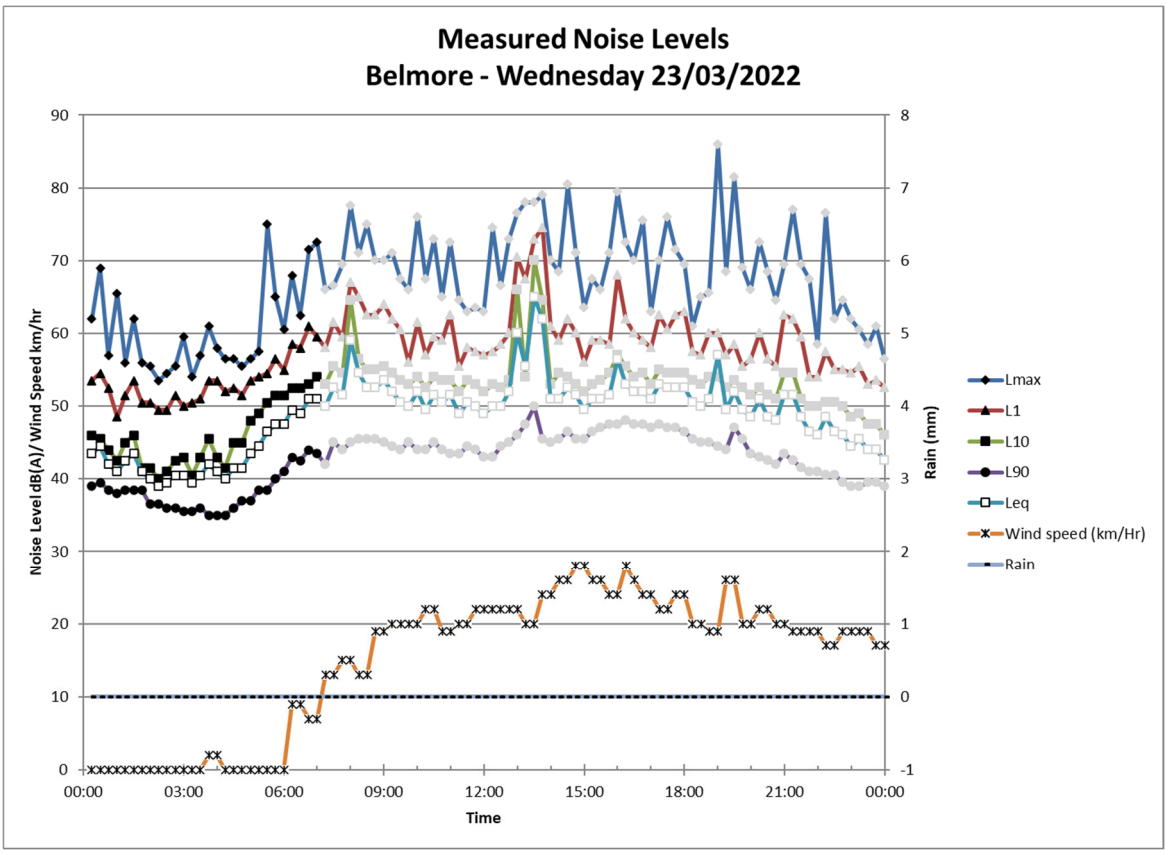
NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

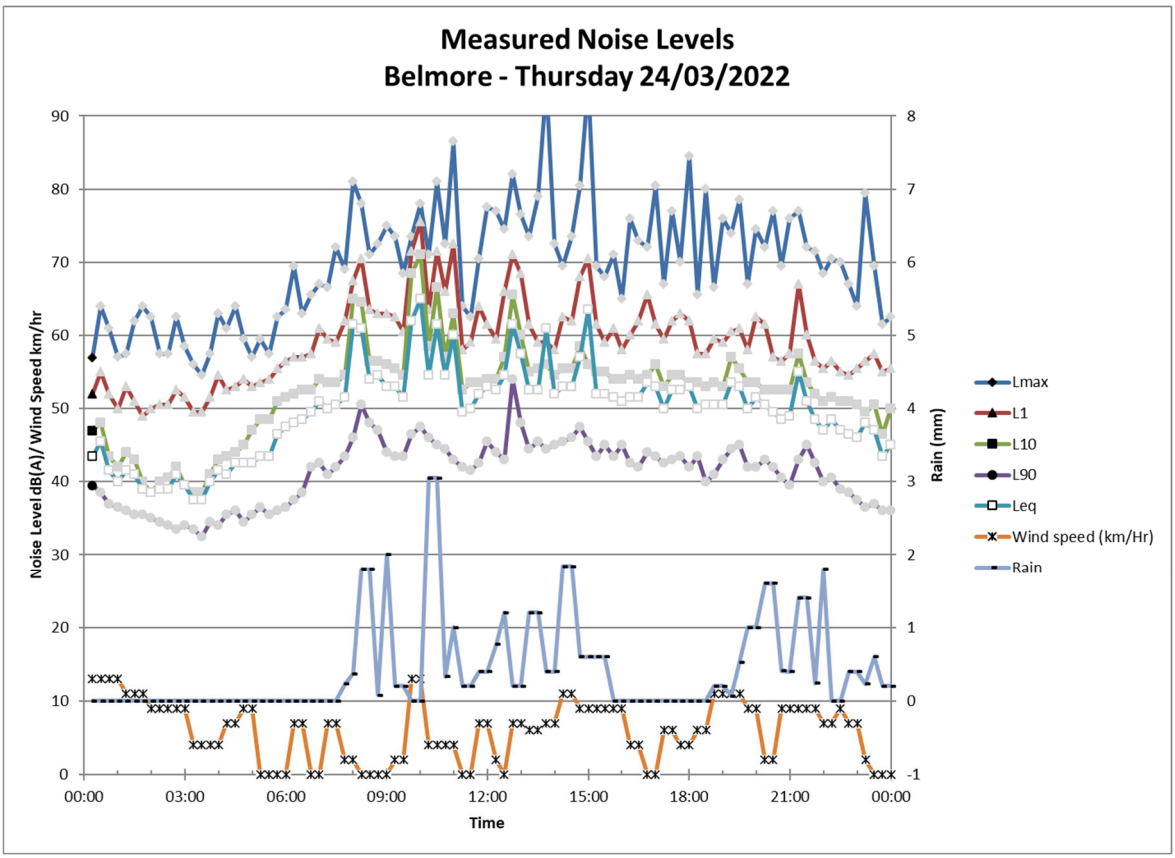
Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

