Proposed Mixed Use Light Industrial Park
Acoustic Assessment
27 Sunny Bank Rd, Lisarow, NSW

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GLOSSARY

NOISE

Noise is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined in **Section 2** below.

NOISE DESCRIPTORS

L_{eq} – The sound pressure level averaged over the measurement period. It can be considered as the equivalent continuous steady-state sound pressure level, which would have the same total acoustic energy as the real fluctuating noise over the same time period.

dB – Decibels. The fundamental unit of sound, a Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. Probably the most common usage of the Decibel in reference to sound loudness is dB sound pressure level (SPL), referenced to the nominal threshold of human hearing. For sound in air and other gases, dB(SPL) is relative to 20 micropascals (μPa) = 2×10^{-5} Pa, the quietest sound a human can hear.

A-WEIGHTING

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements in order to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. The A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

1 INTRODUCTION

1.1 SUMMARY

Acoustic Dynamics has been engaged by **Trend Investments Pty Ltd** to assess noise emission for the proposed mixed use light industrial park development at 27 Sunny Bank Road, Lisarow, NSW.

This document provides a technical assessment, as well as recommendations for remediation works to reduce noise emission with a view to achieving compliance with the relevant acoustic criteria and requirements. It has been prepared in accordance with the requirements of Central Coast Council, the EPA and relevant Australian Standards.

1.2 LOCATION & DESCRIPTION OF PROPOSED DEVELOPMENT

The site is located at 27 Sunny Bank Road, Lisarow, in the Central Coast Council area of NSW. The subject site is zoned IN1 (General Industrial) with the nearest residential receivers located on land zoned R2 (Low Density Residential), separated by an approximate 20m wide area of land zoned RE2 (Public Recreation) along the western site boundary, shown in **Appendix A**.

1.2.1 NEAREST SENSITIVE RECEIVERS

Acoustic Dynamics advise that for the purpose of the acoustical assessment, the nearest sensitive receivers are:

- Residential Receiver [R1] – 4 Perratt Close (W);
- Residential Receiver [R2] – 6 Perratt Close (W);
- Residential Receiver [R3] – 8 Perratt Close (W);
- Residential Receiver [R4] – 10 Perratt Close (W);
- Residential Receiver [R5] – 12 Perratt Close (NW);
- Residential Receiver [R6] – 14 Perratt Close (NW);
- Residential Receiver [R7] – 16 Perratt Close (NW);
- Residential Receiver [R8] – 1 Perratt Close (W);
- Residential Receiver [R9] – 5 Perratt Close (W);
- Residential Receiver [R10] – 5 Prings Road (SSE); and
- Industrial Receiver [R11] – 5 Sunny Bank Road (S);

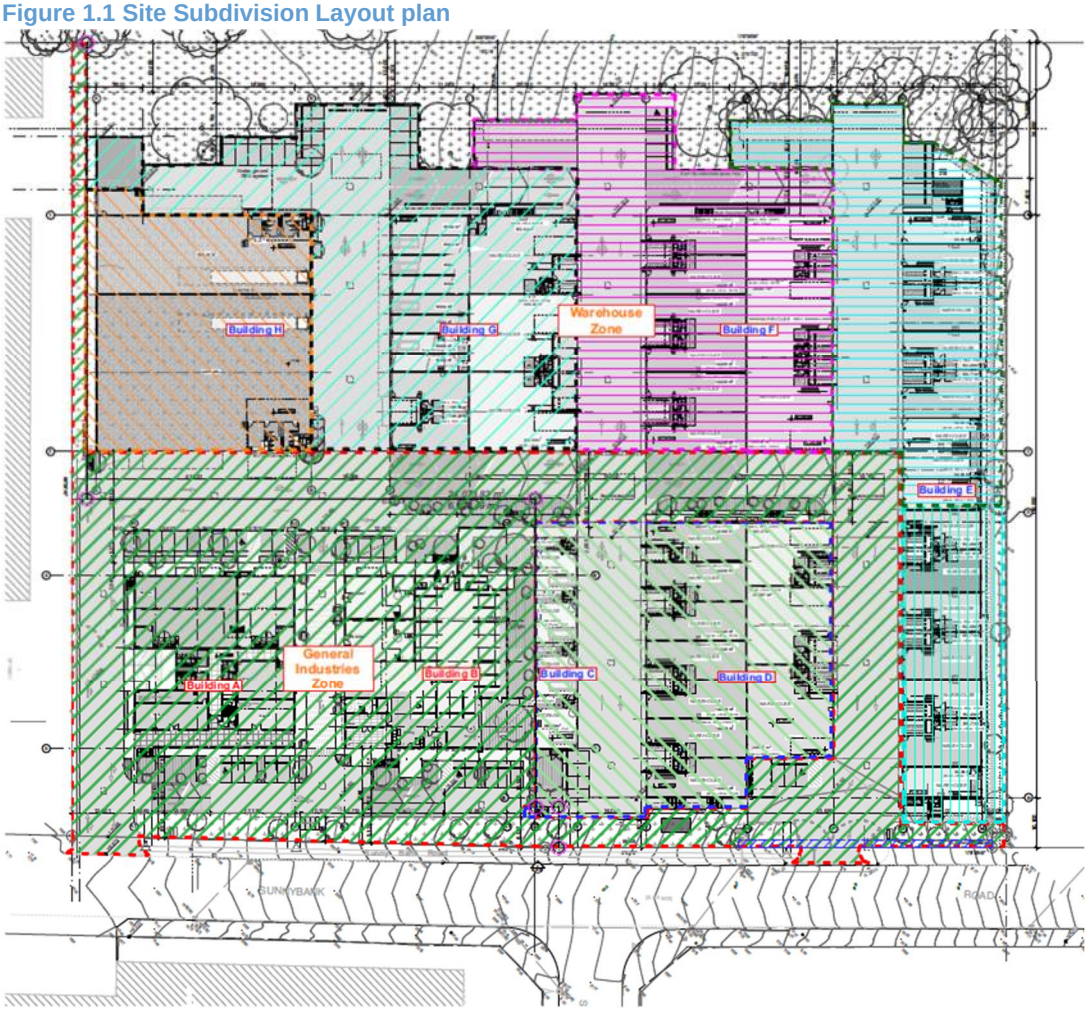
Acoustic Dynamics advises that the above identified sensitive receivers have been assessed at the most affected point in the lot, being either at the boundary (taken at a height of 1.5m above the ground RL) and at the most affected point on the façade (taken at a height of 2.4m above ground RL for single storey dwellings and 5.4m above the ground RL for two storey dwellings).

We assume that the dwelling are of typical construction, being 3m height per floor level, with windows approximately 300mm below the ceiling height per floor level. Our façade receiver assessment-point is taken to be 300mm below the head of a window, which is considered to

be a conservative approach in assessing noise impacts at sensitive receiver locations from the use and operation of the proposed development.

The proposed industrial development is broken up in to stages with Stage 1 comprising of the development of Lot 1 and Lot 2 to follow, shown in **Figure 1.1** below.

Figure 1.1 Site Subdivision Layout plan



Acoustic Dynamics is of the understanding that Lot 1 of the development will primarily be used as a light industrial area for various small to medium sized businesses. It is understood that commercial gym, a child care centre facility and various other businesses are proposed. The Lot 1 development comprises of two (2) buildings (Building A and Building B), both of which will include a basement carpark and multiple levels of businesses. Lot 2 is proposed to be used for industrial purposes, consisting of storage units and warehouses of various size.

Access to these businesses will be from a newly constructed driveway at the south eastern corner of the lot, with external car spaces available for short-term parking.

1.2.2 HOURS OF OPERATION

Acoustic Dynamics is of the understanding that the operating hours of the businesses within Building A and Building B of Lot 1, although unknown at this stage, are likely to be primarily during the daytime period, 7am to 6pm. However, as the development proposes a gym and

restaurant the specific operating hours may vary with the gym possibly operating 24 hours and the restaurant possibly operating until 10pm.

Acoustic Dynamics understands that the operating hours of the businesses within Building C, D, E, F, G & H of Lot 2, although unknown at this stage, are likely to be primarily during the daytime period, 7 am to 6pm. The Evening period, 6pm to 10pm, is expected to have considerable less activity that during the daytime, while the night-time period, 10pm to 6am, would have very minimal activity, with only occasional short-term activities (i.e. Tenant accessing the warehouse unit or storage unit).

The development is shown in the Location Map, Aerial Photo, Zoning Map and Drawings presented within **Appendix A**.

1.3 SCOPE

Acoustic Dynamics has been engaged to provide a noise emission assessment suitable for submission to Central Coast Council.

The scope of the assessment is to include the following:

- Review of legislation, Council criteria and Australian Standards relevant to the development;
- Travel to site to conduct inspections of the proposed site, and the location of the adjacent receivers;
- Conduct noise monitoring at a representative location to determine existing ambient noise levels;
- Establish relevant project specific noise emission criteria;
- Predict the noise emission level at nearby receiver locations, resulting from the use and operation of the proposed industrial development; and
- Recommendation of remediation works to achieve compliance with the relevant acoustic requirements and criteria.

2 RELEVANT ACOUSTIC CRITERIA AND STANDARDS

Acoustic Dynamics has conducted a review of the local council, state government and federal legislation that is applicable to noise assessment for the development. The relevant sections of the legislation are presented below. The most stringent criteria which have been used in the assessment of the development is summarised below.

2.1 CENTRAL COAST COUNCIL REQUIREMENTS

2.1.1 LOCAL ENVIRONMENT PLAN

A review of the Gosford *Local Environment Plan* (LEP) 2014 was conducted yet did not yield specific acoustic information or criteria relating to this development.

2.1.2 DEVELOPMENT CONTROL PLANS

A review of Gosford *Development Control Plan (DCP) 2018 – as amended 29 June 2018* was conducted. References to acoustic requirements and relevant noise criteria are reproduced below.

