

Cox Architecture c/- Bega

National Circularity Centre

DA Noise Assessment

Reference: ARP-AC-REP-001

V4 | 4 October 2024



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1. Introduction

Arup has been engaged by Cox Architecture on behalf of Bega Cheese to assess noise emissions from the proposed National Circularity Centre Bega (the Proposal) in support of the Development Application to Bega Valley Shire Council.

The existing site currently operates a dairy processing facility and the Bega Cheese Heritage Centre and is required to comply with NSW Environment Protection Authority’s (EPA) Environment Protection Licence (EPL) 1511.

1.1 Project description

The site is located along Lagoon Street, Bega. Bega Cheese is currently operating a dairy processing facility (identified in Figure 1) and is proposing a new multi-purpose tourism centre comprising the following:

- Museum
- Restaurant
- Gift shop
- Offices
- Auditorium
- Plant rooms
- Parking spaces including caravan spaces and coach parking spaces.

The Proposal site is presented in Figure 1.

1.2 Hours of operation

It is understood the existing Bega Cheese facility operates at all times.

The proposed hours of operation for the National Circularity Centre is as follows:

- Monday to Sunday: 7am to 10pm.

1.3 Architectural drawings

This noise assessment has been based on the following architectural drawings prepared by Cox Architecture as detailed in Table 1.

Table 1: Architectural drawings (Cox Architecture, Project No. 222111.01)

Drawing number	Revision	Date	Drawing title
DA-1101	2	20/09/2024	Context Plan
DA-1102	2	20/09/2024	Site Plan
DA-2101	2	20/09/2024	Masterplan – Ground Floor Plan
DA-2102	2	20/09/2024	Masterplan – Roof Plan
DA-2110	2	20/09/2024	Ground Floor Plan – Zone A
DA-2111	2	20/09/2024	Ground Floor Plan – Zone B
DA-2112	2	20/09/2024	Ground Floor Plan – Zone C
DA-2114	2	20/09/2024	Roof Plan – Zone B

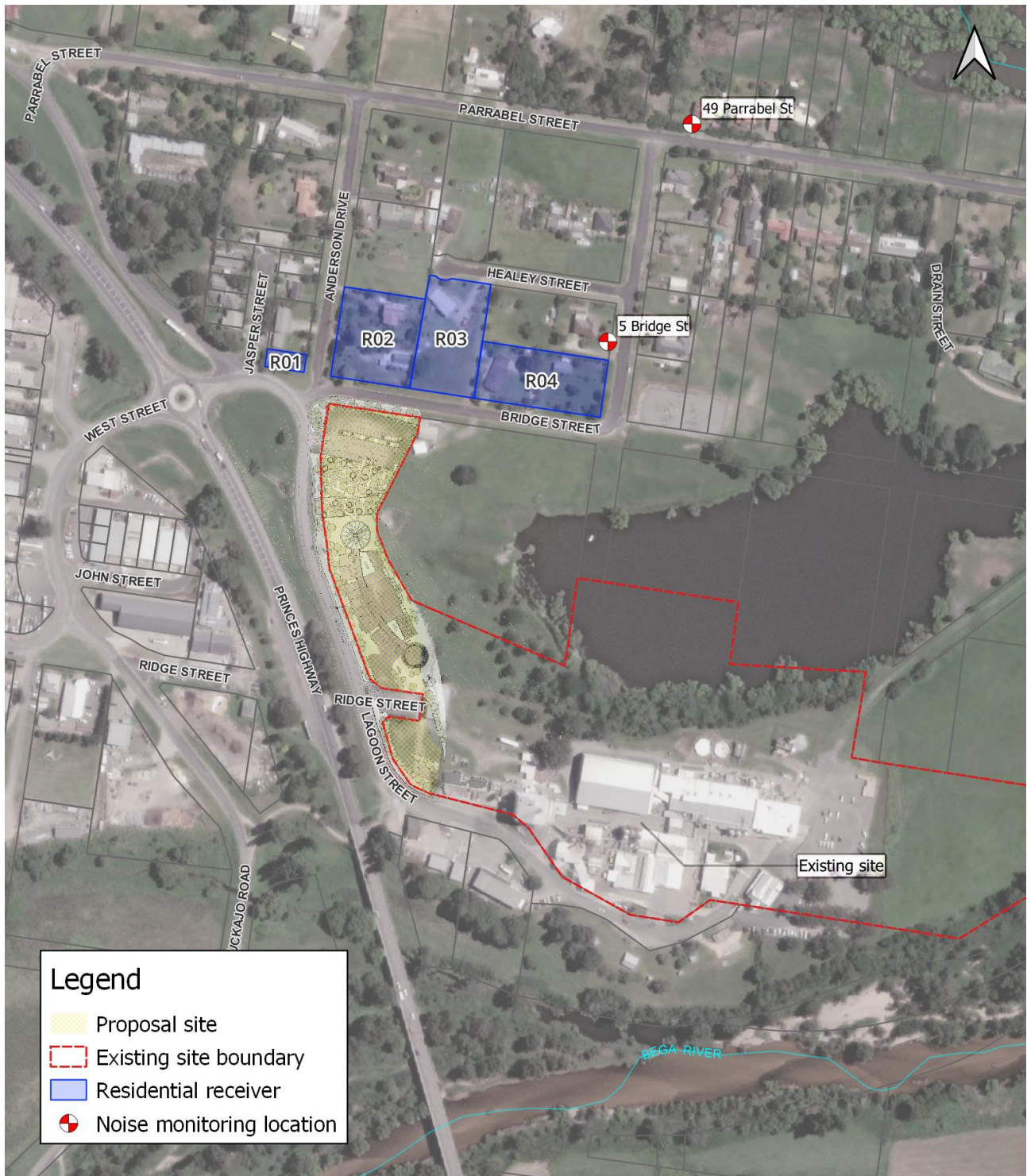


Figure 1: Proposal site and nearest residential receiver locations

2. Existing environment

2.1 Noise sensitive receivers

The nearest residential receivers are identified in Table 2 and presented in Figure 1.

Table 2: Nearest residential receivers

Receiver ID	Address	Description
R01	8 Jasper Street, Bega	Single-storey residential dwelling located northwest of the proposal site.
R02	42-48 Anderson Drive, Bega	Double-storey residential dwelling located north of the proposal site.
R03	2 Healey Street, Bega	Double-storey residential dwelling located north of the proposal site.
R04	7 Bridge Street, Bega	Single-storey residential dwelling located northeast of the proposal site.

2.2 Existing noise levels

As part of the licence conditions under EPL 1511, annual compliance noise monitoring is conducted at the most affected residential properties.

Unattended and attended noise monitoring was conducted as part of the latest noise compliance assessment in March 2023 by Benbow Environmental¹ and is attached in Appendix A. The noise monitoring location at 5 Bridge Street, Bega is representative of the nearest sensitive residential receivers and is presented in Figure 1. Noise monitoring was conducted between 7 and 19 March 2023 and a summary of the long term unattended noise monitoring conducted at 5 Bridge Street has been reproduced in Table 3.

Table 3: Unattended noise monitoring results – 5 Bridge Street, Bega

Measurement descriptor	Measured noise levels - dBA		
	Day	Evening	Night
Average (L _{A1})	59	56	51
Average (L _{A10})	50	51	49
Assessment Background Level (L _{A90})	42	44	45
L _{Aeq}	52	51	49

Notes:

1. Day is 7am to 6pm; Evening is 6pm to 10pm; Night is 10pm to 7am

It was noted that noise contributions included natural sounds (birds), vehicles on Bridge Street and distant road traffic noise from the Princes Highway.

Additional attended noise monitoring was also conducted by Benbow Environmental in the day and night periods on 6 March 2023 at both 5 Bridge Street and 49 Parrabel Street to determine the noise contribution from the existing Bega site. Noise from the site was audible at 5 Bridge Street however it was inaudible at 49 Parrabel Street.

It was noted that constant fan noise from the site was observed at 5 Bridge Street during the day and night however ambient noise levels were also affected by birds, insects, vehicles on Bridge Street and distant traffic on Princes Highway. The noise contribution from the measured existing site noise emissions were

¹ Benbow Environmental, '2023 Noise Compliance Assessment Prepared for Bega Cheese Limited, Bega, NSW', ref. 231018_Rep_Rev1, dated 30 March 2023.

quantified using the measurement results and observations. A summary of the attended noise monitoring results at 5 Bridge Street has been reproduced in Table 4.

Table 4: Attended noise monitoring results – 5 Bridge Street, Bega

Date / Time	Overall, dBA				Comments / noted sound pressure levels, dBA	Site noise contribution, dBA	
	L _{Aeq}	L _{A90}	L _{A10}	L _{A1}		L _{A1}	L _{A10}
Day 6/03/23 5:46pm	49	44	49	60	Site fans <45-49 Site hiss <49 Site clang <49 Car passing ≤65 Distant traffic <48 Birds <47-55	47	45
Night 6/03/23 10:25pm	50	48	52	53	Site fans <46-48 Site clang <51 Insects <46-48 Distant traffic <46 Birds <52	47	45

3. Operational noise assessment

3.1 Existing EPA Environmental Protection Licence

The noise emissions from on-site operations are required to satisfy NSW EPA requirements outlined in the site’s EPL (no. 1511, anniversary date: 1 July). The following conditions apply:

- L3. Noise limits
 - L3.1 Noise from the premises is to be measured at the worst-affected noise-sensitive area in the vicinity of the premises to determine compliance with L3.2 and L3.3
 - L3.2 Noise emissions from the premises must not exceed an LA10 (15 minute) noise emission criterion of 45 dB(A) during the night-time (10pm to 7am), at the most affected residential property.
 - L3.3 Noise emissions form the premises must not exceed an LA1 (15 minute) noise criterion of 53 dB(A).

The criteria stipulated by EPL no. 1511 are summarised in Table 5.

Table 5: EPL no. 1511 noise limits

Time period	Criteria at worst-affected noise-sensitive receiver, dBA	
	LA1 (15min)	LA10 (15min)
Day (7am – 10pm)	53	- ¹
Night (10 pm – 7am)	53	45

Notes:

- 1. LA10 criterion applies to night-time period only

It is noted that the proposed hours of operation for the Proposal is between 7am to 10pm. Therefore, noise emissions from the proposed National Circularity Centre are to be assessed against the daytime LA1 criterion.

3.2 Noise sources

3.2.1 Existing site noise

As discussed in Section 2.2 and presented in Table 4, existing site noise contributions during the daytime period was observed to be as follows:

- Existing site noise contribution at 5 Bridge Street: LA1 47 dBA

3.2.2 Proposed National Circularity Centre noise sources

The main sources of noise identified from the Proposal are from building services plant and traffic noise generated by the operation of the car park.

3.2.2.1 Car parks

The proposed car parks are to be located on the northern and southern sides of the main building, with driveway access to Lagoon Street and Ridge Street. The nearest sensitive receivers are located opposite the north car park across Bridge Street and would be exposed to car park activity noise.

Noise generated by car park activities includes vehicles moving, vehicle doors closing and vehicle engines. Sound power level data from Arup databases and library files were used for the purpose of this assessment and are summarised in Table 6.

Table 6: Sound power levels for car park activities

Car park activity	Sound Power Level, dBA
Vehicle moving (L _{A1})	86
Vehicle door closing (L _{Amax})	87
Vehicle engine (L _{Amax})	92

A traffic and parking impact assessment prepared by McLaren Traffic Engineering and Road Safety Consultants² (referred to herein as the Traffic report) presented an estimation of the anticipated traffic flow generated by the operation of the Proposal. The Traffic report assumed that events held in the auditorium will coincide with peak times of the rest of the Proposal. The Traffic report states that expected peak hourly traffic generation associated with the Proposal is as follows:

- 121 vehicle trips (95 in, 26 out) in the weekday AM peak;
- 121 vehicle trips (26 in, 95 out) in the weekday PM peak; and
- 142 vehicle trips (71 in, 71 out) in the Saturday peak period.

The worst case scenario has been assessed in this assessment (i.e. 142 vehicle trips (71 in, 71 out)). Furthermore, the assessment conservatively assumes that all vehicle movements would occur in the northern car park where the most sensitive receiver is located closest.

3.2.2.2 Mechanical plant noise

At this early stage in the development, the selection and/or location of building service equipment (e.g. mechanical, hydraulic and electrical equipment) for the development has not yet been finalised. During ongoing design of the development, building services equipment will be selected and provided with noise attenuation measures as required to meet the EPL criteria presented in Section 3.1. Nevertheless, general types of noise control measures are presented below and will be considered during the detailed design stage of the project.

Building services equipment and plant associated with the Proposal should be designed to comply with EPL criteria in Section 3.1. The following mitigation measures may apply:

- Selection and specification of maximum sound power levels for all items of plant
- Use of attenuators to control fan noise as required
- Acoustic louvres to control noise from plantroom ventilation openings
- Acoustic screens, barriers or acoustic enclosures around plant, where required
- Incorporation of sound absorptive treatment in plantroom spaces.

3.3 Predicted noise levels

Noise emissions from the cumulative operation of the Proposal and existing dairy processing facility were predicted using spreadsheet distance-based calculations taking into consideration the existing site noise contributions and the proposed car park noise contributions based on the worst case scenario presented in Section 3.2.2.

The predicted noise levels at the nearest sensitive receivers are presented in Table 7.

² McLaren Traffic Engineering & Road Safety Consultants, 'Traffic and Parking Impact Assessment of the Proposed National Circularity Centre at Lot 1 DP1264640, Lagoon Street, Bega' ref. 230456.01DA issue A, dated 4 October 2023

Table 7: Predicted LA1 (15minute) noise levels from the proposed site

Receiver	Receiver Location	Criteria, LA1 (15min) dBA	Predicted noise level, LA1 (15min) dBA
R01	8 Jasper Street, Bega	53	53
R02	42-48 Anderson Drive, Bega	53	53
R03	2 Healey Street, Bega	53	51
R04	7 Bridge Street, Bega	53	52

Results presented in Table 7 indicate that the noise emissions from the Proposal are predicted to comply with the EPL noise limits at the worst affected noise sensitive receivers.

4. Road traffic noise assessment

Noise impacts from the potential increase in traffic on public roads due to the vehicle movements generated by the National Circularity Centre is assessed against the NSW EPA Road Noise Policy (RNP). The RNP presents noise criteria to be applied to particular types of road and land uses.

It is expected that vehicles to/from the Proposal would travel along Lagoon Street and Princes Highway. Lagoon Street is a local road primarily servicing the Bega Cheese site and the Princes Highway is a freeway that is likely to be the dominant noise source in the surrounding area. For existing residences affected by additional traffic generated by land use developments the following road traffic noise criteria would apply:

- Freeway/arterial/sub-arterial roads: Day (7am to 10pm) $L_{Aeq(15\text{hour})}$ 60 dBA (external)
- Local roads: Day (7am to 10pm) $L_{Aeq(1\text{hour})}$ 55 dBA (external)

Furthermore, the RNP states the following regarding increase in traffic noise due to the proposal:

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

Existing traffic volumes on Lagoon Street have been obtained from the Traffic report³ and existing traffic volumes on the Princes Highway have been obtained for the nearest traffic survey location from the Transport for NSW Traffic Volume Viewer website (Station ID 08131). The traffic volumes are presented in Table 8.