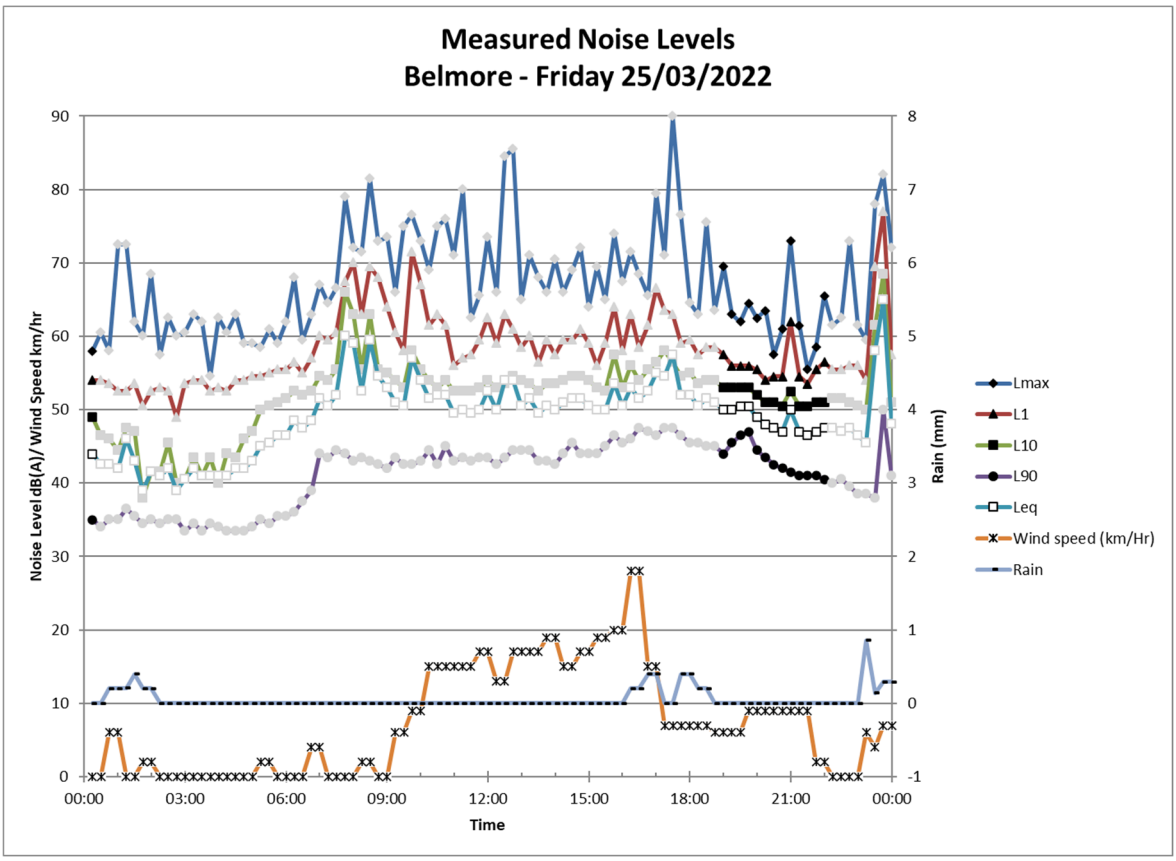
Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