> ***"3.11 Industrial Development***
>
> ***3.11.8.4 Pollution Control***
>
> *a) Noise*
> *Any premises, machinery, or activity shall not give rise to an Offensive noise to either residential or other industrial premises, and shall comply with the requirements of the Industrial Noise Policy of the Department of Environment and Climate Change. Noise should not be transmitted to adjoining incompatible land uses or be permitted to invade into areas within developments that require low noise levels.*
> *Where this is likely to be an issue, or where requested by the Council, an acoustic consultant's assessment and report is to be submitted."*

2.1.3 DA LODGEMENT GUIDELINES

A review of Central Coast Council's *DA Lodgement Guidelines v1.1 2019* was conducted. References to acoustic requirements and relevant noise criteria are reproduced below:

> *"**ACOUSTIC REPORT***
>
> *For noise-generating developments and developments in close proximity to main roads and railway lines an Acoustic Report is required. The report must be prepared by a suitably qualified consultant indicating the proposed development will not adversely affect adjoining land uses or be affected by adjacent noise generating activities."*

2.2 PROTECTION OF THE ENVIRONMENT OPERATION (POEO) ACT 1997

We advise that noise emission from the development must also comply with the requirements of the relevant legislation, being the *Protection of the Environment Operations* (POEO) *Act 1997*. The POEO Act 1997 requires that the development must not generate "offensive noise". Offensive noise is defined as follows:

> *"**"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 is likely to be harmful to) a person who is outside the premises 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."*

2.3 NSW EPA'S ENVIRONMENTAL NOISE CRITERIA

2.3.1 NOISE POLICY FOR INDUSTRY (NPFI) 2017

Acoustic Dynamics advises that noise emission assessment at nearby and adjacent noise sensitive receivers has been conducted with reference to the NSW EPA's *Noise Policy for Industry (NPfI, 2017)* and yielded the following information:

2.3.1.1 PROJECT NOISE TRIGGER LEVEL

The *project noise trigger level* provides a benchmark or objective for assessing a proposal or site. It takes into account (amongst other factors):

- The receiver's background noise environment;
- The time of day of the activity
- The character of the noise; and
- The type of receiver and nature of the area.

Put simply, the *project noise trigger level* is the lower (that is, more stringent) value of the *project intrusiveness noise level* and the *project amenity noise level* which are described in detail below.

2.3.1.2 PROJECT INTRUSIVENESS NOISE LEVEL

The intrusiveness noise level is determined as follows:

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

where:

$L_{Aeq,\ 15min}$	represents the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes.
And	
Rating background noise level	represents the background level to be used for assessment purposes, as determined by the method outlined in Fact Sheets A and B.

2.3.1.3 PROJECT AMENITY NOISE LEVEL

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **project amenity noise level** represents the objective for a noise from a **single** industrial development at a receiver location.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

To establish the acoustic environment at the subject site in accordance with the guidelines of the NSW EPA's NPfI, an unattended noise logger was deployed at the subject development site between Tuesday 17 March 2020 and Saturday 28 March 2020. The logger was deployed within the subject lot near the north western corner. Acoustic Dynamics advises the selected location is likely to be representative of the existing noise environment of the nearest receivers to the subject development site. Operator-attended background noise measurements were undertaken on site to supplement unattended background noise monitoring data collected.

Following the general procedures outlined in the EPA's NPfI, a summary of the established noise environment, and relevant environmental noise criteria is presented in **Table 2.1**.

Acoustic Dynamics advises that the assessment has been based on the **lowest** background noise levels in the area during typical **maximum** operations of the proposed residential development. Acoustic Dynamics advises that such an assessment is conservative and will ensure no loss of amenity to the nearby residential receivers.

Following the general procedures outlined in the EPA's NPfI, a summary of the established noise environment, and relevant environmental noise criteria is presented in **Table 2.1.**

Table 2.1 Summary of Measured Noise Levels and Noise Emission Criteria – At Residences

Location	Time of Day	L_{A90} Rating Background Noise Level (RBL) [dB]	Measured L_{Aeq} [dB]	Project Intrusive Noise Level [dB]	Project Amenity Noise Level[2] L_{Aeq} [dB]	Project Noise Trigger Level L_{Aeq} [dB]
Nearest Residential Receiver(s)	Daytime[1] (7am to 6pm)	44	60	49	58	**49**
	Evening (6pm to 10pm)	43	54	48	48	**48**
	Night time (10pm to 7am)	41	50	46	43	**43**
	Morning Shoulder (6am to 7am)	44	N/A	49	N/A	**49**
Nearest Industrial receiver(s)	When In Use	N/A	N/A	N/A	70	**70**

Note: 1) 8am to 6pm on Sundays and public holidays.

2) Project Amenity adjustment based on "Suburban" receiver type (Table 2.3 of the NPfI). The "Suburban" receiver has been identified to be within an "Industrial Interface" (Table 2.2 of the NPfI). The noise emission objective has been modified in accordance with the recommendations detailed within the NPfI Section 2.2, for time period standardising of the intrusiveness and amenity noise levels ($L_{Aeq,15min}$ will be taken to be equal to the **$L_{Aeq,\ period}$ + 3 decibels (dB).**

The EPA's NPfI specifies additional noise emission level corrections that should be applied when a noise source is determined to include "modifying factors" that can vary the perceived intrusiveness of a noise source. Such modifying factors include tonal, low frequency, impulsive, or intermittent noise.

2.3.2 CHILD CARE CENTRE EXTERNAL NOISE INTRUSION ASSESSMENT

Member firms of the Association of Australasian Acoustical Consultants (AAAC) have prepared the "Guideline for Child Care Centre Acoustic Assessment" (Version 2.0 October 2013) to assist members and local councils in accurately and fairly assessing the external noise intrusion impact on children in child care facilities, and the assessing the noise impact from child care facilities.

Contained within the guideline are recommendations of noise objectives to be used for the assessment of both the impact of external noise on children within child care facilities, and the impact of noise emission from child care facilities to nearby receivers.

The AAAC's recommended external noise intrusion objectives for child care facilities, including noise from road, rail traffic or industry and aircraft, where applicable, have been reproduced in **Table 2.2** below.

Table 2.2 – AAAC's Internal Noise Level Objectives $L_{Aeq(1hr)}$

Area	Time of Day	Description of Noise Source	Internal Noise Level Objective $L_{Aeq(1hr)}$ [dB]
Indoor Play or Sleeping Area	When in use	**Road, Rail Traffic or Industry**	**40**[1]
Outdoor Play or Activity Area			**55**
Indoor Play or Sleeping Area		**Aircraft**	**50**

1) Acoustic Dynamics assumes that this guideline noise level applies to windows closed, therefore guideline noise level with windows open would be 50dB.

Acoustic Dynamics advises that the AAAC recommended external noise intrusion into indoor play area objectives are in line with the NSW EPA's NPfI recommended L_{Aeq} internal noise criterion.

2.3.3 THE EPA'S SLEEP DISTURBANCE CRITERION

Acoustic Dynamics advises that sleep disturbance is a complex issue, and the potential for sleep disturbance to occur depends on both the level of noise at a residential receiver, and the number of events that occur.

The EPA has in the past investigated overseas and Australian research on sleep disturbance. The method of assessing noise for sleep disturbance relies on the application of a screening

that indicates the potential for this to occur. The EPA's Noise Guide for Local Government, provides the following guidance for such a screening test:

> *"Currently, there is no definitive guideline to indicate a noise level that causes sleep disturbance and more research is needed to better define this relationship. Where likely disturbance to sleep is being assessed, a screening test can be applied that indicates the potential for this to occur. For example, this could be where the subject noise exceeds the background noise level by more than 15 dB(A). The most appropriate descriptors for a source relating to sleep disturbance would be $L_{A1(1\ minute)}$ (the level exceeded for 1% of the specified time period of 1 minute) or L_{Amax} (the maximum level during the specified time period) with measurement outside the bedroom window."*

Additionally, the guidelines of the NSW EPA's NPfI provide the following additional information:

> *"Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 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 greater".*

Further to the above information, the following summarizes the sleep disturbance criterion:

L_{Amax} or $L_{A1(1\ minute)}$ < L_{A90} + 15 dB(A)

In addition to the above, the EPA has previously published the following additional information relating to findings of significant research carried out for sleep disturbance:

> *"Maximum internal noise levels below 50-55 dBA are unlikely to cause awakening reactions… One or more noise events per night, with maximum internal noise levels of 65-70 dBA, are not likely to affect health and wellbeing significantly."*

Conservatively based on the measured minimum external ambient background noise level, the following sleep disturbance screening criterion was determined:

L_{Amax} or $L_{A1(1\ minute)}$ = 41 dB(A) (L_{A90}) + 15 dB(A) **= <u>56 dB(A)</u>**

Therefore in accordance with the NPfI guidelines detailed above, the following sleep disturbance screening criterion has been applied for this project:

Sleep Disturbance Criterion = <u>56 dB(A)</u>

2.3.4 THE EPA'S ROAD NOISE POLICY 2011

The NSW Environmental Protection Authority (EPA) presents guidelines for assessment of road traffic noise in its *Road Noise Policy (RNP) 2011*. The document provides road traffic noise criteria for proposed road as well as other developments with the potential to have an impact in relation to traffic noise generation. **Table 2.3** presents the relevant RNP noise criteria for the subject site.

Table 2.3 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project / land use	Assessment Criteria [dB]	
		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 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

3 INSTRUMENTATION & MEASUREMENT STANDARDS

All measurements were conducted in general accordance with Australian Standard 1055.1-1997, *"Acoustics - Description and Measurement of Environmental Noise Part 1: General Procedures"*. Acoustic Dynamics' sound measurements were carried out using precision sound level meters conforming to the requirements of IEC 61672-2002 *"Electroacoustics: Sound Level Meters – Part 1: Specifications"*. The survey instrumentation used during the survey is set out in **Table 3.1**.

Table 3.1 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
4231	1234135	Brüel & Kjaer Acoustic Calibrator
2270	2664115	Brüel & Kjaer Modular Precision Sound Level Meter
4189	2650956	Brüel & Kjaer 12.5 mm Prepolarised Condenser Microphone
XL2	A2A-06816-E0	NTi-XL2 Sound Level Meter

The reference sound pressure level was checked prior to and after the measurements using the acoustic calibrator and remained within acceptable limits.

4 NOISE IMPACT ASSESSMENT

The following section provides an assessment of the maximum noise emission associated with the use of the development, at the residential site boundary, against the various noise criteria and objectives outlined in **Section 2** above.

4.1 OPERATIONAL NOISE ASSESSMENT METHODOLOGY

4.1.1 MODEL CONFIGURATION

Acoustic modelling was undertaken using computer modelling software (CadnaA™ 2020) to predict operational noise levels generated by the proposed mixed use light industrial park development. CadnaA calculates environmental noise propagation according to the applicable international and ISO standards, including the ISO 9613 algorithm.