Table 8: Existing traffic volumes on Princes Highway, Bega

Road / direction	Peak hour volumes		Average Daily Volume	Posted speed / 85 th percentile speed (km/h)	Heavy vehicle %
	Time	Volume			
Lagoon Street (South of Bridge Street) ¹					
Northbound	AM 11am-12pm	32	439	50 / 44	19
	PM 3pm-4pm	43			
Southbound	AM 11am-12pm	37	436	50 / 42	19
	PM 5pm-6pm	36			
Princes Highway (North of Coopers Gully Road) ²					
Northbound	AM 11am-12pm	152	2081	80 / - ³	9
	PM 6pm-7pm	197			
Southbound	AM 9am-10am	232	2108	80 / - ³	10
	PM 3pm-4pm	155			

Notes:

1. Based on traffic survey undertaken by McLaren Traffic Engineering and Road Safety Consultants in June 2023, as presented in the *Traffic report*³
2. Based on Transport for NSW ‘*Traffic Volume Viewer*’, Station ID 08131, Year 2007
3. No measured speed data available

³ McLaren Traffic Engineering & Road Safety Consultants, ‘*Traffic and Parking Impact Assessment of the Proposed National Circularity Centre at Lot 1 DP1264640, Lagoon Street, Bega*’ ref. 230456.01DA issue A, dated 4 October 2023

As discussed previously in Section 3.2.2.1, the worst case peak hourly traffic generated by the Proposal is 142 vehicle trips (71 in, 71 out).

Based on the existing traffic volumes in Table 8 and predicted future traffic, increases to traffic noise levels from Princes Highway due to traffic generated by the Proposal are predicted to be negligible (< 2dBA). No further assessment is therefore required.

Increase to traffic noise levels from Lagoon Street due to traffic generated by the Proposal are predicted to be up to 3 dBA at receiver location R01 during the peak hour. However, it is important to note that this assessment is based on a worst-case scenario occurring only during peak hours. Additionally, the increase in noise levels resulting from the traffic generated by the operation of the Proposal is expected to be less than 2 dBA for the majority of the time. Furthermore, due to the proximity of the Princes Highway to this receiver, it is anticipated that the noise levels experienced at this receiver are more significantly influenced by traffic noise from the Princes highway than by traffic noise from vehicles travelling on Lagoon Street. No mitigation measures are therefore recommended and no further assessment is warranted.

5. Conclusion

A noise assessment has been conducted for the proposed National Circularity Centre located on Lagoon Street, Bega. Noise criteria have been based on limits stipulated in the existing NSW EPA Environment Protection Licence 1511.

Operational noise impacts from the operation of the proposed National Circularity Centre have been predicted based on existing site noise contributions and car park noise contributions from vehicle trips generated by the proposal. Noise from building services equipment and plant are yet to be finalised at this early stage however they will be selected and designed to comply with EPL criteria during the ongoing design of the Proposal. Further recommendations have been made regarding noise management measures and the ongoing design of building services equipment to minimise noise impacts to the nearest sensitive receivers. The predictions demonstrate that compliance with the EPL can be achieved at the nearest sensitive receiver locations.

Traffic noise levels on public roads due to road traffic generated by the Proposal are predicted to increase by up to 3dB on Lagoon Street at one receiver location however this is expected to occur only during worst case peak hour scenarios. Given the proximity to the Princes Highway, traffic noise from Princes Highway is anticipated to be dominant and no further mitigation has been recommended.

Appendix A

2023 Noise Compliance Assessment Report

File:

231018 Noise Rev1.pdf

Location:

\\global.arup.com\australasia\SYD\Projects\297000\297035-00 National Circularity
Centre\Work\Internal\Design\Acoustics\6 Incoming\2023-10-17 Noise Monitoring Report and operating hrs\

**2023 NOISE COMPLIANCE ASSESSMENT
PREPARED FOR
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EXECUTIVE SUMMARY

Benbow Environmental conducted the 2023 Noise Compliance Assessment for the Bega Cheese Limited sites located at Lagoon Street and Ridge Street, Bega.

The noise emissions from the subject sites have been assessed in order to determine the status of compliance with the noise requirements stipulated in the Environment Protection Licence number 1511.

Attended and unattended noise monitoring was conducted at four residential locations surrounding the Ridge Street and Lagoon Street sites. All noise measurements were undertaken in accordance with the AS 1055.1–1997 *Acoustics – Description and Measurement of Environmental Noise* and the requirements of the NSW EPA Noise Policy for Industry (EPA, 2017).

Detailed results of the unattended and attended noise compliance monitoring were presented. The site contributions observed at 49 Parrabel Street (Location A), 2-12 Parrabel Street (Location C) and 33 Miners Close (Location D) were found to be well below the required noise limits.

5 Bridge Street Bega (Location B) was observed to be the residence most impacted from the site contributions of Bega Cheese. The measurements found that noise levels from the site were higher during the night than during the day. Observations from the attended measurements quantified the L_{A1} levels at 47 dB(A) during the day and 47 dB(A) at night, and the L_{A10} levels at 45 dB(A) at night. Long term unattended noise monitoring was analysed when background noise was the lowest between 11pm and 5am which showed that the L_{A1} levels from the Bega Cheese site complied with the criteria.

This report concludes that compliance with noise criteria was achieved at all locations during both daytime and night time at all the monitoring locations. A comparison of the 2023 investigation with previous studies has been presented in Table A, with proactive recommendations to further reduce noise levels contained in section 5.



Table A: Site Noise Contribution – Comparison with Previous Studies - dB(A)

Date	Descriptor	Period	Criteria	Location A 49 Parrabel St	Location B 5 Bridge St	Location C 2-12 Parrabel St	Location D 33 Miners Cl
2010	L _{A1}	Day	53	< 37	53	< 46	-
	L _{A1}	Night	53	< 36	54	< 42	-
	L _{A10}	Night	45	< 36	49	< 42	-
2011	L _{A1}	Day	53	≤ 45	52	≤ 46	-
	L _{A1}	Night	53	≤ 30	52	≤ 39	-
	L _{A10}	Night	45	≤ 30	49	≤ 39	-
2012	L _{A1}	Day	53	-	≤ 48	-	-
	L _{A1}	Night	53	-	51	-	-
	L _{A10}	Night	45	-	49	-	-
2013	Not Carried Out						
2014	L _{A1}	Day	53	-	51	-	-
	L _{A1}	Night	53	-	47	-	-
	L _{A10}	Night	45	-	47	-	-
2015	L _{A1}	Day	53	37	52	≤ 45	< 40
	L _{A1}	Night	53	37	52	45	< 43
	L _{A10}	Night	45	< 37	49	42	< 40
2016	L _{A1}	Day	53	< 33	48	≤ 45	< 40
	L _{A1}	Night	53	< 33	49-50	≤ 45	< 40
	L _{A10}	Night	45	< 33	≤ 47	≤ 45	< 40
2017	L _{A1}	Day	53	< 35	47	< 40	< 40
	L _{A1}	Night	53	< 35	50	< 38	< 36
	L _{A10}	Night	45	< 35	47	< 38	< 36
2018	L _{A1}	Day	53	< 28	50	< 33	< 32
	L _{A1}	Night	53	< 27	49	< 31	< 50
	L _{A10}	Night	45	< 26	44	< 30	< 32
2019	L _{A1}	Day	53	< 35	49	< 35	< 35
	L _{A1}	Night	53	< 35	49	< 41	< 35
	L _{A10}	Night	45	< 30	45	< 35	< 32
2020	L _{A1}	Day	53	< 35	48	< 35	< 46
	L _{A1}	Night	53	< 35	48	< 39	< 44
	L _{A10}	Night	45	< 30	45	< 34	< 39
2021	L _{A1}	Day	53	< 43	49	< 35	< 47
	L _{A1}	Night	53	< 35	47	< 35	< 38
	L _{A10}	Night	45	< 30	45	< 32	< 37
2022	L _{A1}	Day	53	< 35	44	< 35	< 44
	L _{A1}	Night	53	< 35	49	< 35	< 37
	L _{A10}	Night	45	< 30	45	< 32	< 35
2023	L _{A1}	Day	53	< 35	47	< 48	< 48
	L _{A1}	Night	53	< 30	47	< 39	< 41
	L _{A10}	Night	45	< 30	45	< 37	< 39

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1. INTRODUCTION

Benbow Environmental (BE) was commissioned to undertake the 2023 noise compliance assessment for the Bega Cheese Limited ('Bega') sites located at Lagoon Street and Ridge Street, Bega.

This noise investigation report presents the findings of a detailed noise study carried out in order to determine the status of compliance against the NSW EPA set noise limits as stipulated in the site's Environment Protection Licence (reference No. 1511).

Both long-term unattended and short-term attended noise monitoring were undertaken at several residential locations in the vicinity of the site.

1.1 SCOPE OF WORKS

The scope of the study was limited to the following:

- Undertake unattended noise monitoring utilising environmental noise loggers at three residential locations;
- Undertake attended noise monitoring utilising a sound level meter at four residential locations;
- Measure noise emissions associated with the Bega Cheese operations during day period and night period in order to assess compliance with relevant acoustic criteria;
- Outline the status of compliance against the NSW EPA set noise limits stipulated in the site's Environment Protection Licence (reference No. 1511);
- Outline further general noise control options and recommendations, where required; and
- Provide a report detailing the above findings.

Supporting documentation has been included in the Attachments.

2. NSW EPA ENVIRONMENT PROTECTION LICENCE

The noise emissions from the existing on-site operations are required to satisfy specific NSW EPA requirements, as outlined in the site's Environment Protection Licence (Licence # 1511, Anniversary Date: 01 July). The following conditions apply:

"L3 Noise limits

L3.1 Noise from the premises is to be measured at the worst-affected noise-sensitive area in the vicinity of the premises to determine compliance with L3.2 and L3.3

L3.2 Noise from the premises must not exceed an LA10 (15 minute) noise emission criterion of 45 dB(A) during night-time (10pm to 7am), at the most affected residential property.

L3.3 Noise emissions from the premises must not exceed an LA1 (15 minute) noise criterion of 53 dB(A)."

The L_{A10} noise parameter describes the noise level exceeded for 10% of the sample period. The L_{A1} noise parameter describes the noise level exceeded for 1% of the sample period.

This noise compliance assessment has been undertaken in order to determine compliance with the criteria set out in the Environment Protection Licence.



3. NOISE MONITORING LOCATIONS AND METHODOLOGY

A brief outline of the methodology applied to the measurement of the existing noise levels has been detailed below. Unattended noise monitoring was conducted between 6th March 2023 and 20th March 2023. Attended noise measurements were conducted on 6th and 7th March 2023.

3.1 INSTRUMENTATION AND METHODOLOGY

The 2023 Bega Cheese Compliance assessment utilised unattended and attended noise monitoring equipment to determine compliance with the noise criteria. The attended noise measurements were carried out using a SVANTEK SVAN957 Type 1 Precision Sound Level Meter. Unattended noise monitoring was undertaken by using three ARL environmental noise loggers type Ngara.

The instrument sets were calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets complied with AS IEC 61672.1–2004. The operator attended noise monitoring was undertaken over 15-minute statistical intervals during what was considered to be normal site operating conditions. This procedure therefore, allows for a detailed understanding of site-specific noise characteristics and a meaningful final analysis to determine compliance.

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with an acoustic calibrator B&K SN566912. 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. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in the Attachments. The microphones were fitted with windsocks and were positioned between 1.2 and 1.5 metres above ground level.

Unattended noise monitoring data was filtered excluding the data recorded during the presence of adverse weather conditions, in accordance with the NSW EPA Noise Policy for Industry. Weather data was taken from the Bega AWS ID 069139.

The weather conditions during the day and night period of attended noise measurement were considered to be adequate as minimal wind was present and no rain was observed.

3.2 NOISE MONITORING LOCATIONS

The noise monitoring locations used in the current noise investigation is shown on the map presented in Figure 3-1. A description of the locations and the type of monitoring undertaken is presented Table 3-1.

Only attended monitoring was undertaken at Location A to be consistent with previous compliance assessments. Additionally, the property is minimally affected by noise from the Bega sites therefore long term monitoring is not considered warranted.

Table 3-1: Noise Monitoring Locations

Location ID - Name	Address	Description	Monitoring	
			Short-term	Long-term
Location A (Attended monitoring)	49 Parrabel Street, Bega	This residence is located approximately 480 m north of the Lagoon Street factories. The residences on the northern side of Parrabel Street are shielded from the Lagoon Street site by a ridge located between their properties and the Bega factory. The location provides an indication of the existing ambient noise environment with road traffic noise from Parrabel Street and the Princes Highway as well as the impacts of insects and frogs.	✓	✗
Location B (Unattended monitoring and attended monitoring)	5 Bridge Street, Bega	This residence is located approximately 320 metres to the north of the Lagoon Street factories, and is the most impacted residential receiver from either Bega Cheese site. Background noise contributions are received from vehicles along the Princes Highway and Bridge Street, as well as local birds and insects.	✓	✓
Location C (Unattended monitoring and attended monitoring)	2-12 Parrabel Street, Bega	This receiver is located approximately 580 metres to the north-west of the Lagoon Street site and approximately 440 metres from the Ridge Street site. A ridge shields some noise from the Lagoon Street site, while the location has direct line of sight from the Ridge Street site. This location is closer to the Princes Highway compared to the other locations and is more affected by traffic noise levels.	✓	✓
Location D (Unattended monitoring and attended monitoring)	33 Miners Close, Bega	This residence is located approximately 400 metres north of the Ridge Street site. The receiver has direct line of sight to the Ridge Street site, but also receives significant noise contributions from the Princes Highway, other industrial sites and insects.	✓	✓

Figure 3-1: Aerial View of the Site and Compliance Monitoring Locations



4. NOISE MONITORING RESULTS

This section presents the results of the detailed noise-monitoring program. Relevant comments and observations are also presented in this section. Results of the attended noise monitoring and unattended noise monitoring have been included for each individual monitoring location.

Following discussions with Bega Cheese about their operations programme, unattended and attended noise monitoring was undertaken during two weeks of normal site operations.

Noise levels observed during attended measurements were generally consistent with the values recorded by the environmental noise loggers. The values obtained during the detailed attended noise-monitoring program were the primary reference in the assessment of site compliance with the relevant acoustic criteria.

Several noise sources have been identified during the measurements. Thus, during the attended monitoring period, the site-related noise levels have been observed and reported for this assessment.

Unattended noise monitoring data was filtered excluding the data recorded during the presence of adverse weather conditions, in accordance with the NSW EPA Noise Policy for Industry.

Meteorological data including precipitation and wind speed was obtained from the nearest available Bureau of Meteorology automatic weather station of Bega (AWS ID 069139). This data was considered to be representative of the weather conditions at the noise logger locations, with the weather station being located 500 m south-west of the Ridge Street site. Noise logger data recorded during potentially inclement weather including precipitation and wind speeds greater than 5.5 m/s was excluded from the analysis. The noise logger data taken on 06/03/2023 was excluded from analysis as unattended monitoring was started late in the day with a pre-measurement calibration check of 94 dB(A), which heavily skewed measured noise levels. The daily noise logger graphs have been included in the Attachments section.

Noise compliance measurements utilising attended and unattended data are presented in section 4.1 for the four considered receivers.

4.1 NOISE COMPLIANCE MONITORING RESULTS

Attended noise monitoring has been undertaken at Location A at 49 Parrabel Street, Bega.

4.1.1 Location A – 49 Parrabel Street, Bega

4.1.1.1 Short-Term Attended Noise Monitoring Results

The short term operator attended noise monitoring was carried out during the day and night time periods.

Results of the short term operator attended noise monitoring are presented in Table 4-1. Meteorological conditions were observed to be satisfactory during the attended measurements.