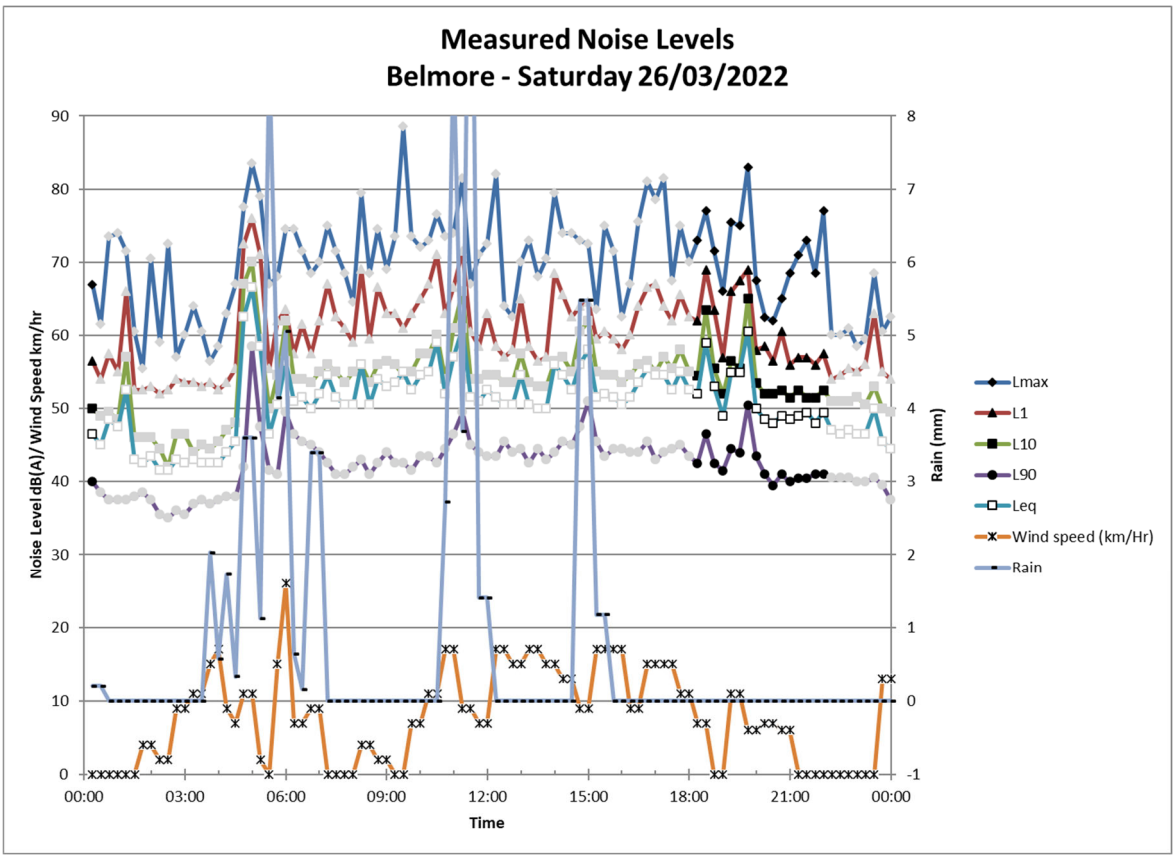

Measured Noise Levels
Belmore - Monday 21/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

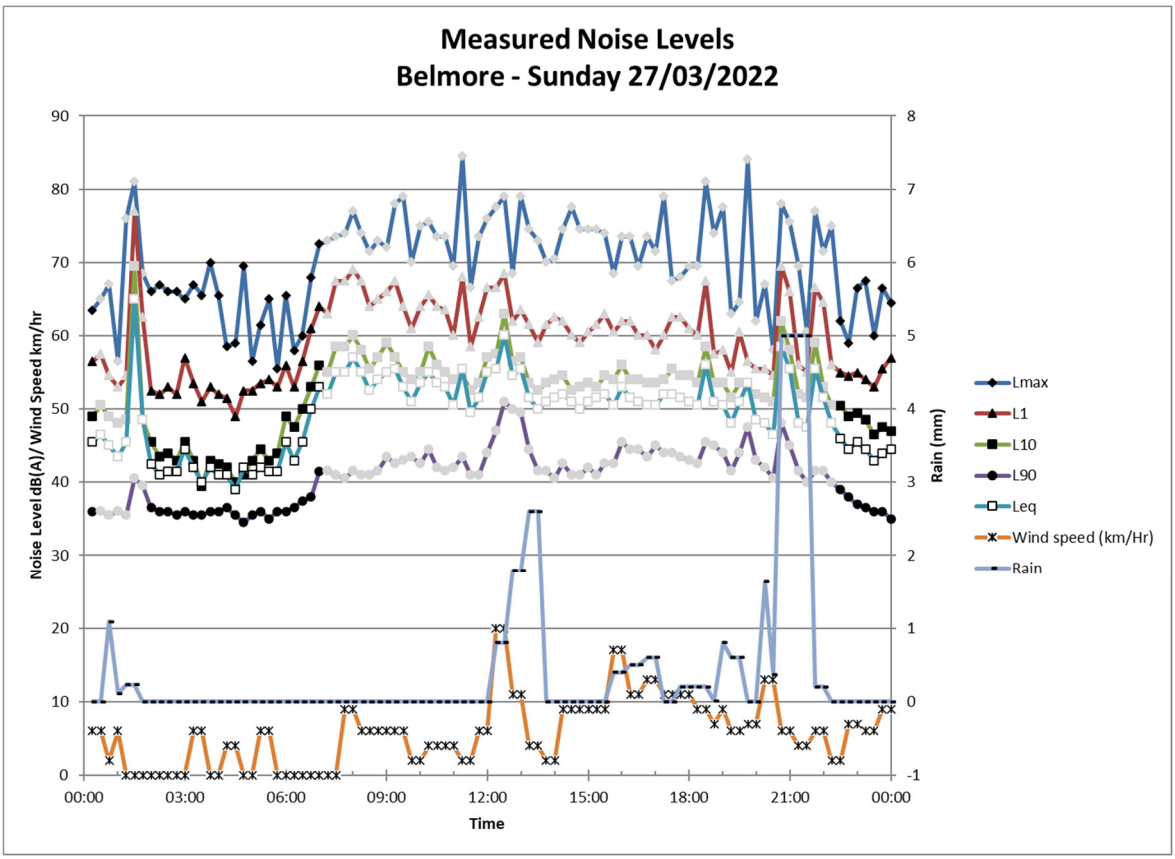

Measured Noise Levels
Belmore - Tuesday 22/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