Ground absorption, reflection and relevant shielding objects are taken into account in the calculations, while topographical information was obtained and imported directly into the model. The following assumptions were made with regard to the configuration of the noise model:

- A ground absorption coefficient of 0.5 is used throughout the model;
- All development site buildings and façade have been modelled as a 'smooth façade/reflective barrier', and the calculations have been configured to include 3 orders of reflections;
- All children are modelled as point sources, 1m above ground RL;
- All Patrons to the gym, café, restaurant and vet are considered adults, and are modelled as point sources, 1.5m above ground RL;
- All source sound power levels are taken from previous measurements;
- All vehicles entering/leaving the site via Sunny Bank Road are modelled as line sources travelling at 20 km/hr, with multiple lines to represent vehicles using either the basement car parks or the external parking spaces;

Further to the above general modelling assumptions, Acoustic Dynamics provide specific assumptions relating to the various proposed tenancies, detailed as follows:

4.1.1.1 LOT 1 BUILDING A & B

Gym

- 100 patrons talking (50 with raised voices) on the outdoor balconies;
- 6 vehicles per hour, during the Daytime/Evening period, and 12 vehicles per hour, during the Night-time period entering/leaving the site, using either the basement car park of Building A or car spaces at the front of the building, to adequately assess a worst case scenario (i.e. peak periods);
- Mechanical Plant is assumed to be located on the rooftop (i.e. air conditioning units) and on the external facades (i.e. Toilet Exhaust Fans (TEF));

Café

- 12 patrons talking (6 with raised voices) within the cafe, with windows and doors open;
- 12 vehicles per hour entering/leaving the site, using the outdoor car spaces at the front of the Building A, for any patrons that do not use the basement car park;
- Mechanical Plant is located as per the Mechanical Engineers mark-up plans, and includes air conditioning units (AC), Kitchen Exhaust Fans (KEF) and Toilet Exhaust Fans (TEF));

Restaurant

- 24 patrons talking (12 with raised voices) within the restaurant, with windows and doors open;
- 8 vehicles per hour entering/leaving the site, using the outdoor car spaces at the front of the Building A, for any patrons that do not use the basement car park;
- Mechanical Plant is located as per the Mechanical Engineers mark-up plans, and includes air conditioning units (AC), Kitchen Exhaust Fans (KEF) and Toilet Exhaust Fans (TEF));

Child Care Centre

- All children playing in outdoor play areas at any one time;
- 36 vehicles per hour entering/leaving the site, either using the basement car park of Building B or car spaces at the front of the building, to adequately assess a worst case scenario (i.e. the morning drop off & the evening pick up);
- Mechanical Plant is located as per the Mechanical Engineers mark-up plans, and includes air conditioning units (AC), Kitchen Exhaust Fans (KEF) and Toilet Exhaust Fans (TEF));

Vet

- 12 patrons talking (6 with raised voices) within the vet, with windows and doors open;
- 4 vehicles per hour entering/leaving the site, using the outdoor car spaces at the front of the Building B, for any patrons that do not use the basement car park;
- Mechanical Plant is located as per the Mechanical Engineers mark-up plans, and includes air conditioning units (AC) and Toilet Exhaust Fans (TEF));

4.1.1.2 LOT 2 BUILDING C, D, E, F, G & H

Warehouse and Storage Units

- 44 vehicles per hour entering/leaving the site, using site driveways and loading bays, as per Traffic Engineers report; and
- Mechanical Plant is located as per the Mechanical Engineers mark-up plans, and includes air conditioning units (AC), Car Park Make-up Air (CP) and Various Exhaust Fans (EF).

4.1.2 MODELLING SCENARIOS

Acoustic Dynamics has conducted modelling of three (3) scenarios, relating to the time of day, as follows:

Scenario A – Daytime (7am to 6pm)

- All noise sources operating simultaneously and continuously, over any 15-minute period during the day.

Scenario B – Evening (6pm to 10pm)

- The proposed gym and associated mechanical equipment operating;
- The proposed child care centre and associated mechanical equipment operating;
- The restaurant and associated mechanical equipment operating;
- Warehouse and Storage units operating at 50% of daytime capacity; and
- All mechanical plant operating.

NB: Assumed to be operating simultaneously and continuously, over any 15-minute period during the evening.

Scenario C – Night-time (10pm to 7am)

- The proposed gym and associated mechanical equipment operating;
- Warehouse and Storage units operating at less than 5% of daytime capacity (i.e only very occasional activity); and
- No mechanical plant operating (other than Gym).

NB: Assumed to be operating simultaneously and continuously, over any 15-minute period during the night-time.

It is highly unlikely that all equipment would be operating at their maximum sound power levels at any one time and certain types of equipment would be used on site for only brief periods during certain activities. Therefore, the noise modelling predictions are considered conservative.

4.1.3 SOURCE SOUND POWER LEVELS

Sound power levels associated with the use and operations of the proposed development are presented in **Table 4.1**. Typical equipment noise levels have been obtained from the previous assessment and other similar projects.

Table 4.1 Equipment Details and Sound Power Levels

Source	Typical Noise Levels SWL [dB(A)][1]
Air conditioning unit (based on a Daikin REYQ12TY1)	81
Gym Patrons (Talking Loud, groups of 5)	92
Children 3-6 yr olds (10 x children actively playing)[2]	88
Small Kitchen Exhaust Fan (KEF)	70
Large Kitchen Exhaust Fan (KEF)	80
Light Vehicles entering/exiting the site (10 km/hr)	85
Heavy Vehicles entering/exiting the site (10 km/hr)	95

Note: 1) Third octave levels have not been displayed, however have been used in the CadnaA modelling.

2) The sound power level (SWL) for 3-6 yr old children is typically the loudest of all children, therefore Acoustic Dynamics considers the use of this SWL to be a conservative approach in assessing the noise impacts from the operation of a child care centre.

4.2 OPERATIONAL NOISE ASSESSMENT PREDICTIONS

The calculated maximum external noise emission levels at the nearest residential receiver locations are presented in **Table 4.2** below, assessed against the criteria presented within **Table 2.1** above. It is advised that by achieving compliance with the nearest residential receiver locations, compliance will also be achieved at those further away.

The predicted noise emission levels presented below in **Table 4.2** include allowances for relevant distance, direction and shielding losses. Acoustic Dynamics advises, although unlikely to occur, the worst-case cumulative impact of all scenarios is presented within **Table 4.2**, demonstrating compliance with the noise impact criteria and objectives.

Table 4.2 External Predicted Noise Emission Levels & Relevant Criteria – Nearest Receivers

Residential Receiver Location	Activity / Noise Source[1]	Calculated Maximum L_{Aeq} Noise Level [dB]	L_{Aeq} Noise Emission Objective [dB]	Complies?
R1 4 Perratt Close [W]	Scenario A	43	49 [Day]	**Yes**
	Scenario B	43	48 [Evening]	**Yes**
	Scenario C	34	43 [Night]	**Yes**
R2 6 Perratt Close [W]	Scenario A	41	49 [Day]	**Yes**
	Scenario B	41	48 [Evening]	**Yes**
	Scenario C	31	43 [Night]	**Yes**
R3 8 Perratt Close [W]	Scenario A	43	49 [Day]	**Yes**
	Scenario B	43	48 [Evening]	**Yes**
	Scenario C	32	43 [Night]	**Yes**
R4 10 Perratt Close [W]	Scenario A	42	49 [Day]	**Yes**
	Scenario B	42	48 [Evening]	**Yes**
	Scenario C	32	43 [Night]	**Yes**
R5 12 Perratt Close [NW]	Scenario A	42	49 [Day]	**Yes**
	Scenario B	42	48 [Evening]	**Yes**
	Scenario C	32	43 [Night]	**Yes**
R6 14 Perratt Close [NW]	Scenario A	41	49 [Day]	**Yes**
	Scenario B	41	48 [Evening]	**Yes**
	Scenario C	32	43 [Night]	**Yes**
R7 16 Perratt Close [NW]	Scenario A	38	49 [Day]	**Yes**
	Scenario B	38	48 [Evening]	**Yes**
	Scenario C	32	43 [Night]	**Yes**
R8 1 Perratt Close [W]	Scenario A	39	49 [Day]	**Yes**
	Scenario B	39	48 [Evening]	**Yes**
	Scenario C	31	43 [Night]	**Yes**
R9 5 Perratt Close [W]	Scenario A	39	49 [Day]	**Yes**
	Scenario B	39	48 [Evening]	**Yes**
	Scenario C	32	43 [Night]	**Yes**
R10 5 Prings Road [SSE]	Scenario A	36	49 [Day]	**Yes**
	Scenario B	36	48 [Evening]	**Yes**
	Scenario C	34	43 [Night]	**Yes**
R11 5 Sunny Bank Road [S]	Scenario A	56	70 (When In Use)	**Yes**

Note 1) The description of the activities and noise sources for each scenario is detailed in **Section 4.1.2**.

4.3 CHILD CARE CENTRE EXTERNAL NOISE INTRUSION ASSESSMENT

Operator-attended noise monitoring measurements were conducted at a representative location within the subject site. **Table 4.3** presents the maximum predicted noise intrusion levels from the measured L_{Aeq} noise data obtained from the operator-attended noise monitoring measurement.

Table 4.3 Maximum Predicted L_{Aeq} Noise Intrusion Levels at the Subject Child Care Centre

Location	Description of Noise Source	Maximum Predicted L_{Aeq} Noise Level [dB]	L_{Aeq} Criterion [dB]	Achieves Compliance?
Indoor Play or Sleeping Areas	Road, Rail Traffic or Industry	≤ 20 (windows closed)	40	**Yes**
		≤40 (windows open)		**Yes**[1]
Outdoor Play or Activity Area		≤49	55	**Yes**

Note: 1) Acoustic Dynamics assumes that this guideline noise level applies to windows closed; therefore, guideline noise level with windows open would be 50 dB.

Based on Acoustic Dynamics' noise measurements, we advise that the Child Care Centre meets the assessment guideline values of the Association of Australasian Acoustical Consultants (AAAC).

4.4 ROAD TRAFFIC NOISE ASSESSMENT

Vehicles will enter and leave the site via Sunny Bank Road. Vehicles travelling on Sunny Bank Road (local road) are assessed with consideration to the daytime $L_{Aeq,1hr}$ and night-time $L_{Aeq,1hr}$ criteria outlined earlier in **Section 2.3.3**.

The calculated maximum noise emission levels at sensitive residential receivers, due to the vehicles accessing the site via Sunny Bank Road and Railway Crescent, are presented in **Table 4.4** below. It is advised that by achieving compliance with the nearest residential locations, compliance will also be achieved at all other residential and receiver locations further away.

Table 4.4 Modelled Sensitive Receiver Daytime $L_{eq,1hr}$ and Night-time $L_{eq,1hr}$ Sound Pressure Level

Most Affected Receiver	Relevant $L_{Aeq,1hr}$ Objective [dB]	Predicted $L_{eq,1hr}$ Sound Pressure Level [dB]	Complies? (Yes/No)
R1 – R9 1 -16 Perratt [W]	55 [Daytime]	<25	**Yes**
	50 [Night-time]	<20	**Yes**
R10 5 Prings Road [SSE]	55 [Daytime]	<35	**Yes**
	50 [Night-time]	<25	**Yes**

Note: 1) Predicted L_{Aeq} noise level is the maximum noise level within a 1hr period.