Table 4-1: Operator Attended Noise Measurements, dB(A) – Location A

Date/Time	L _{Aeq}	L _{A90}	L _{A10}	L _{A1}	Comments	Site Noise Contribution		Criteria	
						L _{A1}	L _{A10}	L _{A1}	L _{A10}
Day Time 06/03/2023 17:08pm	53	31	43	53	Site Noise Inaudible L_{A1} < 35 dB(A) L_{A10} < 35 dB(A) Car passing ≤ 62-78 dB(A) Birds ≤ 39-57 dB(A) Distant traffic ≤ 37 dB(A)	< 35✓	< 35	53	–
Night Time 06/03/2023 23:11pm	57	39	42	58	Site Noise Inaudible L_{A1} < 30 dB(A) L_{A10} < 30 dB(A) Truck passing < 85 dB(A) Birds ≤ 44 dB(A) Insects < 41-42 dB(A) Clang from house < 47 dB(A)	< 30✓	< 30✓	53	45

Comments:

At Location A on Parrabel Street, the noise emissions from the Bega Cheese Lagoon Street site were inaudible during the day time and night time. During the day the background noise was dominated by surrounding birds, cars passing and distant traffic. During the night period, the background and L_{Aeq} noise levels were further reduced, but the site was still inaudible throughout the measurement period. The background noise was dominated by constant bird and insect noise. The high L_{Aeq} and L₁ can be attributed to a truck passing right by the logger towards the end of the measurement. The noise levels observed from the Bega Cheese site were determined to be well below the noise criteria.

4.1.2 Location B – 5 Bridge Street, Bega

The 5 Bridge Street residence has been observed to be the location most exposed to noise from the Bega Cheese site. The residence has direct line of site with the Lagoon Street site, as shown in Figure 4-1.

Figure 4-1: Location B – Monitoring location photograph in direction of Lagoon Street Site



4.1.2.1 Unattended Noise Monitoring Results – Location B

Table 4-2: Measured Noise Levels – Unattended Noise Monitoring – Location B – dB(A)

Date	Average (L _{A1})			Average (L _{A10})			ABL (L _{A90})			L _{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
7/03/2023	59	56	52	51	51	50	41	47	46	52	51	49
8/03/2023	61	-	51	53	-	48	43	-	44	54	-	48
9/03/2023	60	56	50	51	51	47	43	45	43	52	51	46
10/03/2023	63	57	50	53	50	47	43	44	43	57	50	47
11/03/2023	60	57	51	50	50	48	43	43	44	51	51	48
12/03/2023	58	54	50	49	50	49	41	46	43	49	51	48
13/03/2023	-	54	52	-	51	49	-	47	45	-	50	49
14/03/2023	-	57	-	-	52	-	-	41	-	-	52	-
15/03/2023	58	56	51	49	51	49	43	42	45	49	50	49
16/03/2023	58	57	53	50	51	51	43	43	46	50	52	51
17/03/2023	59	54	52	50	49	49	43	43	45	50	49	49
18/03/2023	57	53	51	46	49	49	39	42	45	49	49	48
19/03/2023	57	-	52	49	-	49	40	-	45	51	-	50
Average	59	56	51	50	51	49	*	*	*	*	*	*
Median	*	*	*	*	*	*	42	44	45	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	52	51	49

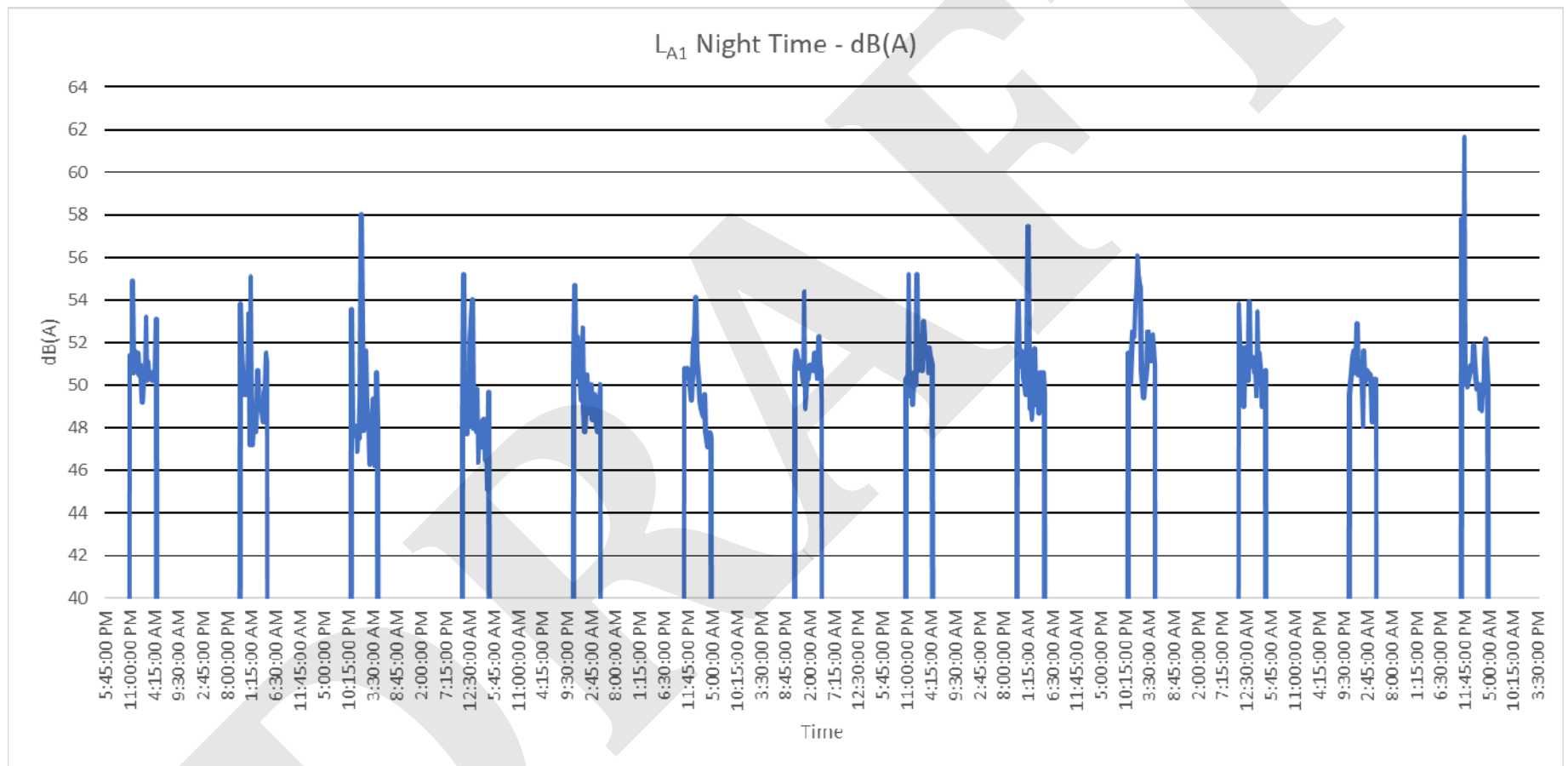
Note: - indicates values that has not been considered due to adverse weather conditions
* Indicates values that are not relevant to that noise descriptor

The L_{A1} , L_{A10} , L_{A90} and L_{Aeq} long term unattended noise monitoring results at location B are shown in Table 4-2. The presented noise levels include contributions from all sources, with the L_{A1} and L_{A10} noise levels influenced in particular by birds, vehicles on Bridge Street and distant road traffic from the Princes Highway. While some unattended L_{A1} periods are impacted by passing cars on Bridge Street, trucks accelerating on the Princes Highway and aircraft, it was observed that the unattended L_{A1} levels were less impacted from outside sources than the unattended L_{A10} noise levels at night, and thus the unattended L_{A1} levels have been analysed in Figure 4-2 in more detail.

Unattended L_{A1} noise levels between 10pm and 11pm and from 5am onwards were found to be significantly affected by road traffic noise, from Bridge Street and the Princes Highway. Therefore, these periods have been excluded from the measurements in Figure 4-2 as they do not provide representative noise data from the site.

A graph showing the unattended L_{A1} noise levels monitored during the night time is presented in Figure 4-2.

Figure 4-2: Logger B - Night Time Unattended L_{A1} Noise Levels – dB(A)



The presented unattended L_{A1} noise levels in Figure 4-2 include all noise sources at 5 Bridge Street: noise from the site, as well as extraneous noise sources such as cars on Bridge Street and trucks from the Princes Highway. Therefore, while the unattended L_{A1} results above can be used as an indication of the noise emissions from the site, it is likely that noise from the site alone would achieve an even higher level of compliance with the L_{A1} criteria.

Analysis of the results of Figure 4-2 shows that excluding weather impacts, the total unattended L_{A1} noise levels from all noise sources showed four instances of clearly exceeding the criteria of 53 dB(A) and multiple exceedances slightly over the criteria. The audio from these 15 minute periods taken over the two week night measurements was listened to, with the causes of clear exceedances shown in Table 4-3.

It is shown that in Table 4-3 that the exceedances of the unattended L_{A1} noise levels was due to vehicles on Bridge Street, trucks on the Princes Highway, aircraft and constant noise from insects. No exceedances of the L_{A1} criteria were observed due to site noise from Bega Cheese throughout the period of unattended monitoring.

Table 4-3: Selected Recorded L_{A1} Noise Levels at 5 Bridge Street

Date	Period	Description	Exceedance not associated with site
9/03/2023	1:15 – 1:30	Vehicles passing by	✓
15/03/2023	1:15 – 1:30	Vehicles passing by	✓
16/03/2023	1:00 – 1:15	Constant insect noise	✓
18/03/2023	23:00 - 23:15	Truck passing by	✓
18/03/2023	23:45 - 0:00	Airplane	✓

4.1.2.2 Attended Noise Monitoring Results – Location B

The short term operator attended noise monitoring was carried out during the day and night time periods at Location B. Results of the short term operator attended noise monitoring are presented in Table 4-4.

Table 4-4: Measured Noise Levels – Attended Noise Monitoring – Location B – dB(A)

Date/ Time	L _{Aeq}	L _{A90}	L _{A10}	L _{A1}	Comments (Sound Pressure Levels)	Site Noise Contribution		Criteria	
						L _{A1}	L _{A10}	L _{A1}	L _{A10}
Daytime 06/03/2023 17:46pm	49	44	49	60	Site Noise Contribution L_{A1} = 47 dB(A) L_{A10} = 45 dB(A) Site Fans <45-49 dB(A) Site Hiss <49 dB(A) Site Clang <49 dB(A) Car passing ≤ 65 dB(A) Distant traffic <48db(A) Birds <47-55 dB(A)	47✓	45	53	–
Night time 06/03/2023 22:25pm	50	48	52	53	Site Noise Contribution L_{A1} = 47 dB(A) L_{A10} = 45 dB(A) Site Fans <46 -48 dB(A) Insects <46-48 dB(A) Distant traffic <46 dB(A) Bird < 52 dB(A) Site clang <51 dB(A)	47✓	45✓	53	45

Note: – indicates not applicable



Comments:

At the most noise affected resident, 5 Bridge Street Bega (Location B), the noise emissions from the Lagoon Street site were audible during the day and night periods.

During the day period, the noise levels were dominated by bird noise and constant distant traffic on Princes Highway. Surrounding noise also included a few cars passing by on Bridge Street. There were only a couple of audible impulse noises from the Lagoon Street site which were much quieter due to the elevated background noise than at night.

During the night period, the noise influence from road traffic was reduced, however insect noise was a consistent background noise source at the mid to high frequencies. There was also bird noise and several impulse noises from the site and other industrial sources.

The influence of noise sources at the measurement point such as Princes Highway and Bridge Street road traffic, birds, insects and dogs mean that observations from the attended measurements, and not just measured numbers, become important in determining compliance.

During the day period, a constant noise from on site fans is present, approximately 45-49 dB(A). Additional observed noise impacts from the site were minimal, masked by the higher ambient noise levels during the day period. Taking into account the impact of background traffic and the ambient birds and local vehicles, the day contribution from the Lagoon Street site was observed to be $L_{A1} = 47$ dB(A), $L_{A10} = 45$ dB(A).

Site noise during the night period was similar in nature to the day period however fan noise was observed to be slightly louder. Due to the lower traffic noise levels and the reduction in ambient sources such as birds and cars along Bridge Street, the noise contribution from the site was easier to quantify. Noise from the outlets and pumps appeared to be constant between 46–48 dB(A). Accounting for the impact of insects and background sources, the night-time contribution from the Lagoon Street site was observed to be $L_{A1} = 47$ dB(A), $L_{A10} = 45$ dB(A).

The L_{A1} levels from the site during the day and night periods were observed to be well below the 53 dB(A) criteria. The L_{A10} noise levels were observed to be at the 45 dB(A) criteria.

Long term noise monitoring was also carried out at 5 Bridge Street, as outlined in section 4.1.2.1. Based on the analysis of the long term noise monitoring data, between 11pm and 5am, the night-time L_{A1} noise levels from site were found to comply with the L_{A1} noise criteria during all 15 minute periods over the two weeks.

4.1.3 Location C – 2-12 Parrabel Street, Bega

Figure 4-3: Location C – Monitoring location photograph in direction of Ridge Street Site



4.1.3.1 Unattended Noise Monitoring Results – Location C

Table 4-5: Measured Noise Levels – Unattended Noise Monitoring – Location C – dB(A)

Date	Average (L _{A1})			Average (L _{A10})			ABL (L _{A90})			L _{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
7/03/2023	62	57	55	55	51	51	40	42	37	53	49	49
8/03/2023	61	-	55	54	-	46	40	-	33	52	-	47
9/03/2023	60	59	54	54	52	49	40	40	33	52	50	48
10/03/2023	60	58	56	53	52	46	39	39	32	52	49	47
11/03/2023	59	57	55	52	51	48	39	36	38	51	50	47
12/03/2023	58	55	53	52	49	49	37	37	38	49	47	48
13/03/2023	-	56	55	-	51	47	-	41	37	-	50	48
14/03/2023	-	56	-	-	50	-	-	37	-	-	47	-
15/03/2023	60	58	53	53	51	45	40	39	35	51	49	45
16/03/2023	60	57	53	53	51	45	41	40	36	51	48	46
17/03/2023	61	57	53	54	50	45	40	35	34	52	47	47
18/03/2023	57	53	51	46	49	49	39	42	45	49	49	48
Average	60	57	54	53	51	47	*	*	*	*	*	*
Median	*	*	*	*	*	*	40	39	36	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	52	49	47

Note: - indicates values that has not been considered due to adverse weather conditions

* Indicates values that are not relevant to that noise descriptor

4.1.3.2 Attended Noise Monitoring Results – Location C

The short term operator attended noise monitoring was carried out during the day and night time periods at Location C. Results of the short term operator attended noise monitoring are presented in Table 4-6.

