NOISE IMPACT ASSESSMENT
FOR GOW STREET RECYCLING CENTRE PTY LTD
81 GOW STREET, PADSTOW

Prepared for: Gow Street Recycling Centre Pty Ltd
NSW EPA

Prepared by: Victoria Hale, Environmental Scientist
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EXECUTIVE SUMMARY

Benbow Environmental has been engaged by Gow Street Recycling Centre to prepare a Noise Impact Assessment (NIA) for a resource recovery facility at 81 Gow Street, Padstow (Lot A DP 103140). This report has been completed as part of an Environmental Impact Statement (EIS) for the proponent, which aim to update their existing Environmental Protection License (10943) which currently allows them to have a processing capacity of 80,000 tpa, and a maximum storage quantity of 7,300 at any one time.

The proposal will include a staged development. Stage 1 of the development is the focus of this noise report and includes establishment of a liquid waste processing plant, with a capacity of 250,000 tonnes per year. These operations will take place on site 24/7.

The nearest receivers and the noise generating activities have been identified. Noise criteria for the project have been formed, with assessment of the proposed site activities conducted against the NSW Noise Policy for Industry (EPA, 2017), NSW Interim Construction Guidelines (DECCW,2009) and the NSW Road Noise Policy (DECCW, 2011). Modelling of the activities was conducted using the noise modelling software SoundPlan.

This noise impact assessment finds that predicted noise levels will be below the criteria set out in accordance with the NSW Noise Policy for Industry, at all receivers and time periods.

During the night from 10pm – 6am the crusher, vacuum truck pump and excavator should not be used. An internal pump can be used at night such that the tanker truck vacuum pump is not needed.

Compliance with the guidelines set out in the NSW Road Noise Policy was predicted at all considered receptors.

No major construction will take place therefore construction noise and vibration impacts are considered minimal.

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1. INTRODUCTION

Benbow Environmental has been engaged by Gow Street Recycling Centre to prepare a Noise Impact Assessment (NIA) for a resource recovery facility at 81 Gow Street, Padstow (Lot A DP 103140). This report has been completed as part of an Environmental Impact Statement (EIS) for the proponent, which aim to update their existing Environmental Protection License (10943) which currently allows them to have a processing capacity of 80,000 tpa, and a maximum storage quantity of 7,300 at any one time.

The proposal will include a staged development. Stage 1 of the development is the focus of this noise report and includes establishment of a drilling mud processing plant, with a capacity of 250,000 tonnes per. These operations will take place on site 24/7.

Future stages of the proposed development include:

- Establishment of a Concrete batching plant with a processing capacity of 500,000 tpa; and
- Increase in the processing capacity of the current resource recovery facility on site to 250,000 tpa and an increase of storage quantity to 10,000 tonnes at any one time.

Approval for future stages is not sought at this time.

Stage 1 of the proposal constitutes State Significant Development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 as it falls under the definition of a waste and resource management facility that would handle more than 1,000 tonnes per year of liquid industrial waste.

Principal noise sources resulting from the site are expected to be due to; screening equipment, crushing equipment, excavators, front end loaders, truck movements and pumps

The potential noise impacts of operational and road traffic activities on the nearby receivers have been predicted utilising noise modelling software, SoundPlan. This noise impact assessment has been prepared in accordance with the following guidelines and documents:

- NSW Noise Policy for Industry (EPA, 2017);
- NSW Interim Construction Guideline (DECCW, 2009);
- NSW Road Noise Policy (RNP) (DECCW, 2011); and
- Bankstown Development Control Plan (DCP) 2015.

1.1 Scope of Works

This noise impact assessment has been limited to the following scope of works:

a) Review of proposed plans and operations;
b) Long term and short term ambient and background noise monitoring in accordance with relevant guidelines;
c) Identify project specific noise levels;
d) Determine all potential noise sources associated with the proposed development;
e) Collect required noise source data;
f) Predict potential noise impacts at the nearest potentially affected receptors to the site;

g) Assess potential noise impacts against relevant legislation and guidelines;
h) Recommend control measures where required; and
i) Compile this report with concise statements of potential noise impact.

To aid in the review of this report, supporting documentation has been included within the Attachments. A glossary of terminology is included in Attachment 1.

2. PROPOSED DEVELOPMENT

2.1 Site Location

The site is located at 81-87 Gow Street, Padstow, 2211, in Sydney's south-west, within the boundaries of the Canterbury-Bankstown Council. The property is also known as Lot A DP 103140.

The site has an area of approximately 1 ha and can be accessed from Gow Street. The site is situated in IN1 – General Industrial land use zoning under the Bankstown Local Environmental Plan (LEP) 2015. It is located in an industrial precinct, the all adjacent receptors are industrial Figure 2-1 shows the site in a regional context.

Figure 2-1: Site Location in a regional context

Source: Six Maps 2019

↑N
Not to scale

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Northmead NSW 2152

2.2 Hours of Operations

The new proposed facility is requesting approval to operate 24 hours per day, 7 day per week. The operations therefore span the day, evening and night periods as defined by the Noise Policy for Industry (EPA, 2017).

2.3 Existing Resource Recovery Facility

The site contains an existing resource recovery facility with approval under DA-51/1997 to process up to 80,000 tonnes per year and store tpa of construction and demolition (C&D) waste and has a storage capacity of 7,300 tonnes at any one time. The facility is authorised to accept the following wastes:

- General solid waste (non-putrescible) including:
  - Glass, plastic, rubber, plasterboard, ceramics, bricks, concrete or metal;
  - Virgin excavated material;
  - Building and Demolition waste;
  - Asphalt waste;
  - Cured concrete waste;
  - Any mixture of the wastes referred to above.

- Drilling mud, meaning a mixture of naturally occurring rock and soil, including but not limited to materials such as sandstone, shale and clay, and drilling fluid generated during drilling operations such as horizontal or directional drilling or potholing. This does not included drilling mud that has been generated by:
  - Deep drilling for mineral, gas or coal exploration; or
  - Drilling through contaminated soils, acid sulphate soils (ASS) or potential acid sulphate soils (PASS).

It should be noted that the facility currently does not accept drilling mud and this waste type is currently not included on the Site's EPL.

The site is fully developed and consists of two weighbridges, a wheel wash, a warehouse building, demountable office and a demountable lunchroom. Crushing and screening equipment are located in the south-east corner and there are 12 pre-cast concrete external storage bunkers for the storage of incoming wastes and recovered materials.

The existing development site is a fully developed industrial premises with a total area of approximately 10,115 m^2. The entire site consists of sealed concrete hardstand.

Approved hours of operation of the existing resource recovery facility are between 6.00am - 6.00pm on weekdays and 7.00 am - 6.00 pm weekends.

A description of the existing processes is provided in the following section.

2.3.1 Existing Process Description

The following steps are undertaken at the existing approved resource recovery facility:

- Incoming waste is received pre-sorted from skip bin facilities and is inspected at the weighbridge upon arrival at the site.
- Acceptable waste is weighed and recorded.
- Trucks unload the waste at the pre-crushed storage area.
- Material is crushed and screened to suitable sizes.
- Recovered material is stored in designated external storage bunkers.
- Materials are loaded onto trucks and weighed before leaving the site via the wheel wash for off-site reuse as road-base material.

Waste dockets are maintained for record keeping purposes.

2.4 Proposed Liquid Waste Dewatering Facility

Establishment and operation of a liquid waste dewatering plant is proposed. This plant would essentially operate separately from the existing approved resource recovery facility, however, there would be some minor interactions between processes. The proposal consists of the following elements:

- Construction of purpose-built building to enclose the dewatering facility. This would replace the existing warehouse building that would be demolished.
- A new office building would be constructed. This would replace the existing demountable office and amenities building as well as the demountable lunchroom that would be removed from site. The new office building would be used by staff of both the existing and proposed developments.
- Installation of dewatering equipment including a flocculant station/pit, screw separator and screen, slurry homogeniser, 2 x 60 kL silos, and filter press.
- A truck unloading area inside the building.
- Six (6) inground pits and sumps inside the building. Pits and sump details are as follows:
  - Inground Pit (receivals), 8.0 x 4.5 x 3.0 m deep (Volume: 108,000 L)
  - Floc Plant: Clean water pit, 3.0 x 2.835 x 2.5 m deep (Volume: 21,263 L)
  - Floc Plant: Dirty water pit (1), 2 x 2.835 x 2.5 m deep (Volume: 14,175 L)
  - Floc Plant: Dirty water pit (2), 3.33 x 2.835 x 2.5 m deep (Volume: 23,601 L)
  - Floc Plant: Sump Pit, 1.6 x 2.835 x 2.5 m deep (Volume: 11,340 L)
- Six (6) bunkers. Four (4) bunkers would be located inside the building and two (2) would be located external to the building under an awning. Bunker contents and dimensions are:
  - Bunker 1: Filter cake 6.3 x 8.5 m
  - Bunker 2: Sand 5.07 x 5.805 m
  - Bunker 3: Sand 5.295 x 5.805 m
  - Bunker 4: Sand 5.295 x 5.805 m
  - Bunker 5: Aggregate, 6.2 x 4.0 m
  - Bunker 6: Aggregate, 6.2 x 4.0 m
- Extension of the boundary wall up to new building behind the new aggregate bunkers.
- Connection to Sydney Water tradewaste under an agreement.
- Stormwater upgrades including a first flush system that directs the first 20 mm of on-site stormwater to a silt arrester and detention tank which will be used in the dewatering plant while the clean overflow is discharged to the stormwater easement using the existing stormwater connection during a heavy rain event.

A proposed site plan and equipment layout are provided in Appendix 8. A description of the dewatering process is provided in the following sub-section.

2.4.1 Proposed Process Description

The dewatering facility would operate as a recycling facility for the drilling mud and concrete washout water and stormwater captured onsite. The facility would involve the following activities:

- Unloading of drilling mud/concrete washout water into dirty water containment pits.
- This liquid is transferred into the dirty water pit and then into the flocculent station.
- The flocculants assist in settling sediments at the bottom of the tank.
- The sand/rock/sediment slurry is pumped from the bottom of the tank and into a screw separator.
- The screw separator removes the solids from the water.
- The solids are then transferred to a vibrating screen where the aggregates and sands are conveyed to internal and external storage bays.
- The water from the flocculent station and the screw separator is pumped to the two 60 kL silos, the slurry homogeniser tank and then into the filter press.
- The filter press removes the remaining silts and the cleaned water is pumped to the clean water pit.
- The sediments/silt from the filter press becomes a fine biscuit which is removed offsite as for application to land under the Treated Drilling Mud Exemption 2014 or to landfill.
- The filter press requires intermittent backwashing where backwash water is pumped to the dirty water pit to be reprocessed through the system.
- The clean water pit would be pH adjusted and then used for cleaning aggregates and sand during the screening process, dust suppression and washdown onsite. Excess water would be sent to tradewaste under a Trade Waste Agreement.

Site washdown water and stormwater will be collected in a 200 kL underground tank and through the above dewatering system.

The maximum quantity of liquid waste that can be processed through the dewatering plant in a 24-hour period is approximately 1,500 tonnes. This can easily accommodate stormwater runoff and the proposed 250,000 tonnes per annum.

2.5 DESCRIPTION OF THE SURROUNDING AREA

The site and immediate surrounding receivers are located within land zoned IN1 – General Industrial under Bankstown Local Environmental Plan, 2015, shown below in Figure 2-3. The nearest residential area is located to the south-east of the site, which is also located in Padstow. There are some IN2 – Light Industrial land zoning areas to the south and south-east of the site. There are RE1 – Public Recreation land zoning areas that run alongside Salt Pan Creek. The South Western Motorway, or the M5, is located in SP2 – Infrastructure land zoning directly south of the site.

Figure 2-2: Land Zoning Map

Source: NSW Planning Portal 2019

↑N
Not to scale

Legend:

Zone

B1	Neighbourhood Centre	R2	Low Density Residential
B2	Local Centre	R3	Medium Density Residential
B4	Mixed Use	R4	High Density Residential
B5	Business Development	RE1	Public Recreation
B6	Enterprise Corridor	RE2	Private Recreation
B7	Business Park	RU4	Primary Production Small Lots
E1	National Park and Nature Reserves	SP1	Special Activities
IN1	General Industrial	SP2	Infrastructure
IN2	Light Industrial	W1	Natural Waterways

2.6 Nearest Sensitive Receptors

Table 2-1 lists the location of representative potentially affected receivers that are considered in this assessment. The locations are shown in Figure 2-3.

Table 2-1: Table of Nearest Receptors

Receptor ID	Address	Direction from Site	Lot & DP	Approx. Distance from Proposed Development	Type of Receptor
R1	24 Bryant Street, Padstow	SW	17 DP 18539	240 m	Residential
R2	59 Gibson Avenue, Padstow	W	1 DP 18270	430 m	Residential
R3	39 Gibson Avenue, Padstow	W	2 DP 26399	500 m	Residential
R4	168 Canterbury Road, Bankstown	NW	3 DP 10428	610 m	Residential
R5	76 Chapel Road, Bankstown	NW	6 DP 132453	780 m	Residential
R6	61 Marshall Street, Bankstown	N	4 DP 13275	700 m	Residential
R7	26 John Street, Punchbowl	NE	1 DP 36047	900 m	Residential
R8	62 Moxon Road, Punchbowl	E	1 DP 1129073	1030 m	Residential
R9	98-100 Gibson Avenue, Padstow	SW	11 DP 1208760	390 m	School Classroom
R10	9 Gatwood Close, Padstow	W	71 DP 1163243	290 m	Place of Worship
R11	89 Gow Street, Padstow	W	A SP 103140	Adjacent	Industrial
R12	82 Gow Street, Padstow	N	2 DP 392634	Adjacent	Industrial
R13	79 Gow Street, Padstow	E	3 DP 371357	Adjacent	Industrial
R14	78 Gibson Avenue, Padstow	S	SP 22907	Adjacent	Industrial
R15	9 Wordie Place, Padstow	SW	12 DP 242730	Adjacent	Industrial

Note: distances measured from the boundaries of the site

Figure 2-3: Map of Nearest Receptors

Source: Google Earth 2018

↑N Not to scale	**Legend:** + Receiver location	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

3. EXISTING ACOUSTIC ENVIRONMENT

The level of background noise varies over the course of any 24 hour period, typically from a minimum at 3.00am to a maximum during morning and afternoon traffic peak hours. Therefore the NSW EPA Noise Policy for Industry (2017) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night time periods. The Noise Policy for Industry defines these periods as follows:

- **Day** – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays;
- **Evening** – the period from 6pm to 10pm; and
- **Night** – the remaining periods.

3.1 Noise Monitoring Equipment and Methodology

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

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with an acoustic calibrator. There were no excessive variances observed in the reference signal between the pre-measurement and post-measurement calibration. The instruments were set on A-weighted Fast response and noise levels were measured over 15-minute statistical intervals. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in Attachment 3. The microphones were fitted with windsocks and were positioned between 1.2 metres and 1.5 metres above ground level. Details of the instrumentation and setting utilised are provided in Table 3-1.