Based on the above, Acoustic Dynamics advises that the noise emission due additional traffic as a result of the activity of the proposed development will achieve compliance with the NSW EPA's Road Noise Policy.

4.4.1 SLEEP DISTURBANCE

To assess any potential for sleep disturbance, maximum noise levels due to car door slams were predicted at the nearest sensitive receiver using CadnaA noise modelling software. The maximum impulsive sound power level was derived from British Standard BS5228:2009 *Code of Practice for noise and vibration control on construction and open sites – Part 1 Noise.* The L_{max} impulsive event noise level was modelled as a point source.

Modeling results indicate received noise levels resulting from activities commonly associated with the use and operation of the development during the morning shoulder period i.e. 6am to 7am, determined the potential maximum $L_{A1(60\ Sec)}$ noise emission to be **34 dB**. These activities achieve compliance with the EPA's sleep disturbance screening criterion of **$L_{A1(60sec)}$ ≤ 56 dB** during night-time hours.

5 DISCUSSION

The measurement and calculation results presented within **Table 4.2** above indicate that noise emission resulting from the use and operation of the proposed mixed use light industrial park development, at all external residential and commercial receivers, will **comply** with all noise emission objectives within Central Coast Council requirements, NSW guidelines and Australian Standards, provided the recommendations within **Section 6** are implemented.

6 RECOMMENDATIONS

Acoustic Dynamics understands that the development is likely to be utilised by a variety of vehicles throughout the operating times, including vehicles used for deliveries (vans & trucks etc) however Acoustic Dynamics advises that control of the noise emission from various vehicles will greatly reduce the noise emission from the loading zone areas.

Acoustic Dynamics recommends the incorporation of broadband reversing alarms on the all vehicles used on site. The broadband reversing alarm will reduce the tonal aspects of the traditional beeping alarm and will maintain the safety of the workers on site.

Furthermore, Acoustic Dynamics' also recommends displaying signage requesting and ensuring that all people using the site leave in a quiet and sensible manner to minimise any potential impacts on the surrounding amenity.

7 CONCLUSION AND ACOUSTIC OPINION

Acoustic Dynamics has conducted an acoustic assessment of the noise emission resulting from the use and operation of the proposed mixed use light industrial park development, located at 27 Sunny Bank Road, Lisarow.

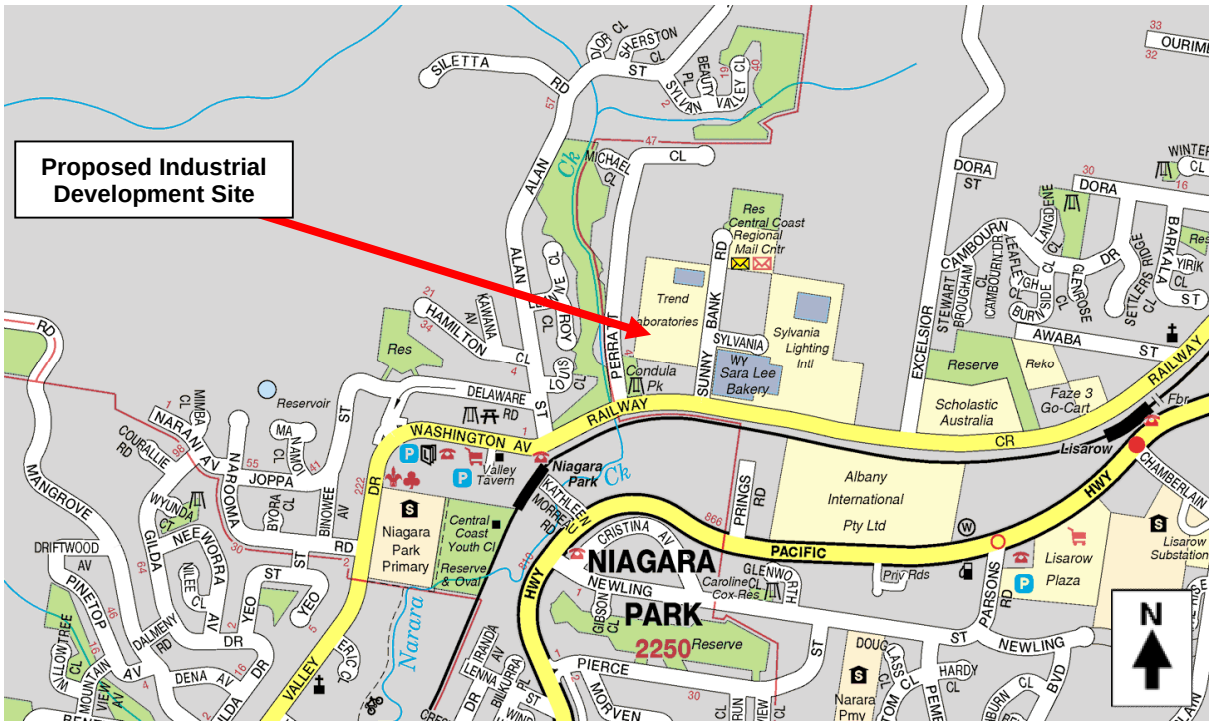
Acoustic Opinion

Further to the noise monitoring and measurements conducted, our review of the relevant acoustic criteria, requirements and our calculations, the proposed operation of the proposed mixed use light industrial park development will comply with relevant noise emission criteria of Central Coast Council, NSW guidelines and Australian Standards, following the incorporation of our recommendations outlined in Section 6.

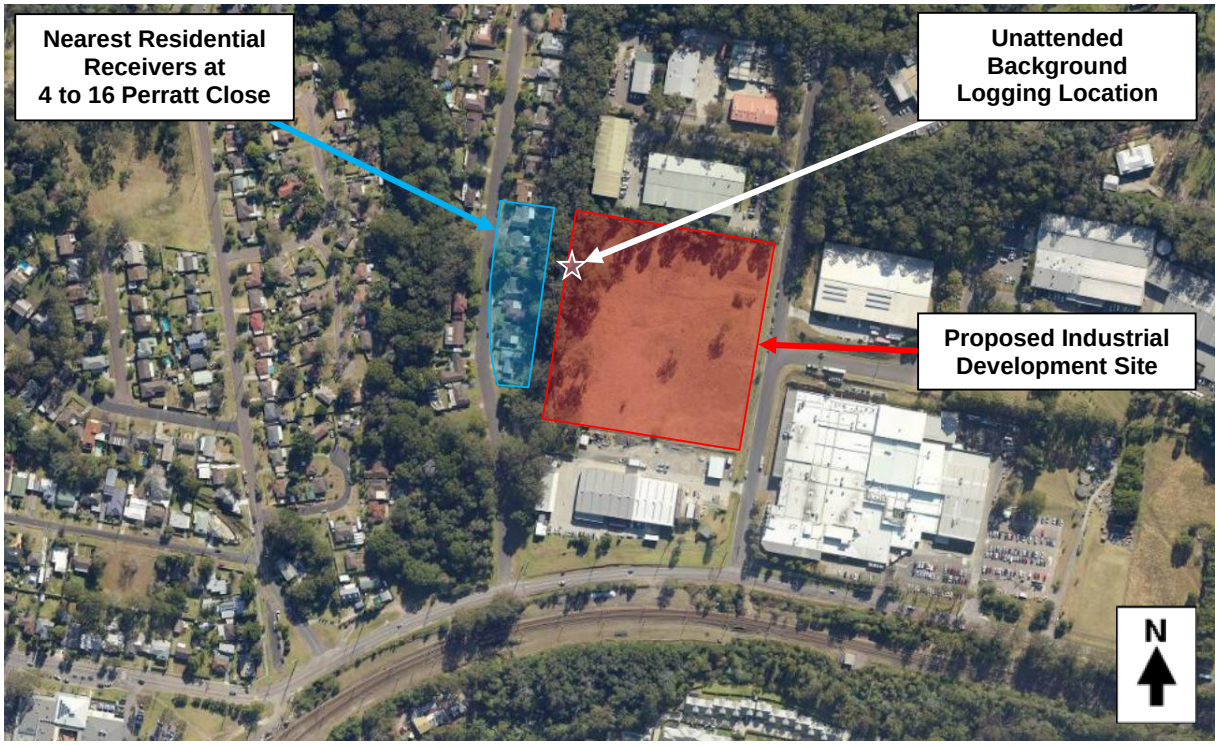
We trust that the above information meets with your requirements and expectations. Please do not hesitate to contact us on 02 9908 1270 should you require more information.