Table 4-6: Measured Noise Levels – Attended Noise Monitoring – Location C – dB(A)

Date/ Time	L _{Aeq}	L _{A90}	L _{A10}	L _{A1}	Comments (Sound Pressure Levels)	Site Noise Contribution		Criteria	
						L _{A1}	L _{A10}	L _{A1}	L _{A10}
Daytime 07/03/2023 08:38am	55	47	57	64	Site Noise mostly inaudible L_{A1} < 48 dB(A) L_{A10} < 46 dB(A) Site hum <48-49 dB(A) Site hiss <48 dB(A) Site equipment <48 dB(A) Site forklift horn <46 dB(A) Bird chirps <57-63 dB(A) Kookaburras < 70 dB(A) Bus passing <70 dB(A) Car passing <55-60 dB(A) Tractor <66 dB(A) Truck <59 dB(A) Traffic on Princes Highway passing <56 dB(A)	< 48✓	< 46	53	-
Night time 06/03/2023 22:48pm	43	41	45	48	Site Noise Contribution L_{A1} < 39 dB(A) L_{A10} < 37 dB(A) Constant insect noise <39-40 dB(A) Loud insects <56 dB(A) Site fans <39-41 dB(A) Intermittent clang from house <42 dB(A) Van on Princes Highway ≤ 52 dB(A) Birds ≤ 45 dB(A) Truck passing on Princes Highway < 64 dB(A)	< 39✓	< 37✓	53	45

Note: - indicates not applicable

Comments:

At the 2-12 Parrabel Street monitoring location the noise emissions from the Bega Cheese Lagoon Street and Ridge Street sites were audible during the day period. A high background noise level from Princes Highway and nearby industrial sites (not Bega Cheese) on the western side of the Princes Highway was observed with occasional noise from the site.

During the night period, unattended monitoring observed exceedances of the 53 dB(A) criteria. The audio from these 15 minute periods taken were listened to and the noise was attributed to trucks, site noise and intermittent clanging coming from another nearby industrial site. Road



traffic noise levels were much lower, while insect noise was also more prevalent. During lower background noise, noise levels were barely audible from the Ridge Street Bega Cheese site.

The noise levels associated with the site's operations comply with the noise limits during both daytime and night time at 2-12 Parrabel Street.

DRAFT

4.1.4 Location D – 33 Miners Close, Bega

The 33 Miners Close residence was primarily exposed to noise from the Ridge Street site, however distant contributions can be obtained from the Lagoon Street site during periods of low background noise levels. The site noise was mostly inaudible with the occasional truck engine and horn sounds.

Figure 4-4: Location D – Monitoring location photograph in direction of Ridge Street Site



4.1.4.1 Unattended Noise Monitoring Results – Location D

Table 4-7 displays the long term unattended noise monitoring results for Location D on Miners Close.

Table 4-7: Measured Noise Levels – Unattended Noise Monitoring – Location D – dB(A)

Date	Average (L _{A1})			Average (L _{A10})			ABL (L _{A90})			L _{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
7/03/2023	62	54	49	55	48	44	40	43	38	59	47	46
8/03/2023	59	-	51	52	-	44	41	-	32	53	-	44
9/03/2023	57	53	48	50	49	40	40	39	30	51	47	40
10/03/2023	58	54	49	52	50	43	41	43	31	51	48	43
11/03/2023	56	51	49	49	47	43	39	40	33	49	45	42
12/03/2023	54	50	47	48	46	43	37	41	34	46	45	42
13/03/2023	-	52	48	-	47	44	-	41	37	-	46	44
14/03/2023	-	53	-	-	49	-	-	41	-	-	47	-
15/03/2023	56	52	48	50	47	44	40	40	37	48	46	43
16/03/2023	56	54	48	51	49	45	42	43	38	49	47	44
17/03/2023	56	52	49	51	48	43	41	39	36	49	46	43
18/03/2023	55	53	49	49	49	44	37	41	36	48	48	45
Average	57	53	49	51	48	43	*	*	*	*	*	*
Median	*	*	*	*	*	*	40	41	36	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	52	47	43

Note: - indicates values that has not been considered due to adverse weather conditions

* Indicates values that are not relevant to that noise descriptor

4.1.4.2 Attended Noise Monitoring Results – Location D

The short term operator attended noise monitoring was carried out during the day and night time periods at Location D. Results of the short term operator attended noise monitoring are presented in Table 4-8.

Table 4-8: Measured Noise Levels – Attended Noise Monitoring – Location D – dB(A)

Date/ Time	L _{Aeq}	L _{A90}	L _{A10}	L _{A1}	Comments (Sound Pressure Levels)	Site Noise Contribution		Criteria	
						L _{A1}	L _{A10}	L _{A1}	L _{A10}
Daytime 07/03/2023 08:10am	51	44	52	60	Site Noise Contribution L_{A1} ≤ 48 dB(A) L_{A10} ≤ 46 dB(A) Princes Highway traffic ≤ 54 dB(A) Birds ≤ 56-74 dB(A) Site hum <43-44 dB(A) Site hiss <43-44 dB(A) Site forklifts <45 dB(A) Site clang <52 dB(A)	≤ 48 ✓	≤ 46	53	-
Night time 06/03/2023 22:01pm	43	41	45	48	Site Noise Contribution L_{A1} < 41 dB(A) L_{A10} < 39 dB(A) Distant traffic < 47 dB(A) Truck <54 dB(A) Insects <42-43 dB(A) Site equipment <36 dB(A) Site engine <43 dB(A) Forklift horn <37 dB(A)	< 41 ✓	< 39 ✓	53	45

Note: - indicates not applicable

Comments:

At 33 Miners Close, noise emissions from the Ridge Street were barely audible and noise emissions from the Lagoon Street site were not audible during the day, and barely audible at night with the lower background noise levels. During the day time, the observed noise levels were dominated by road traffic from the Princes Highway and noise from other industrial sites.

A very distant hum and audible site fans were observed potentially coming from the Lagoon Street site on occasion when background noise levels were low. There was a constant noise from birds, frequent vehicles on Princes Highway as well as constant distant traffic. The observed noise levels from the two sites were well below the noise criteria at the Miners Close receiver.

4.2 SUMMARY OF NOISE MONITORING RESULTS

A summary of the observed attended noise levels from the Bega factory sites is included in Table 4-9 below. Full compliance with the day and night criteria is shown at all considered receivers.

Table 4-9: Attended Data Summary Based on Site Noise Contribution – dB(A)

Location	Site Noise Contribution			Criteria			Exceedance
	Day	Night		Day	Night		
	L _{A1}	L _{A1}	L _{A10}	L _{A1}	L _{A1}	L _{A10}	
Location A – 49 Parrabel Street Bega	< 35 ✓	< 30 ✓	< 30 ✓	53	53	45	–
Location B – 5 Bridge Street Bega	47 ✓	47 ✓	45 ✓	53	53	45	–
Location C – 2-12 Parrabel Street Bega	< 48 ✓	< 39 ✓	< 37 ✓	53	53	45	–
Location D – 33 Miners Close Bega	< 48 ✓	< 41 ✓	< 39 ✓	53	53	45	–

Notes: ✓ Compliance
✗ Non Compliance



5. RECOMMENDATIONS

This report concludes that the Bega Cheese factories at Ridge Street and Lagoon Street are in compliance with the criteria set out in the Environment Protection Licence number 1511.

It is recommended that in the event of a complaint, a noise compliance investigation be undertaken.

No further noise mitigation measures are required to comply with the site criteria. However, if Bega Cheese wishes to further reduce noise levels at residential receivers, additional shielding could be provided with a well-designed noise wall or earth berm around the pumps, noise levels may be able to be reduced at surrounding receivers.



6. CONCLUSIONS

This report presents the findings of the detailed environmental noise compliance study undertaken for the Bega Cheese Limited sites at Lagoon Street and Ridge Street, Bega.

The scope of the works was to assess the noise emissions from the subject sites and determine compliance with the Environment Protection Licence number 1511.

This investigation included unattended noise monitoring at three (3) residential locations and attended noise monitoring at four (4) residential locations. Noise measurements were conducted in accordance with AS 1055.1–1997 *Acoustics – Description and Measurement of Environmental Noise* and the NSW Noise Policy for Industry (EPA, 2017).

5 Bridge Street Bega (Location B) was observed to be the most impacted residential receiver from either Bega Cheese site. This investigation at Location B quantified the L_{A1} levels at 47 dB(A) during the day and 47 dB(A) at night, and the L_{A10} levels at 45 dB(A) at night. Long term unattended noise monitoring was analysed when background noise was the lowest between 11pm and 5am which showed that the L_{A1} levels from the Bega Cheese site complied with criteria at all time periods not impacted by weather.

The Bega Cheese site contributions observed at 49 Parrabel Street (Location A), 2-12 Parrabel Street (Location C) and 33 Miners Close (Location D) were found to be well below the required noise limits.

Compliance with the noise criteria was therefore achieved at all locations during daytime and night time attended and unattended measurements.

This concludes the 2023 noise compliance assessment for the Bega Cheese Limited sites.

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7. 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 Bega Cheese Limited, as per our agreement for providing environmental services. Only Bega Cheese Limited 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 Bega Cheese Limited 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

Attachment 1: 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.

DECIBEL

The decibel (dB) 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

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 L_{Aeq} 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.

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.

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.

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.

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."

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m²).

SOUND PRESSURE LEVEL, L_p

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (P_a/P_o)^2$ dB (or $20 \log_{10} (P_a/P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is 20 μ Pa (20×10^{-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, L_w

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. $L_w = L_p + 10 \log_{10} 'a'$ dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m²) in a free field.

STATISTICAL NOISE LEVELS, L_n .

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 $L_{AF10, T}$ 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 $L_{AF90, T}$ is measured over periods of 15 minutes, and is used to describe the average minimum 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).

Attachment 2: QA/QC Procedures

UNATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

ARL noise loggers type Ngara were used to conduct the long-term unattended noise monitoring. This equipment complies with AS IEC 61672.1–2004 and is designated as a Type 2 instrument suitable for field use.

The measured data is processed statistically and stored in memory every 15 minutes. The equipment was calibrated prior and subsequent to the measurement period using a Rion NC-73 sound level calibrator. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 3.

METEOROLOGICAL CONSIDERATION DURING MONITORING

For the long-term attended monitoring, meteorological data for the relevant period were provided by the Bureau of Meteorology, which was considered representative of the site for throughout the monitoring period.

Measurements affected by wind or rain over certain limits were excluded from the final analyses of the recorded data in accordance with the EPA's Noise Policy for Industry. The wind data were modified to take into account the difference of height between the AWS (Automatic Weather Station) used by the Bureau of Meteorology (10 m above ground level), and the microphone (1.5 m above ground level). The correction factor applied to the data was calculated according to the Australian Standard AS 1170.2 1989 Clause 4.2.5.1.

DESCRIPTORS & FILTERS USED FOR MONITORING

Noise levels are commonly measured using A-weighted filters and are usually described as dB(A). The "A-weighting" refers to standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low frequency sound than it is to high frequency sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Noise environments can be described using various descriptors depending on characteristics of noise or purpose of assessments. For this survey the L_{A90} , L_{Aeq} and L_{Amax} levels were used to analyse the monitoring results. The statistical descriptors L_{A90} measures the noise level exceeded for 90% of the sample measurement time, and is used to describe the "Background noise". Background noise is the underlying level of noise present in the ambient noise, excluding extraneous noise or the noise source under investigation. The L_{Aeq} level is the equivalent continuous noise level or the level averaged on an equal energy basis which is used to describe the "Ambient Noise". The L_{Amax} noise levels are maximum sound pressure levels measured over the sampling period and this parameter is commonly used when assessing noise impact.

Measurement sample periods were fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring location are presented in Attachment 4.

Calibration of Sound Level Meters

A sound level meter requires regular calibration to ensure its measurement performance remains within specification. Benbow Environmental sound level meters are calibrated by a National Association of Testing Authority (NATA) registered laboratory or a laboratory approved by the NSW Environment Protection Authority (EPA) every two years and after each major repair, in accordance with AS IEC 61672.1–2004.

The calibration of the sound level meter was checked immediately before and after each series of measurements using an acoustic calibrator. The acoustic calibrator provides a known sound pressure level, which the meter indicates when the calibrator is activated while positioned on the meter microphone.

The sound level meters also incorporate an internal calibrator for use in setting up. This provides a check of the electrical calibration of the meter, but does not check the performance of the microphone. Acoustical calibration checks the entire instrument including the microphone. Calibration certificates for the instrument sets used have been included as Attachment 3.

Care and Maintenance of Sound Level Meters

Noise measuring equipment contains delicate components and therefore must be handled accordingly. The equipment is manufactured to comply with international and national standards and is checked periodically for compliance. The technical specifications for sound level meters used in Australia are defined in AS IEC 61672.1–2004.

The sound level meters and associated accessories are protected during storage, measurement and transportation against dirt, corrosion, rapid changes of temperature, humidity, rain, wind, vibration, electric and magnetic fields. Microphone cables and adaptors are always connected and disconnected with the power turned off. Batteries are removed (with the instrument turned off) if the instrument is not to be used for some time.

Investigation Procedures

All investigative procedures were conducted in accordance with AS 1055.1–1997 *Acoustics – “Description and Measurement of Environmental Noise Part 1: General Procedures”*.

The following information was recorded and kept for reference purposes:

- type of instrumentation used and measurement procedure conducted;
- description of the time aspect of the measurements, ie. measurement time intervals; and
- positions of measurements and the time and date were noted.

As per AS 1055.1–1997, all measurements were carried out at least 3.5 m from any reflecting structure other than the ground. The preferred measurement height of 1.2 m above the ground was utilised. A sketch of the area was made identifying positions of measurement and the approximate location of the noise source and distances in meters (approx.).

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS IEC 61672.1-2004 and was set on A-weighted, fast response.

The microphone was positioned at 1.2 to 1.5 metres above ground level and was fitted with a windsock. The instrument was calibrated using a Bruel & Kjaer 4230 sound level calibrator prior and subsequent to the measurement period to ensure the reliability and accuracy of the instrument sets. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 3.

WEATHER CONDITIONS

The weather conditions during all attended noise monitoring were observed to be adequate.

METHODOLOGY

The attended noise measurements were carried out generally in accordance with Australian Standard AS 1055-1997 - *Acoustics – “Description and Measurement of Environmental Noise”*.

Attachment 3: Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE No: **SLM29940**

EQUIPMENT TESTED: Sound & Vibration Analyser

Manufacturer: Svantek
Type No: Svan-957
Mic. Type: 7052H
Pre-Amp. Type: SV12L
Filter Type: 1/3 Octave
Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Serial No: 15335
Serial No: 40814
Serial No: 18742

Test No: FILT 6547

Tests IEC 61672-3:2013,
Performed: IEC 1260:1995, & AS/NZS 4476:1997
Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1007 hPa ± 1 hPa	Date of Receipt :	02/07/2021
Temperature	22 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$	Date of Calibration :	05/07/2021
Relative Humidity	38 % $\pm 5\%$	Date of Issue :	05/07/2021

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

CHECKED BY:

AUTHORISED SIGNATURE:

Hein Soc

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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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) 9689 8133
www.acu-vib.com.au

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.i.) k=2

CONDITION OF TEST:

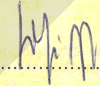
Ambient Pressure 1004 hPa ±1 hPa
Temperature 23 °C ±1° C
Relative Humidity 49 % ±5%

Date of Receipt : 26/05/2021
Date of Calibration : 26/05/2021
Date of Issue : 26/05/2021

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: 

AUTHORISED
SIGNATURE: 

Jack Kielt

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CERTIFICATE OF CALIBRATION

CERTIFICATE No: C29541

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Rion

Type No: NC-73

Serial No: 10186522

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 μ Pa)	Frequency (Hz)	THD&N (%)
Level:	NA	N	93.83 dB	990.43 Hz	2.51 %
Uncertainty			± 0.11 dB	$\pm 0.05\%$	$\pm 0.20\%$
Uncertainty (at 95% c.i.) k=2					

CONDITION OF TEST:

Ambient Pressure 998 hPa ± 1 hPa
Temperature 23 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$
Relative Humidity 43 % $\pm 5\%$

Date of Receipt : 13/05/2021
Date of Calibration : 14/05/2021
Date of Issue : 14/05/2021

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: 

AUTHORISED
SIGNATURE: 

Heide Sae

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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate
Calibration Number C22123

Client Details		Benbow Environmental 25-27 Sherwood Street Northmead NSW 2152
Equipment Tested/ Model Number :		ARL Ngara
Instrument Serial Number :		8780AC
Microphone Serial Number :		317859
Pre-amplifier Serial Number :		27984
Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions
Ambient Temperature : 25.3°C		Ambient Temperature : 25.2°C
Relative Humidity : 58.5%		Relative Humidity : 58%
Barometric Pressure : 100.79kPa		Barometric Pressure : 100.76kPa
Calibration Technician : Lucky Jaiswal		Secondary Check: Max Moore
Calibration Date : 23 Feb 2022		Report Issue Date : 24 Feb 2022
Approved Signatory : 		Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	N/A
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	N/A
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -			
Acoustic Tests		Environmental Conditions	
125Hz	±0.13dB	Temperature	±0.1°C
1kHz	±0.13dB	Relative Humidity	±1.9%
8kHz	±0.14dB	Barometric Pressure	±0.014kPa
Electrical Tests	±0.10dB		

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

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



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Accredited for compliance with ISO/IEC 17025 - Calibration.