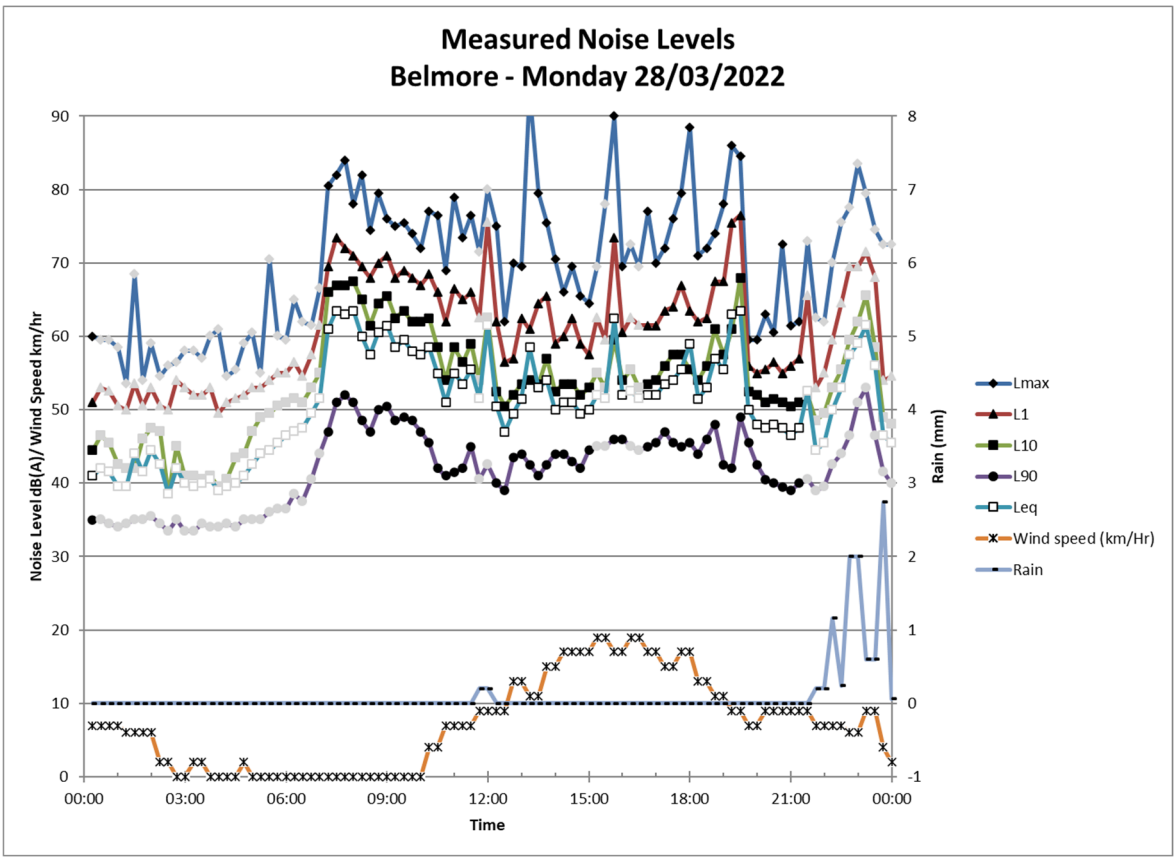

Measured Noise Levels
Belmore - Wednesday 23/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

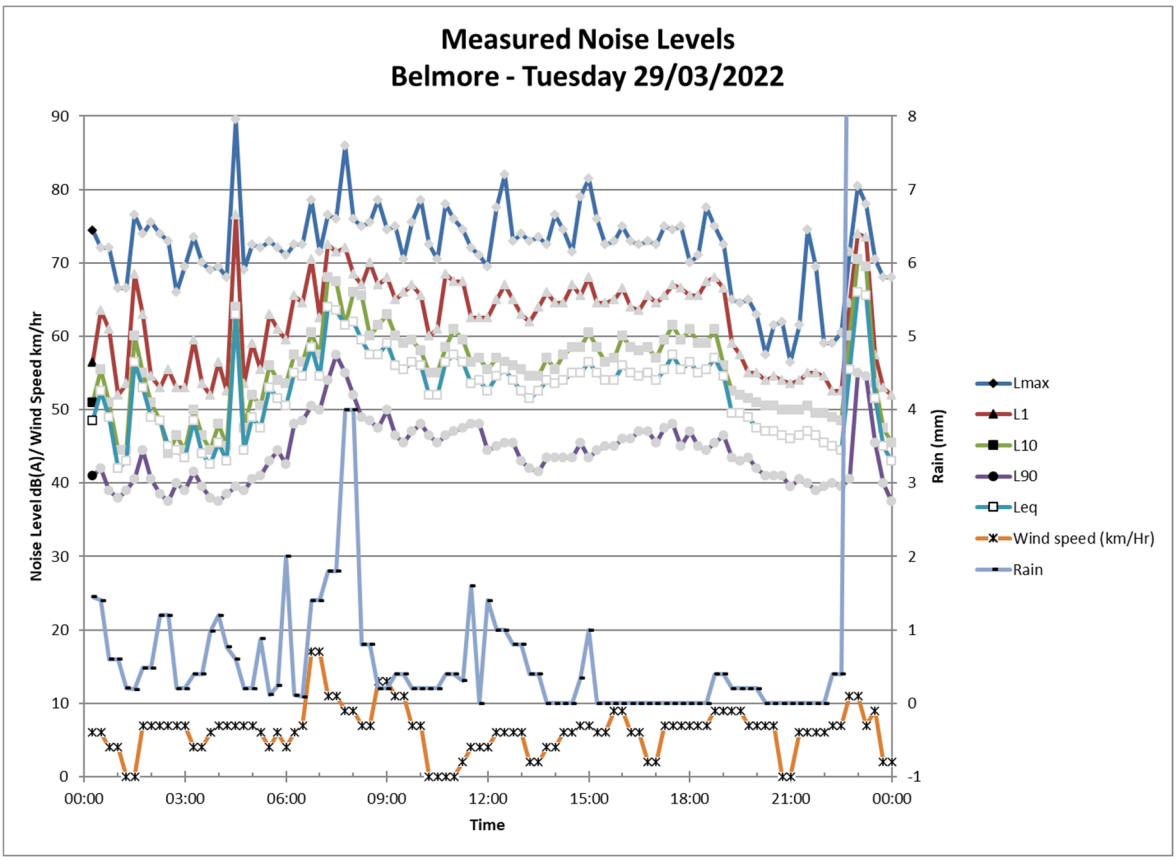

Measured Noise Levels
Belmore - Thursday 24/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