APPENDIX A – SITE LOCATION MAP, AERIAL IMAGE & DRAWINGS

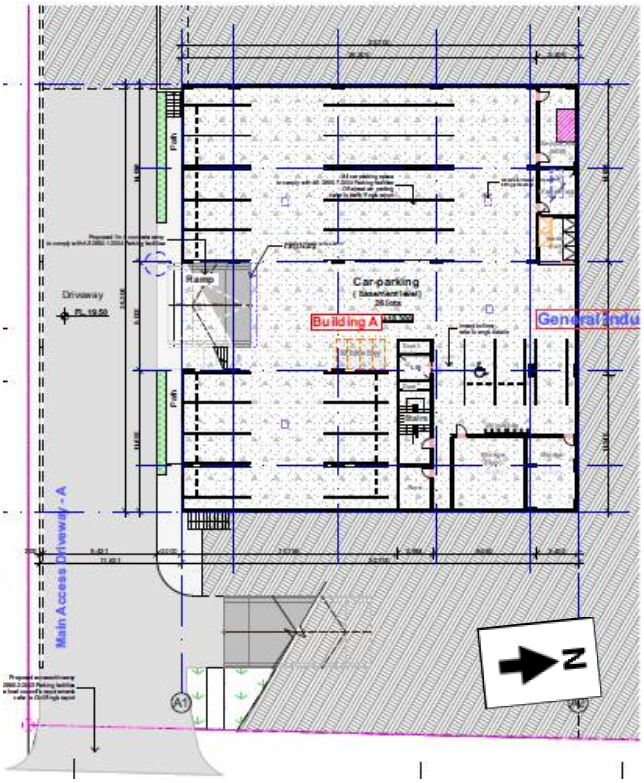
A.1 LOCATION MAP



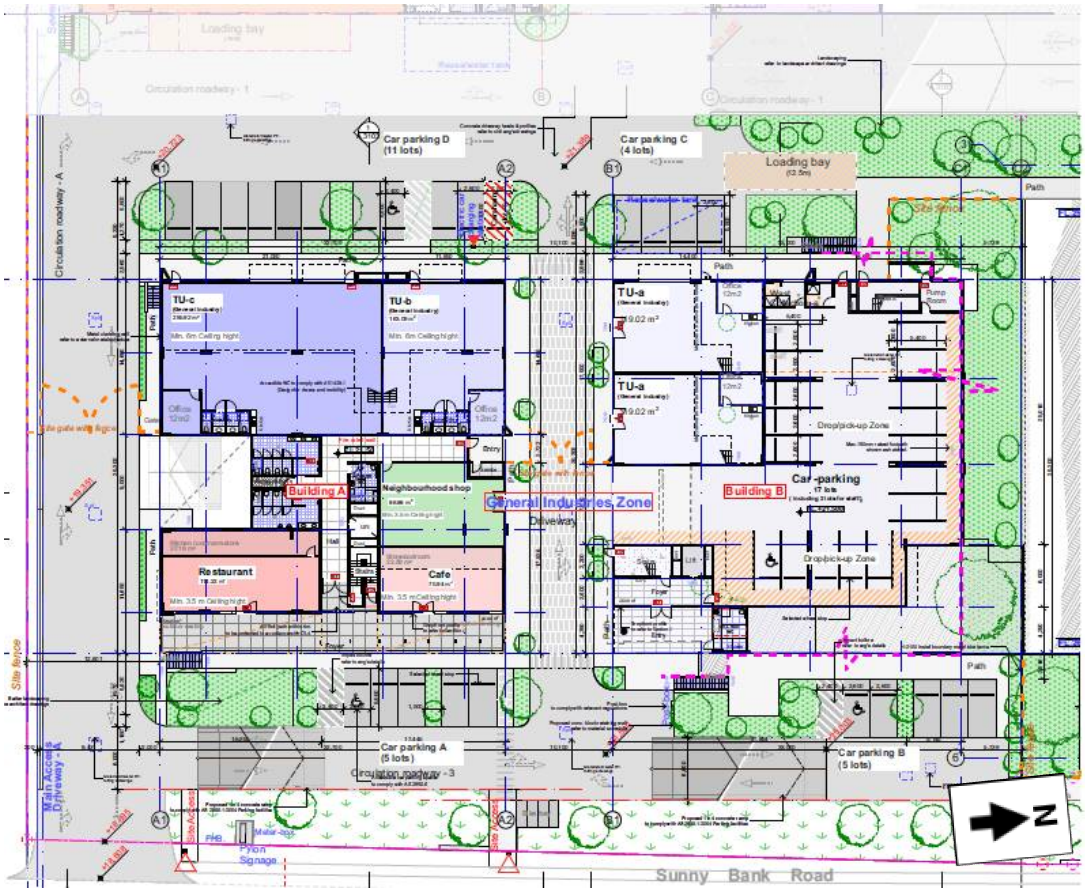
A.2 AERIAL IMAGE (COURTESY OF SIX MAPS)



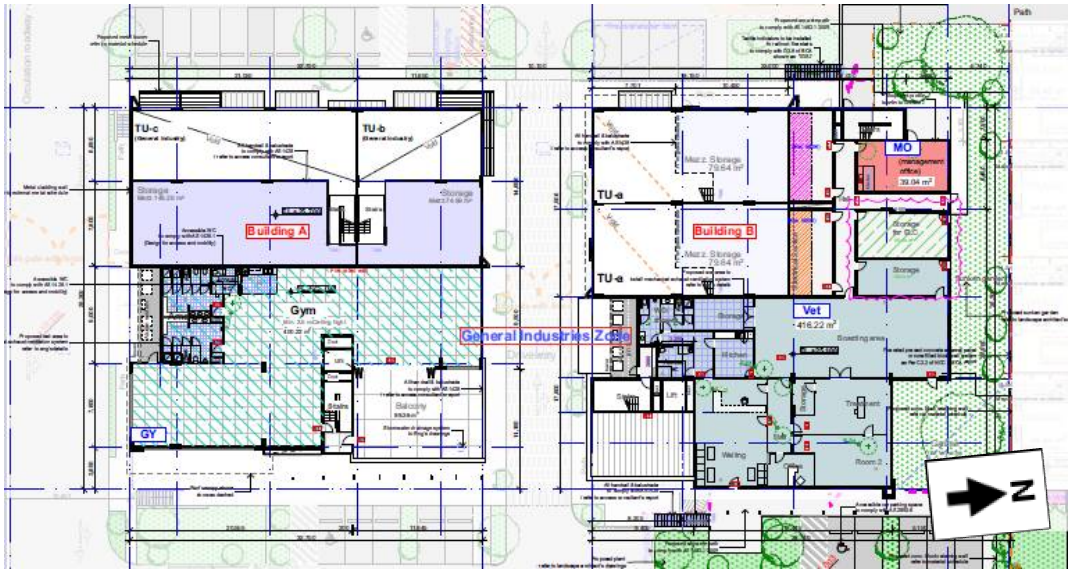
A.3.1. LOT 1 BUILDING A – BASEMENT FLOOR LAYOUT



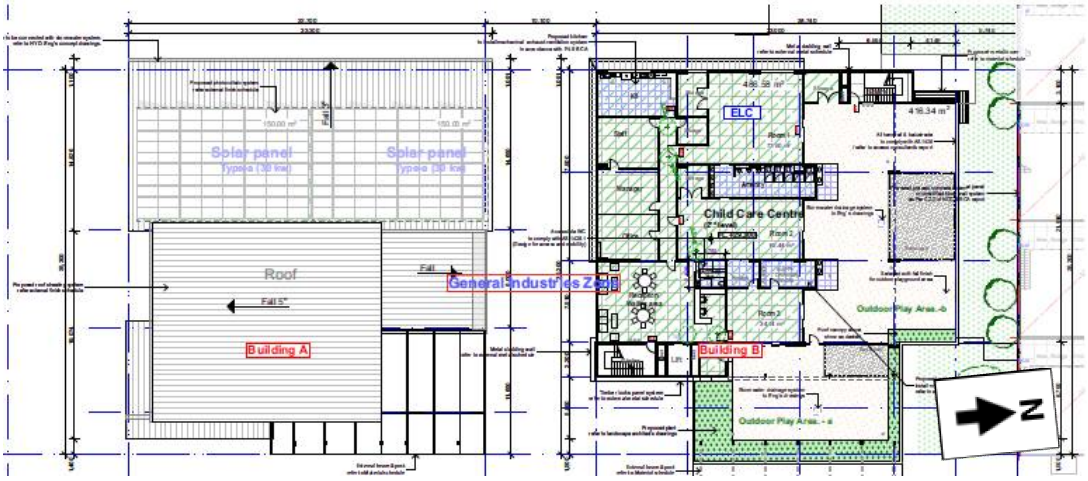
A.3.2. LOT 1 BUILDING A & B – GROUND FLOOR LAYOUT



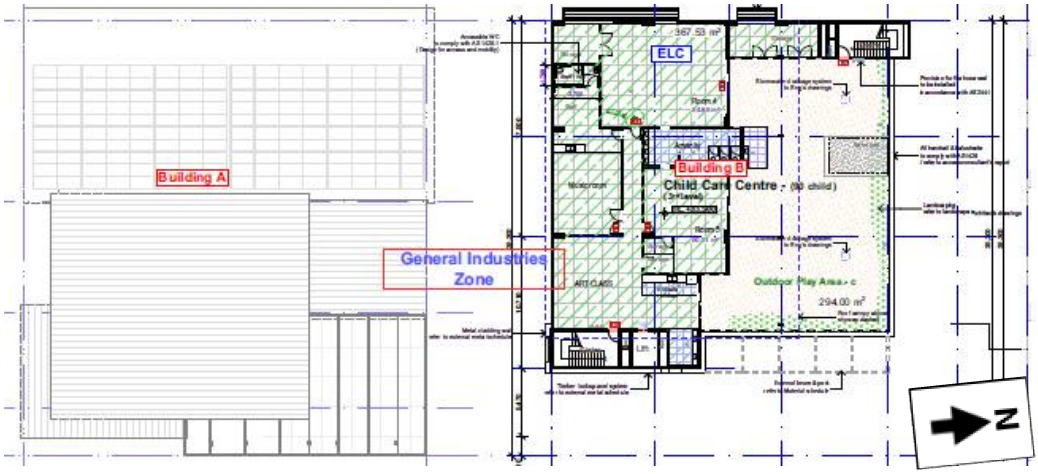
A.3.3. LOT 1 BUILDING A & B – FIRST FLOOR LAYOUT



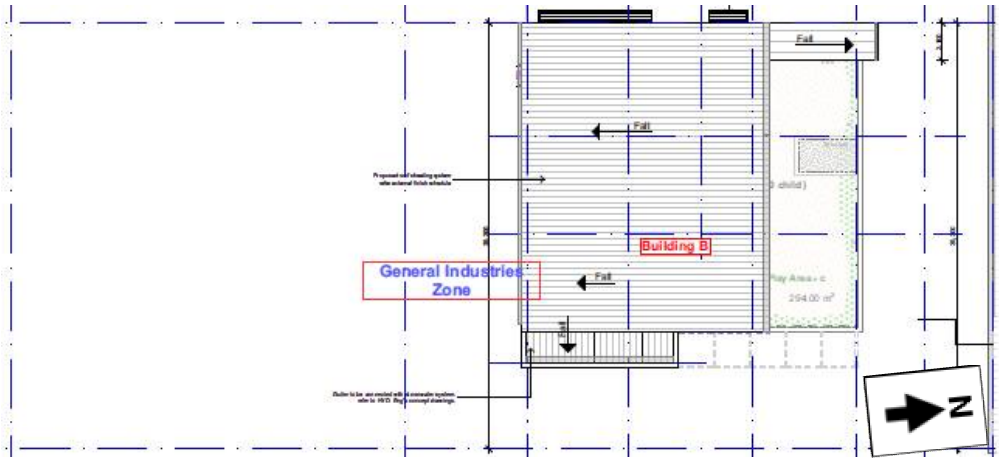
A.3.4. LOT 1 BUILDING A & B – SECOND FLOOR LAYOUT