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Sound Level Meter

IEC 61672-3:2013

Calibration Certificate

Calibration Number C22124

Client Details		Benbow Environmental 25-27 Sherwood Street Northmead NSW 2152
Equipment Tested/ Model Number :		ARL Ngara
Instrument Serial Number :		8780AD
Microphone Serial Number :		317856
Pre-amplifier Serial Number :		27983
Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions
Ambient Temperature : 25°C		Ambient Temperature : 25.1°C
Relative Humidity : 58%		Relative Humidity : 59.4%
Barometric Pressure : 100.72kPa		Barometric Pressure : 100.7kPa
Calibration Technician : Lucky Jaiswal		Secondary Check: Max Moore
Calibration Date : 23 Feb 2022		Report Issue Date : 24 Feb 2022

Approved Signatory :

Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	N/A
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	N/A
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -			
Acoustic Tests		Environmental Conditions	
125Hz	±0.13dB	Temperature	±0.1°C
1kHz	±0.13dB	Relative Humidity	±1.9%
8kHz	±0.14dB	Barometric Pressure	±0.014kPa
Electrical Tests	±0.10dB		

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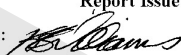
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Sound Level Meter
IEC 61672-3:2013
Calibration Certificate
Calibration Number C22125

Client Details		Benbow Environmental 25-27 Sherwood Street Northmead NSW 2152
Equipment Tested/ Model Number :		ARL Ngara
Instrument Serial Number :		8780AE
Microphone Serial Number :		321775
Pre-amplifier Serial Number :		27982
Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions
Ambient Temperature : 23.5°C		Ambient Temperature : 24.4°C
Relative Humidity : 62%		Relative Humidity : 60.3%
Barometric Pressure : 100.77kPa		Barometric Pressure : 100.75kPa
Calibration Technician : Lucky Jaiswal		Secondary Check: Max Moore
Calibration Date : 24 Feb 2022		Report Issue Date : 24 Feb 2022
Approved Signatory : 		Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	N/A
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	N/A
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -			
Environmental Conditions			
Acoustic Tests		Temperature	±0.1°C
125Hz	±0.13dB	Relative Humidity	±1.9%
1kHz	±0.13dB	Barometric Pressure	±0.014kPa
8kHz	±0.14dB		
Electrical Tests	±0.10dB		

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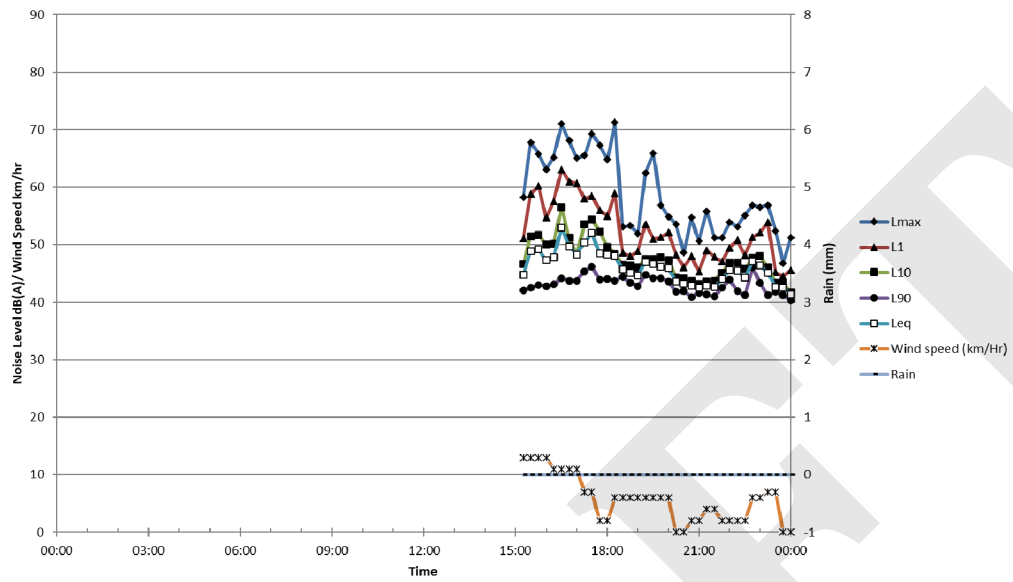
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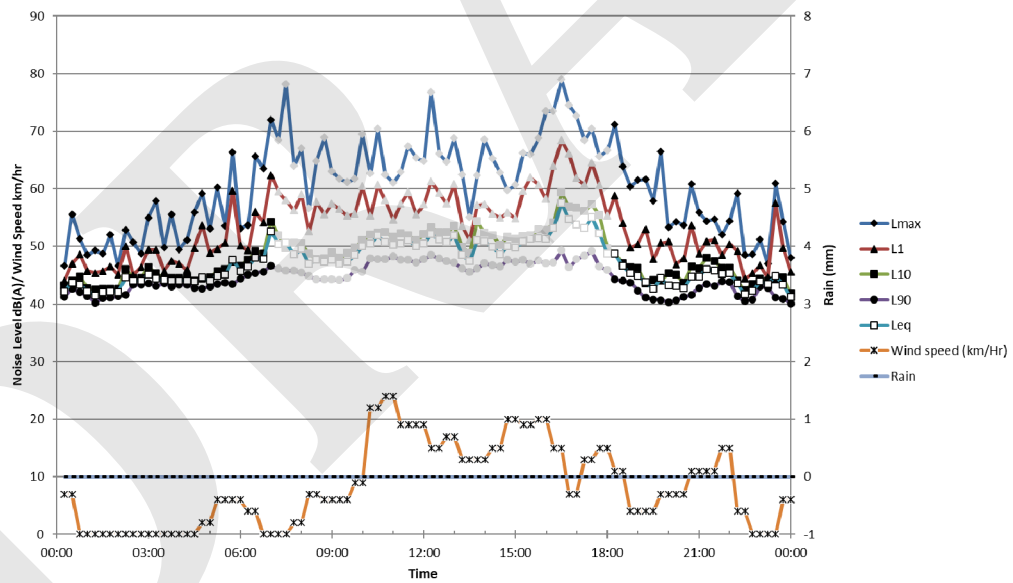


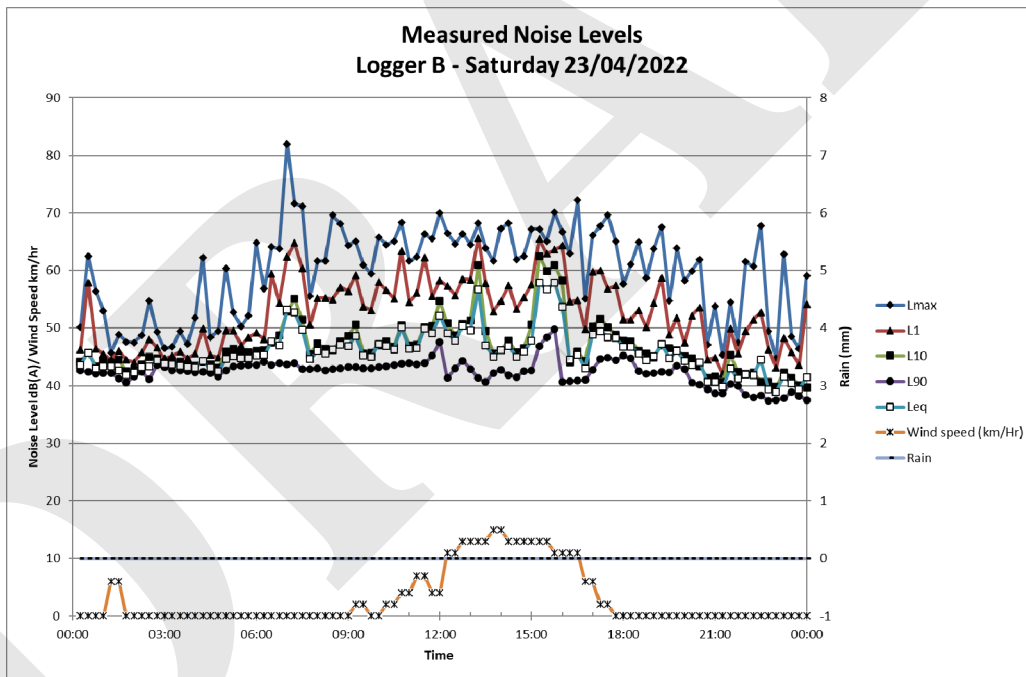
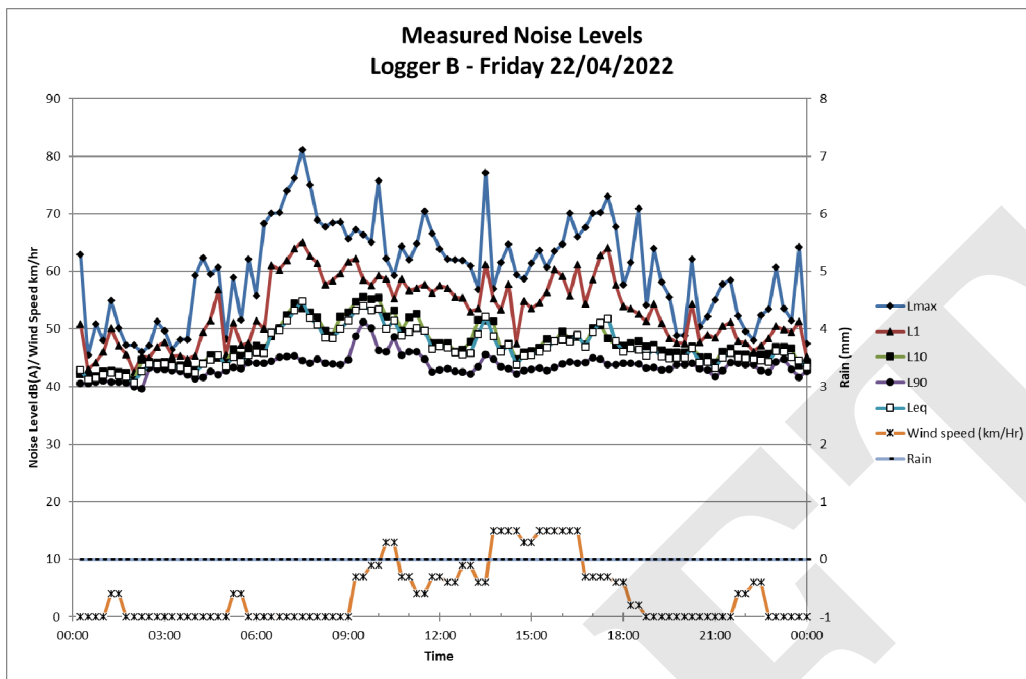
Attachment 4: Daily Noise Logger Charts

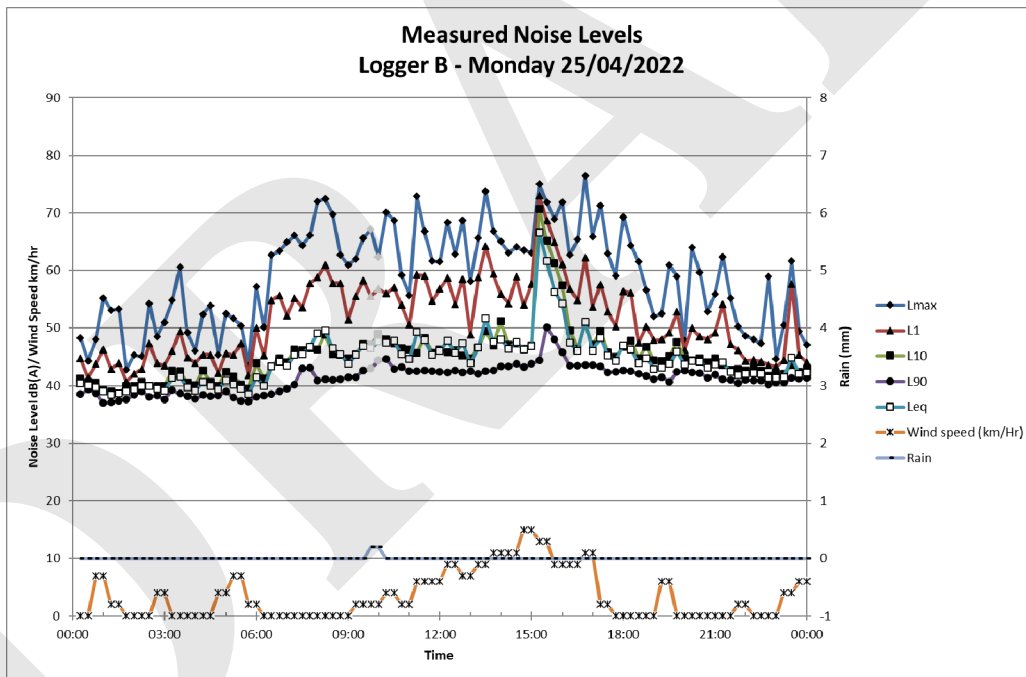
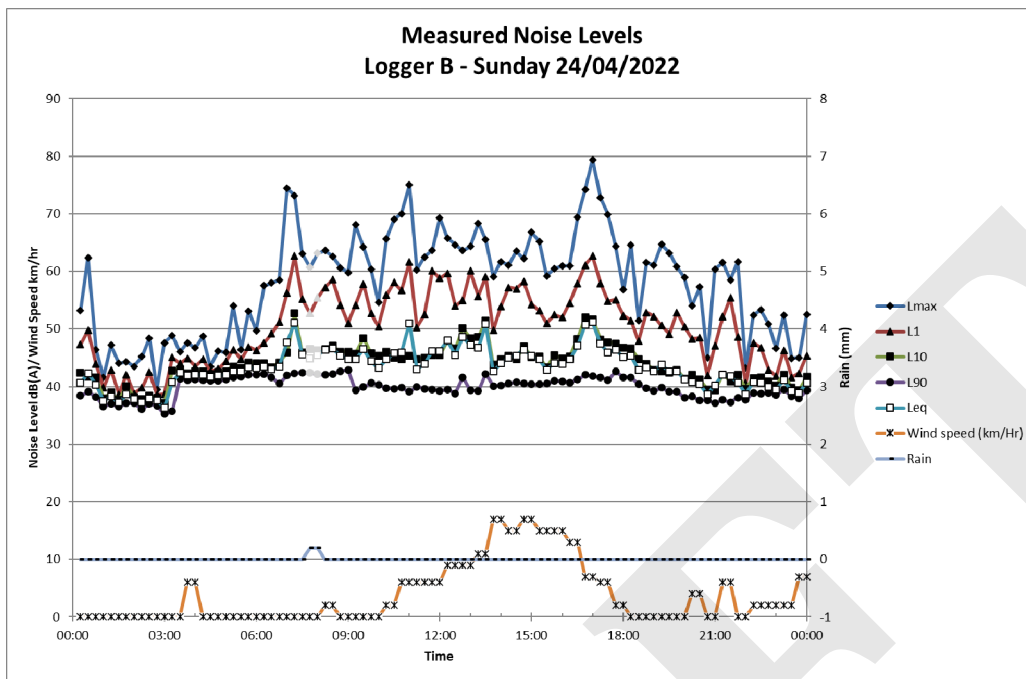
Measured Noise Levels
Logger B - Wednesday 20/04/2022