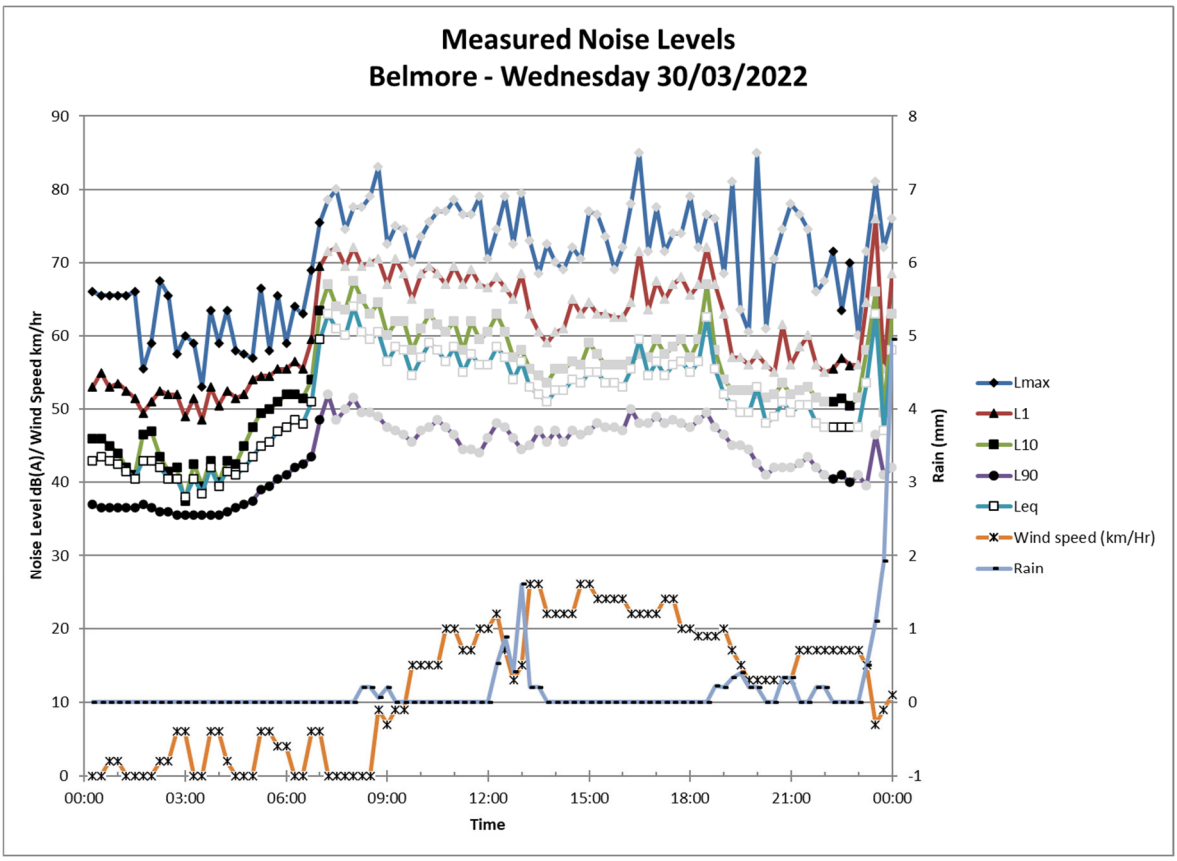

Measured Noise Levels
Belmore - Friday 25/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

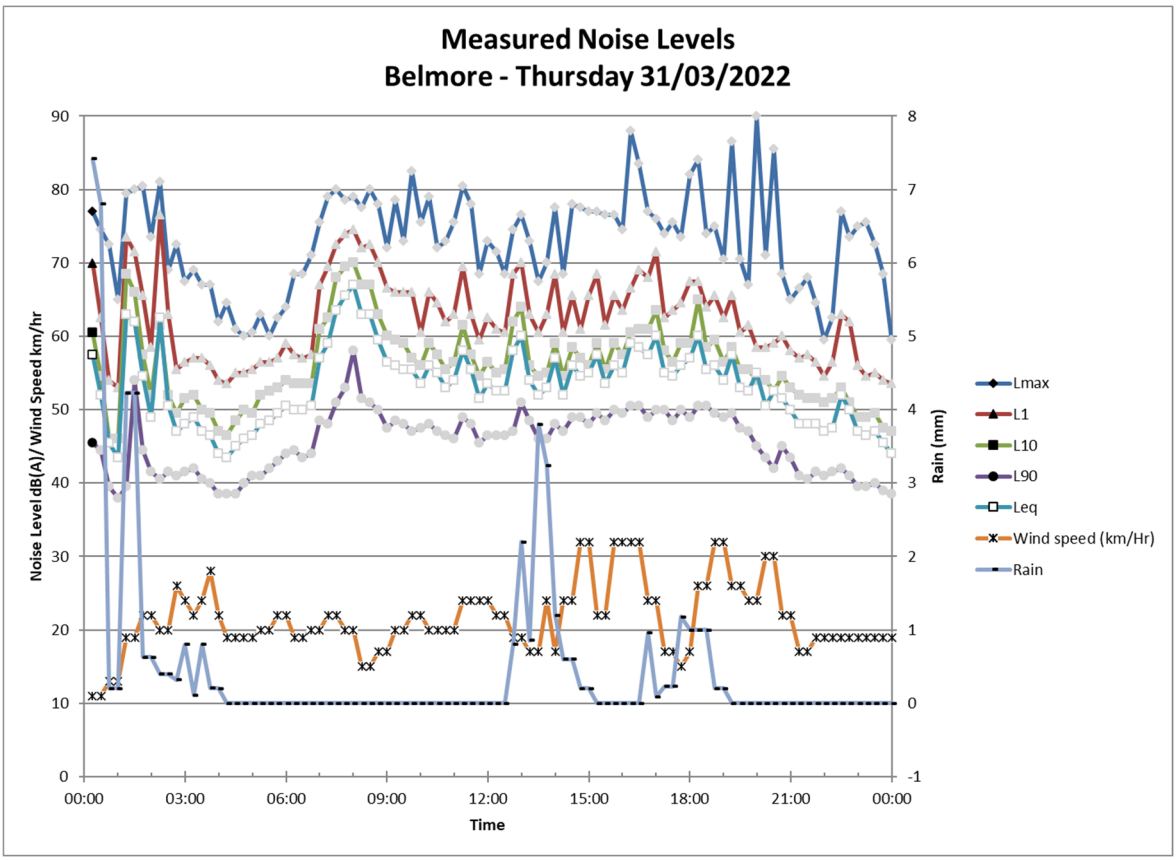

Measured Noise Levels
Belmore - Saturday 26/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