A.3.5. LOT 1 BUILDING A – ROOF LAYOUT & BUILDING B – THIRD FLOOR LAYOUT



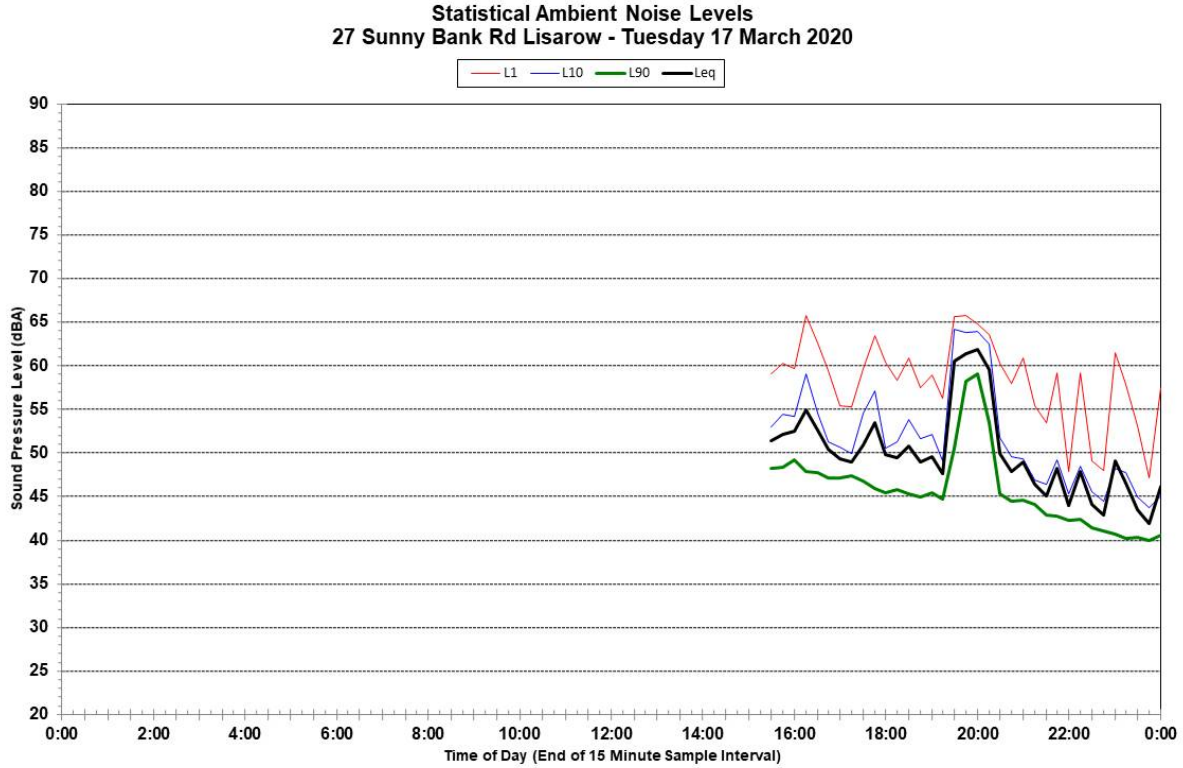
A.3.6. LOT 1 BUILDING B – ROOF LAYOUT

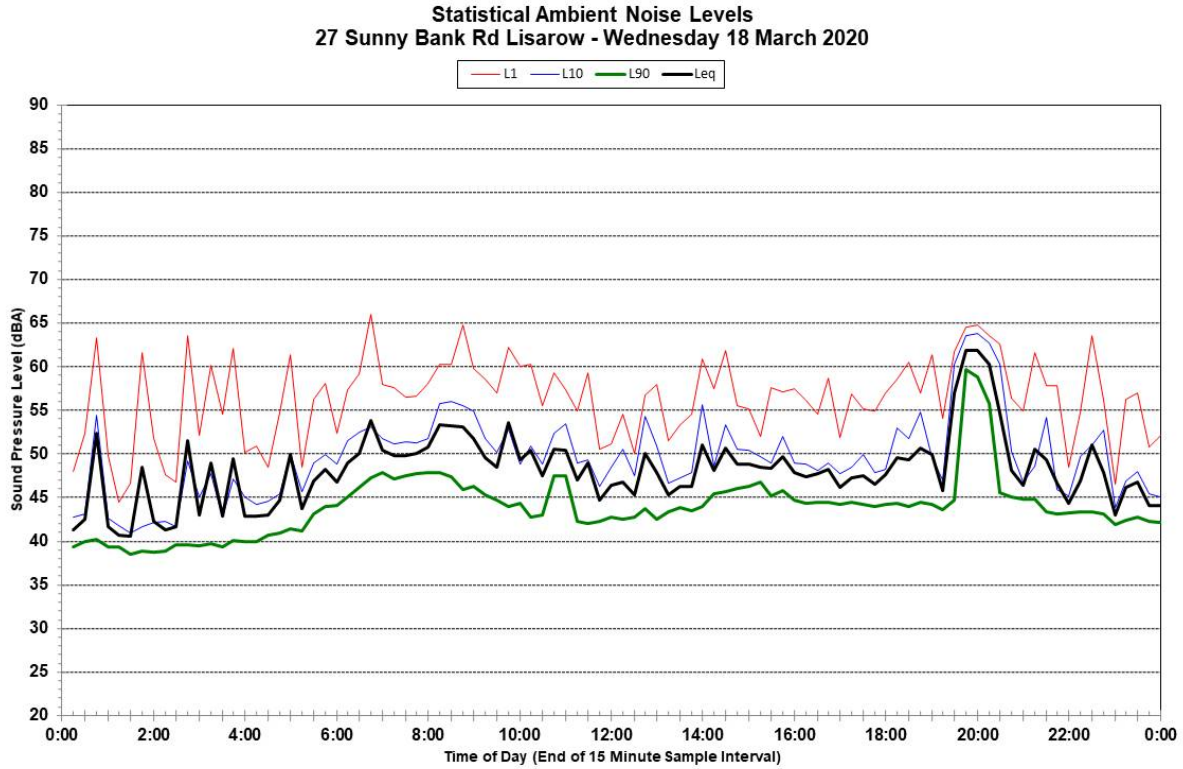


A.3.7. LOT 1 & LOT 2 GENERAL LAYOUT

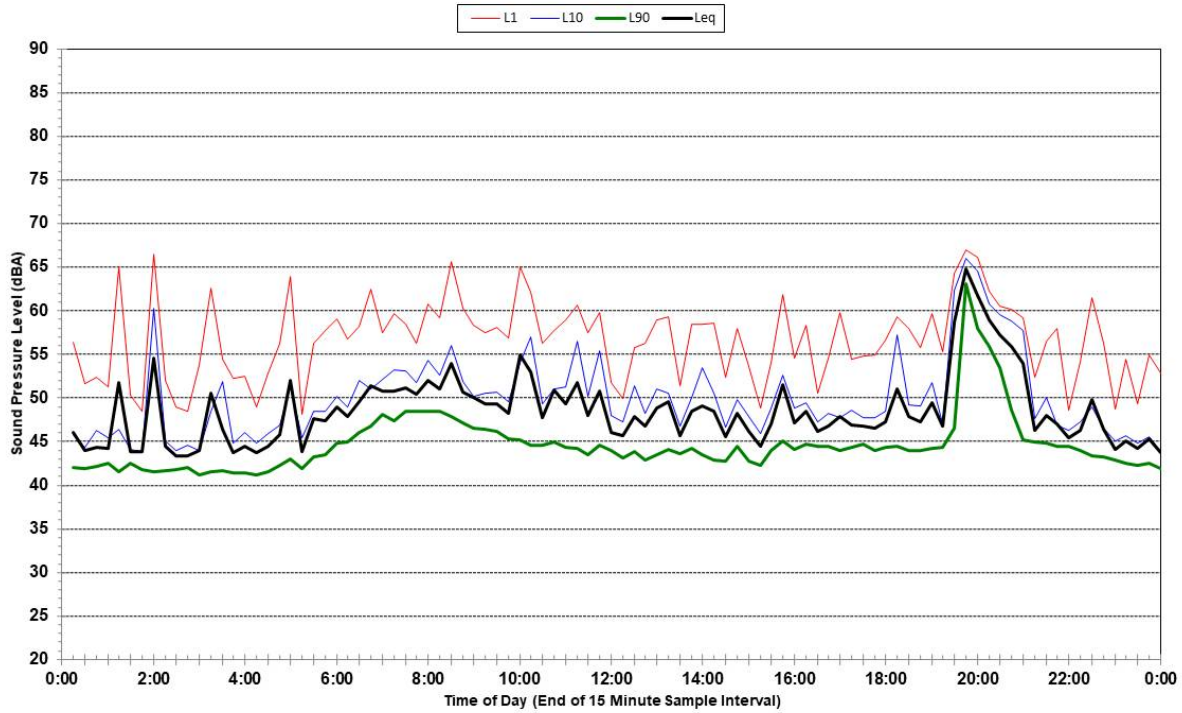
APPENDIX B – UNATTENDED NOISE LOGGER DATA

B.1 LOGGER GRAPHS

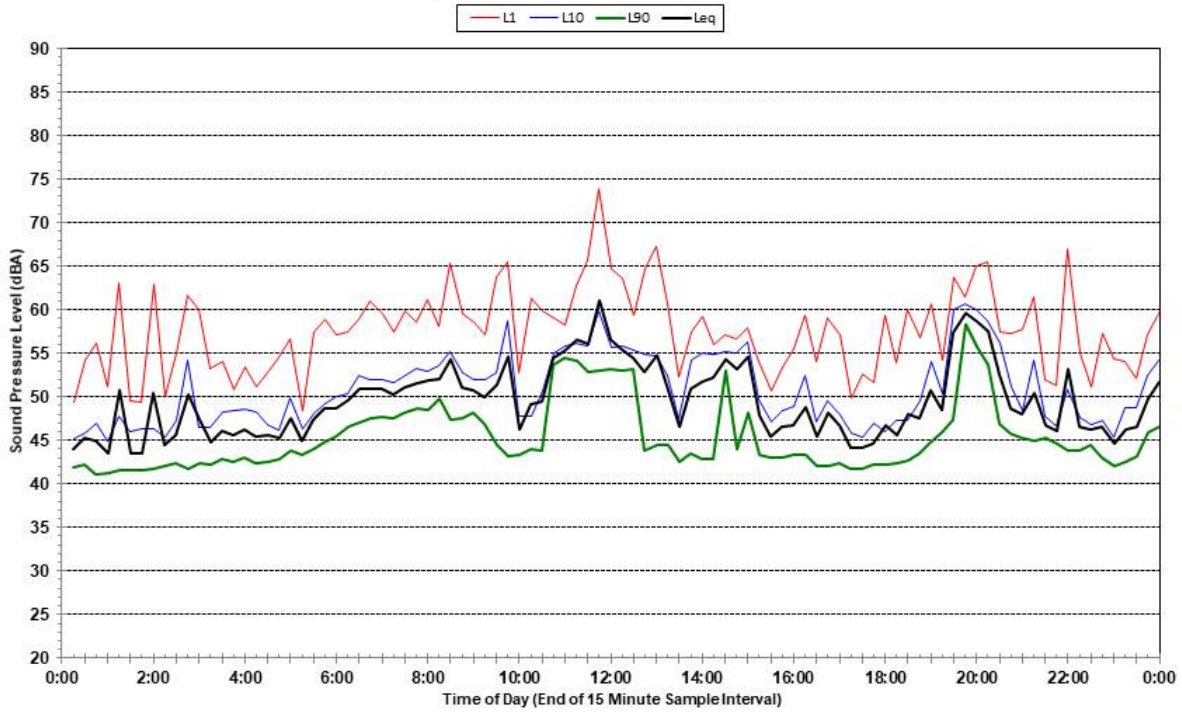




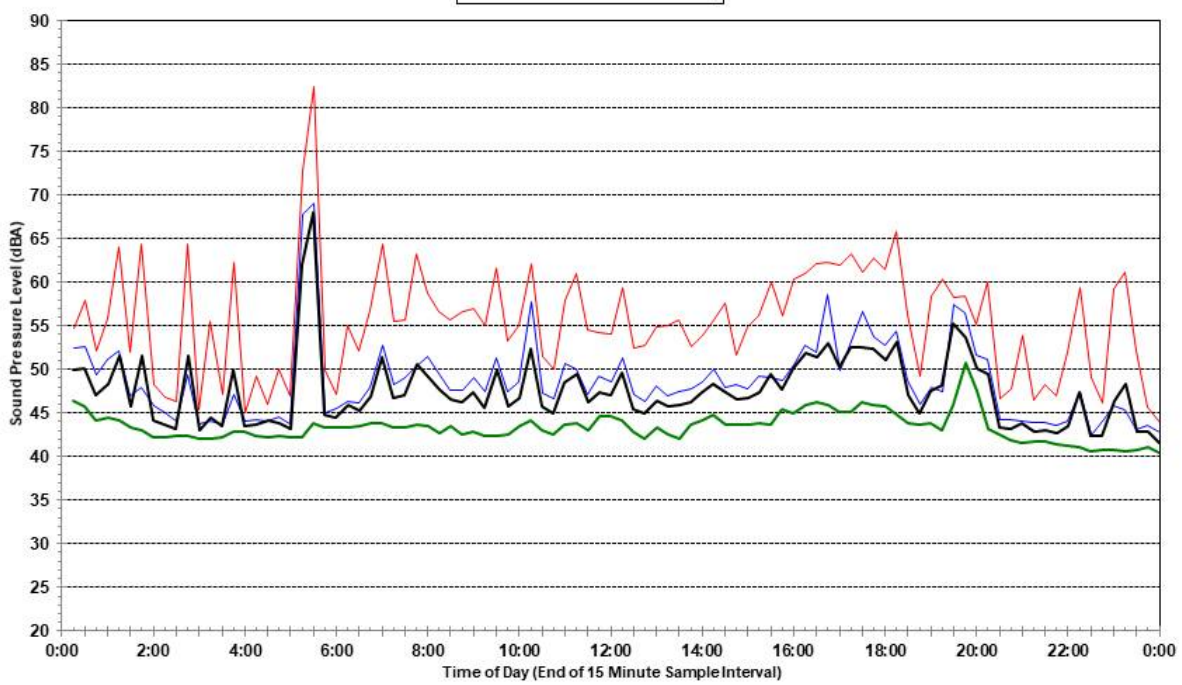
Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Thursday 19 March 2020



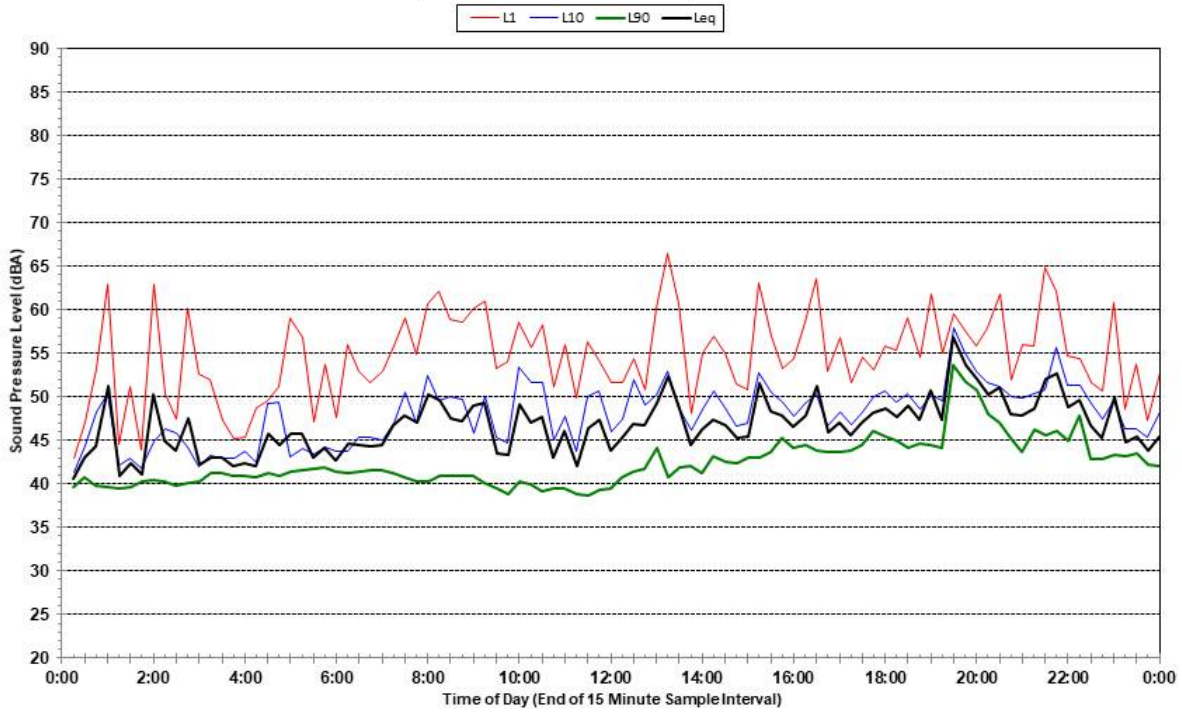
Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Friday 20 March 2020