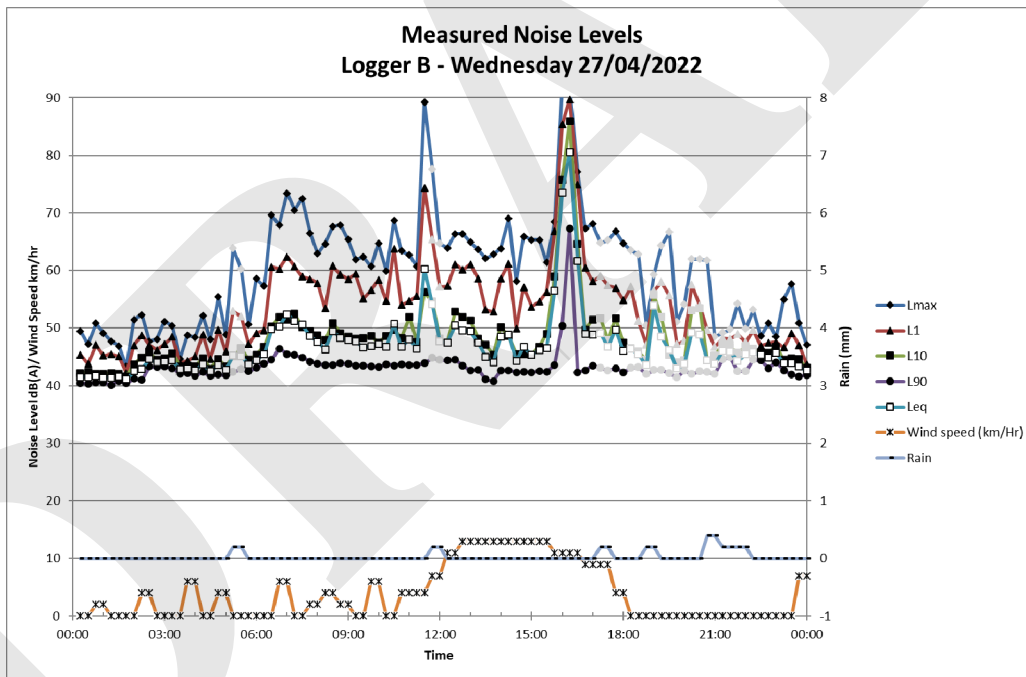
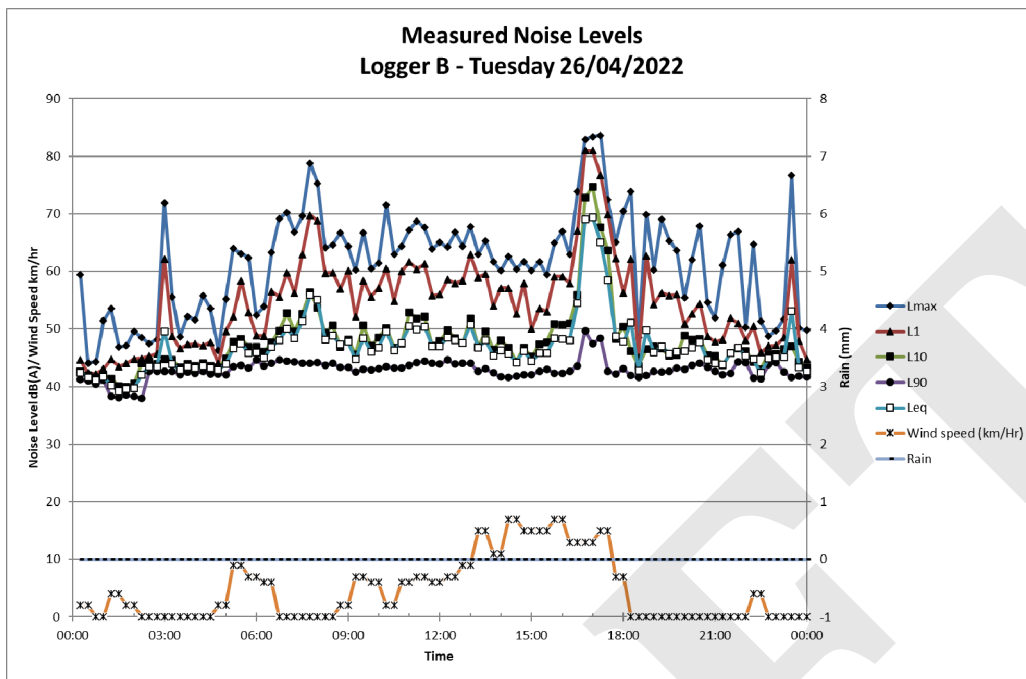


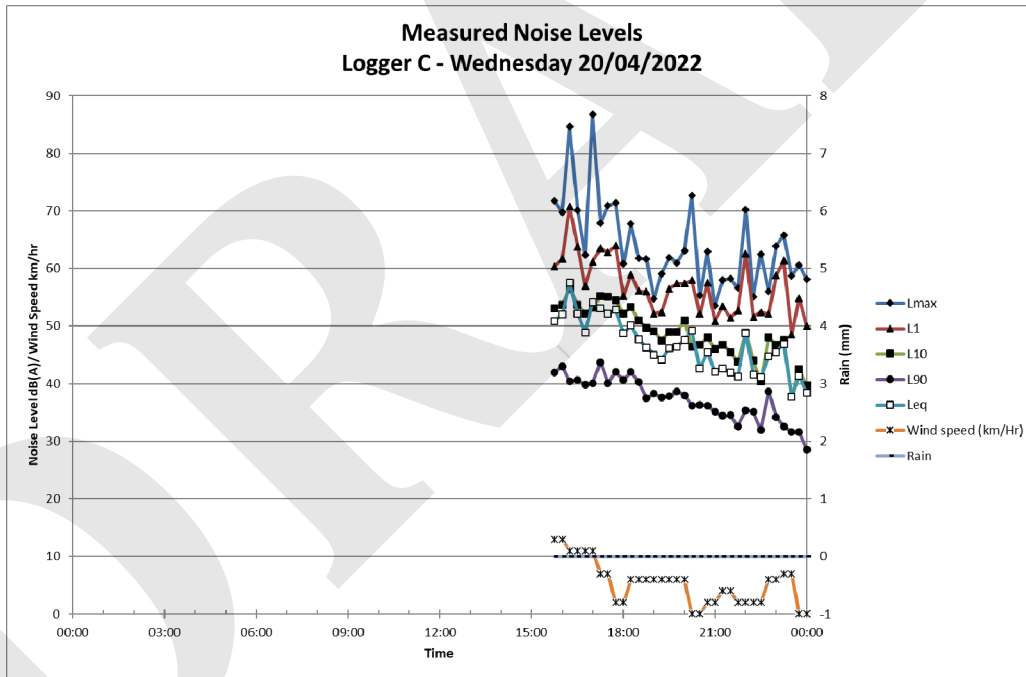
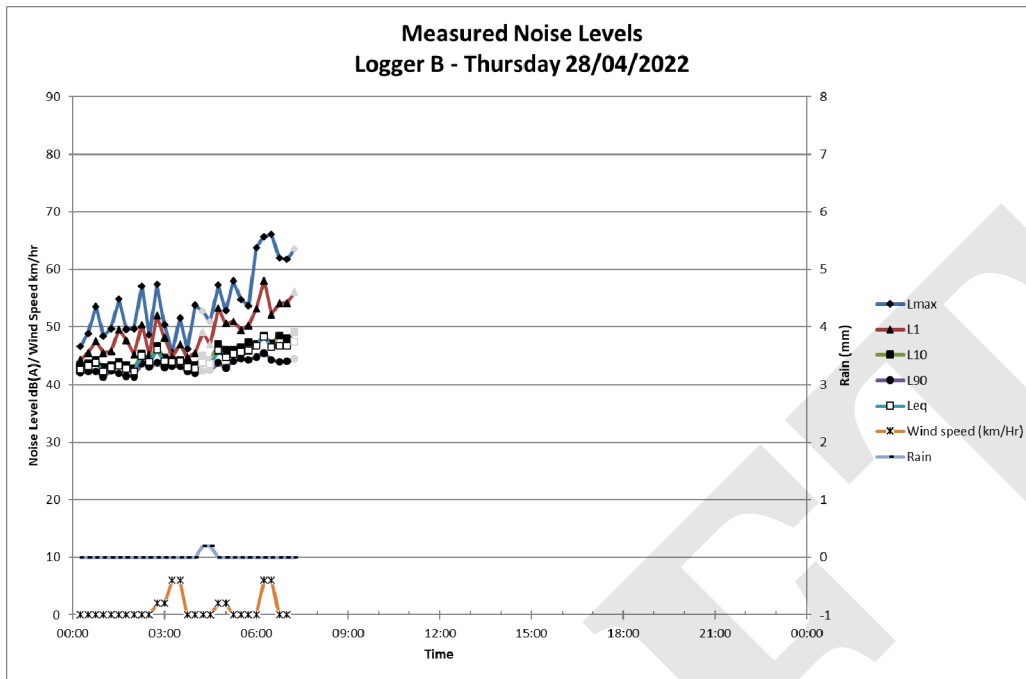
Measured Noise Levels
Logger B - Thursday 21/04/2022

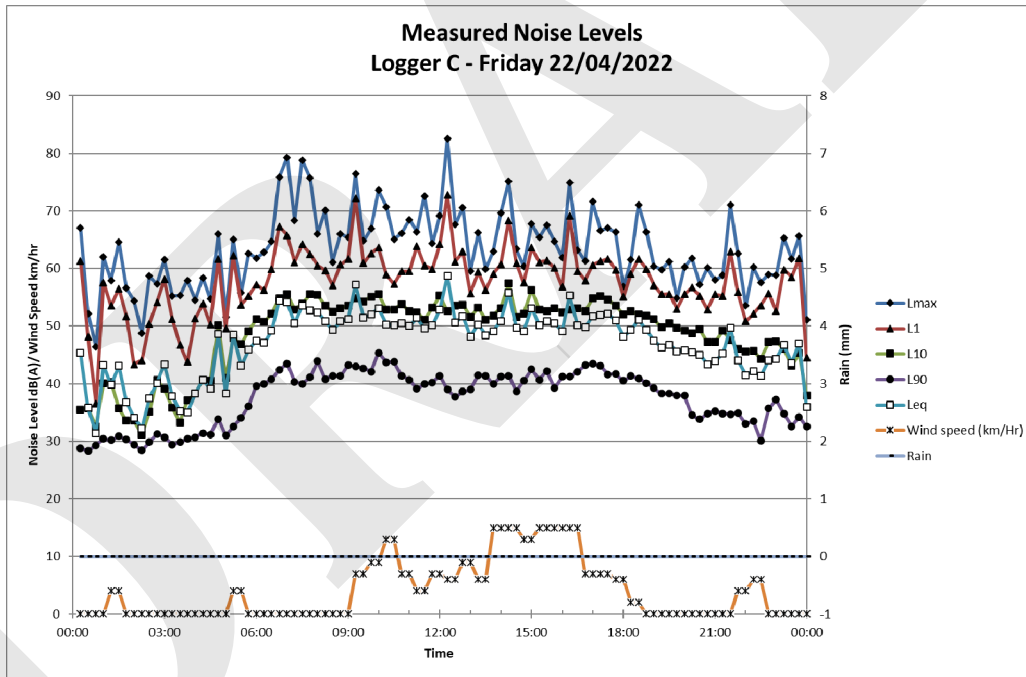
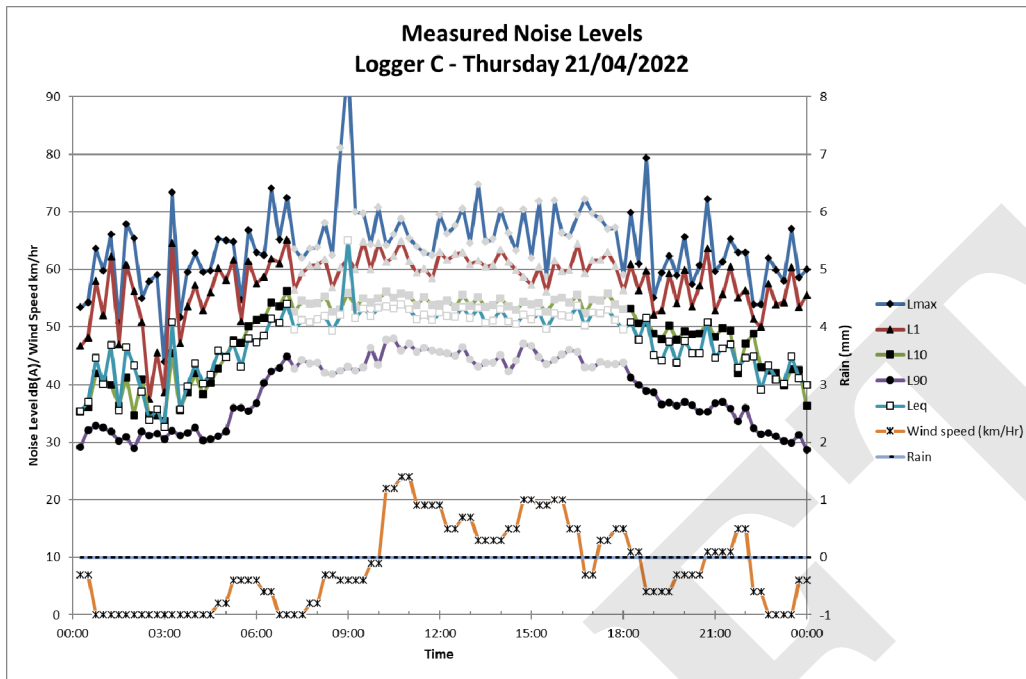


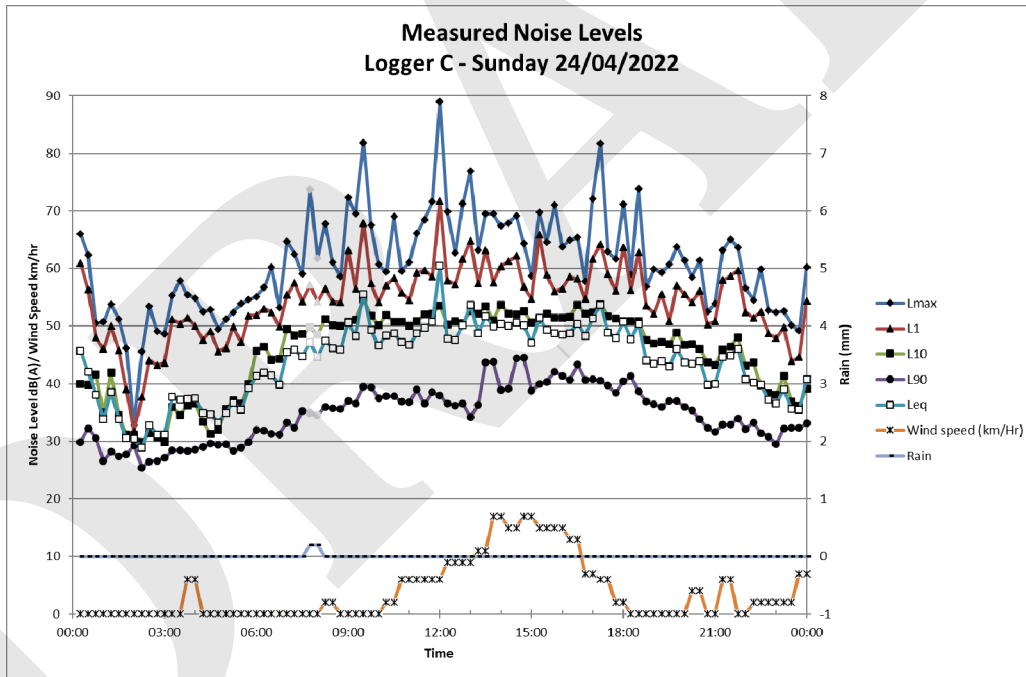
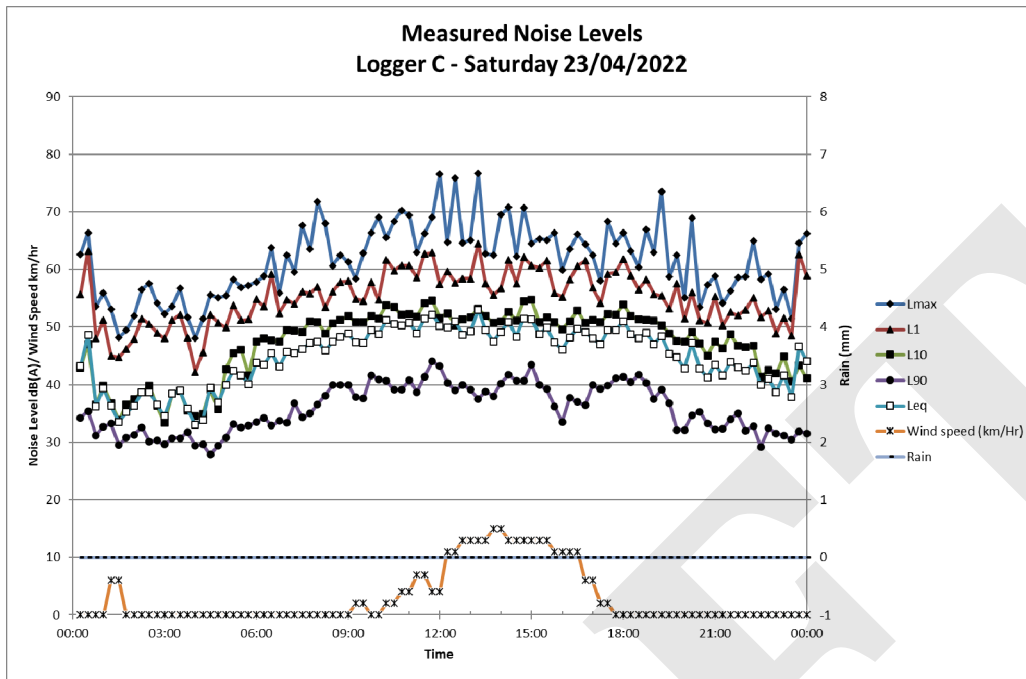


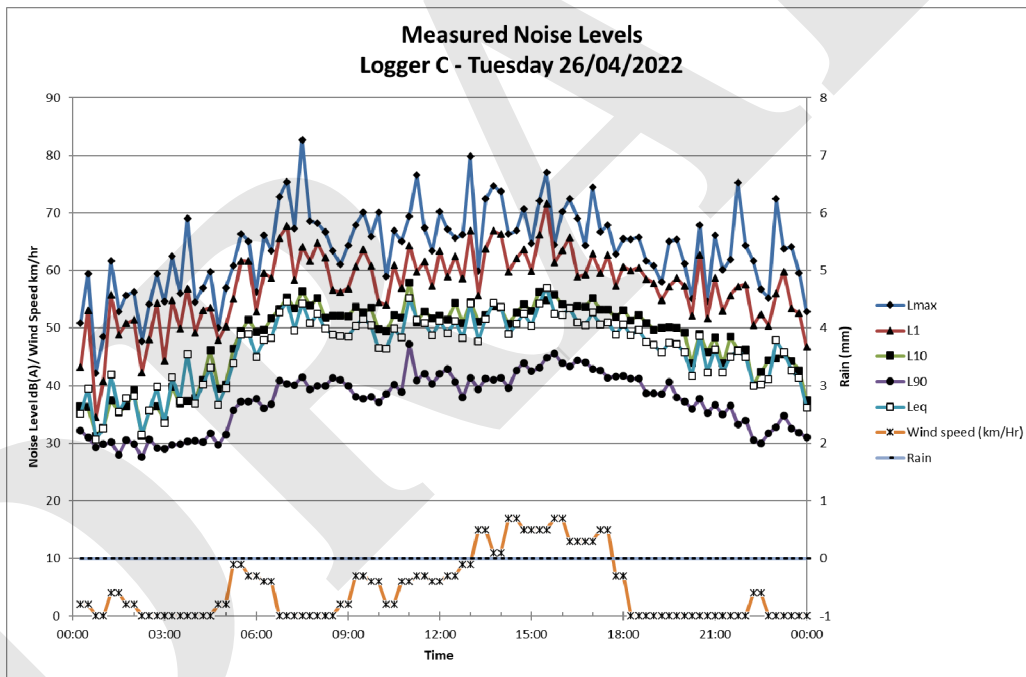
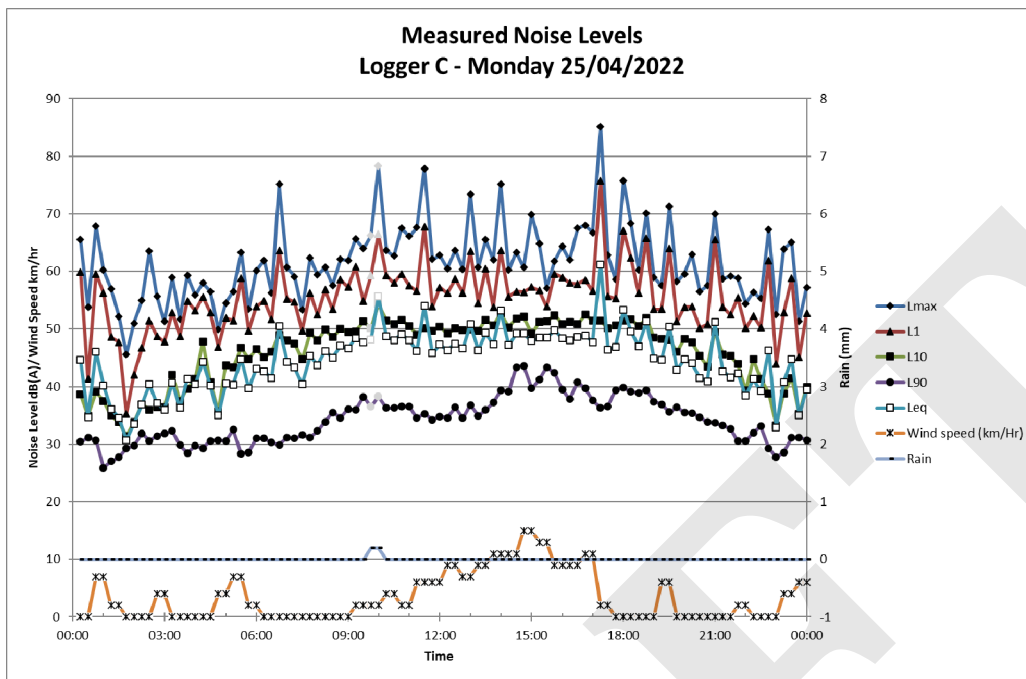


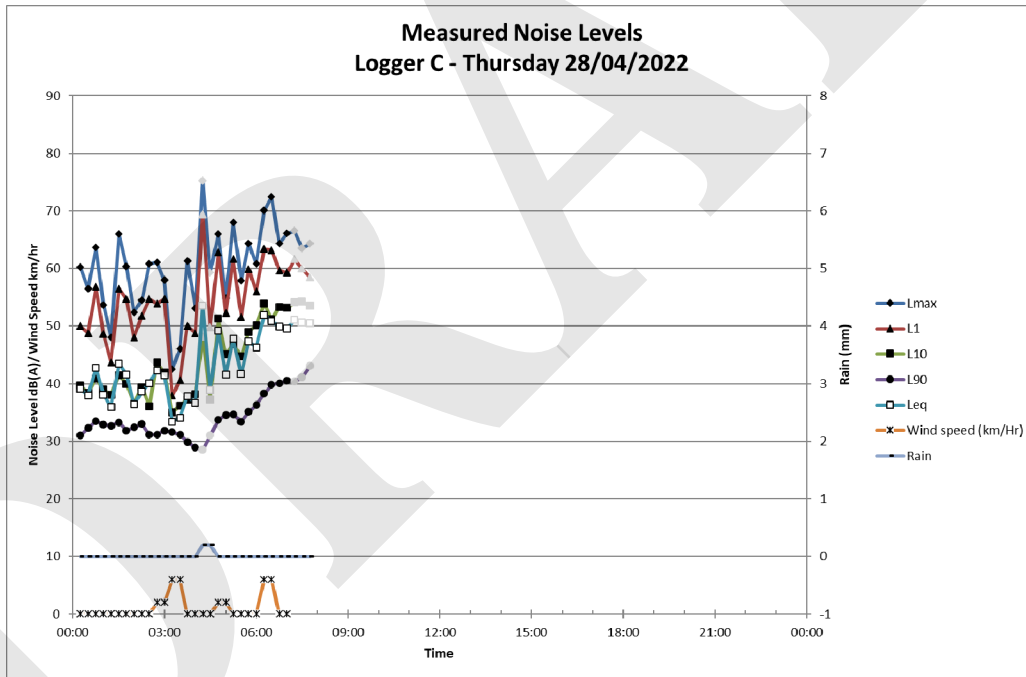
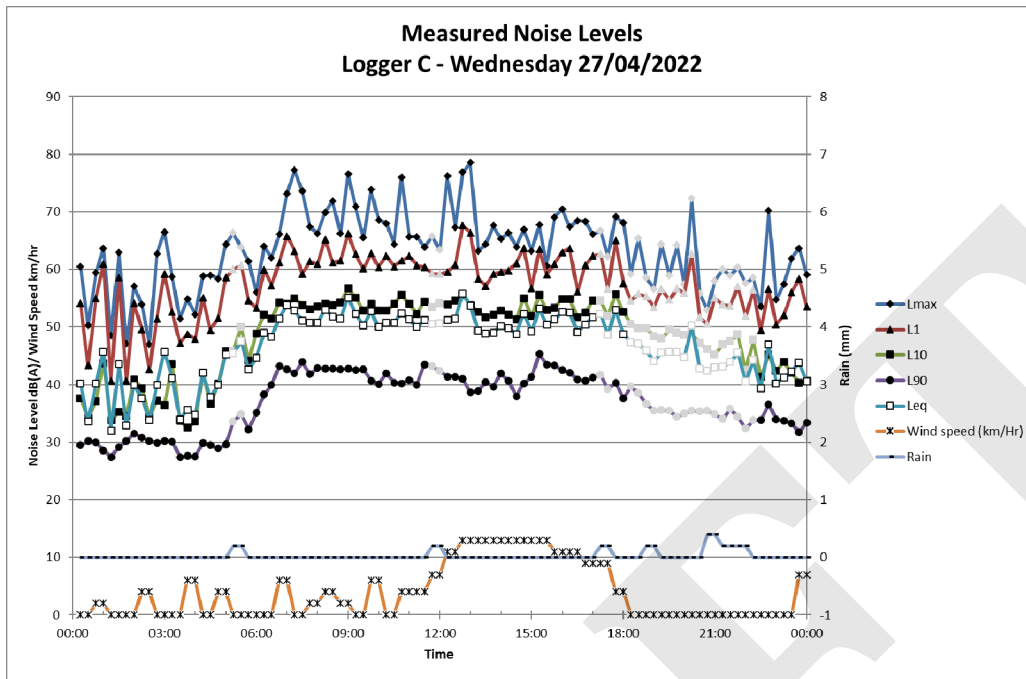


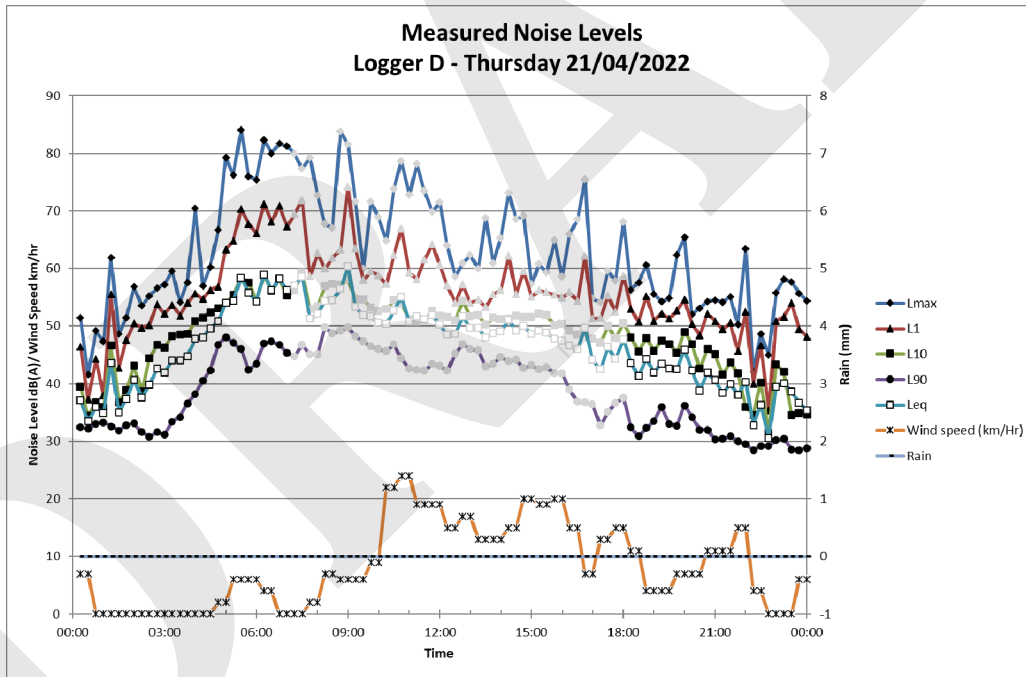
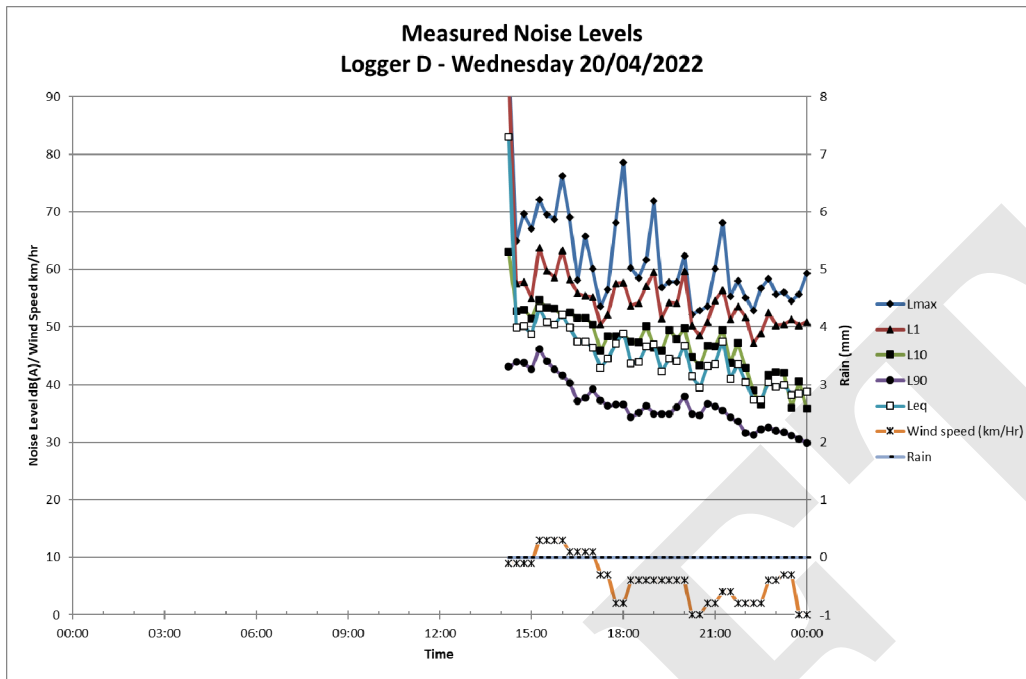