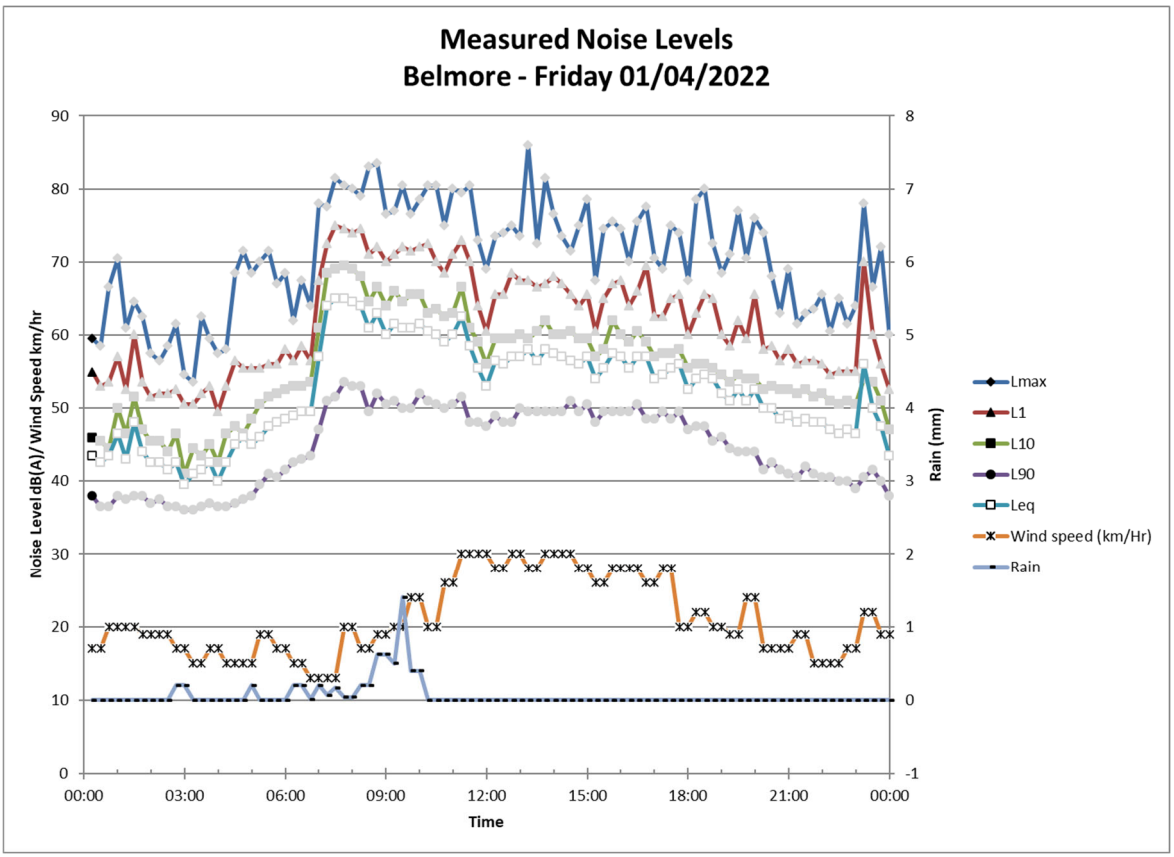

Measured Noise Levels
Belmore - Sunday 27/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