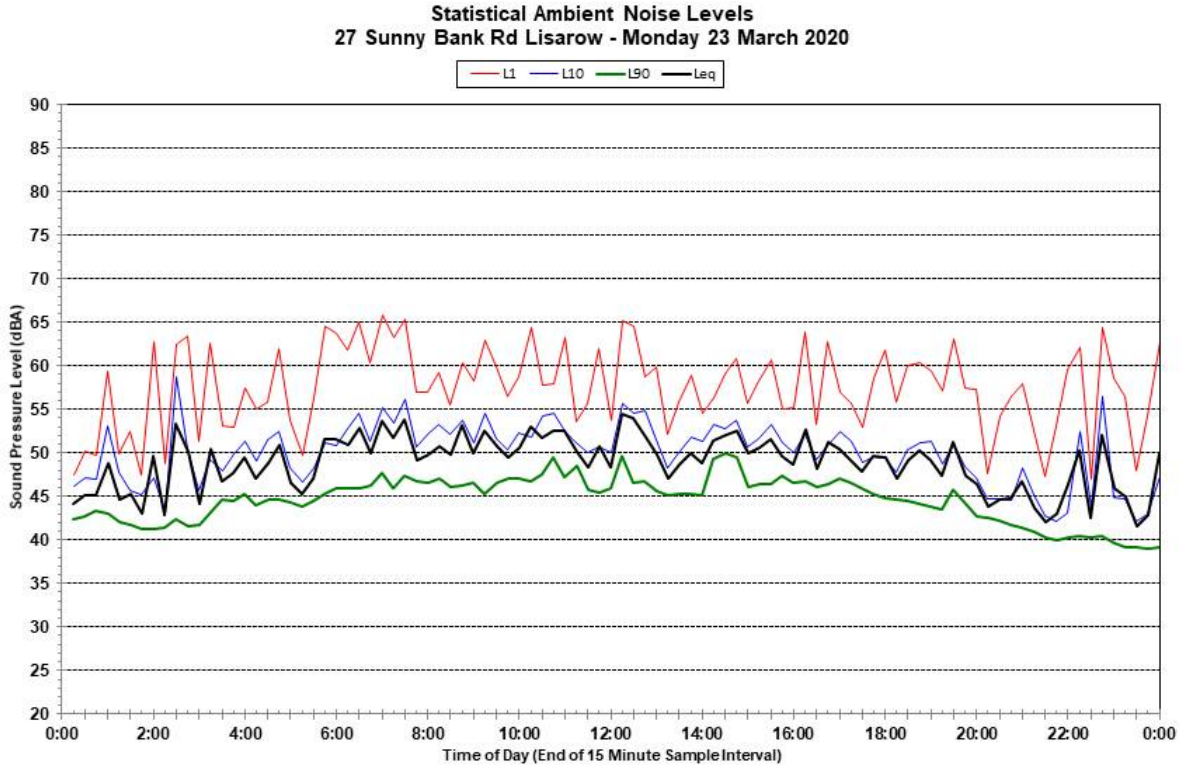


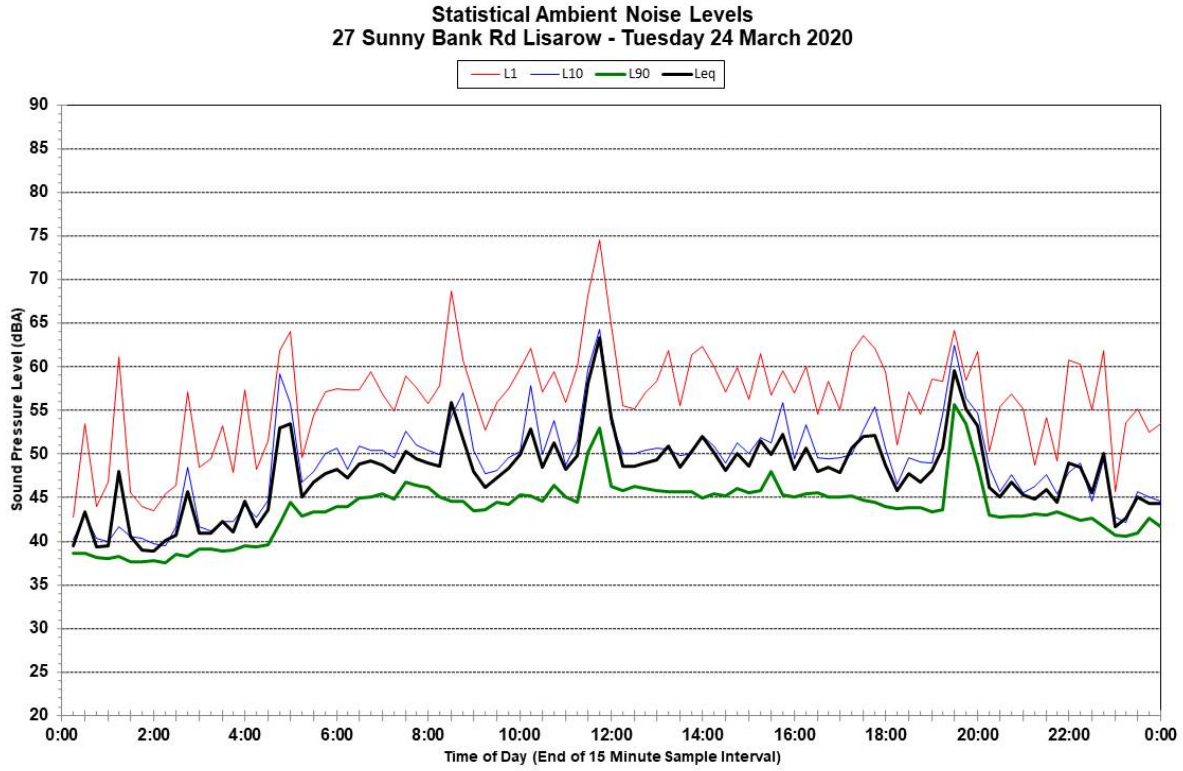
Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Saturday 21 March 2020



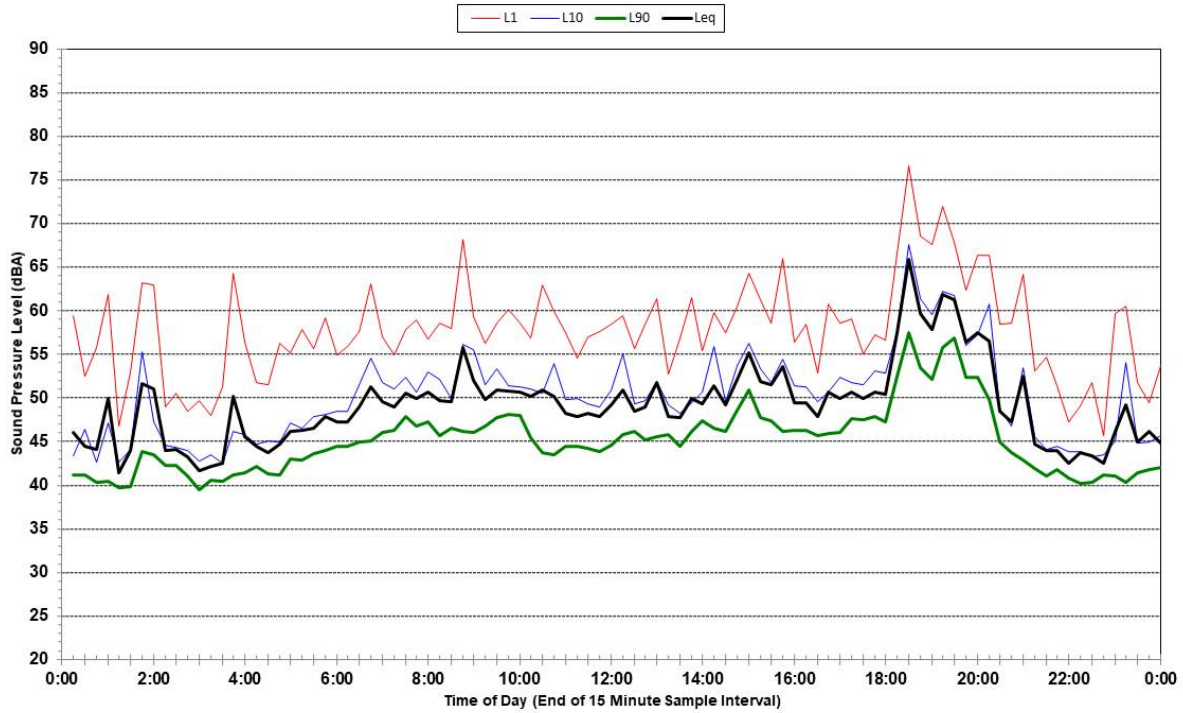
Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Sunday 22 March 2020



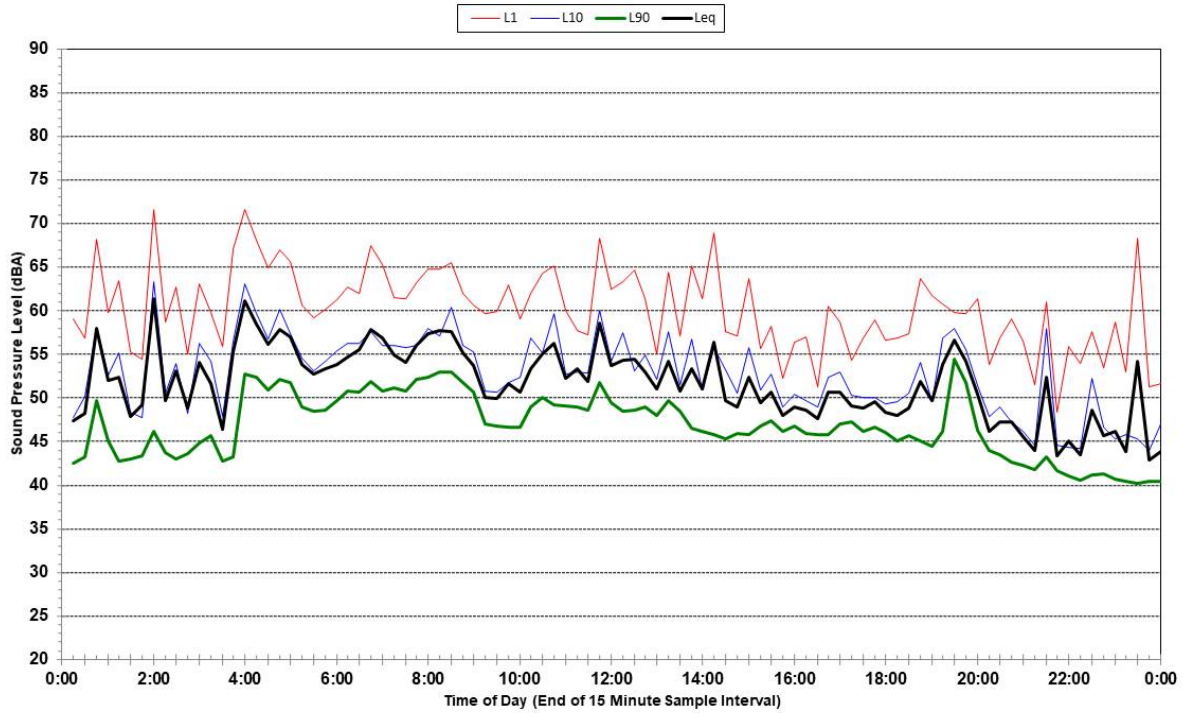

Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Monday 23 March 2020
L1
L10
L90
Leq
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)

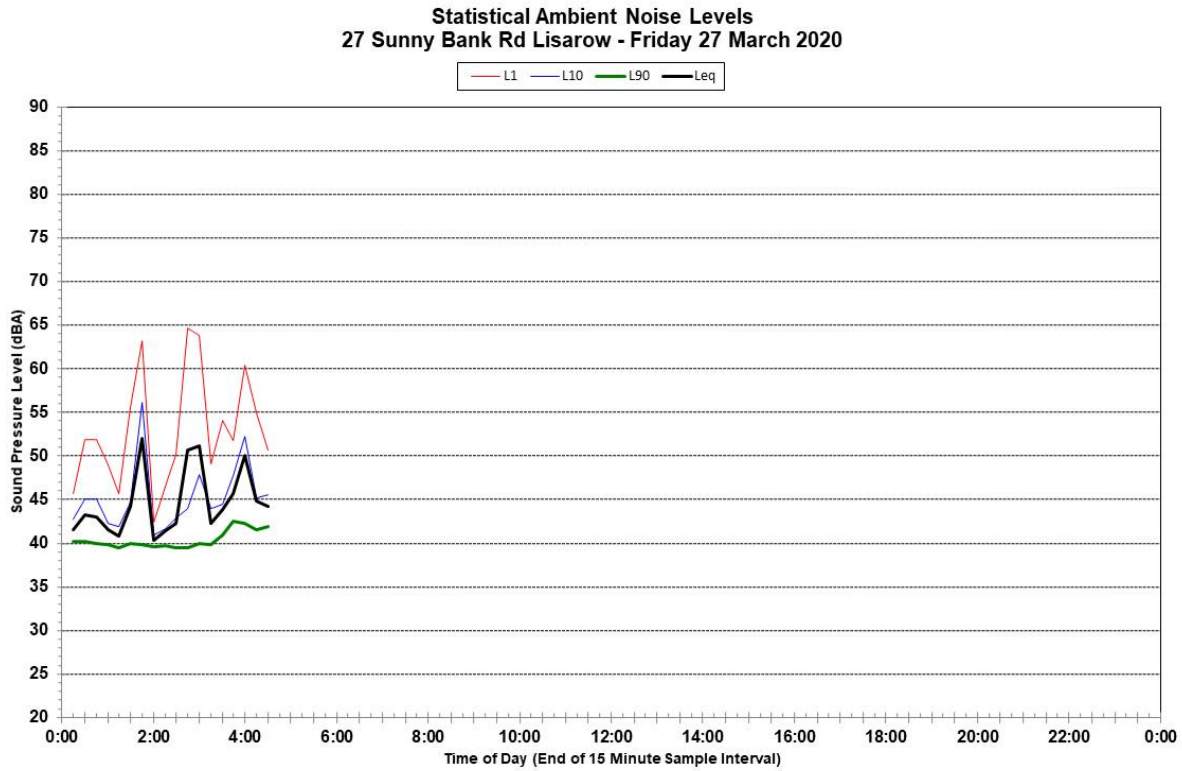

Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Tuesday 24 March 2020
L1
L10
L90
Leq
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Wednesday 25 March 2020



Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Thursday 26 March 2020




Statistical Ambient Noise Levels
27 Sunny Bank Rd Lisarow - Friday 27 March 2020
L1
L10
L90
Leq
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)