Table 3-1: Instrumentation and Setup Details

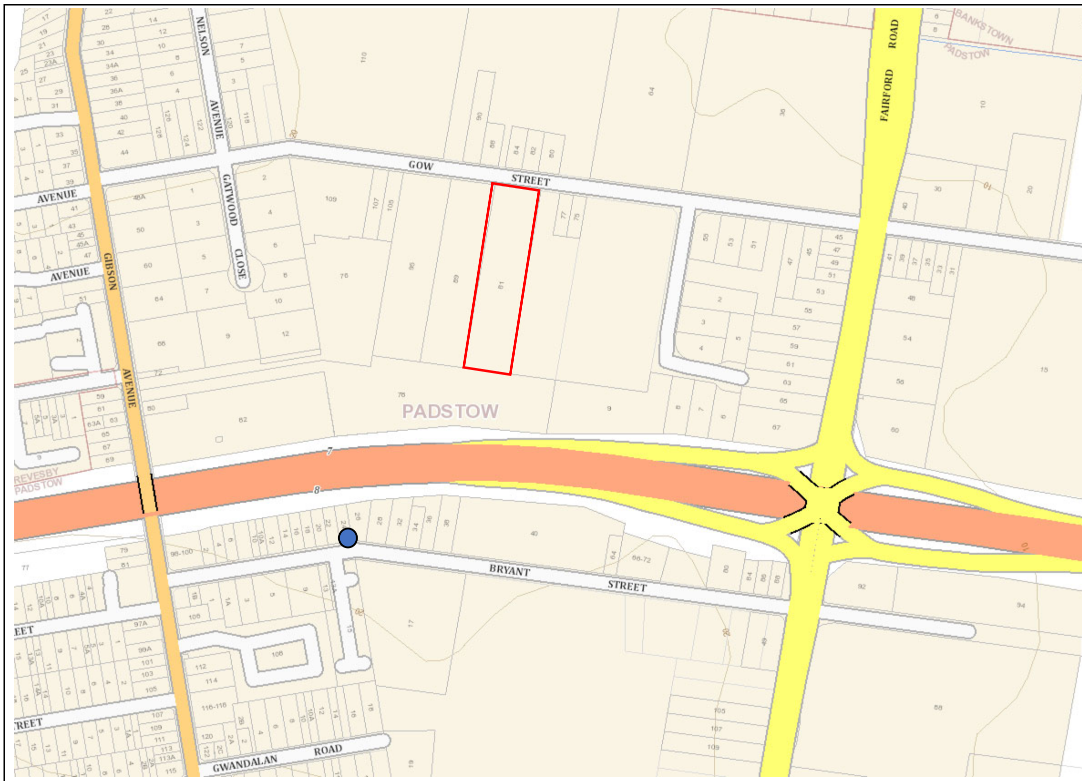
Type of Monitoring	Equipment	Serial Number	Setup Details
Long-term Unattended	ARL-215	194552	A-weighted Fast Response 15 minute integration period
Short-term Attended	Svantek SVAN957 Type 1 Integrating Sound and Vibration analyser	15335	Three channels: A-weighted Fast Response C-weighted Fast Response A-weighted Impulse Response 15 minute integration period 1/3 octave band recorded every 100 ms Logger file Recorded at steps of 100 ms

3.2 Measurement Location

Unattended long-term noise monitoring was undertaken from 11th March 2019 to 26th March 2019 at one representative location, 24 Bryant Street, Padstow, as shown in Figure 3-1.

Attended noise monitoring was undertaken at the same location on 11th March 2019. The attended and noise logging locations are shown in Figure 3-1. Noise Logger Charts are presented in Attachment 3.

Figure 3-1: Noise Logging Location



Source: Six Maps 2019

↑N Not to scale	**Legend**: Noise logging and attended location ● Site Boundaries ▭	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

3.3 MEASURED NOISE LEVELS

3.3.1 Long-Term Unattended Noise Monitoring Results

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

The results of the long-term unattended noise monitoring are displayed inTable 3-2. Daily noise logger graphs have been included in Attachment 3.

Table 3-2: Unattended Noise Monitoring Results, dB(A)

Date	Average L_1			Average L_{10}			ABL (L_{90})			L_{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
11/3/2019	-	59	59	-	56	54	-	48	42	-	53	51
12/3/2019	64	-	-	60	-	-	53	-	-	58	-	-
13/3/2019	65	61	60	61	57	55	53	48	38	59	55	53
14/3/2019	-	-	-	-	-	-	-	-	-	-	-	-
15/3/2019	-	-	-	-	-	-	-	-	-	-	-	-
16/3/2019	-	-	-	-	-	-	-	-	-	-	-	-
17/3/2019	-	62	-	-	58	-	-	51	-	-	57	-
18/3/2019	65	62	-	62	59	-	55	49	-	60	59	-
19/3/2019	-	63	-	-	60	-	-	50	-	-	60	-
20/3/2019	-	63	60	-	59	56	-	50	42	-	58	54
21/3/2019	-	62	61	-	59	56	-	51	43	-	58	55
22/3/2019	66	62	60	61	59	56	53	50	44	59	58	54
23/3/2019	65	63	59	60	58	54	52	50	40	62	59	52
24/3/2019	63	-	58	58	-	53	51	-	42	57	-	51
25/3/2019	-	61	-	-	57	-	-	51	-	-	55	-
26/3/2019	64	-	60	61	-	56	53	-	42	59	-	54
Average	**65**	**62**	**60**	**60**	**58**	**55**	*	*	*	*	*	*
Median (RBL)	*	*	*	*	*	*	**53**	**50**	**42**	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	**60**	**58**	**53**

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

3.3.2 Short-Term Attended Noise Monitoring Results

Given that the results of the unattended noise monitoring are affected by all ambient noise sources such as local fauna, road traffic and industrial sources, it is not possible to determine with precision the exact existing industrial noise contribution based on unattended monitoring alone. Therefore, the attended noise monitoring allows for a more detailed understanding of the existing ambient noise characteristics and a more meaningful final analysis to be undertaken. The results of the short-term attended noise monitoring are displayed in Table 3-3.

Table 3-3: Attended Noise Monitoring Results, dB(A)

Location / Time	Noise Descriptor				Comments
	L_{Aeq}	L_{A90}	L_{A10}	L_{A1}	
24 Bryant Street, Padstow	60	57	63	67	*Cars, M5 < 63 dB(A)* *Truck, M5 < 72 dB(A)* *Motorbike, M5 < 68 dB(A)* *Wind through trees, < 50 dB(A)* *Bird chirp close < 62 dB(A)* *Existing Orange Bins site inaudible*

4. METEOROLOGICAL CONDITIONS

Wind and temperature inversions may affect the noise emissions from the site and are to be incorporated in the assessment when considered to be a feature of the area.

In this section, an analysis of the 2019 weather data has been conducted to establish whether significant winds are characteristic of the area.

4.1 WIND EFFECTS

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

4.1.1 Wind Rose Plots

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

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

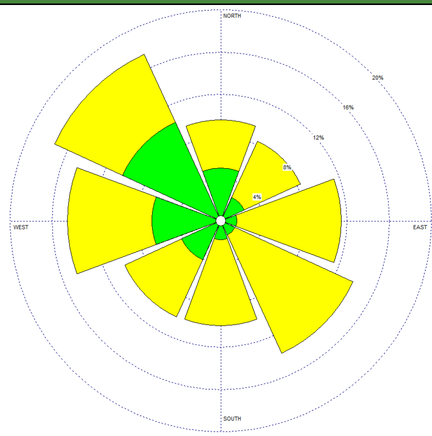
The concentric circles in each wind rose are the axis, which denote frequencies. In comparing the plots it should be noted that the axis varies between wind roses, although all wind roses are similar in size. The frequencies denoted on the axes are indicated beneath each wind rose.

4.1.2 Local Wind Trends

Seasonal wind rose plots for this site utilising Bankstown Airport AWS 2019 data have been included in Figure 4-1, Figure 4-2 and Figure 4-3 for day, evening and night periods respectively.

Figure 4-1: Wind Rose Plots – BOM Bankstown Airport AWS ID 066137 – 2019 – Day time

All Seasons

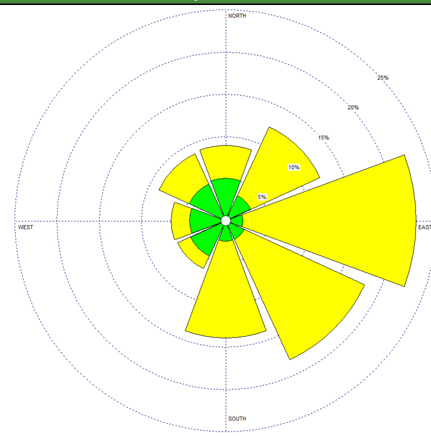


Average Wind Speed: 4.00 m/s

Calms Frequencies: 4.47%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)

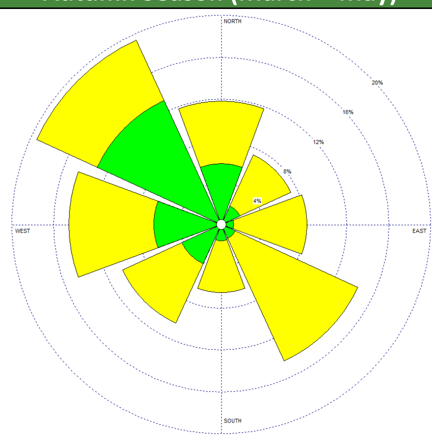


Average Wind Speed: 4.37 m/s

Calms Frequencies: 2.81%

Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Autumn Season (March – May)

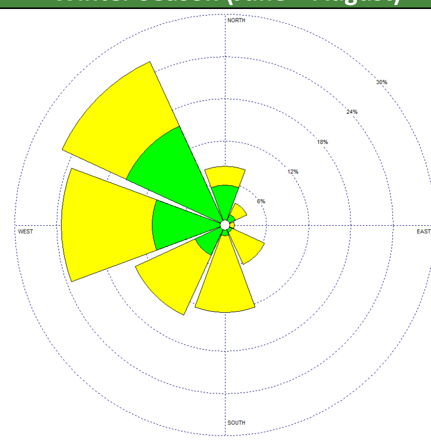


Average Wind Speed: 3.51 m/s

Calms Frequencies: 7.61%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Winter Season (June – August)

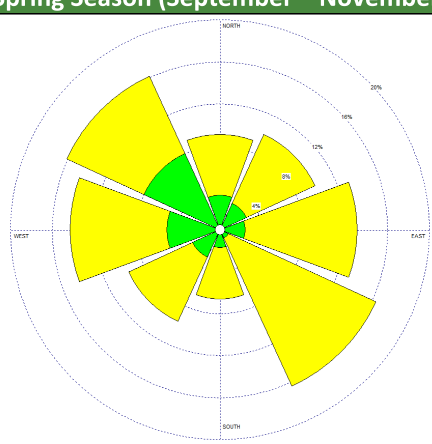


Average Wind Speed: 3.70 m/s

Calms Frequencies: 5.04%

Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Spring Season (September – November)



Average Wind Speed: 4.43 m/s

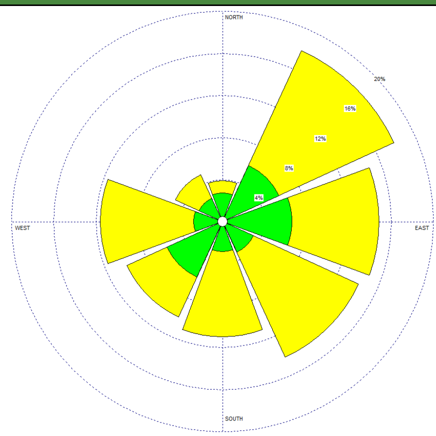
Calms Frequencies: 2.50%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Legend

Figure 4-2: Wind Rose Plots – BOM Bankstown Airport AWS ID 066137 – 2019 – Evening time

All Seasons

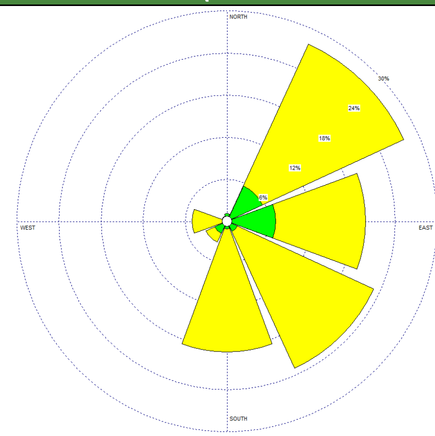


Average Wind Speed: 3.39 m/s

Calms Frequencies: 11.51%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)

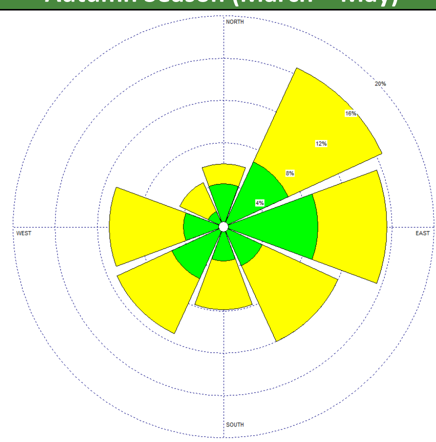


Average Wind Speed: 4.47 m/s

Calms Frequencies: 0.56%

Axis Frequencies: 7%, 14%, 21%, 28%, 35%

Autumn Season (March – May)

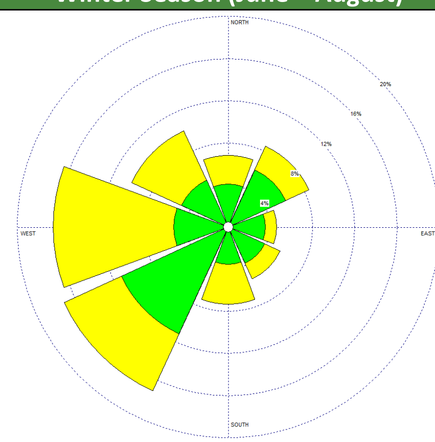


Average Wind Speed: 2.84 m/s

Calms Frequencies: 15.49%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Winter Season (June – August)

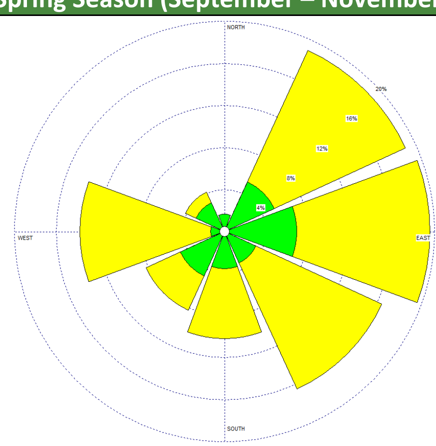


Average Wind Speed: 2.43 m/s

Calms Frequencies: 23.64%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Spring Season (September – November)