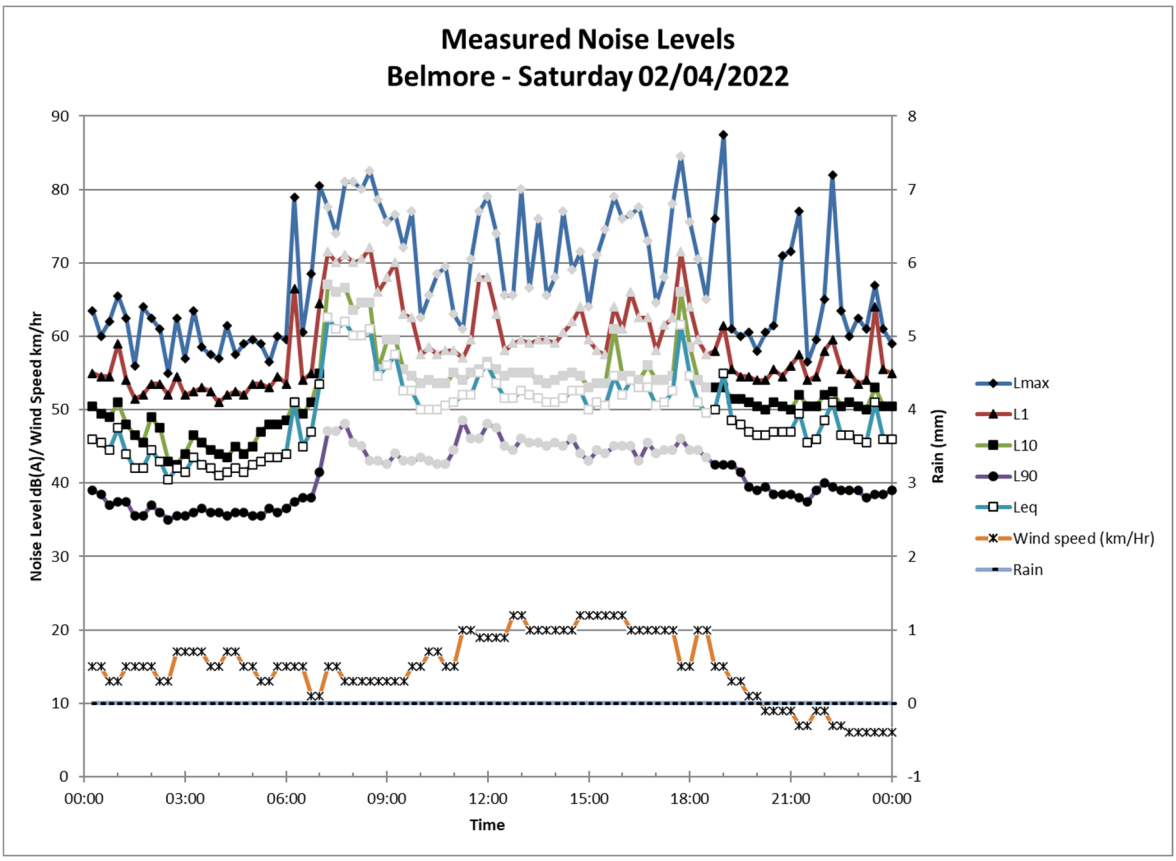

Measured Noise Levels
Belmore - Monday 28/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

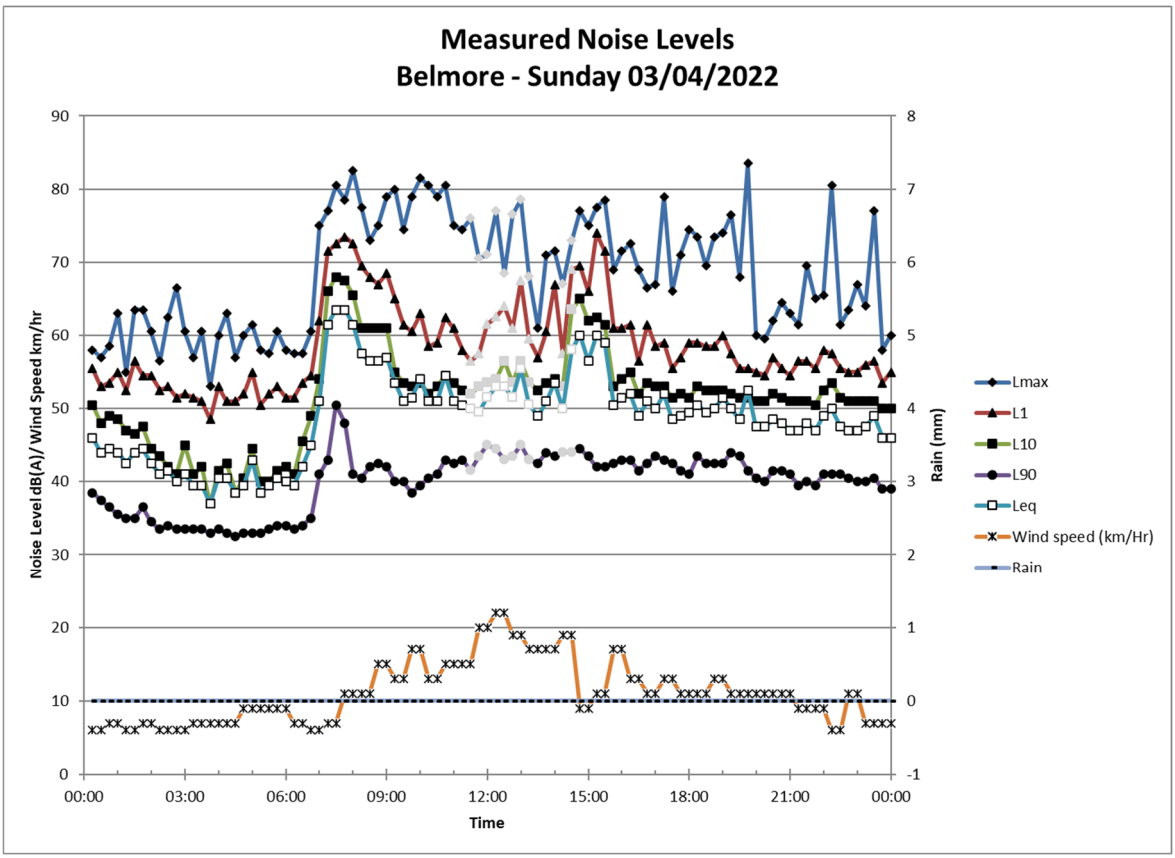

Measured Noise Levels
Belmore - Tuesday 29/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