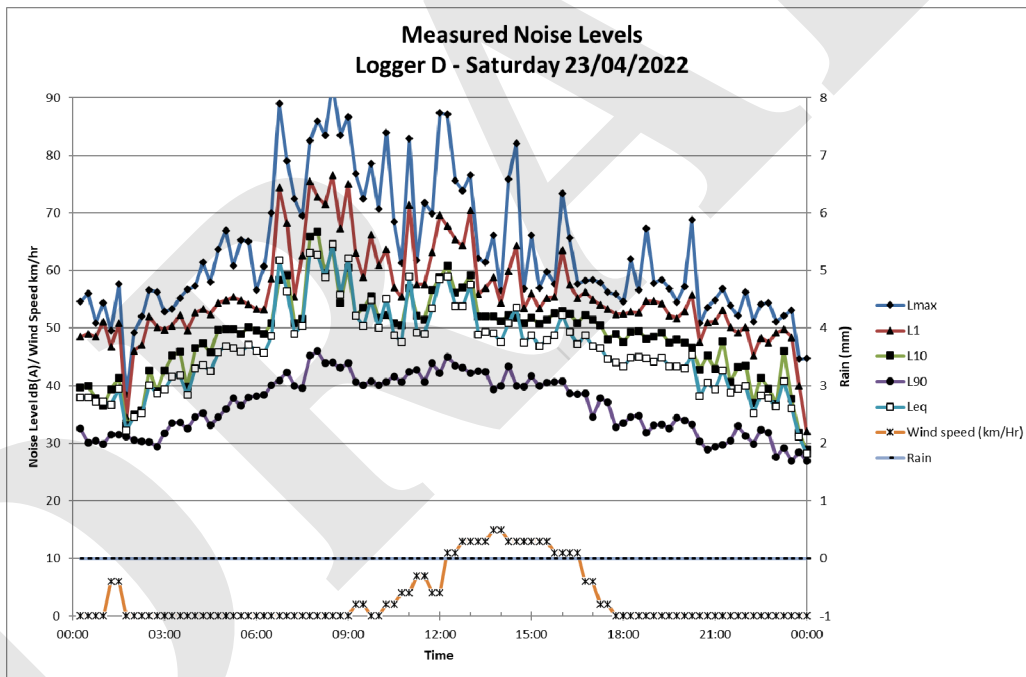
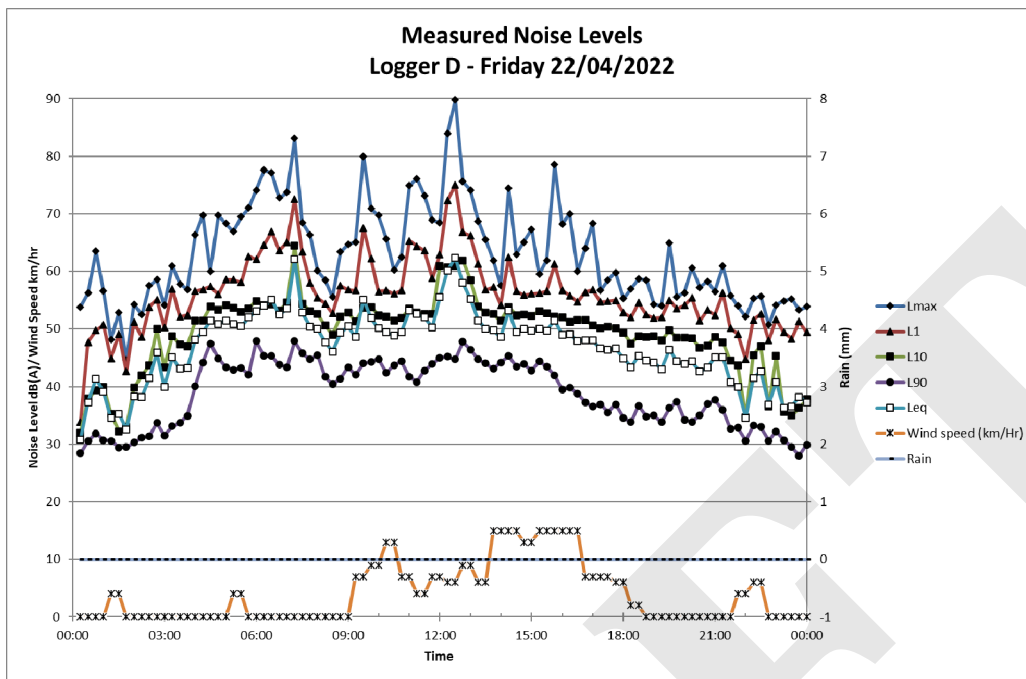


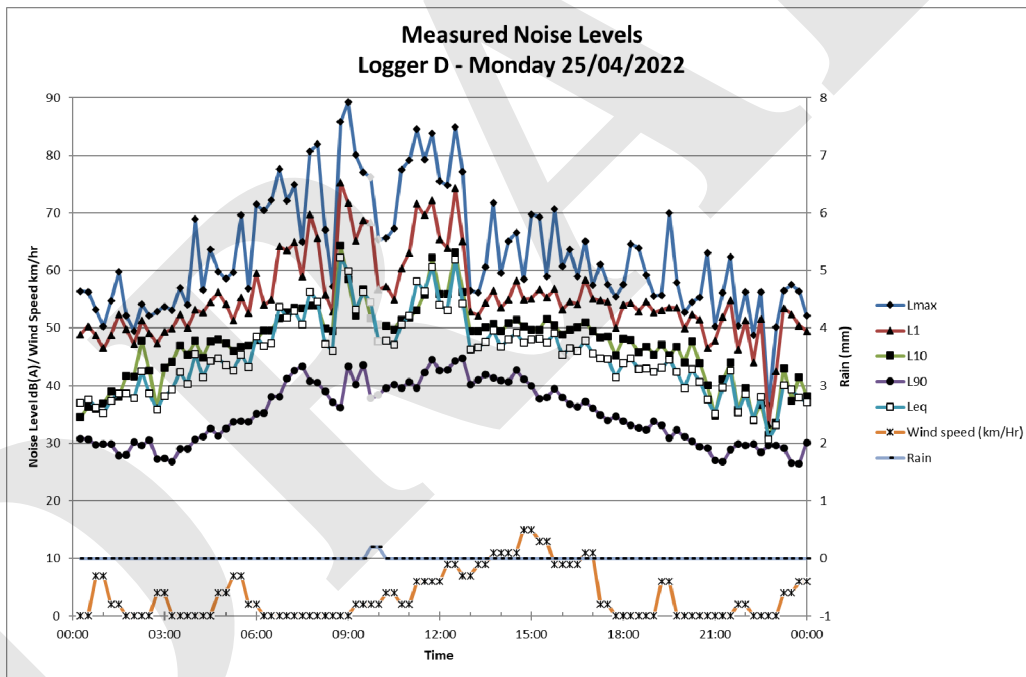
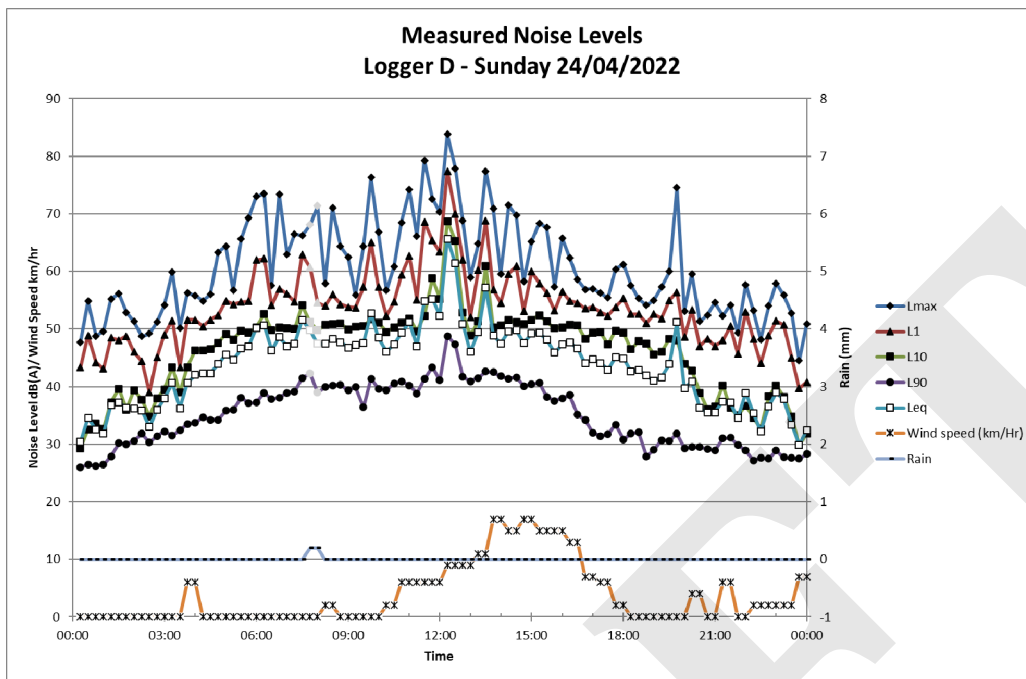


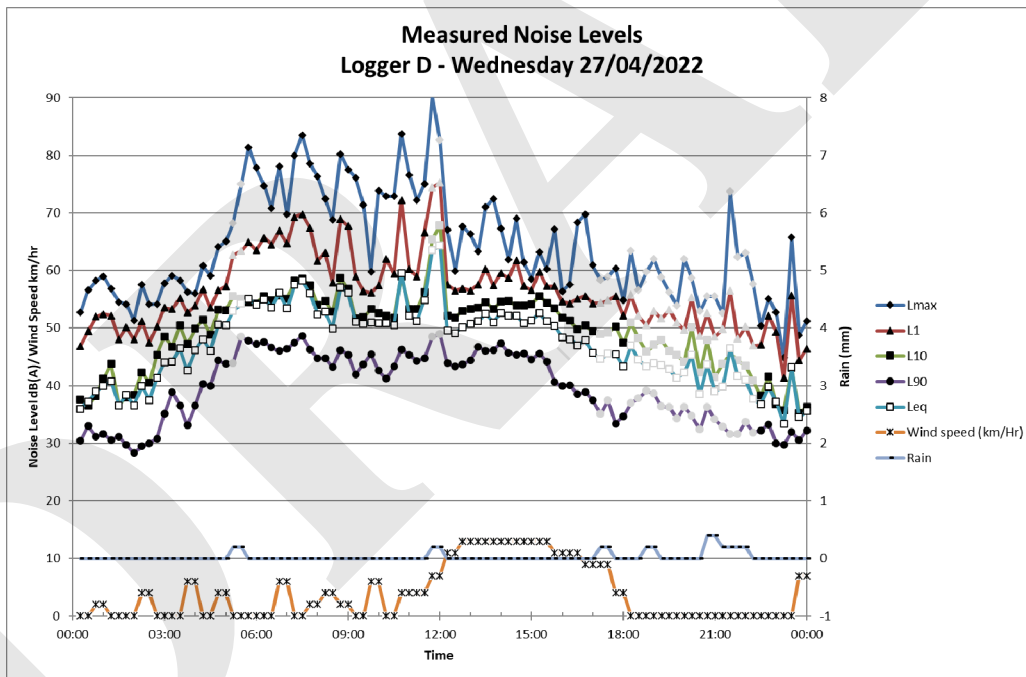
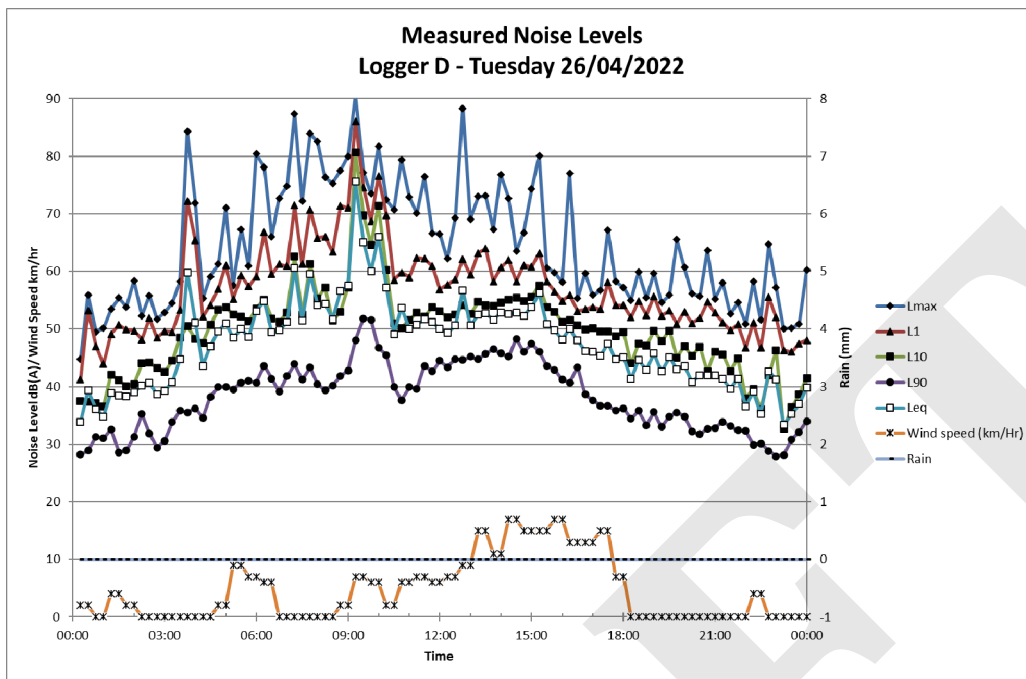












Measured Noise Levels
Logger D - Thursday 28/04/2022