Average Wind Speed: 3.86 m/s

Calms Frequencies: 6.04%

Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Legend

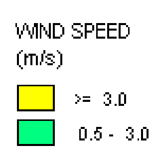
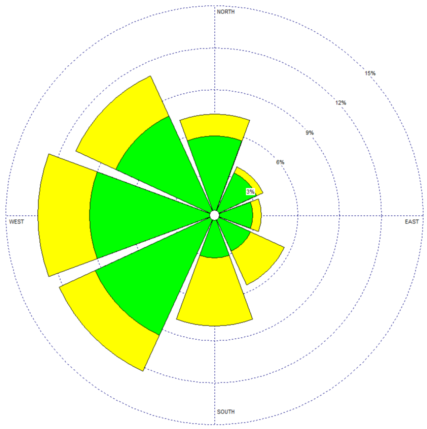


Figure 4-3: Wind Rose Plots – BOM Bankstown Airport AWS ID 066137 – 2019 – Night time

All Seasons

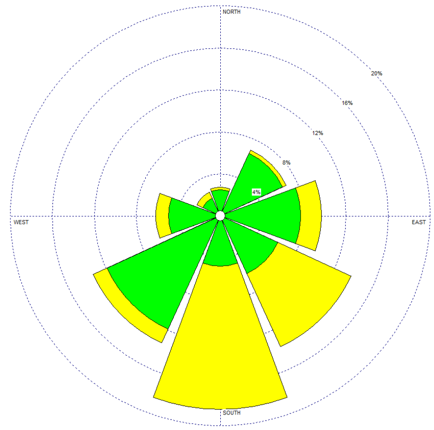


Average Wind Speed: 1.60 m/s

Calms Frequencies: 35.86%

Axis Frequencies: 3%, 6%, 9%, 12%, 15%

Summer Season (December – February)

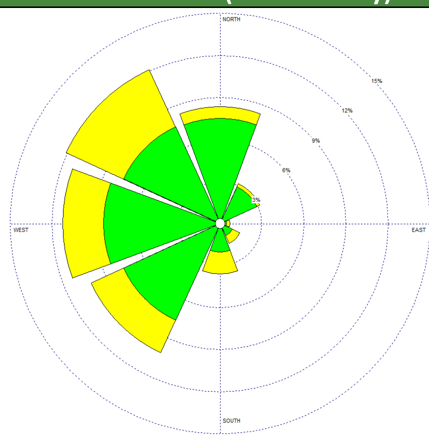


Average Wind Speed: 2.00 m/s

Calms Frequencies: 26.67%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Autumn Season (March – May)

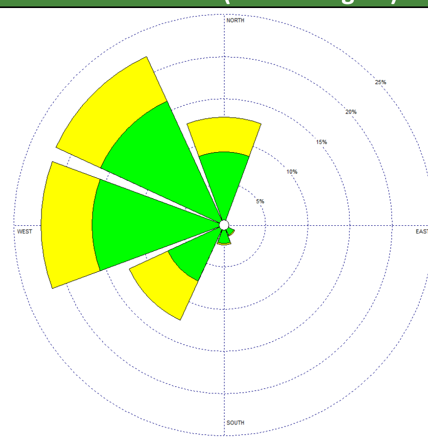


Average Wind Speed: 1.12 m/s

Calms Frequencies: 49.15%

Axis Frequencies: 3%, 6%, 9%, 12%, 15%

Winter Season (June – August)

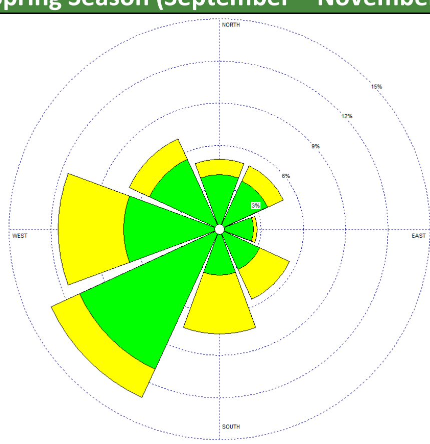


Average Wind Speed: 1.81 m/s

Calms Frequencies: 26.21%

Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Spring Season (September – November)

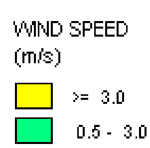


Average Wind Speed: 1.48 m/s

Calms Frequencies: 41.27%

Axis Frequencies: 3%, 6%, 9%, 12%, 15%

Legend



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

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

It can be seen from Table 4-1 that there is one instance where during a period/season, more than 30% of wind speeds are less than 3 m/s in the plus and minus 45 degree arc from source to receiver.

Therefore, wind effects have been included in the assessment.

Table 4-1: Noise Wind Component Analysis 2019 Bankstown Airport AWS

Receiver	Day				Evening				Night			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
R1	9.8	10.9	7.4	6.8	10.7	12	9	11.5	9.9	9.8	8.5	8.2
R2	9.1	6.9	4.2	6.7	13.8	15.8	5.7	14	12.6	3.6	1.1	6.4
R3	7.5	5.7	4.5	4.8	18.2	16.8	4.6	16.8	15.6	2.1	1.6	7
R4	6.8	4.4	4.2	3.7	8.1	11.7	3.5	11.3	13.2	2.1	1.6	5.1
R5	5.2	2.9	2.7	2.7	3.9	6.3	3.5	5.8	9.3	1.7	1.9	3.8
R6	5.7	5.2	6.2	4.3	3.4	9.8	12.8	9.1	15.3	5.5	5.2	9.9
R7	7.6	10.1	15	6.9	3.9	12.2	19	8.5	19.8	15.8	20.7	18.6
R8	11	16.5	23.6	13.3	1.8	9.5	16.6	7.7	13.2	18.8	30.8	18.3
R9	9.6	8.7	5	6.2	13.5	13.3	6.8	13.7	10.1	5.5	3	6.5
R10	9.1	6.9	4.1	6.5	13.8	15.5	5.7	13.5	12.4	3.6	1.2	6.4
R11	9.8	11.2	7.4	7.2	11.2	12.2	9.5	11.5	9.6	9.7	9.1	8.2
R12	7.7	7.2	8.6	5.6	3.9	11.1	15.5	11	19.6	9.2	10.5	13.6
R13	11.4	20.3	21.1	13.7	1.3	7.1	12	6.9	4.6	16.4	27.7	9.9
R14	11.6	15.7	11.8	10.2	6	10.6	13	7.1	5.6	13.6	18.2	7.9

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

4.2 Temperature Inversions

Temperature inversions are considered a feature where they occur more than 30% of the total night time during winter (June, July and August) between 6:00pm and 7:00am. This is different from the night noise assessment period over which inversions are to be assessed, which is from 10:00pm to 7:00am.

This involves determining the percentage occurrence of moderate (Class F) and strong (Class G) inversions. Weak inversions (Class E) should not be included in the analysis.

The analysis conducted on the 2019 weather data highlighted that during winter 38.29% of the nights presented temperature inversion conditions, therefore these effects have been included in the noise impact assessment.

4.2.1 Weather Conditions Considered in the Assessment

The following conditions were considered:

- Condition A: Neutral Weather Conditions
- Condition B: Temperature Inversion
- Condition C: 3 m/s Wind from SW (at R8)

The meteorological condition considered in the noise model has been displayed in detail in Table 4-2.

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

Condition	Classification	Ambient Temp.	Ambient Humidity	Wind Speed	Wind Direction (blowing from)	Temperature Inversion	Affected Receptors	Applicability
A	Neutral	10°C	70%	–	–	No	All	All periods
B	Inversion	10°C	70%	2 m/s	3°C/100 m	Yes	All	Night time
C	Gradient Flow	10 °C	70%	3 m/s	From SW	No	R8	Night time

5. CURRENT LEGISLATION AND GUIDELINES

5.1 NSW EPA NOISE POLICY FOR INDUSTRY

5.1.1 Introduction

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

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

5.1.2 Project Intrusiveness Noise Level

The project intrusiveness noise level is determined as follows:

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

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

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

5.1.3 Amenity Noise Level

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW Noise Policy for Industry 2017. The relevant recommended noise levels applicable from the Noise Policy for Industry are reproduced in Table 5-1. The suburban category has been selected for the residential noise amenity criteria to match the characteristics of the area.

Table 5-1: Relevant amenity noise levels.

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} dB(A) Recommended amenity noise level
Residential	Urban	Day	60
		Evening	50
		Night	45
Industrial premises	All	When in use	70
School Classroom - Internal	All	When in use	40[1]
School Classroom - External	All	When in use	External: 50[2]

Note: 1) In the case where existing schools are affected by noise from existing sources, the acceptable L_{Aeq} noise level may be increased to L_{Aeq} 1 hour.
2) Where internal amenity noise levels are specified, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided. In cases where gaining internal access for monitoring is difficult, then external noise levels 10 dB(A) above the internal levels apply.
Source: Table 2.2 and Section 2.6, NSW Noise Policy for Industry

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

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

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

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

5.1.4 Sleep Disturbance Criteria

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

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

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

a detailed maximum noise level assessment should be undertaken.

5.1.5 Assessment Periods and Shoulder Periods

The proposed facility would operate the crusher from 6:00 am.

As stated in the NSW EPA Noise Policy for Industry the daytime period is defined as 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays.

Also the aforementioned guideline includes the follows:

> Fact Sheet A: A3 - *"There will be situations that call for different assessment periods. For example, where early morning (5 am to 7 am) operations are proposed, it may be unreasonable to expect such operations to be assessed against the night-time project noise trigger levels—especially if existing background noise levels are steadily rising in these early morning hours. In these situations, and where operations outside of daytime hours can be justified, appropriate noise level targets may be negotiated with the regulatory/consent authority on a case-by-case basis. As a rule of thumb and for the purposes of deriving the instrusiveness noise level only, it may be appropriate to assign a shoulder period rating background noise level."*

Considering the above, the subject site would operate within the morning shoulder period, between 6:00am and 7:00am.

The results of the long-term unattended noise monitoring undertaken by Benbow Environmental highlights that during the shoulder periods the background noise level is consistent with the day-time background noise level. This can be seen from the noise logger charts presented in Attachment 4.

Benbow Environmental believes that the day-time background noise level is representative of the shoulder periods as well; therefore, this has been considered in this noise impact assessment.

5.1.6 Project Noise Trigger Levels

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

The table below presents the rating background level, project intrusive noise level, recommended amenity noise level, and project amenity noise level. The project noise trigger level is the lowest value of intrusiveness or project amenity noise level after conversion to $L_{Aeq\ 15\ minute}$, dB(A) equivalent level. Sleep disturbance trigger levels associated with operational activities are presented in Table 5-2.

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

Table 5-2: Project Noise Trigger Levels (PNTL) for Operational Activities, dB(A)

Receiver	Type of Receptor	Time of day	Rating background noise level	Project intrusiveness noise level $L_{eq\ 15\ minute}$	Recommended amenity noise level $L_{Aeq\ period}$	Project amenity noise level $L_{Aeq\ 15\ minute}$[1]	PNTL $L_{Aeq\ 15\ minute}$	Sleep Disturbance L_{Amax}
R1-R8	Residential – Urban	Day	53	58	60	**58**	**58**	-
		Evening	50	55	50	**48**	**48**	-
		Night	42	47	45	**43**	**43**	**57**
R9	School Classroom - Internal	Noisiest 1-hour when in use	-	-	50[2]	50[2]	**50**	
R10	Place of worship	When in use	-	-	50[3]	48	**48**	-
R11-R15	Industrial Premises	When in use	-	-	70	68	**68**	-

Notes:
1) These levels have been converted to $L_{Aeq\ 15\ minute}$ using the following: $L_{Aeq\ 15\ minute} = L_{Aeq\ period} + 3$ dB (NSW Noise Policy for Industry Section 2.2).
2) In the case where existing schools are affected by noise from existing industrial noise sources,the acceptable LAeqnoise level may be increased to 40 dB LAeq(1hr).
3) 10 dB has been added to the internal criteria to give the outdoor noise limit

5.2 BANKSTOWN DEVELOPMENT CONTROL PLAN

The proposed site sits within the applicable land for the Bankstown Development Control Plan (DCP). Part B3 – Industrial Precincts of the DCP is aimed towards IN1 and IN2 zoned areas under the LEP, and as such, is relevant to the site.

Section 4 – Environmental Management of the DCP provides required controls for Industrial Developments, and as such, is relevant of the site.

> ***Acoustic Privacy***
>
> *4.1 Development must:*
>
> > *(a) consider the Industrial Noise Policy and the acoustic amenity of adjoining residential zoned land; and*
> >
> > *(b) may require adequate soundproofing to any machinery or activity that is considered to create a noise nuisance.*

This Noise Impact Assessment is designed to meet all requirements in the NSW EPA Noise Policy for Industry, and there is no adjoining residential properties. Mitigation strategies to avoid excessive noise are discussed in Section 6.3 of this report. As such, the requirements of the Bankstown DCP will be met.

5.3 NSW ROAD NOISE POLICY

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

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

5.3.1 Road Category

The subject site is accessed via Gow Street. There are no nearby residential receivers on this street. The nearest street that would be used for the proposed development that has residential receivers is Gibson Ave. This is classified as a local road in accordance with the RNP descriptions.

5.3.2 Noise Assessment Criteria

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

Table 5-3: Road Traffic Noise Assessment Criteria For Residential Land Uses, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)*	
		Day (7am-10pm)	Night (10pm-7am)
Sub-arterial Roads	3. Existing residences affected by additional traffic on existing sub-arterial roads generated by land use developments	$L_{Aeq\ (15\ hour)}$ 60 dB	$L_{Aeq\ (9\ hour)}$ 55 dB
Local Roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq\ (1\ hour)}$ 55 dB	$L_{Aeq\ (1\ hour)}$ 50 dB

* Measured at 1 m from a building façade.

5.3.3 Relative Increase Criteria

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

Table 6 of the RNP outlines the relative increase criteria for residential land uses, with the details applicable to this project shown in Table 5-4.

Table 5-4: Relative Increase Criteria For Residential Land Uses, dB(A)

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

The assessment criteria provided in Table 5-3 and the relative increase criteria provided in Table 5-4 should both be considered when designing project specific noise levels. When existing traffic levels are below the criteria in Table 5-3, the lower of the relative increase criteria and the assessment criteria in Table 5-3 should be adopted. For example, if the assessment criteria is 60 dB(A) and the relative increase criteria is 42 dB(A), then a project specific noise level of 42 dB(A) should be adopted. Similarly, if the assessment criteria is 60 dB(A) and the relative increase criteria is 65 dB(A), a project specific noise level of 60 dB(A) should be adopted.

5.3.4 Exceedance of Criteria

If the criteria shown in Table 5-3 cannot be achieved, justification should be provided that all feasible and reasonable mitigation measures have been applied.

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

5.3.5 Assessment Locations for Existing Land Uses

Table 5-5: Assessment Locations for Existing Land Uses

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

Table 5-5: Assessment Locations for Existing Land Uses

Assessment Type	Assessment Location
Commercial or industrial premises	The noise level is to be assessed at the reasonably most affected point or within the property boundary. This requirement should not be read to infer that the noise level only applies at the 'reasonably worst-affected location'.

5.4 CONSTRUCTION NOISE CRITERIA

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

5.4.1 NSW Interim Construction Noise Guideline

Residential Criteria

Table 2 of the Interim Construction Noise Guideline (DECC, 2009), sets out construction noise management levels for noise at residences and how they are to be applied. The management noise levels are reproduced in Table 5-6 below. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

Table 5-6: Management Levels at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq(15\ minute)}$	How to Apply
Recommended standard hours: Monday to Friday 7am – 6pm Saturday 8am – 1pm No work on Sundays or Public Holidays	Noise Affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15\ minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. • The proponent should also inform all potentially affected residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or mid-afternoon for works near residents. 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2 (RNP)

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

Other Land Uses

Table 5-7 sets out management levels for construction noise at other land uses applicable to the surrounding area.

Table 5-7: Management Levels at Other Land Uses

Land use	Management Level $L_{Aeq(15\ minute)}$ (applies when properties are being used)
Industrial Premises	External Noise Level 75 dB(A)
School Classrooms[1]	External Noise Level 55 dB(A)
Place of Worship	External Noise Level 55 dB(A)

Note: [1] As per Section 4.1.2 of the Interim Construction Noise Guideline, a conservative estimate of 10 dB difference between internal and external levels is applied.

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

Noise Criterion

The noise criterion for construction noise is presented in Table 5-8.

Table 5-8: Construction Noise Criterion dB(A)

Receiver	Land Use	Period	RBL L_{A90}	Management Level $L_{Aeq(15\ minute)}$
R1-R8	Residential	Standard Hours	53	63
R9	School/Childcare Centre	During Use	-	55
R10	Place of Worship	During Use	-	55
R11-R15	Industrial	During Use	-	75

5.4.2 Vibration Criteria

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

5.4.3 BS 7385-2:1993

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

Table 5-9: Vibration criteria for cosmetic damage (BS 7385:2 1993)

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

5.4.4 DIN4150-3:1999

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

Table 5-10: Structural damage criteria heritage structures (DIN4150-3 1999)

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

5.4.5 Human Exposure

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

Table 5-11: Preferred and maximum weighted rms z-axis values, 1-80 Hz

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

6. OPERATIONAL NOISE IMPACT ASSESSMENT

An outline of the predictive noise modelling methodology and operational noise modelling scenarios has been provided in this section of the report.

6.1 MODELLING METHODOLOGY

Noise propagation modelling was carried out using the Concawe algorithm within SoundPLAN. This model has been extensively utilised by Benbow Environmental for assessing noise emissions for existing and proposed developments, and is recognised by regulatory authorities throughout Australia. The model allows for the prediction of noise from a site at the specified receptor, by calculating the contribution of each noise source. Other model inputs included the noise sources, topographical features of the subject area, surrounding buildings, noise walls and receiver locations. Modelling for the temperature inversion has been considered within the ISO9613 algorithm, as per previous direction from the NSW EPA.

The modelling scenario has been carried out using the L_{Aeq} and L_{Amax} descriptors. Using the model, noise levels were predicted at the potentially most affected receivers to determine the noise impact against the project specific noise levels and other relevant noise criteria in accordance with the NSW Noise Policy for Industry (EPA, 2017).

6.1.1 Noise Sources

The sound power levels for the identified noise sources associated with the operational activities have been taken from Benbow Environmental's database.

A-weighted third octave band centre frequency sound power levels have been used and are presented in Table 6-1 below. The noise sources utilised as part of this assessment comprise of the primary noise generating activities associated with the effective operation of the proposed development.

Table 6-1: A-weighted Sound Power Levels Associated with Operational Activities, dB(A)

Noise Source	Height	Max	Overall	Third Octave Band Centre Frequency (Hz)									
				25	31	40	50	63	80	100	125	160	200
				250	315	400	500	630	800	1000	1250	1600	2000
				2500	3150	4000	5000	6300	8000	10000	12500	16000	20000
Trommel screen	1 m	110	104	46	45	64	66	68	69	73	73	77	80
				82	86	87	88	91	91	93	94	95	95
				95	95	97	89	87	84	78	74	68	61
Excavator	1 m	109	106	43	52	57	65	80	74	76	82	81	85
				86	86	91	93	93	94	96	97	97	97
				97	96	94	92	90	86	81	76	70	62
Front End Loader (<111 kW at 2000 rpm)	1 m	105	102	44	51	59	65	64	77	77	78	80	85
				89	85	85	88	88	90	93	94	93	92
				91	90	88	87	84	81	77	73	66	60
Crusher	1 m	112	108	50	63	68	75	82	86	91	94	97	97
				91	90	94	99	101	98	96	97	96	94
				92	89	86	84	81	78	75	71	67	62
Pump	1 m	-	98	36	40	41	72	69	59	65	64	71	71
				74	74	77	81	80	83	89	87	91	89
				89	88	86	85	83	76	68	64	53	36
Vacuum Pump	1 m	109	106	33	56	56	60	70	66	68	79	74	74
				74	78	84	86	98	104	90	94	93	95
				93	90	88	87	83	84	77	-	-	-
Truck Engine	1.5 m	106	103	44	48	57	65	70	73	78	78	80	82
				83	85	94	98	94	96	89	88	82	87
				85	84	82	83	83	82	78	-	-	-
Truck Exhaust	3m	104	101	42	46	55	63	68	71	76	76	78	80
				81	83	92	96	92	94	87	86	80	85
				83	82	80	81	81	80	76	-	-	-
Screw Separator	1 m	-	97	35	39	40	71	68	58	64	63	70	73
				73	73	76	80	79	82	88	86	90	88
				88	87	85	84	82	75	67	63	52	35
Vibrating Screen (indoors)	1 m	-	105	43	45	60	65	76	77	76	82	83	84
				84	85	91	94	91	93	95	96	96	96
				95	94	92	90	87	83	78	74	68	60
Conveyor	1-4 m	81	78	27	30	28	34	37	47	44	47	52	56
				56	63	66	69	67	70	69	71	70	69
				62	61	57	55	51	47	43	41	34	27

6.1.2 Modelling Scenario

Three scenarios with varying weather conditions were modelled for operational noise emissions. The scenario covers proposed day, evening and night operations, including proposed heavy vehicle movements, and indoor and outdoor sources. Figure 6-1 shows the locations of the noise sources for the operational scenario.

Table 6-2: Modelled Noise Sources

Scenario	Description
Scenario 1: Operations Day and Evening	This scenario includes the following: Outdoor noise sources • Truck Movements (2 per 15 minute period); • Front End Loader x 2; • 8T Excavator x 1; • Crusher x 1; • Screen x 1; • Vacuum Pump x 1; and • Conveyor x2. Indoor noise sources • Pump x 3; • Vibrating screen; • Screw Separator; and • Conveyor x 2.
Scenario 2: Operations Night Temperature Inversion and Wind Conditions at R8	This scenario includes the following: Outdoor noise sources • Truck Movements (2 per 15 minute period); • Front End Loader x 2; • Screen x 1; and • Conveyor x 2. Indoor noise sources • Pump x 3; • Vibrating screen; • Screw Separator; and • Conveyor x 2.

Figure 6-1: Scenario 1 Day and Evening Operations

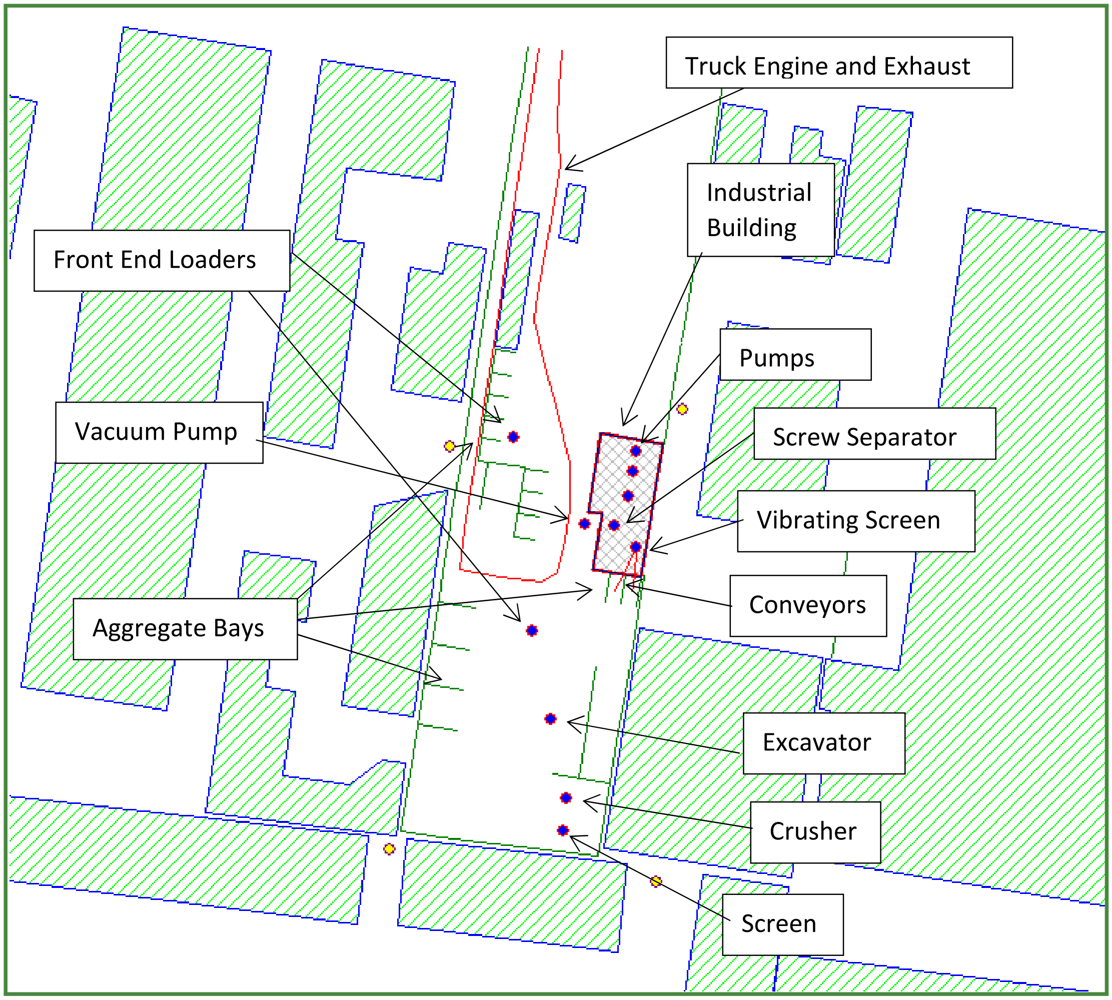
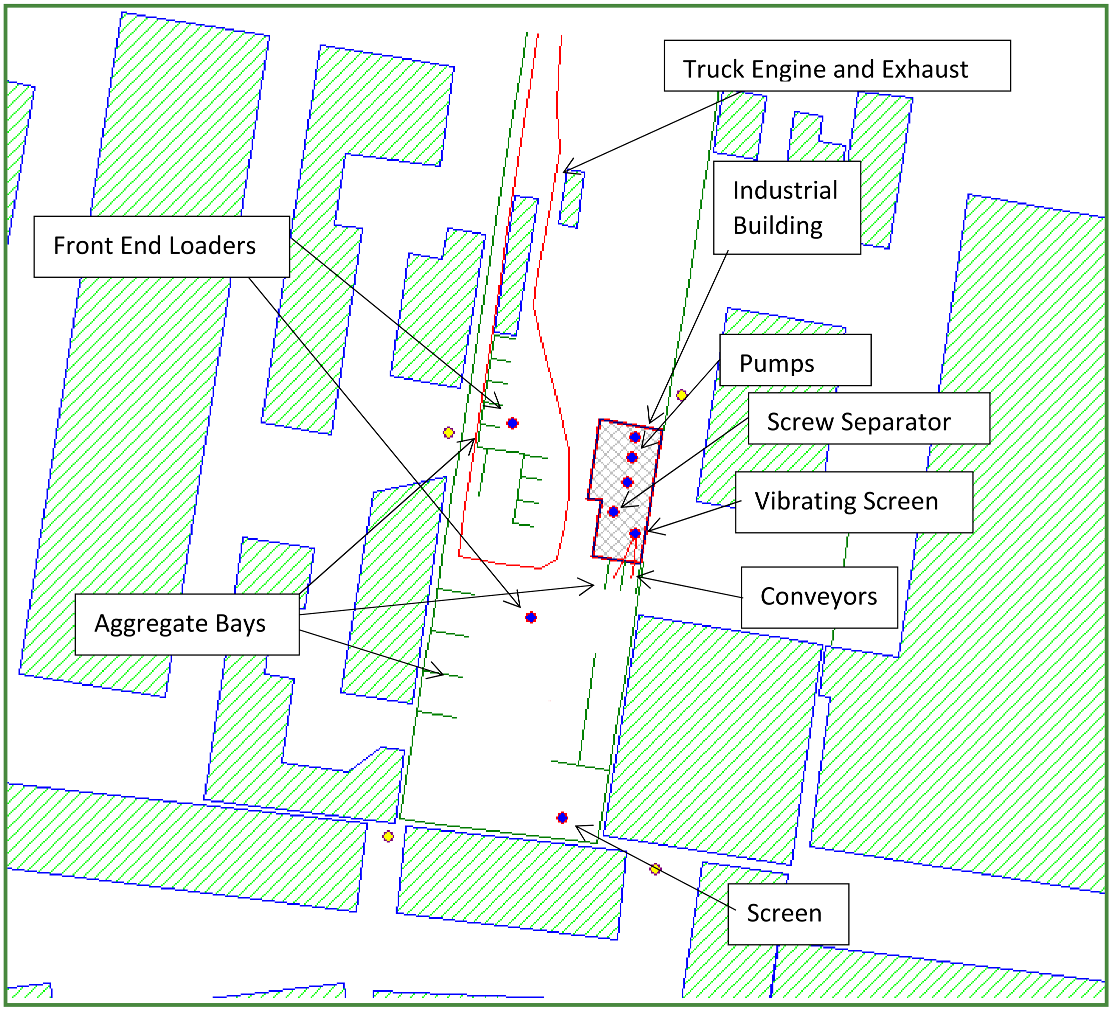


Figure 6-2: Scenario 2 – Night Operations



6.1.3 Modelling Assumptions

The relevant assessment period for operational noise emissions is 15 minutes when assessing noise levels against the Intrusive Criterion; therefore noise source durations detailed throughout the following assumptions section should be considered per 15 minute period in view of potential noise impacts under worst-case scenarios. Each assessment-specific assumption has been detailed below:

- Topographical information has been obtained from Google Earth and implemented in SoundPLAN.
- All ground areas surrounding the subject site and the nearest nominated occupancies have been modelled considering different ground factors ranging from 0 to 1. The site and surrounding industrial areas have been modelled with a ground absorption factor of 0 (hard).
- Surrounding buildings have been included in the noise model.
- 2 truck movements are assumed to enter and leave the site every 15 minutes in a worst case scenario. Trucks have been assumed to travel on the site at 20 km/h. Trucks are modelled in sound plan as line sources, utilising moving point source definition. They occur during all time periods.
- The screen, pumps, and FELs are all assumed to be point sources, and are assumed to operate 100% of the time as a worst case scenario during all time periods. The crusher, vacuum pump and excavator will operate 100% of the time only during the day (including morning shoulder period) and evening periods (6am – 10pm).
- The main building has been modelled with brick the walls and roof as 0.48 mm Trimdek (R_w 22 dB). There are two roller shutter doors on the western side of the building which have been modelled in the open position (R_w 0db).
- All residential receivers were modelled at 1.5 m above ground level at the most noise-affected point within the property boundary.

6.2 PREDICTED NOISE LEVELS – OPERATIONAL

Noise levels at the nearest receptors have been calculated and results of the predictive noise modelling considering operational activities are shown in Table 6-3. The modelled scenarios are predicted to comply with the $L_{eq(15\ minute)}$ project specific criteria at all sensitive receptors. Exceedance of the L_{AMax} sleep disturbance is not predicted at any residential receptors.

Proactive noise management practices are outlined in Section 1.1.

Table 6-3: Predicted Noise Levels – Operational Activities dB(A)

Receptor	Project Criteria $L_{eq(15\ minute)}$			Project Criteria L_{Amax}	Scenario 1 – Day and Evening	Scenario 2 – Night (temperature inversion/R8 wind conditions)	
	Day	Evening	Night		Predicted $L_{eq(15\ minute)}$	Predicted $L_{eq(15\ minute)}$	Predicted L_{Amax}
R1	58	48	43	57	43 ✓	42 ✓	48 ✓
R2	58	48	43	57	37 ✓	38 ✓	46 ✓
R3	58	48	43	57	32 ✓	32 ✓	48 ✓
R4	58	48	43	57	28 ✓	27 ✓	37 ✓
R5	58	48	43	57	34 ✓	35 ✓	42 ✓
R6	58	48	43	57	43 ✓	42 ✓	49 ✓
R7	58	48	43	57	28 ✓	33 ✓	47 ✓
R8	58	48	43	57	20 ✓	23 ✓	37 ✓
R9	50			N/A	37 ✓	38 ✓	N/A
R10	48			N/A	41 ✓	42 ✓	N/A
R11	68			N/A	58 ✓	57 ✓	N/A
R12	68			N/A	64 ✓	64 ✓	N/A
R13	68			N/A	62 ✓	61 ✓	N/A
R14	68			N/A	56 ✓	51 ✓	N/A
R15	68			N/A	56 ✓	52 ✓	N/A

✓Complies ✖ Non-compliance

6.3 RECOMMENDED MITIGATION MEASURES

The noise assessment in Section 6 predicted that if the assumptions listed in 6.1.3 are carried out, noise levels would be met at all surrounding residential receivers during all time periods.

During the night from 10pm – 6am the crusher, vacuum truck pump and excavator should not be used. An internal pump can be used at night such that the tanker truck vacuum pump is not needed.

While further noise mitigation measures are not required to meet the project criteria at the residential receivers, the following noise control measures are recommended in order to proactively further reduce noise levels at surrounding receivers:

- Prohibition of extended periods of on-site revving/idling;
- Minimisation of the use of truck exhaust brakes on site;
- Enforcement of low on-site speed limits; and
- Signs to encourage quiet operations during the night period.

7. ROAD TRAFFIC NOISE IMPACT ASSESSMENT

The maximum number of truck movements along Gibson Ave during the daytime is assumed to be 15 per hour. The maximum number of truck movements along Gibson Ave during the night time is assumed to be 4 per hour. The worst case residential receiver utilised in this assessment is 59 Gibson Ave, the receiver has been placed 1.5 m above the ground and 1 m from the façade of the residence. Trucks have been modelled passing this house as moving point sources (sound power levels are shown in Table 6-1) travelling at the posted speed of 60km/hr. The predicted results are shown in the following table.

Table 7-1: Predicted Levels for Road Traffic Noise

Receptor	Noise Criteria		Site Contribution	
	Day $L_{Aeq,\ 1\ hour}$	Night $L_{Aeq,\ 1\ hour}$	Day $L_{Aeq,\ 1\ hour}$	Night $L_{Aeq,\ 1\ hour}$
59 Gibson Ave (R2)	55	50	54✓	48✓

For the residential dwellings that front onto Gibson Ave, the predicted noise levels associated with the vehicle movements from the site would be below the criteria for local roads.

Step 3 of Section 3.4.1 of the RNP identifies possible reasonable and feasible control measures when exceedances of either the outlined criteria. As no exceedances are predicted, the proposed vehicle movements comply with the RNP, and no additional mitigation strategies are recommended.

8. CONSTRUCTION NOISE IMPACT ASSESSMENT

Proposed construction at the site would be limited to internal fit out. This would readily comply with the NSW interim construction noise guideline as the existing residential receivers are well shielded. A full construction impact assessment is not considered warranted.

9. STATEMENT OF POTENTIAL NOISE IMPACT

Benbow Environmental has been engaged by Gow Street Recycling Centre to prepare a Noise Impact Assessment (NIA) for a resource recovery facility at 81 Gow Street, Padstow (Lot A DP 103140). This report has been completed as part of an Environmental Impact Statement (EIS) for the proponent, which aim to update their existing Environmental Protection License (10943) which currently allows them to have a processing capacity of 80,000 tpa, and a maximum storage quantity of 7,300 at any one time.

The proposal will include a staged development. Stage 1 of the development is the focus of this noise report and includes establishment of a drilling mud processing plant, with a capacity of 250,000 tonnes per.

The noise impact assessment was undertaken in accordance with the following guidelines:

- NSW Noise Policy for Industry (EPA, 2017);
- NSW Road Noise Policy (RNP) (DECCW, 2011); and
- Blacktown Development Control Plan (DCP) 2015.

Assessment criteria for noise emissions from the subject site were used to determine whether the potential noise impacts from the site were within the derived limits or in exceedance of the guidelines.

The nearest receivers and noise criteria were identified. The site operations were modelled using the predictive noise software, Sound Plan V7.3.

The activities proposed by the proponent were found to be within the framework of the NSW EPA Noise Policy for Industry.

The modelled scenarios are predicted to comply with the $L_{eq(15\ minute)}$ project specific criteria at all sensitive receptors. Exceedance of the L_{AMax} sleep disturbance is not predicted at any residential receptors.

The noise assessment in Section 6 predicted that if the assumptions listed in 6.1.3 are carried out, noise levels would be met at all surrounding residential receivers during all time periods.

During the night from 10pm – 6am the crusher, vacuum pump and excavator should not be used. An internal pump can be used at night such that the tanker truck vacuum pump is not needed.

Compliance with the guidelines set out in the NSW Road Noise Policy was predicted at all considered receptors.

No major construction will take place therefore construction noise and vibration impacts are considered minimal.

This concludes the report.

Victoria Hale
Environmental Scientist

R T Benbow
Principal Consultant

10. 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 Gow Street Recycling Centre, as per our agreement for providing environmental services. Only Gow Street Recycling Centre 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 Gow Street Recycling Centre 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.

‘C’ FREQUENCY WEIGHTING

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

DECIBEL

The decibel (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

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

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

'F'(FAST) TIME WEIGHTING

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

FLETCHER–MUNSON EQUAL LOUDNESS CONTOUR CURVES

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

FREE FIELD

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

FREQUENCY

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

IMPACT ISOLATION CLASS (IIC)

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

'I' (IMPULSE) TIME WEIGHTING

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

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

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

IMPULSE NOISE

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

LOUDNESS

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

MAXIMUM NOISE LEVEL, LAFmax

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

MAXIMUM NOISE LEVEL, LASmax

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

NOISE RATING NUMBERS

A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the 'A' frequency weighted dB level minus five.

NOISE

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

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient"

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act (1997). "Offensive Noise means noise:
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE

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

REVERBERATION TIME, T60

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

SOUND ABSORPTION COEFFICIENT, α

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

‘S’ (SLOW) TIME WEIGHTING

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

SOUND ATTENUATION

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

SOUND EXPOSURE LEVEL (LAE)

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

SOUND PRESSURE

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

SOUND PRESSURE LEVEL, Lp

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

SOUND POWER

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

SOUND POWER LEVEL, Lw

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

SOUND TRANSMISSION CLASS (STC)

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

SOUND TRANSMISSION LOSS

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

STATISTICAL NOISE LEVELS, Ln.

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

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

WEIGHTED SOUND REDUCTION INDEX, Rw

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

WHITE NOISE

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

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1–2004: 'Electroacoustics - Sound level meters – Specifications'.

Attachment 2: Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 21111 & FILT 4097

Equipment Description: Sound & Vibration Analyser

Manufacturer: Svantek

Model No: Svan-957 **Serial No:** 15336

Microphone Type: 7052E **Serial No:** 47869

Filter Type: 1/3 Octave **Serial No:** 15336

Comments: All tests passed for class 1.
(See over for details)

Owner: Benbow Environmental
13 Daking Street
North Parramatta 2151

Ambient Pressure: 1004 hPa ±1.5 hPa

Temperature: 21 °C ±2° C **Relative Humidity:** 36% ±5%

Date of Calibration: 25/07/2017 **Issue Date:** 26/07/2017

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

CHECKED BY: .... **AUTHORISED SIGNATURE:** ....
Jack Kielt

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 23100

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Rion
Type No: NC-73 **Serial No:** 10186522
Owner: Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.16	990.12	3.98
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1010 hPa ±1.5 hPa **Relative Humidity:** 31% ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 11/07/2018 **Issue Date:** 11/07/2018
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2004

CHECKED BY: .... **AUTHORISED SIGNATURE:** ....
Jack Kielt

.Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
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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Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter

AS 1259.1:1990 - AS 1259.2:1990

Calibration Certificate

Calibration Number C18128_Reissued

Client Details Benbow Environmental
13 Daking Street
North Paramatta NSW 2151

Equipment Tested/ Model Number : ARL EL-215
Instrument Serial Number : 194441
Microphone Serial Number : N/A
Pre-amplifier Serial Number : N/A

Atmospheric Conditions
Ambient Temperature : 23.4°C
Relative Humidity : 52.3%
Barometric Pressure : 100.4kPa

Calibration Technician : Lucky Jaiswal   **Secondary Check:** Sandra Minto
Calibration Date : 9 Mar 2018   **Report Issue Date :** 3 Oct 2018

Approved Signatory : Ken Williams

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

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.21dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015Pa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

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

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

NATA WORLD RECOGNISED ACCREDITATION

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

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

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

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

Attachment 3: QA/QC Procedures

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 1259–1990.

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 1.

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 Australian Standard AS 1259–1990 "*Sound Level Meters*".

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.).

Unattended Noise Monitoring

NOISE MONITORING EQUIPMENT

ARL noise loggers type Ngara and EL-215 were used to conduct the long-term unattended noise monitoring. This equipment complies with Australian Standard 1259.2–1990 *Acoustics – Sound Level Meters* and is designated as a Type 1 and 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 1.

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.

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} was 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.

Measurement sample periods were fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring location are presented in Attachment 3.

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

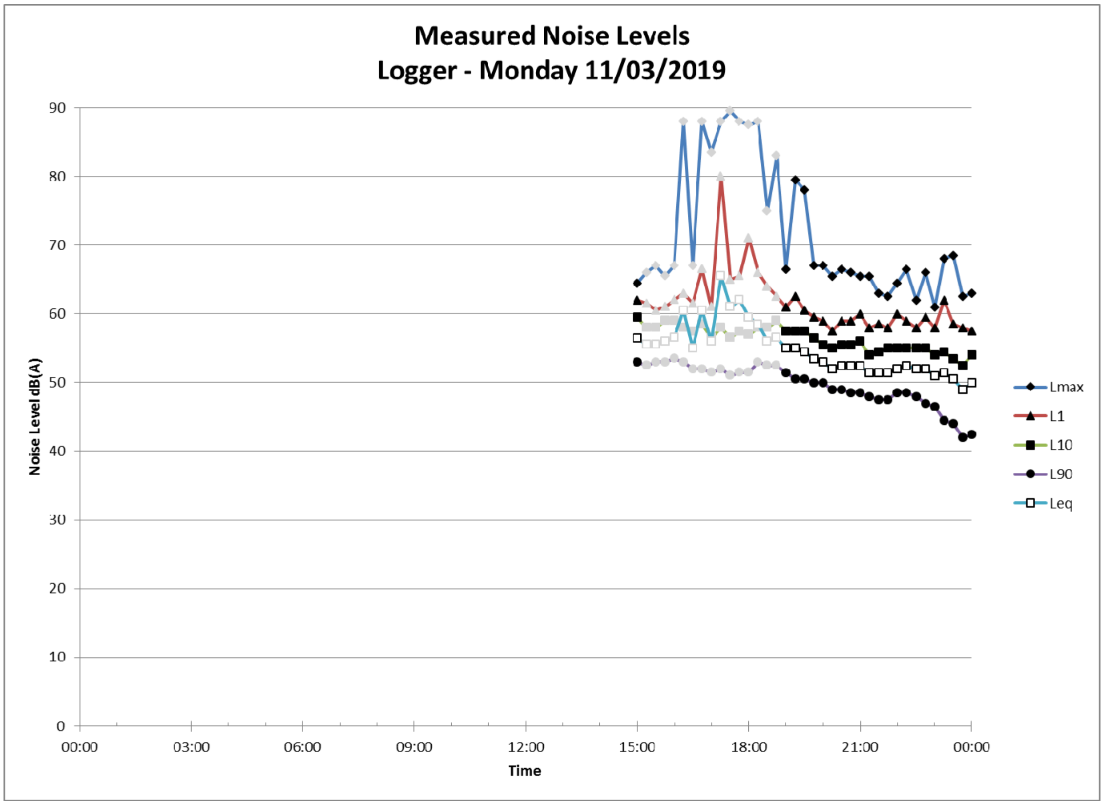
The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS 1259 and was set on A-weighted, fast response.

The microphone was positioned at 1.5 metres above ground level and was fitted with a windsock. The instrument was calibrated using a Rion NC-73 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 1.

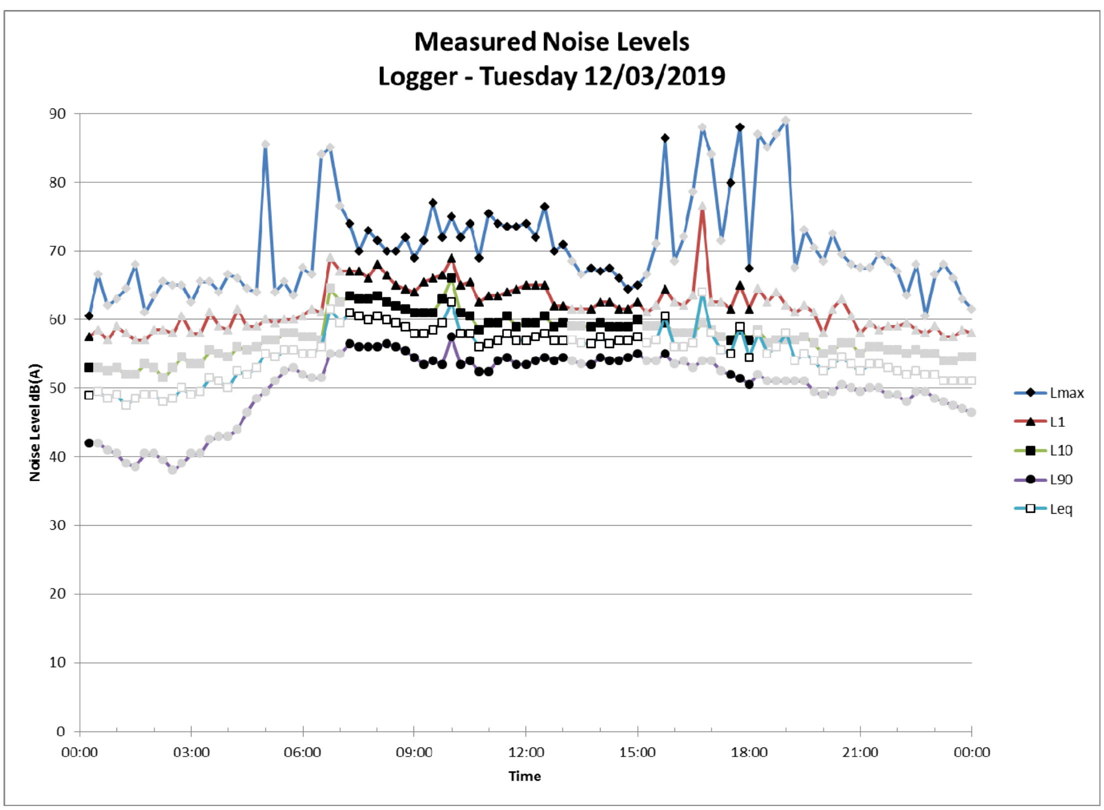
WEATHER CONDITIONS
It was partially cloudy, fine without significant breeze.

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

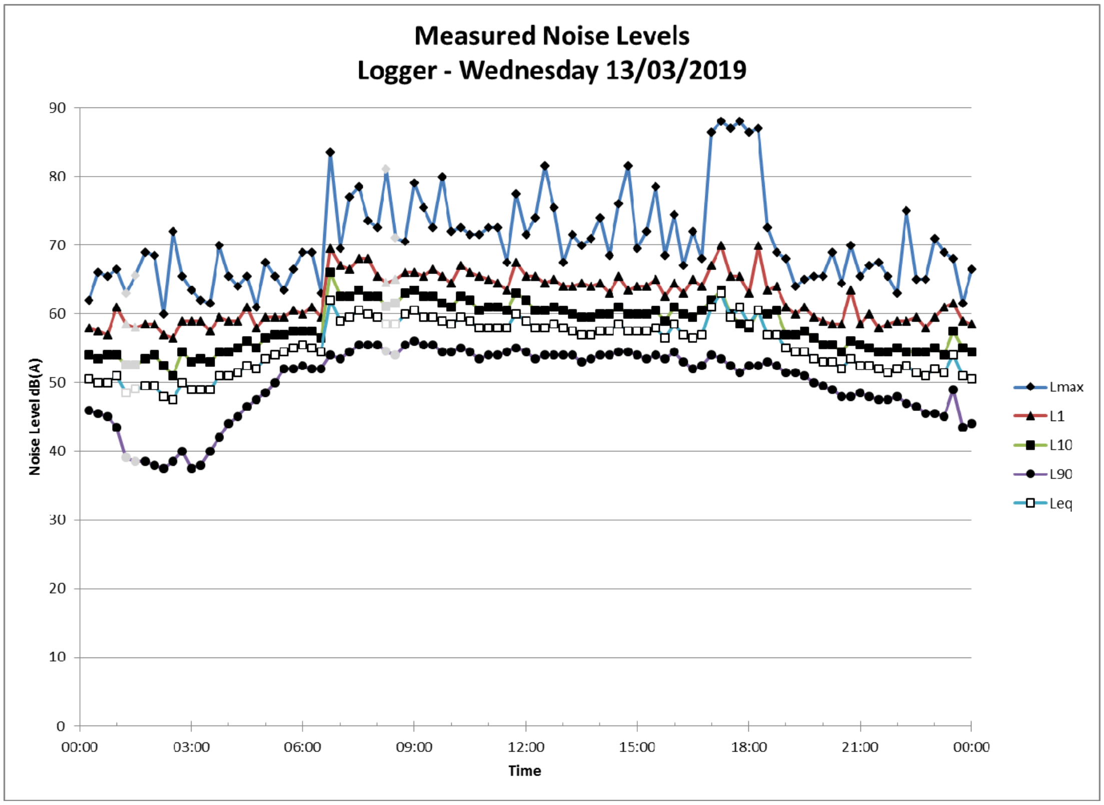
Attachment 4: Daily Noise Logger Charts

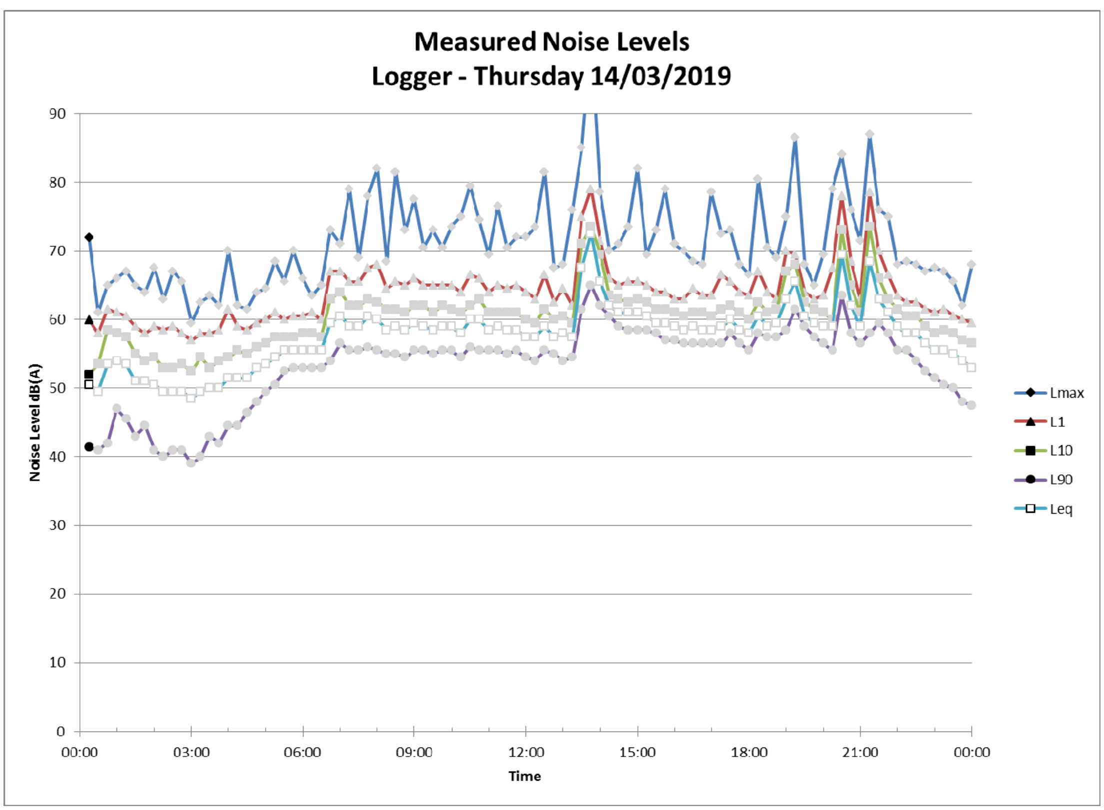


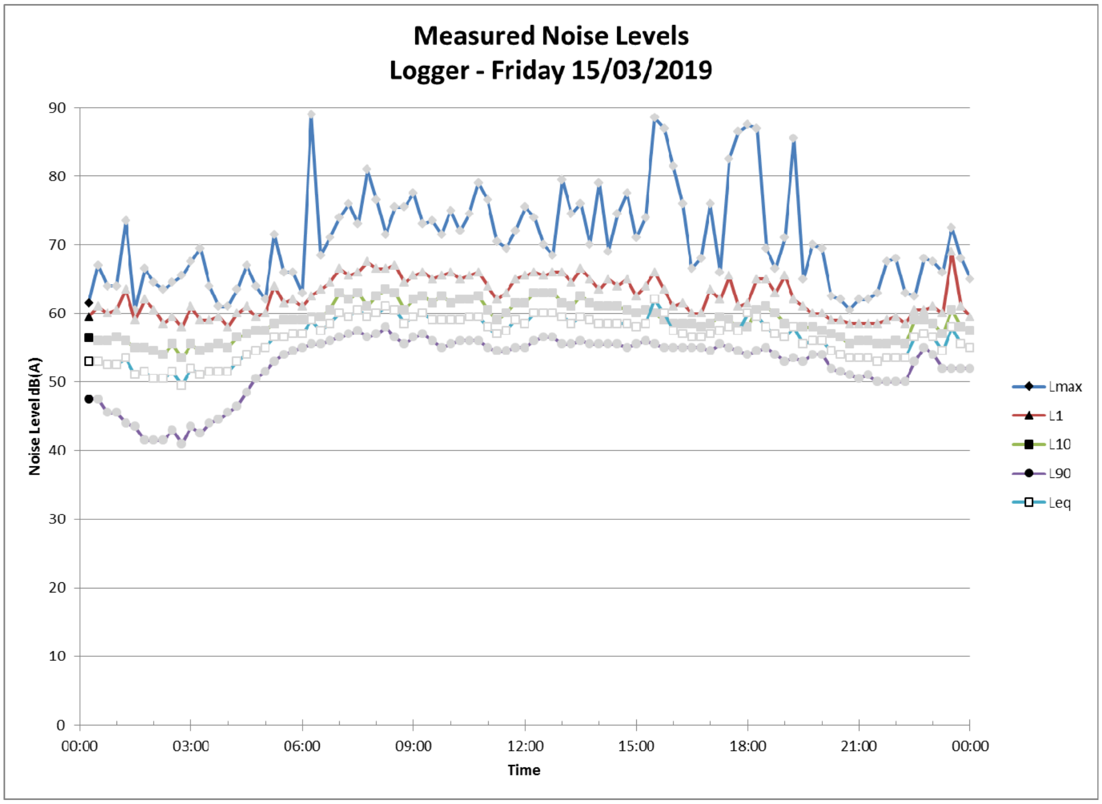
Measured Noise Levels
Logger - Monday 11/03/2019
Noise Level dB(A)
Time
Lmax
L1
L10
L90
Leq



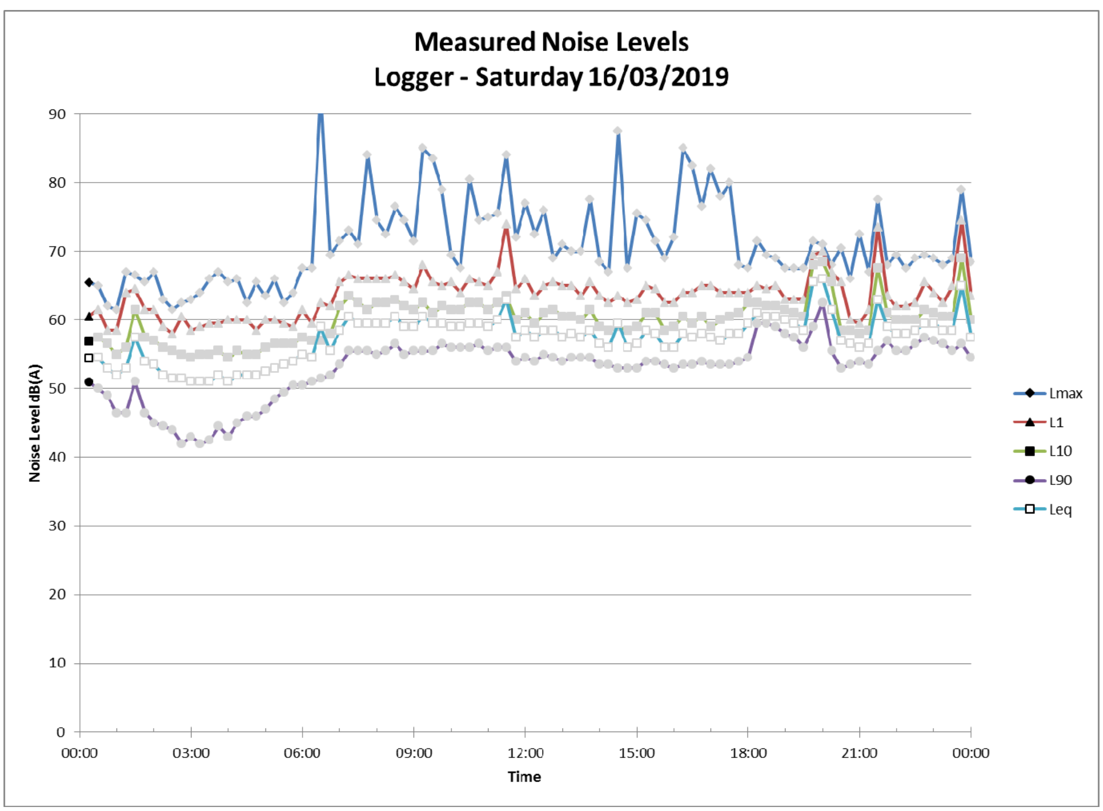
Measured Noise Levels
Logger - Tuesday 12/03/2019
Noise Level dB(A)
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger - Wednesday 13/03/2019
Noise Level dB(A)
Time
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq

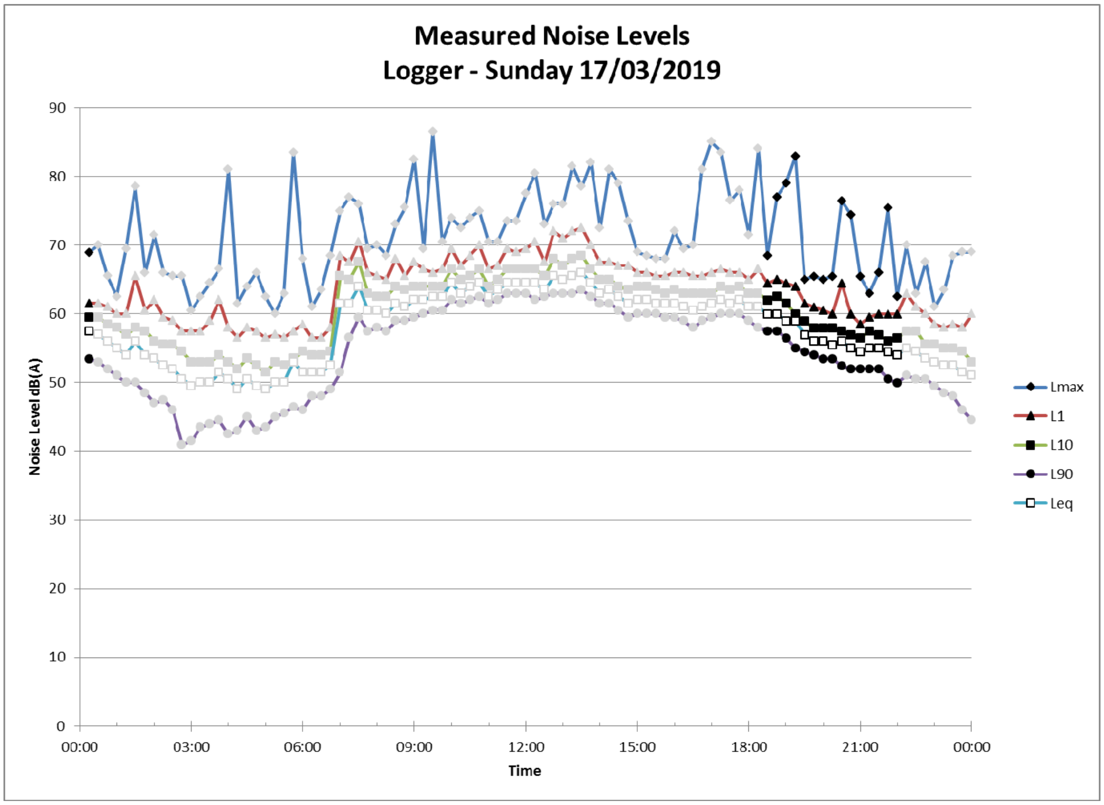

Measured Noise Levels
Logger - Thursday 14/03/2019
Noise Level dB(A)
Time
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq



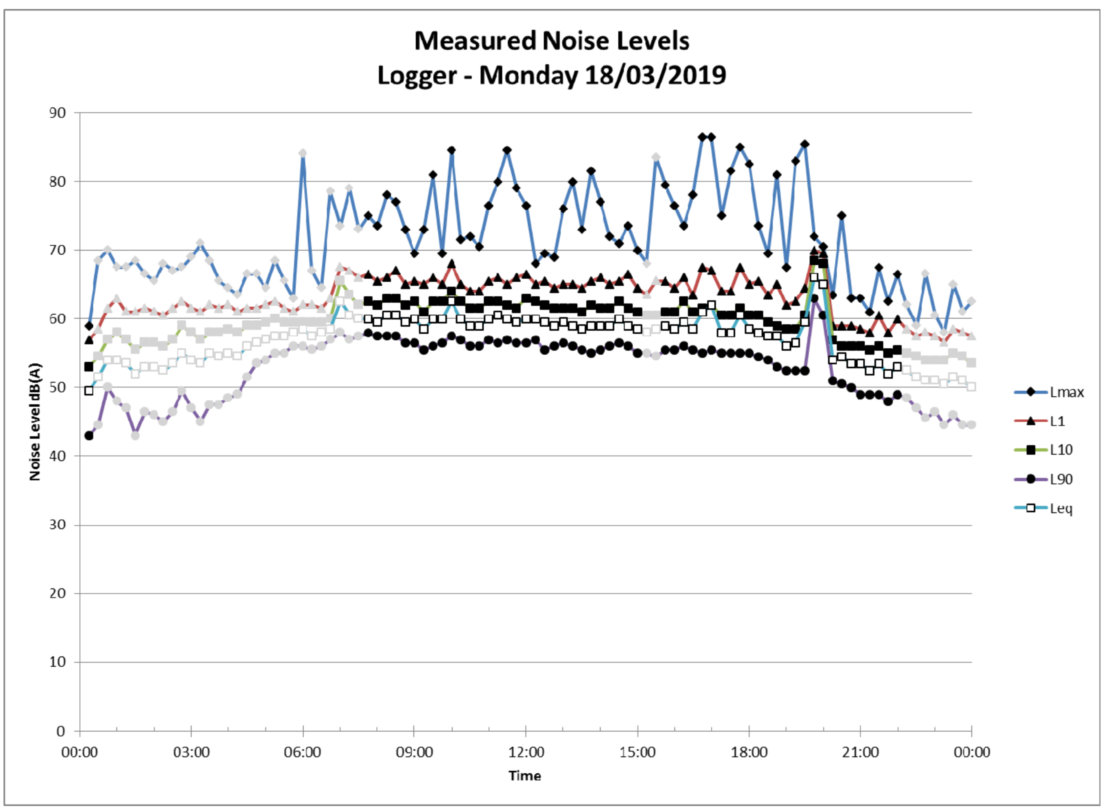
Measured Noise Levels
Logger - Friday 15/03/2019
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq



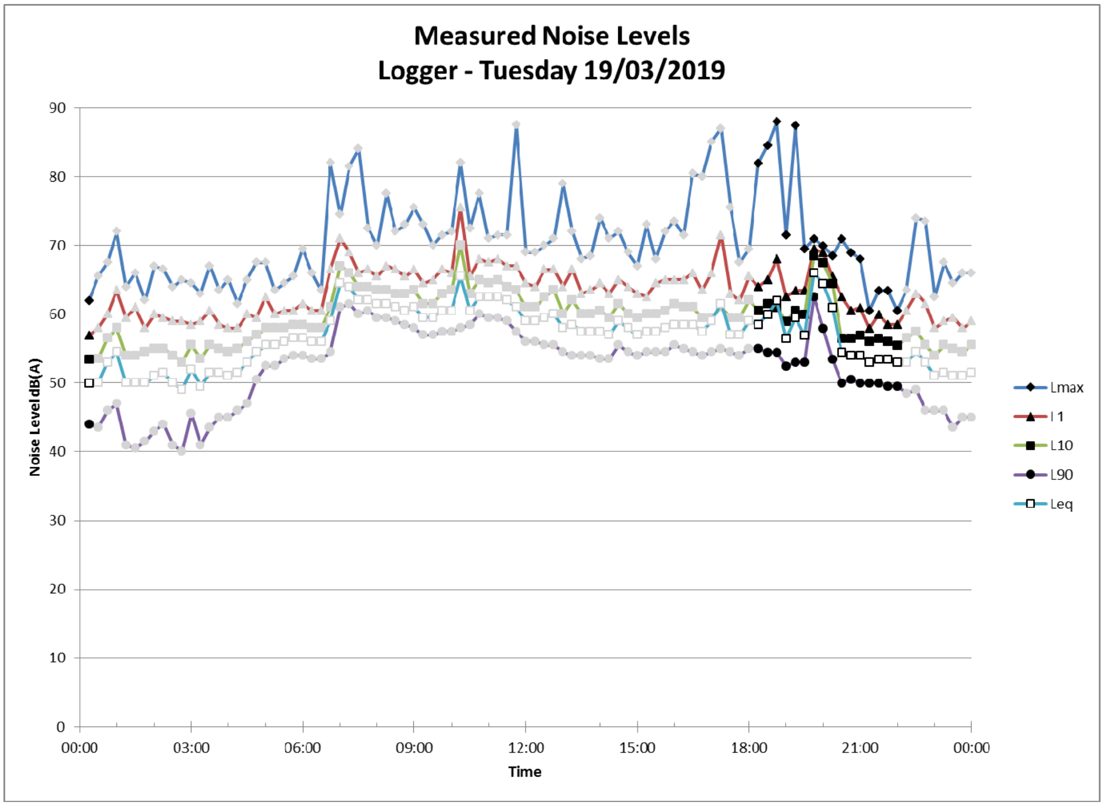
Measured Noise Levels
Logger - Saturday 16/03/2019
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq



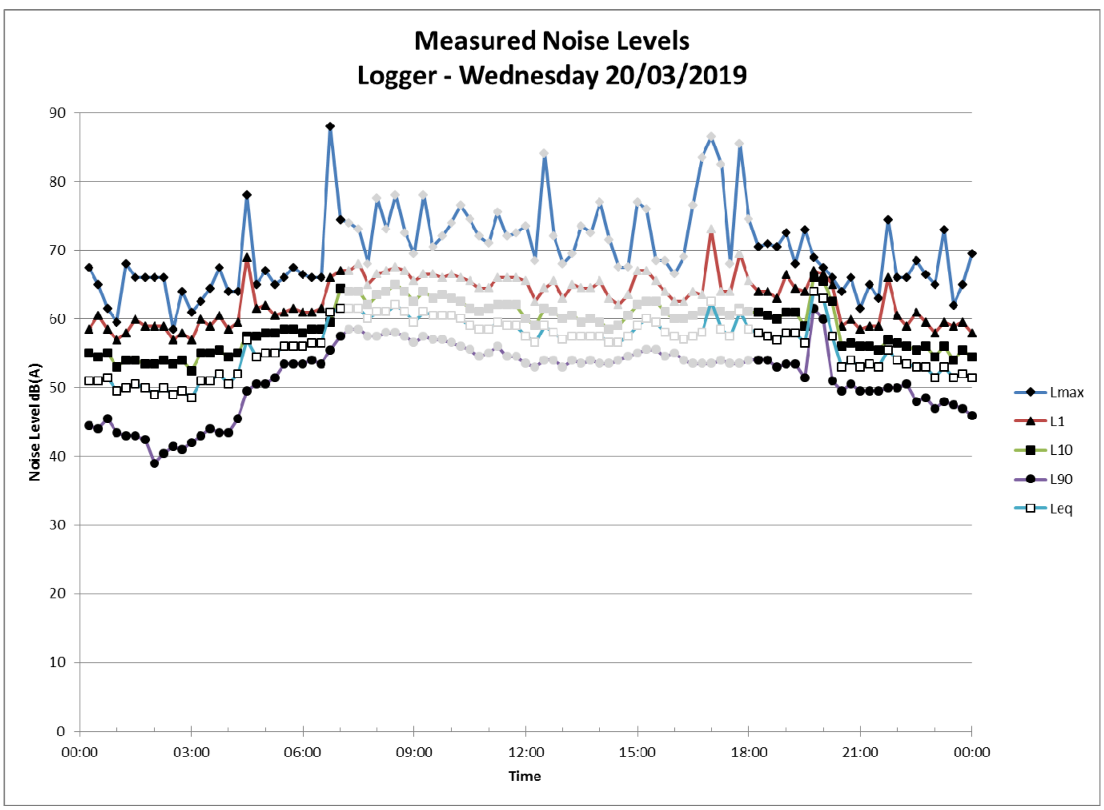
Measured Noise Levels
Logger - Sunday 17/03/2019
Noise Level dB(A)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq



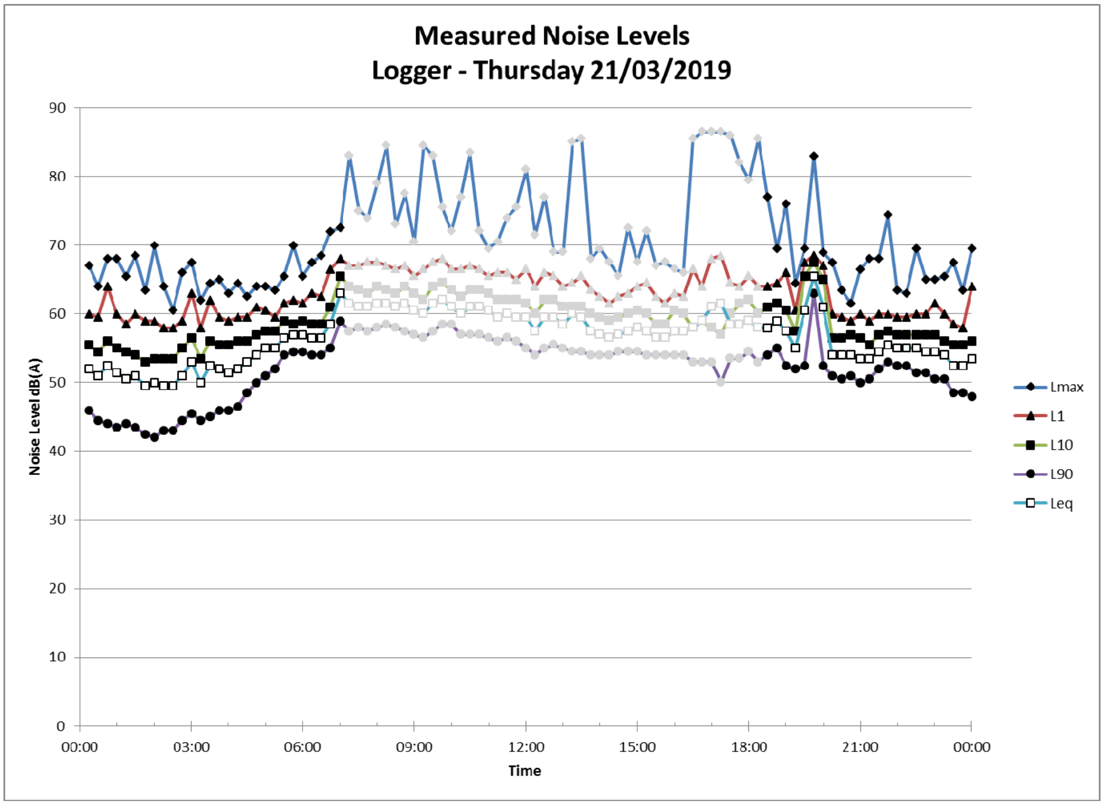
Measured Noise Levels
Logger - Monday 18/03/2019
Noise Level dB(A)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq



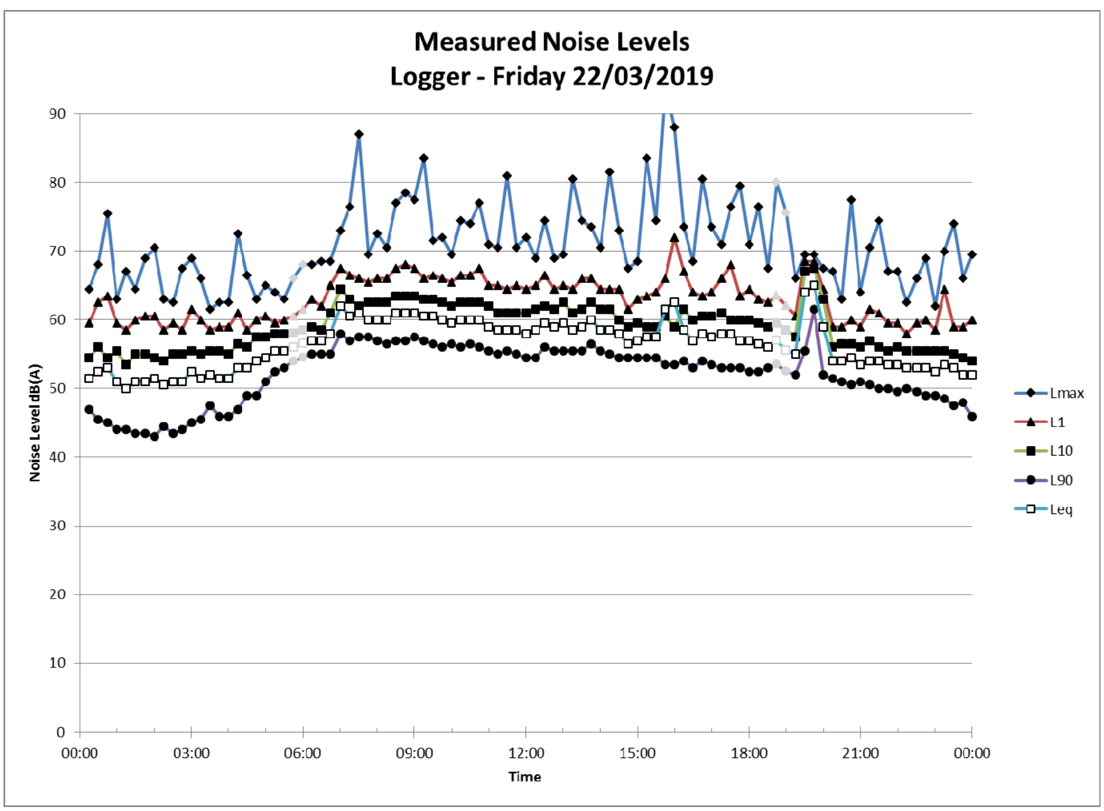
Measured Noise Levels
Logger - Tuesday 19/03/2019
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq



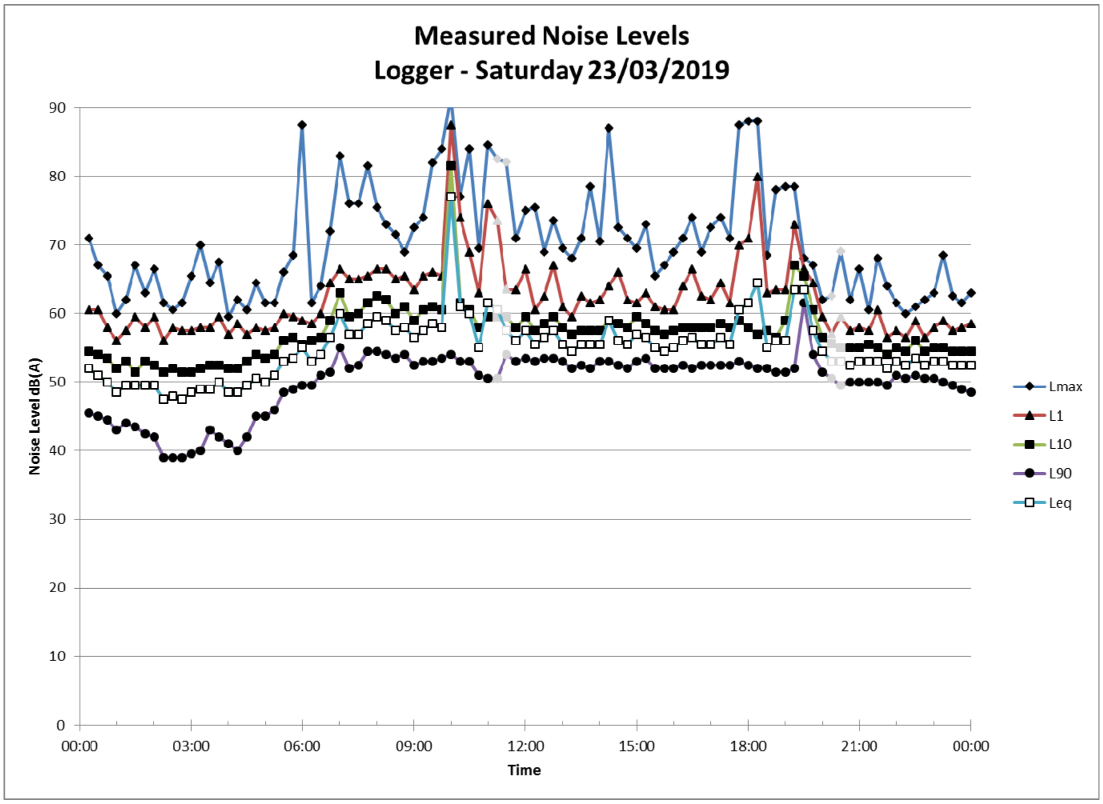
Measured Noise Levels
Logger - Wednesday 20/03/2019
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq



Measured Noise Levels
Logger - Thursday 21/03/2019
Noise Level dB(A)
Time
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq



Measured Noise Levels
Logger - Friday 22/03/2019
Noise Level dB(A)
Time
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger - Saturday 23/03/2019
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
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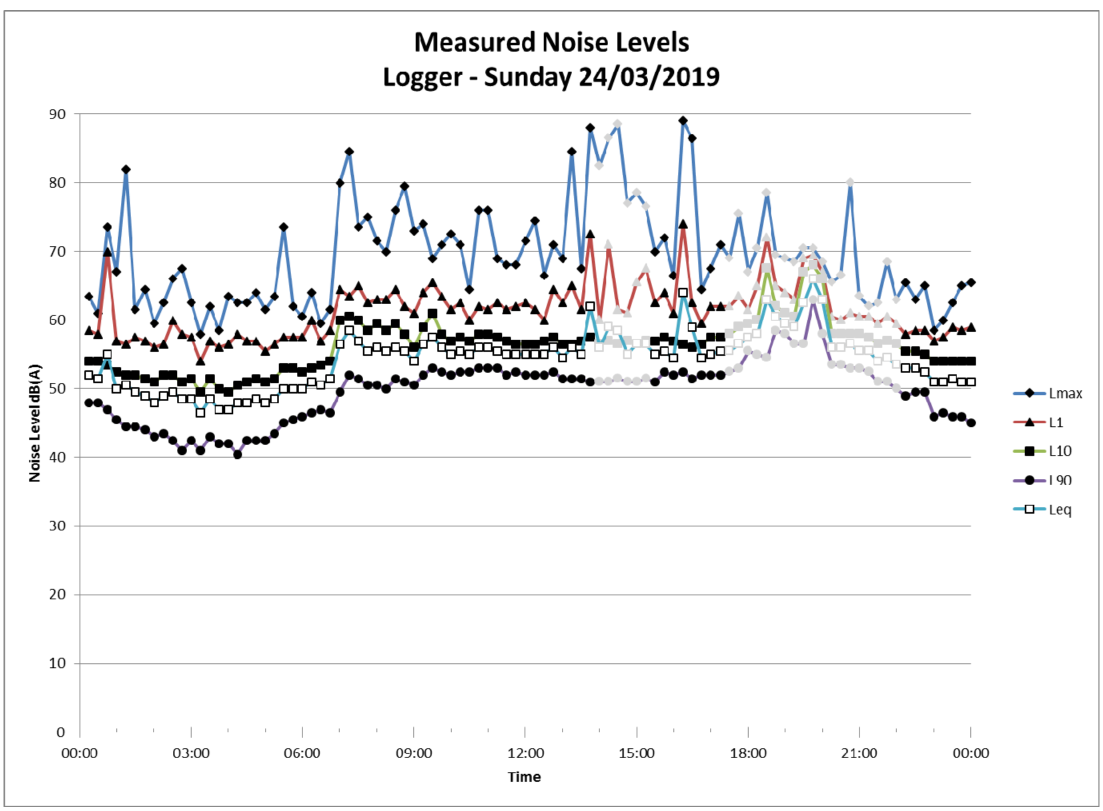
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger - Sunday 24/03/2019
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
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12:00
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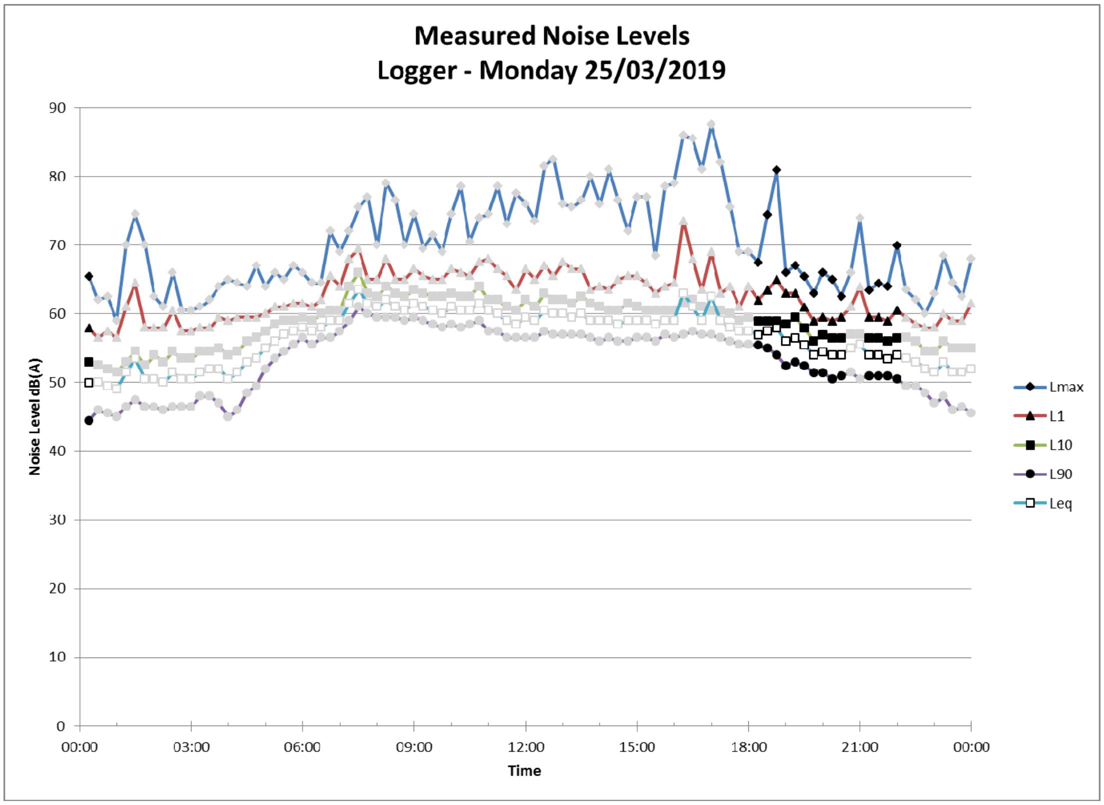
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger - Monday 25/03/2019
Noise Level dB(A)
Time
Lmax
L1
L10
L90
Leq
0
10
20
30
40
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60
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00:00
03:00
06:00
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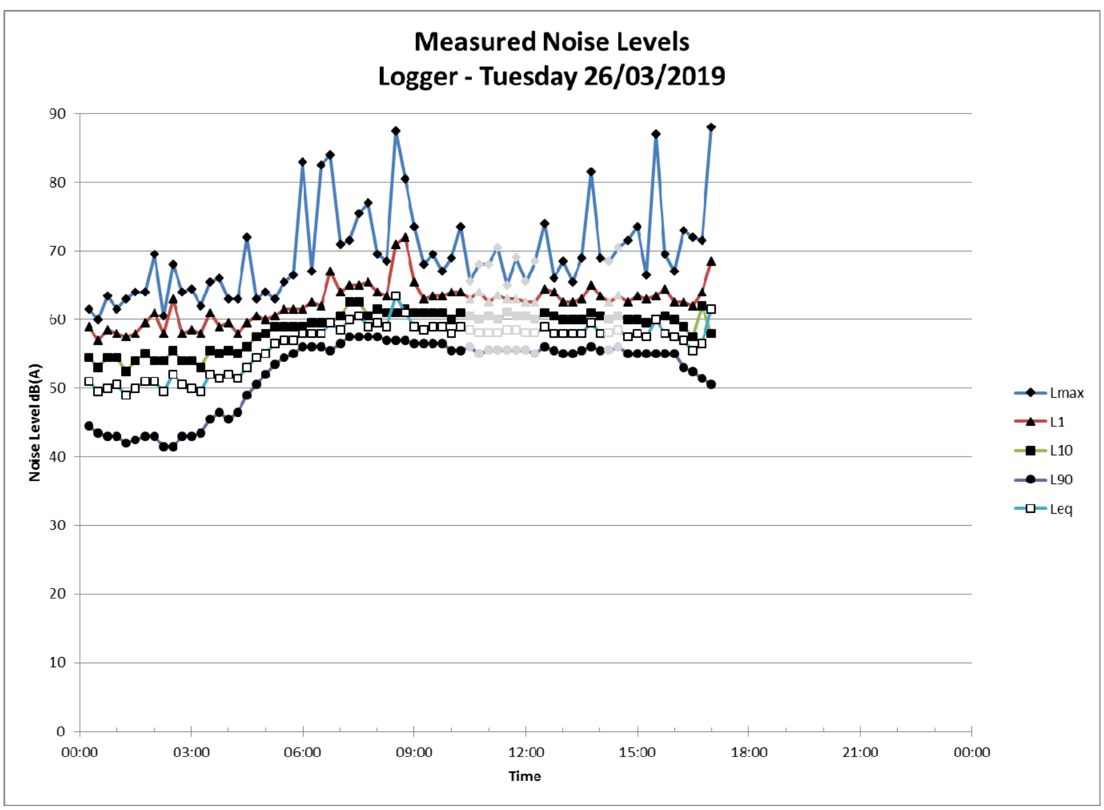
18:00
21:00
00:00


Measured Noise Levels
Logger - Tuesday 26/03/2019
Noise Level dB(A)
Time
Lmax
L1
L10
L90
Leq
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00