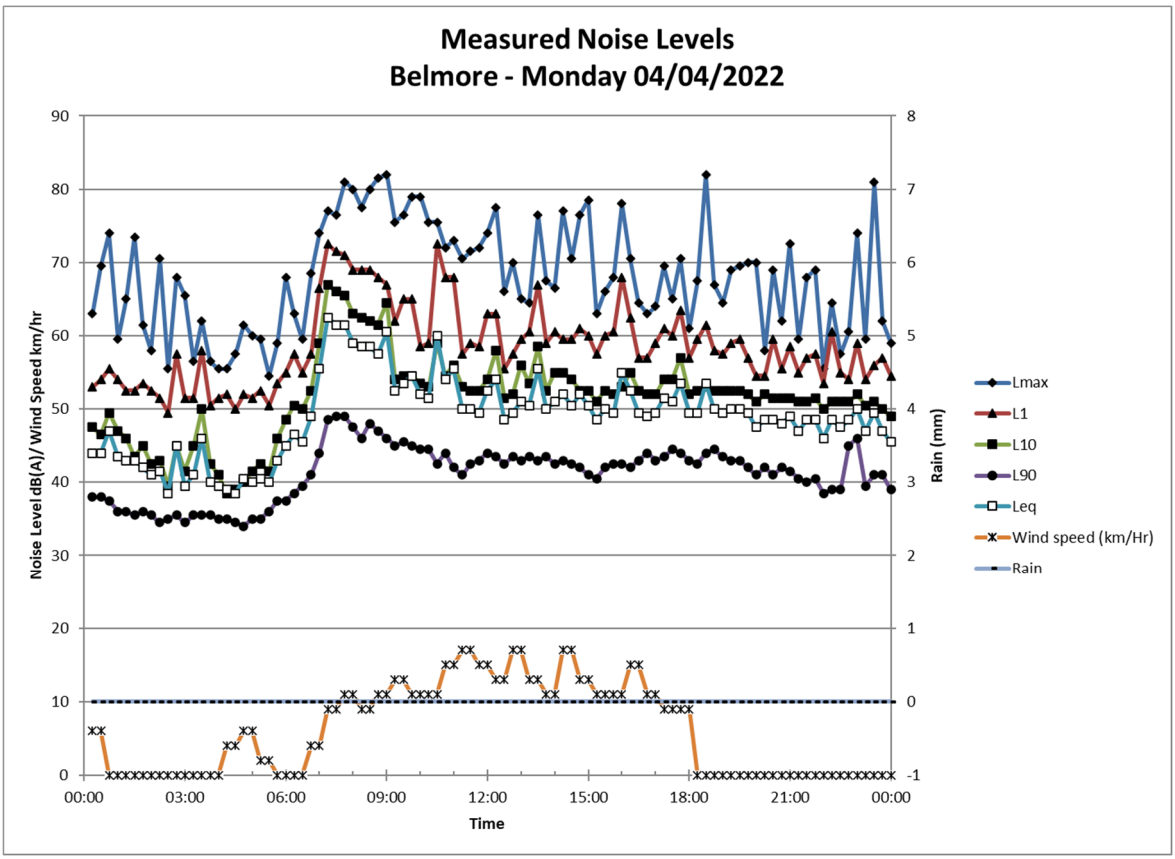

Measured Noise Levels
Belmore - Wednesday 30/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

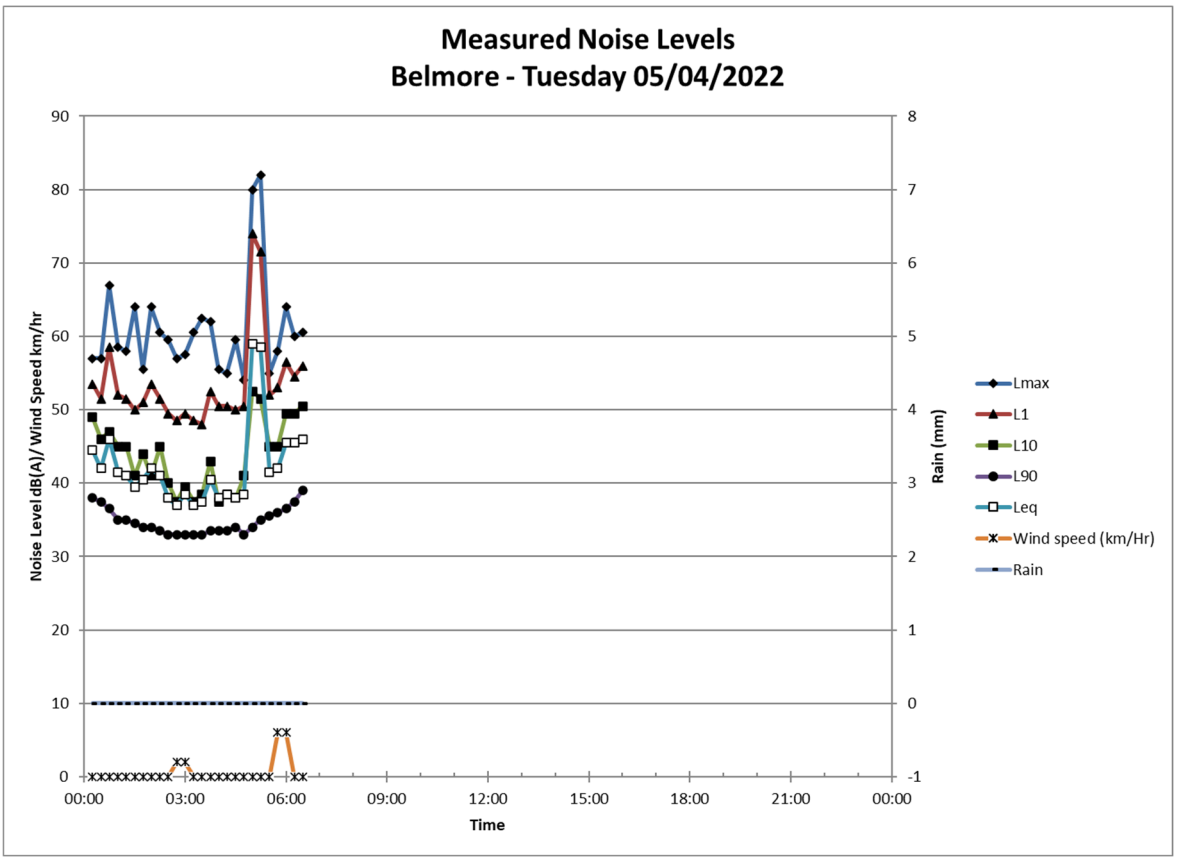

Measured Noise Levels
Belmore - Thursday 31/03/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Belmore - Friday 01/04/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Belmore - Saturday 02/04/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Belmore - Sunday 03/04/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Belmore - Monday 04/04/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Belmore - Tuesday 05/04/2022
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain