

APPENDIX A

ACOUSTIC IMPACT ASSESSMENT



Stockpile Extension Project – Noise Impact Assessment

Cooranbong Entry Site

Centennial Northern Coal Services Pty Limited

24 January 2025

→ **The Power of Commitment**



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Executive summary

Centennial Northern Coal Services Pty Limited proposes to apply for the Modification (Modification 4) of SSD-5145 under Section 4.55(2) of the EP&A Act for:

- Development of the existing coal stockpile at Cooranbong Entry Site to increase capacity from 100,000 tonnes to approximately 400,000 tonnes.
- Construction of infrastructure associated with the modified stockpile footprint. This will include access tracks, lighting towers, water sprays, fencing and water management infrastructure.

This Noise and Vibration Impact Assessment (NVIA) has been prepared by GHD Pty Ltd (GHD) to support the proposed modification. The NVIA assesses the potential noise and vibration impacts from the construction and operation of the Project.

Noise and vibration impacts were assessed in accordance with the methods outlined in the NSW Noise Policy for Industry (EPA 2017), NSW Road Noise Policy (EPA 2011), and the Interim Construction Noise Guideline (EPA 2019). Criteria was determined based on noise monitoring undertaken at different locations across the Project site. Noise modelling was undertaken using SoundPLAN 3D modelling software (Version 9), to predict noise emissions from the construction and operation of the Project.

Noise from construction of the Project is predicted to exceed the noise affected noise management levels during the civil works at a number of nearby sensitive receptors. However, all predicted construction noise impacts are below the highly noise affected management level during all construction scenarios at all assessment receptor locations.

The relative increases in road traffic associated with the construction of the Project were predicted to not increase noise levels by more than 2 dBA along Gradwells Road.

Vibration from the construction of the Project identified no existing sensitive receivers within the structural damage safe working distances.

No sensitive receivers were identified to potentially experience vibration levels above the British Standard and *Assessing Vibration: a technical guideline* (AVTG) (2006). AVTG daytime human comfort criteria during the access road construction activities.

Noise modelling predictions indicated negligible impacts during the operation of the Project at surrounding sensitive receivers.

There will be no change to the existing approved operational offsite traffic conditions as a result of the Project.

No operational vibration impacts are anticipated given the distance between the nearest sensitive receptors to the Project.

All reasonable and feasible mitigation strategies to minimise construction and operational noise and vibration impacts are presented in Section 8.

Glossary

Term	Definition
AHD	Australian Height Datum.
AS	Australian Standard.
AWS	Automatic Weather Station.
Ambient Noise Level	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' ($L_{Aeq, T}$).
Background Noise Level	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 seven days).
BOM	Bureau of Meteorology.
CEMP	Construction Environmental Management Plans.
Centennial	Centennial Northern Coal Services Pty Ltd.
CES	Cooranbong Entry Site.
CNVG	Construction Noise and Vibration Guideline (TfNSW 2023).
CNVS	Construction Noise and Vibration Strategy (TfNSW 2020).
CONCAWE	Conservation of Clean Air and Water Europe.
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dba	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
DECC	Department of Environment and Climate Change (NSW Government), later known as the Department of Environment Climate Change and Water and the Office of Environment and Heritage (OEH) and now known as Department of Climate Change, Energy, the Environment and Water (NSW Government).
Drainage winds	Drainage-flow wind is the localised drainage of cold air under the influence of the local topography, and travels in one direction only (direction of decreasing altitude).
EPA	Environment Protection Authority.
EPL	Environmental Protection Licence.
ICNG	Interim Construction Noise Guideline (DECC NSW, 2009).
$L_{Aeq}(\text{period})$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A1}(\text{period})$	The sound pressure level that is exceeded for 1 % of the measurement period.
$L_{A10}(\text{period})$	The sound pressure level that is exceeded for 10 % of the measurement period.
$L_{A90}(\text{period})$	The sound pressure level that is exceeded for 90 % of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
Mitigation	Reduction in severity.
NATA	National Association of Testing Authorities.

Term	Definition
NCS	Northern Coal Services.
NML	Noise management level.
Noise Sensitive Receptor	Noise sensitive land use that may be impacts by noise from the development.
NPI	Noise Policy for Industry (NSW EPA, 2017).
NVIA	Noise and Vibration Impact Assessment.
PSNG	Project Specific Noise Goals.
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
Sound Pressure Level (SPL or L_p)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (P_a/P_o)^2$ dB (or $20 \log_{10} (P_a/P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is $20 \mu\text{Pa}$ (20×10^{-6} Pa) for airborne sound. SPL varies with distance from a noise source.
RNP	Road Noise Policy (DECCW 2011).
Sound Power Level, L_w	The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment.
Sound transmission Loss	The amount in decibels by which a random sound is reduced as it passes through a sound barrier.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.
UTM	Universal Transverse Mercator - a plane coordinate grid system, which it is based on Transverse Mercator.
WHO	World Health Organisation.

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1 Introduction

1.1 Overview

GHD Pty Ltd (GHD) has been engaged by Centennial Northern Coal Services Pty Limited (Centennial) to develop a calibrated noise model and provide noise modelling prediction results associated with a stockpile extension proposed for the Cooranbong Entry Site (CES).

1.2 Purpose of this report

The purpose of this report is to present the noise modelling prediction results associated with the stockpile extension project. The noise model developed as part of this assessment will be included as an appendix to the Northern Coal Services CES Stockpile Extension Modification Report (SSD-5145 Modification 4).

1.3 Scope of work

The scope of work undertaken by GHD for this assessment is summarised below:

Baseline noise monitoring

- Initial desktop review to identify the study area for the assessment and the key noise sensitive receptors for the Project.
- Desktop review of the surrounding environment from aerial imagery to identify potential existing noise sensitive receptors.
- Undertake unattended noise monitoring for a minimum period of one week at two (2) locations representative of the local environment (nearest residential dwellings) in order to determine local background noise levels at the nearest sensitive receptors.
- Assess and filter invalid noise data due to extraneous noise or adverse weather conditions.
- One 15-minute attended noise measurement was undertaken adjacent to the unattended noise loggers at sensitive receptors to assist in the identification and quantification of existing noise sources.

Construction noise and vibration impact assessment

- Review of information provided by Centennial detailing the proposed construction staging and equipment, traffic generation and operational activities.
- Develop construction scenarios based on the construction staging and period of construction.
- Determine the project noise management levels for the key sensitive receptors in the study area, based on the Interim Construction Noise Guideline (DECC, 2009).
- Develop a 3D construction noise model to predict impacts at the identified sensitive receptors for each construction scenario associated with the construction activities.
- Assess the impacts against the construction noise management levels.
- Provide reasonable and feasible construction noise management and mitigation measures to minimise impacts on the community.
- Assess vibration from construction activities using safe working distances from vibratory intensive equipment and relevant management measures will be recommended.
- Assess noise associated with the increase in road traffic on the nominated traffic routes would be assessed for all stages of construction. Mitigation measures would be assessed as required to manage traffic noise impacts.
- Provide reasonable and feasible in-principle noise mitigation measures to reduce noise levels to within compliant levels, if required.

Operational noise and vibration impact assessment

- Review design details, assumptions provided for noise generating equipment and any attenuation built into the design.
- Determine the project noise trigger levels for the key sensitive receptors in the study based on the Noise Policy for Industry (EPA 2017).
- A 3D noise model of all the key noise sources associated with the Project at maximum capacity will be developed (based on measure noise source data onsite / drawings as agreed).
- Predict noise levels at the key sensitive receptors locations in the study area including operational impacts, sleep disturbance impacts, and traffic noise impacts at sensitive receptors.
- Compare predicted operational noise levels with project noise trigger levels determined for sensitive receptors in the area and identify any exceedances.
- Noise associated with the increase in road traffic from operational deliveries and maintenance staff on the nominated traffic routes would be assessed.
- Where project noise trigger levels are exceeded, identify feasible and reasonable noise mitigation measures.

1.3.1 Assumptions and exclusions

The following assumptions and exclusions were made in preparation of this report:

- The information presented in this assessment are to support Centennial in making a decision on the reasonability and feasibility of the proposed mitigation measures. This information is to be used for informational purposes and as an input only and not as evidence of compliance with requirements.
- GHD is relying on information provided by Centennial and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.
- Ongoing advice outside of that prescribed in the scope of works has not been allowed for.
- Sensitive receptors were identified using aerial photography and land use planning and may not include all existing or future receptors, but are considered representative of receptors.
- Key construction scenarios have been considered in this assessment. Assumed equipment and noise levels are provided in Table 6.4.
- Construction noise is assessed assuming that each piece of construction equipment is operating concurrently for each scenario.
- Construction plant and equipment is assumed to operate at maximum sound power.
- As part of the construction traffic forecasting, assumptions were agreed with Centennial and are detailed in Section 6.4.5.

1.4 Limitations

This report has been prepared by GHD for Centennial Northern Coal Services Pty Limited and may only be used and relied on by Centennial Northern Coal Services Pty Limited for the purpose agreed between GHD and Centennial Northern Coal Services Pty Limited as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Centennial Northern Coal Services Pty Limited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.3.1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared the Noise Model ("Model") for, and for the benefit and sole use of, Centennial Northern Coal Services Pty Limited to support the assessment of noise impacts and must not be used for any other purpose or by any other person.

The Model is a representation only and does not reflect reality in every aspect. The Model contains simplified assumptions to derive a modelled outcome. The actual variables will inevitably be different to those used to prepare the Model. Accordingly, the outputs of the Model cannot be relied upon to represent actual conditions without due consideration of the inherent and expected inaccuracies. Such considerations are beyond GHD's scope.

The information, data and assumptions ("Inputs") used as inputs into the Model are from publicly available sources or provided by or on behalf of the Centennial Northern Coal Services Pty Limited, (including possibly through stakeholder engagements). GHD has not independently verified or checked Inputs beyond its agreed scope of work. GHD's scope of work does not include review or update of the Model as further Inputs becomes available.

The Model is limited by the mathematical rules and assumptions that are set out in the Report or included in the Model and by the software environment in which the Model is developed.

The Model is a customised model and not intended to be amended in any form or extracted to other software for amending. Any change made to the Model, other than by GHD, is undertaken on the express understanding that GHD is not responsible, and has no liability, for the changed Model including any outputs.

GHD has prepared this report on the basis of information provided by Centennial Northern Coal Services Pty Limited and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2 Project description

2.1 Site description

The CES is an existing coal delivery and handling facility that forms part of Centennial Northern Coal Services (NCS) operations approved under SSD-5145. It is located on the western side of Lake Macquarie approximately 130 km north of Sydney NSW and two kilometres north of the township of Dora Creek.

Figure 2.1 shows the CES in its regional setting on the western side of Lake Macquarie within both the Lake Macquarie and Central Coast Local Government Areas (LGAs).

2.2 Cooranbong entry site operational overview

Centennial NCS operations includes surface coal handling and processing facilities at CES. Centennial propose a modification to expand the existing coal stockpile at CES. It is identified that noise impact is a key aspect for the proposed Modification.

2.2.1 Existing stockpile operation

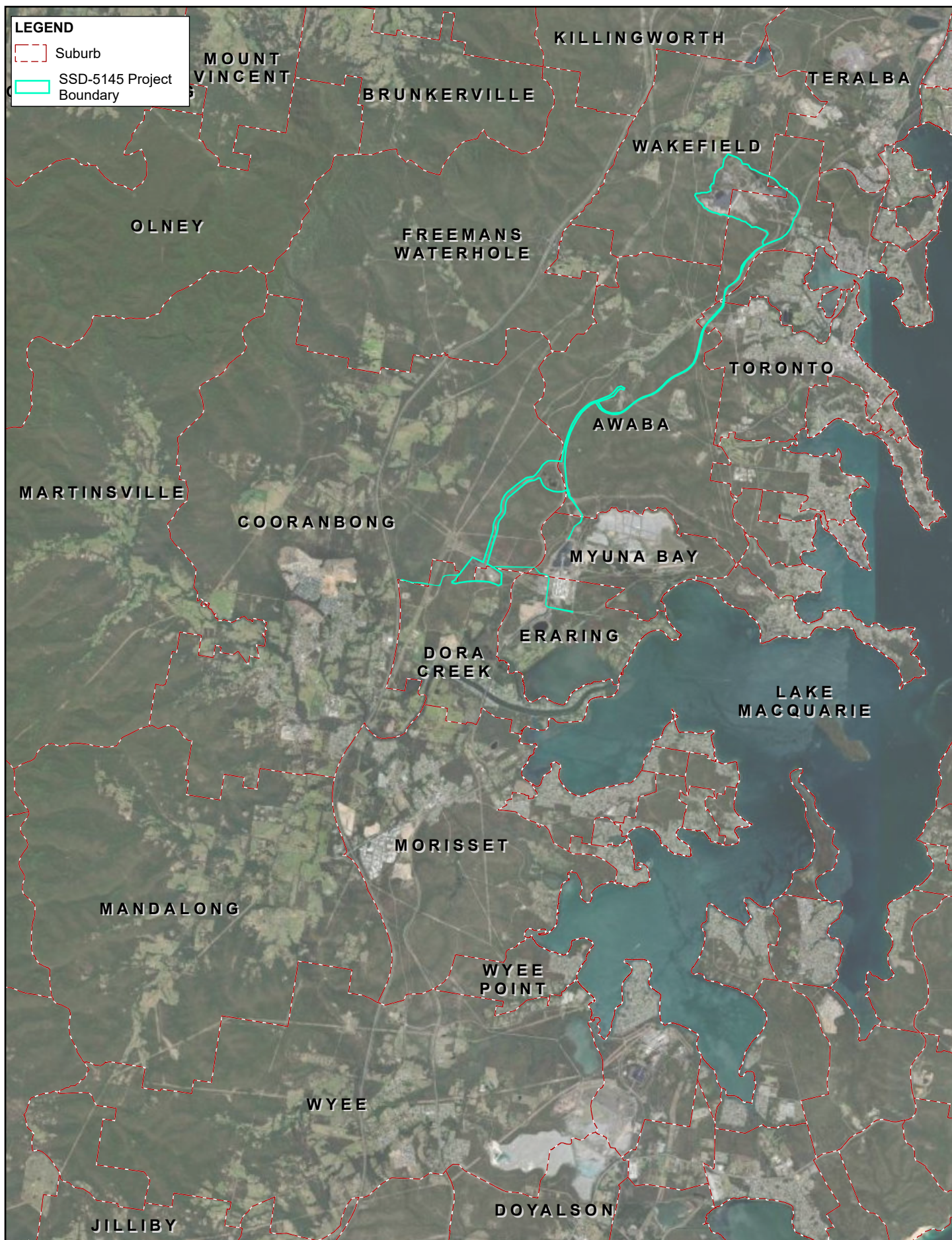
CES currently operates several coal stockpile areas including the existing 100,000 tonne coal stockpile. This stockpile operates by stacking coal from an overhead conveyor gantry onto the stockpile. A front end loader is used to load the stockpiled coal onto trucks. A dozer is also used on the coal stockpile for bulk pushing of stockpiled coal as required.

2.2.2 Proposed stockpile operation

Centennial proposes to apply for the Modification (Modification 4) of SSD-5145 under Section 4.55(2) of the EP&A Act for:

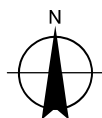
- Development of the existing coal stockpile at CES to increase capacity from 100,000 tonnes to approximately 400,000 tonnes.
- Construction of infrastructure associated with the modified stockpile footprint. This will include access tracks, lighting towers, water sprays, fencing and water management infrastructure.

The stockpile is proposed to be increased in footprint from approximately 2.5 Ha to 5.5 Ha, with a maximum material height of approximately 50 m AHD (refer to Figure 2.2). Operation of the modified stockpile would also require the use of two dozers (one additional dozer than is currently used in approved CES operations).



Paper Size ISO A4
0 1 2 3
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

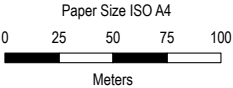


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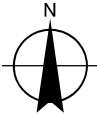
Project No. 12600696
Revision No. 0
Date 18/12/2024

Regional locality

FIGURE 2.1



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



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Noise Impact Assessment

Project No. 12600696
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Proposed stockpile layout

FIGURE 2.2

3 Noise sensitive receptors

Land uses within the surrounding area consist of bushland, rural land uses with homesteads and residential properties.

A list of the nearest potentially affected noise sensitive receptors in the vicinity of the CES is presented in Table 3.1.

Table 3.1 *Identified sensitive noise receptors*

Receptor number ¹	MGA Zone 56	
	Easting (mE)	Northing (mN)
R1 (23) ²	360222	6340540
R2 (26) ²	360201	6340471
R3 (22)	360002	6340503
R4 (28)	360081	6340274
R5 (32) ²	360190	6340241
R6 (31)	359733	6340052
R7 (35)	359873	6339911
R8 (30)	359383	6339664
R9 (33)	359188	6339819
R10 ²	360196	6340325
R11	360065	6340359

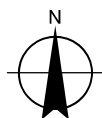
Note 1: Numbers in brackets correspond to sensitive receptor identifiers from Appendix 4, Figure 2 of SSD-5145.

Note 2: Receptor has a negotiated noise agreement with Centennial currently in place.



Paper Size ISO A4
0 140 280 420 560 700
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



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Noise Impact Assessment

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Date 18/12/2024

Noise sensitive receptors
- Cooranbong Entry Site

FIGURE 3.1

4 Existing acoustic environment

4.1 General methodology

An ambient noise survey was conducted to characterise and quantify the existing acoustical environment in the area surrounding the Project.

The ambient noise monitoring consisted of continuous, unattended noise logging and operator attended noise surveys. The operator attended noise surveys help to define noise sources and the character of noise in the area and are, therefore, used to qualify unattended noise logging results.

Attended noise measurements were undertaken using a Brüel & Kjær 2270 Type 1 sound level meter (serial number 3030991). Unattended noise measurements were undertaken using two (2) SVAN 977 Type 1 sound level meters (serial number 45748 and 92124). These instruments can measure continuous A-weighted 1/3 octave sound pressure levels and is able to record L_{Amin} , L_{A90} , L_{A10} , L_{A1} , L_{Amax} and L_{Aeq} noise descriptors.

Unattended noise monitoring was undertaken from 29 May 2023 to 16 June 2023 and the noise data is still considered to be representative of the area.

Field calibrations were checked by GHD immediately before and after each set of measurements using a SVAN SV-36 sound level calibrator (serial number 106878). In all cases, pre and post calibration checks were within the acceptable range of 94 dB +/- 0.5 dB.

Noise measurements were conducted with reference to AS 1055-2018 Acoustics –Description and Measurement of Environmental Noise and the Noise Policy for Industry (NPI).

All instrumentation used during noise measurements comply with the requirements of AS IEC 61672.1-2019 Electroacoustics – Sound Level Meters – Specifications, AS IEC 61672.2-2019, AS IEC 61672.3-2019 and carry current NATA or manufacturer calibration certificates. Calibration certificates for the sound level meters used during the monitoring period are attached in Appendix A.

4.2 Monitoring locations

Noise monitoring was undertaken at a location considered representative of the nearest potentially-affected noise-sensitive receptors.

The noise monitoring location is detailed in Table 4.1 and shown in Figure 4.1.

Table 4.1 *Monitoring locations*

Monitoring Location	UTM Zone 56		Picture
	Easting (mE)	Northing (mN)	
M1	360186	6340619	
M2	359604	6339865	

4.3 Attended noise monitoring

Attended monitoring was undertaken at each monitoring location for 15 minutes during the day, evening and night period to determine the character and relative contribution of noise sources. The operator attended noise surveys help to identify noise sources and the character of noise in the area to supplement and assist in interpretation of the unattended monitoring results.

The results of the operator attended noise survey are given in Table 4.2. Ambient noise levels given in the table include all noise sources such as traffic, insects, birds. Table 4.2 provides the following information:

- Monitoring location
- Date and start time
- Wind velocity (m/s) and temperature (°C) at the measurement location
- Typical maximum (L_{Amax}) and contributed noise levels

Table 4.2 Operator attended noise survey results

Location	Date Start time Period Weather	Primary noise descriptor (dBA re 20 μ Pa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
M1	Date/Start time:29/05/2023 17:09 Period: Day Wind:0.69WSW Temperature:17.2 Humidity:49.9 Stability Category: B Cloud cover:0/8	77	56	43	39	50	Insect/frogs 40 to 43 dBA Dogs 42 to 47 dBA Local road traffic 50 to 77 dBA Distant road traffic 40 to 45 dBA CES: Coal loading haul trucks 48 to 55 dBA
	Date/Start time:29/05/2023 20:26 Period: Evening Wind:0.75WNW Temperature:8.8 Humidity:80.9 Stability Category: E Cloud cover:0/8	72	53	45	37	46	Birds 48 dBA Insect/frogs 42 to 48 dBA Local road traffic 48 to 72 dBA Distant road traffic 40 to 41 dBA Rail pass by 44 to 50 dBA CES: CHPP/Rotary breaker 36 to 39 dBA Dropping material 46 to 48 dBA
	Date/Start time:29/05/2023 23:36 Period: Night Wind:1.19NW Temperature:6.8 Humidity:86.8 Stability Category: E Cloud cover:0/8	50	45	43	40	41	Birds 49 to 50 dBA Insect/frogs 41 to 47 dBA CES: CHPP/Rotary breaker 38 to 41 dBA Coal loading haul trucks 45 to 46 dBA
M2	Date/Start time:29/05/2023 16:49 Period: Day Wind:0.22W Temperature:17.7 Humidity:49 Stability Category: A Cloud cover:0/8	66	56	46	42	45	Birds 50 to 54 dBA Local road traffic 65 to 66 dBA Distant road traffic 40 to 48 dBA CES: Not Discernible
	Date/Start time:29/05/2023 20:08 Period: Evening Wind:0.58NW Temperature:8.8 Humidity:78.2 Stability Category: D Cloud cover:0/8	64	52	43	36	42	Birds 41 to 42 dBA Insect/frogs 25 dBA Local road traffic 53 to 64 dBA Distant road traffic 35 to 52 dBA resident 48 dBA Bats 42 to 45 dBA CES: Not Discernible

Location	Date Start time Period Weather	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L _{Amax} (dBA)
		L _{Amax}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	
	Date/Start time:29/05/2023 23:17 Period: Night Wind:1.05NW Temperature:7.6 Humidity:86.4 Stability Category: E Cloud cover:1/8	58	55	46	39	44	Local road traffic 53 to 56 dBA Distant road traffic 43 to 51 dBA Rail pass by 43 to 58 dBA bats 42 to 54 dBA CES: Not Discernible

Note 1: Day is defined as the period from 7:00 am to 6:00 pm. Evening is defined as the period from 6:00 pm to 10:00 pm. Night-time is defined as 10:00 pm to 7:00 am.

4.3.1 Existing compliance monitoring

Attended noise measurements are currently undertaken every quarter, as per requirements in the Site's Environmental Protection Licence 365 (refer to Section 5.3.1). Three measurements have been conducted in 2024 so far and the results show that the Site is compliant. Details of the compliance monitoring methodology and results can be found in the quarterly noise monitoring reports.

4.4 Unattended noise monitoring

Noise levels were monitored from Monday 29 May 2023 to Friday 16 June 2023. The noise logger was programmed to record statistical noise level indices continuously in 15-minute intervals, including L_{Amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and unwanted reflections from adjacent buildings.

The purpose of the monitoring was to determine existing background noise levels for the noise assessment. The noise loggers were located in areas that were considered representative of the local background and ambient noise levels. The monitoring locations were also chosen as a safe and secure place for staff and unattended equipment, minimising the risk of theft, vandalism, or damage by natural causes. Property access permission was also a factor that contributed to the final selection of the locations.

Although the noise data was captured in 2023, it is still considered to be representative of the area.

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods of time where average wind speeds at ground level were greater than 5 m/s, or when rainfall occurred. Meteorological data for the monitoring period was sourced from the Bureau of Meteorology (BOM) weather station located at the Lake Macquarie.

Rating background levels and ambient noise levels with and without the CES contributions recorded at each location are summarised in Appendix D. Centennial kept an operational activity log during the unattended noise monitoring that was used to exclude time periods when the acoustically significant plant at CES was in operation (refer to Appendix G).

It should be noted that the time periods in each unattended monitoring table is as follows:

Monday to Saturday

Daytime 7:00 am to 6:00 pm, Evening 6:00 to 10:00 pm, Night-time 10:00 pm to 7:00 am.

On Sundays and Public Holidays

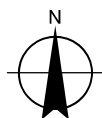
Daytime 8:00 am to 6:00 pm, Evening 6:00 to 10:00 pm, Night-time 10:00 pm to 8:00 am.

Daily noise monitoring charts for the entire monitoring period at each location are presented in Appendix E and Appendix F.



Paper Size ISO A4
0 140 280 420 560 700
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

Project No. 12600696
Revision No. 0
Date 18/12/2024

Noise monitoring locations

FIGURE 4.1

4.5 Effects of meteorology on noise levels

4.5.1 Overview

Meteorological conditions may increase noise levels by focusing soundwave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level), and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receiver.

The NPI provides two options for a proponent to consider meteorological effects on noise levels:

1. *Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receptors and F class temperature inversions with wind speeds up to 2 m/s at night.*
2. *Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.*

This assessment has used the option 2 approach and determined the significance of noise-enhancing conditions.

4.5.2 Wind

Wind has the potential to increase noise at a receptor when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration. Where wind blows from the source to the receptor at speeds up to 3 m/s for more than 30% of the time in any season (NPI, 2017), then wind is considered to be a feature of the area.

Wind speed and direction data, among other parameters, have been measured at the BoM automated weather station (AWS) at Lake Macquarie – Cooranbong (Station Number 061412) for many years. Thus, a detailed approach has been utilised for the purpose of this assessment.

In order to determine the prevailing conditions, weather data from the full calendar year of 2021 was obtained from the BOM AWS at Lake Macquarie – Cooranbong (approximately 5 km southwest of the site). 2021 data was used as it was the most recent complete dataset available when the assessment began. The 2021 weather data is still considered representative of the area.

In accordance with the NPI, this data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night-time period. The results of the wind analysis are provided in Table 4.3 and presented graphically in Figure 4.2 to Figure 4.5. In each figure, the wind directions and percentage occurrence are those dominant during each season.

Seasonal wind records indicate that winds up to 3 m/s do exceed the 30% threshold during the daytime period only. Prevailing winds are therefore considered a feature of the area during the daytime period and have been considered as part of this assessment.

Table 4.3 *Percentage occurrence of winds 0.5 m/s to 3 m/s*

Wind direction	Percentage occurrence of winds between 0.5 m/s to 3 m/s (%)											
	Spring			Summer			Autumn			Winter		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
N	12	9	7	9	9	1	15	4	4	23	13	14
NNE	12	9	5	11	12	1	13	5	3	17	8	8
NE	15	9	3	16	13	1	14	6	2	13	4	3
ENE	19	9	2	23	16	1	16	6	3	10	2	1
E	22	7	1	28	17	2	18	4	3	8	1	0
ESE	25	5	1	32	17	2	21	5	4	7	1	0
SE	24	6	3	34	19	4	22	5	4	6	1	0
SSE	21	9	5	32	19	8	20	5	4	4	1	1
S	19	12	8	30	21	13	21	6	5	7	2	3
SSW	16	14	10	26	21	18	22	6	8	11	4	4
SW	13	13	11	18	17	20	21	7	10	14	7	5
WSW	11	12	9	11	11	16	19	9	11	17	11	6
W	9	12	9	5	6	10	16	8	10	19	14	8
WNW	9	12	8	3	3	4	14	7	7	21	16	13
NW	10	11	9	4	4	2	14	5	6	24	18	17
NNW	12	10	9	7	7	1	15	3	5	25	16	18
Calm	63	40	25	72	53	27	70	23	22	57	29	26

Note 1: 16-direction wind compass rose the percentage occurrence of light winds for each of the 16 directions is the arithmetic sum of the direction being reported and the four closest directions (that is, two on either side).

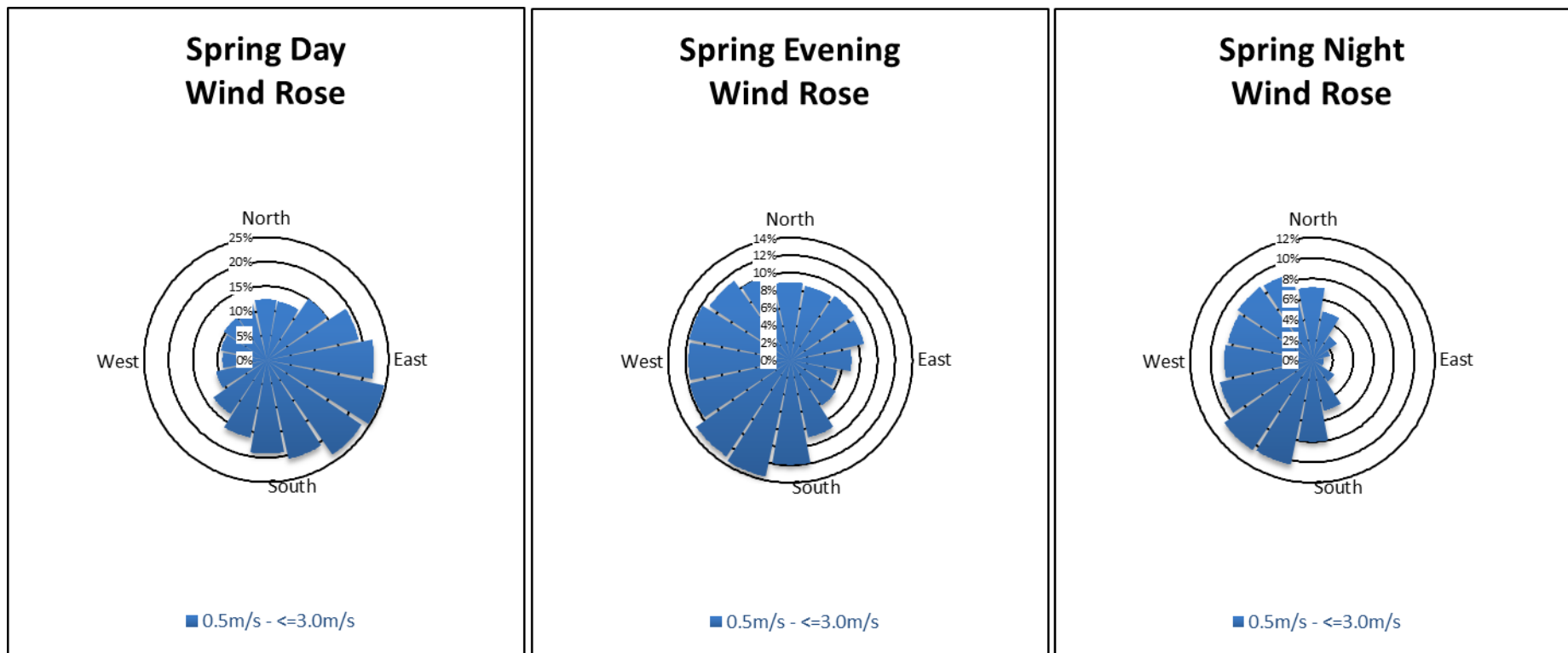


Figure 4.2 Spring wind rose summary

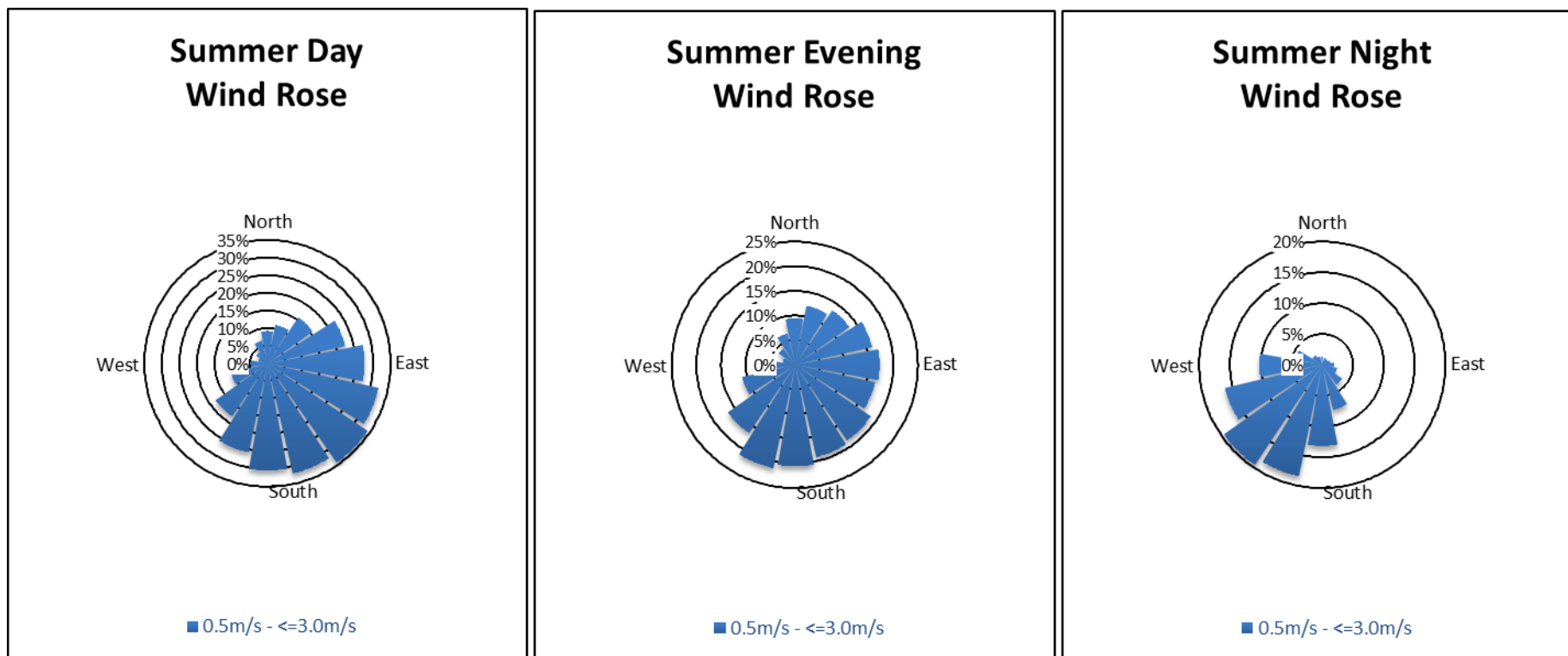


Figure 4.3 Summer wind rose summary

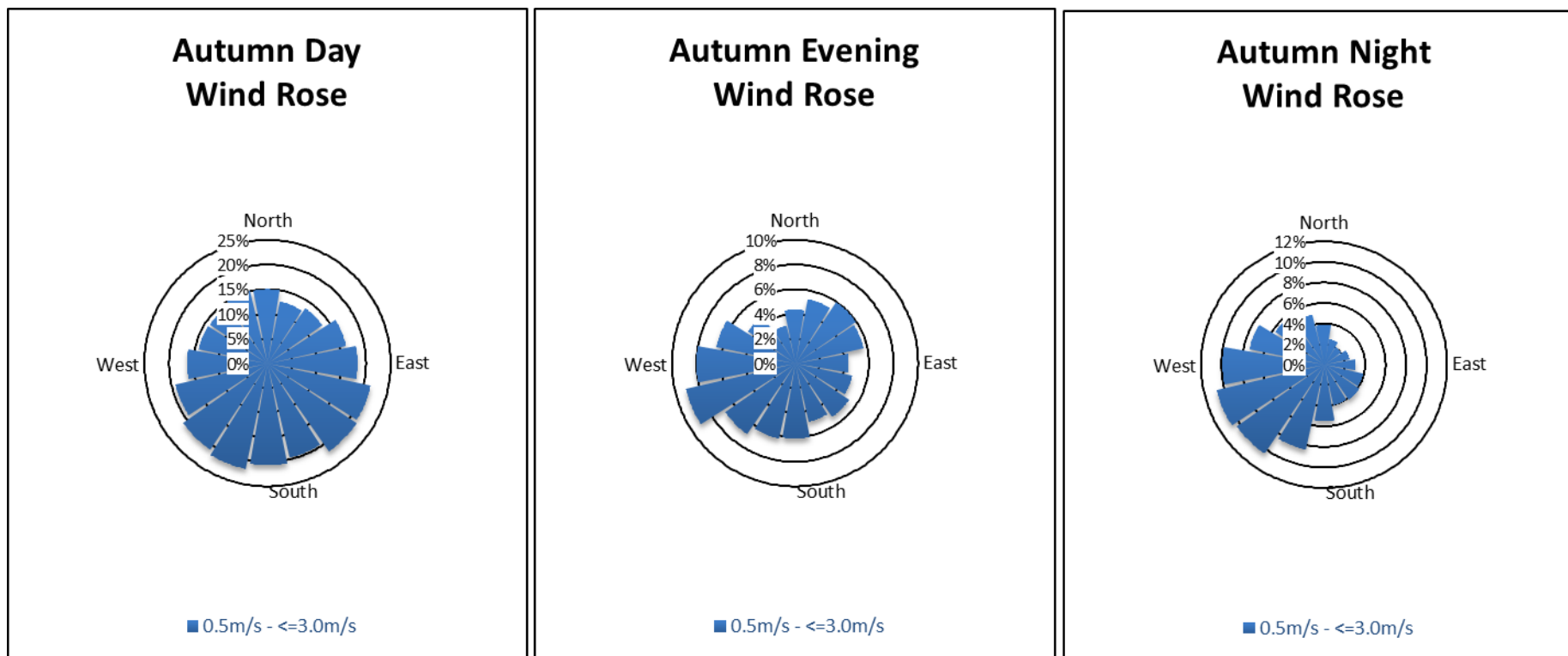


Figure 4.4 Autumn wind rose summary

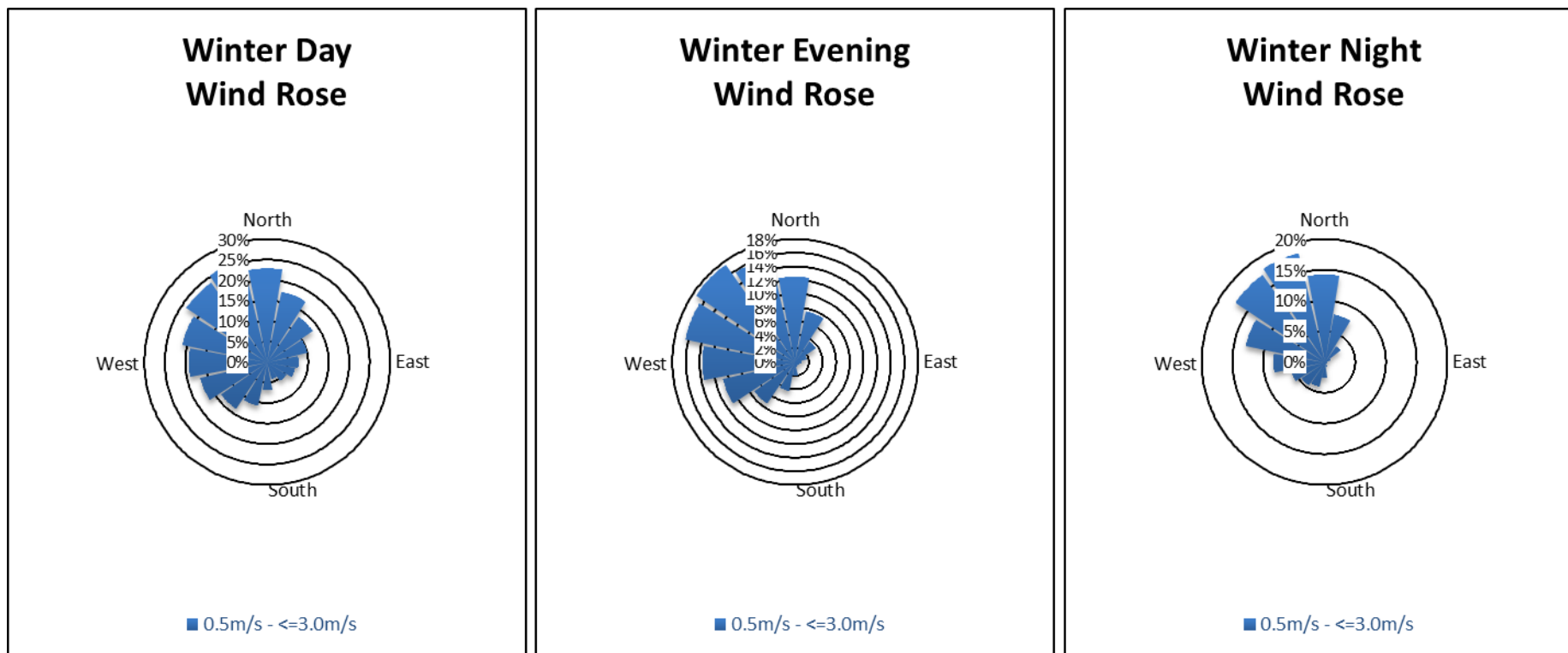


Figure 4.5 Winter wind rose summary

4.5.3 Temperature inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter.

Meteorological data was available from the AWS at Lake Macquarie – Cooranbong to allow the determination of the percentage occurrence of temperature inversions during winter nights. The most current temperature inversion data was contained in the years 2021.

An analysis of the occurrence of each stability class has been conducted and is provided in Table 4.4.

Table 4.4 Seasonal Frequency of Occurrence of Temperature Inversion – Night

Stability Class	Winter
A	0.00%
B	0.00%
C	0.00%
D	13.53%
E	9.42%
F	20.29%
G	56.76%
F + G	77.05%

Results of the analysis is provided in Table 4.4 indicate that temperature inversions occur in the area and have therefore been considered as part of this noise assessment. In accordance with the NPI, where the combination of F-stability class and G-stability class occurs for at least 30 percent of the total night-time winter, F-stability class are to be used in noise predictions.

5 Noise and vibration guidelines

5.1 Construction noise goals

The EPA released the Interim Construction Noise Guideline (ICNG) in July 2009 and is designated in Schedule 3, condition 1 of the Northern Coal Services (SSD-5145) approval. The guideline sets out noise management levels in relation to construction type activities, for sensitive receptors and how they are to be applied. These guidelines provide two different methods for the assessment of construction noise and vibration: a qualitative method and a quantitative method.

The quantitative method involves predicting noise levels and comparing them with the levels in the guideline. The guidance noise levels are given for airborne noise at sensitive land uses, including commercial and industrial premises, ground-borne noise, and sleep disturbance.

The qualitative method for assessing noise is a simplified way to identify the cause of potential noise impacts. It avoids the need to perform complex predictions by using a checklist approach to assessing and managing noise.

A quantitative assessment method has been conducted for the works given that the construction period will be longer than three weeks.

5.1.1 Hours of construction

The work periods defined in the Construction Noise and Vibration Guideline (CNVG) (TfNSW 2023) for construction activities are provided in Table 5.1.

Table 5.1 Transport construction hours ^{1,2}

Hour commencing	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday																								
Tuesday																								
Wednesday																								
Thursday																								
Friday																								
Saturday																								
Sunday																								
Public Holiday																								

Notes:

- Standard construction hours are defined as: Monday to Friday 7:00 am to 6:00 pm and Saturdays from 8:00 am to 1:00 pm.
- Work outside of standard construction hours is defined as Out-of-Hours Work (OOHW) and can be divided into 2 periods of sensitivity.
 - OOHW Period 1 is defined as Monday to Saturday 6:00 pm to 10:00 pm (evenings), Saturday 7:00 am to 8:00 am and 1:00 pm to 10:00 pm (day & evening) and Sunday and Public holidays 8:00 am to 6:00 pm (days).
 - OOHW Period 2 is defined as Monday to Saturday 10:00 pm to 7:00 am (nights) and Sundays and public holidays 6:00 pm to 8:00 am (nights).

5.1.2 Airborne noise

5.1.2.1 Residential noise goals

The residential noise criteria for general construction activities are provided in Table 5.2.

Table 5.2 Airborne noise objectives at sensitive land uses (residential)

Time of day	Noise management level L _{Aeq} (15 minute)	How to apply
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dBA	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 practices to minimise noise. The proponent should also inform all potentially impacted residents and stakeholders of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	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 proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise levels of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours:	Noise affected RBL + 5 dBA	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 the noise is more than 5 dBA above the noise affected level, the proponent should consult with the community.

The ICNG acknowledges that the following activities can be justified to be conducted outside the recommended construction hours:

- The delivery of oversized plant or structure.
- Emergency work.
- Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours.
- Works which maintain noise levels at receptors below the night-time noise affected construction noise management levels.

5.1.2.2 Other sensitive receptor noise objectives

Internal noise criteria are provided for non-residential sensitive receptors in Table 5.3. These criteria apply when the land is in use. External noise levels have been determined by assuming a 10 dBA reduction through a partially open window (ICNG).

Table 5.3 Airborne noise objectives at sensitive land uses (other than residential)

Type of occupancy / activity	Management level, L _{Aeq} dBA (applies when land use is being utilised)	
	Internal	External
Classrooms at schools and other educational institutions	45	55
Hospital wards and operating theatres	45	55
Places of worship	45	55
Active recreation (Characterised by sporting activities and activities which generate their own noise or focus of participants, making them less sensitive to external noise intrusion).	-	65
Passive recreation (Characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation).	-	60
Offices, retail outlets	-	70
Industrial premises	-	75
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses.	

5.1.2.3 Construction traffic noise objectives

The ICNG provides the following in relation to construction traffic noise objectives:

Noise from public roads and construction traffic on public roads – this is assessed under the Environmental Criteria for Road Traffic Noise (EPA 1999) (currently under review).

It is relevant to note the Environmental Criteria for Road Traffic Noise has been superseded by the Road Noise Policy (RNP) (DECCW 2011). The RNP (DECCW 2011) provides the following in relation to construction noise related activities outside of this policy:

Appendix C – Road related activities outside this policy

C1 Construction and maintenance activities

Advice on the management of construction noise impacts from all types of road development in NSW is given in NSW interim construction noise guideline (Department of Environment and Climate Change 2009). Guidance on dealing with noise emissions from the maintenance and renewal of existing roads is also provided in the above guideline. The NSW Roads and Traffic Authority provides practical guidance on noise and vibration from its activities in Environmental noise management manual (NSW Roads and Traffic Authority 2001).

However, the RNP (DECCW 2011) does state that in assessing feasible and reasonable mitigation measures, an increase in road traffic noise of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. For existing residences and other sensitive land uses affected by *additional traffic on existing roads generated by land use developments* (in this case the construction area), any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'without construction' scenario.

Further guidance is provided in the CNVG (TfNSW 2023) which states the following in relation to construction-related traffic noise goals:

8. Construction Traffic

The EPA Interim Construction Noise Guideline references the EPA NSW Road Noise Policy for the assessment of construction traffic on public roads.

For Transport projects, an initial screening test should first be applied by evaluating whether noise levels will increase by more than 2dBA due to construction traffic or a temporary reroute due to a road closure. Where increases are 2dBA or less then no further assessment is required.

Where noise levels increase by more than 2dBA (2.1dBA) further assessment is required based upon Transport's Road Noise Criteria Guideline. This documents Transport's approach to implementing the EPA NSW Road Noise Policy. Consideration should also be given under the Road Noise Criteria Guideline as to whether the construction traffic or temporary reroute triggers new road criteria due to changes in road category.

Noise mitigation should be considered using Appendices B and C. However, since noise from construction traffic is temporary, guidance to feasible and reasonable noise mitigation differs from operational traffic noise.

5.1.3 Ground-borne noise

Ground-borne noise (structure borne noise or generated noise) is the noise radiated into a room caused by structural vibration, due to, for example, underground works using road headers and tunnel boring machines. Ground-borne noise has significant low frequency components and tends to be more noticeable compared with airborne noise as the same A-weighted level. Where this is observed the internal noise limits (as per the ICNG (DEC 2009)) presented in Table 5.4 shall be used to determine whether additional reasonable and practicable mitigation options should be investigated.

Table 5.4 Ground-borne noise objectives at residences

Building	Ground-borne noise objectives L_{Aeq} (15 minute)
Daytime 7:00 am to 6:00 pm	Human comfort vibration objectives only
Evening 6:00 pm to 10:00 pm	40 dBA – Internal
Night-time 10:00 pm to 7:00 am	35 dBA – Internal

5.2 Construction vibration objectives

5.2.1 Ground-borne vibration

5.2.1.1 Human comfort vibration objectives

Guidance in relation to acceptable vibration levels for human comfort are provided in EPA's *Assessing Vibration: a technical guideline* (AVTG) (2006). The document is based on the guidelines contained in British Standard BS 6472-1:1992 *Evaluation of human exposure to vibration in buildings (1–80 Hz)*.

Typically, construction works generate ground vibration of an intermittent nature. In accordance with BS 6472-1:1992, intermittent vibration is assessed using the Vibration Dose Value (VDV). Acceptable VDV, as outlined in *Assessing Vibration: A Technical Guideline*, are listed in Table 5.5.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. Activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum range may be used if they can be justified. For values beyond the maximum value, the proponent should negotiate with the affected community.

Table 5.5 Acceptable vibration dose values for intermittent vibration

Location	Daytime ¹ (m/s ^{1.75})		Night-time ¹ (m/s ^{1.75})	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas ²	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:

1. Daytime is 7:00 am to 10:00 pm and night-time is 10:00 pm to 7:00 am.
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.

While the assessment of response to vibration in BS 6472-1:1992 is based on VDV and weighted acceleration, for construction-related vibration, it is considered more appropriate to provide guidance in terms of Peak Particle Velocity (PPV), since this parameter is more likely to be routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels well below those that risk causing damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in British Standard *BS 5228-2:2009 Code of practice for noise and vibration on construction and open sites – Part 2: Vibration* as listed in Table 5.6.

Table 5.6 Guidance on the effects of vibration levels

Approximate vibration level	Degree of perception
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30 mm/s	Vibration might be just perceptible in residential environments.
1.00 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10.00 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

5.2.1.2 Structural damage due to vibration

Currently, there is no Australian Standard that sets criteria for the assessment of building damage caused by vibration. Australian Standard AS 2187: Part 2-2006 *Explosives – Storage and Use – Part 2: Use of Explosives* contains the most relevant vibration damage objectives and recommends the frequency dependent guidelines values and assessment methods given in British Standard BS 7385-2:1993 *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground-borne vibration for building damage criteria* as they “are applicable to Australian conditions”.

The vibration levels adopted are related to transient vibration which does not give rise to resonant responses in structures and low-rise buildings. Dynamic loading caused by continuous vibration (e.g., vibratory piling, rock breaking, rock hammering) may give rise to dynamic magnification due to resonance. In these cases, BS 7385 recommends a reduction of the transient vibration levels.

The standard states that the guide values relate predominately to transient vibration which does not give rise to resonant responses in structures, and to low rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies, where lower guide values apply then the guide values may need to be reduced by up to 50%. A conservative level of continuous “minimal risk of cosmetic damage” criteria has been adopted and is presented in Table 5.7.

Table 5.7 Transient vibration guide values—minimal risk of cosmetic damage

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	25 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures residential or light commercial type buildings	7.5 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above

The CNVG (TfNSW 2023) references German Standard DIN 4150-3:2016 *Structural Vibration – Part 3: Effects of vibration on structures for the assessment of damage to structures that are of intrinsic value*. The DIN 4150-3 criteria are presented in Table 5.8 below.

Table 5.8 Guideline values for short term vibration on structures – DIN 4150-3

Line	Type of structure	Guideline values for velocity, $v_i(t)$ ⁽¹⁾ [mm/s]		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20-40	40-50
2	Dwellings and buildings of similar design and/or occupancy	5	5-15	15-20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example listed buildings under preservation order)	3	3-8	8-10

Source: German Standard DIN 4150-3: 2016-02 Structural Vibration – Part 3: Effects of vibration on structures

Notes:

1. The term v_i refers to vibration levels in any of the x, y or z axes
2. At frequencies above 100 Hz the values given in this column may be used as minimum values

Guideline values for long-term vibration are provided in Table 5.9, including vibration that may cause resonance in a structure being evaluated.

Table 5.9 Guideline values for long-term vibration on structures

Line	Type of structure	Guideline values for velocity, v_i in mm/s	
		Top floor. Horizontal, all frequencies	Ceiling. Vertical, all frequencies
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	10	10
2	Dwellings and buildings of similar design and/or occupancy.	5	10
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (such as heritage listed buildings under preservation order).	2.5	10 ^(a)

Source: German Standard DIN 4150-3: 2016-12 Structural Vibration – Part 3: Effects of vibration on structures

Notes:

1. Even if the reference values according to line 1, column 2 are observed, slight damage cannot be ruled out.
- (a) significant reduction in this reference value may be necessary to prevent minor damage

For this NVIA, the BS criteria has been adopted for structural damage to all buildings and the DIN criteria has been adopted for structural damage to heritage buildings.

5.2.1.3 Vibration damage to utilities

The Construction Noise and Vibration Strategy (CNVS) (TfNSW 2019) references the British Standard BS 5228-2:2009 *Code of Practice for noise and vibration control on construction and open sites* and the German Standard

4150-3: 2016-12 *Structural Vibration – Part 3: Effects of vibration on structures*, which provide information on the vulnerability of ground-related services and structures to vibration. Table 5.9, Table 5.10 and Table 5.11 present the vibration guideline values in the British Standard (BS) and German Standard (DIN), respectively.

For this assessment, the BS criteria (the more conservative criteria) has been adopted for damage to underground services due to vibration and can be summarised as 30 mm/s for intermittent or transient vibrations (excavators, pile driving, trucks etc.) and 15 mm/s for continuous vibrations (compactors and rollers).

Table 5.10 *Vibration guide values for underground services – BS 5228*

Type of utility	Guideline maximum values for velocity measured on the pipe (mm/s)	
	Intermittent or transient vibrations	Continuous vibrations
Underground services	30	15

Table 5.11 *Guideline values for vibration on buried pipework – DIN 4150-3*

Line	Type of utility	Guideline values for velocity measured on the pipe (mm/s)
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with and without flange)	80
3	Masonry, plastic	50

The criteria shown in Table 5.12 for underground assets has been developed based on discussions GHD has had with underground asset owners.

Table 5.12 *Guideline values for underground assets*

Type of utility	Guideline values for velocity measured on the pipe (mm/s)
Telstra (and other comms agencies by proxy)	50 ¹
Energex (other electricity providers by proxy)	25
APA (gas pipelines)	20 ²

Notes:

1. Telstra generally anticipate that when construction activities comply with a minimum vibration limit / peak particle velocity of 50 mm/s there would be no damage or disruption to telecommunication assets (in particular, light transmitting in the fibre networks).
2. Vibration levels shall be monitored during the installation of the pile/pile sleeve if installed by way of a vibration driver or by impact hammer. The ground vibration at the pipeline shall be monitored and the vibration levels controlled to less than 20 mm/s. Works shall cease if levels exceed 20 mm/s and new method of installation sought.

5.2.2 Airborne vibration

Airborne vibration is structural vibration induced by low frequency sound. Sources of airborne vibration may include air blast (overpressure due to blasting), pile driving (both impact and vibratory) and vibratory compaction plant.

The CNVG (TfNSW 2023) does not provide specific limits for impacts associated with airborne vibration due to construction activities other than blasting as they are typically rare and should be considered on a case-by-case basis.

5.3 Operational noise goals

5.3.1 Environment protection licence 365

The relevant sections of the EPL 365 relating to noise are reproduced below. These noise conditions are consistent with the Centennial's *Noise Management Plan – Northern Region March 2023*, Environmental and Development Consent SSD-5144 and SSD-5145.

L5 Noise limits

L5.1 The licensee must ensure that noise generated by the activities within the premises do not exceed the following criteria measured by dB(A) at any of the following locations or on more than 25% of any privately-owned land.

Location Receiver number	Day L_{Aeq} (15min)	Evening L_{Aeq} (15min)	Night L_{Aeq}(15 min)	Night L_{A1} (1 min)
R2	40	40	40	52
R3	42	42	42	52
R4	39	39	39	52
R5	41	41	41	61
R6	40	40	40	61
R7 & R8	43	43	43	61
R9	42	42	42	61
R10	39	39	39	61
All other residences on privately -owned land	35	35	35	45
EPA Point 20 (M1)			37	45
EPA Point 21 (M4)			42	52
EPA Point 22 (M6)			41	61
EPA Point 23 (M7)			43	61
EPA Point 24 (M8)			43	61
EPA Point 25 (M10)			39	61
EPA Point 26 (M11)			35	45

Note: Locations R2, R3, R4, R5, R6, R7, R8, R9, R10 and All other residences on privately-owned land are as defined in Development Consent SSD-5144 MOD8. Locations EPA Point 20, 21, 22, 23, 24 and 25 are defined in plan titled "Centennial Coal, Noise Management Plan, Northern Region, March 2023" EPA Reference DOC23/737125.

L5.2 For the purpose of condition L5.1:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays.*
- Evening is defined as the period 6pm to 10pm, and*
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.*

L5.3 The noise limits set out in conditions L5.1 apply under all meteorological conditions except for any one of the following:

- Wind speeds greater than 3 metres/second at 10 metres above ground level; or*
- Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or*
- Stability category G temperature inversion conditions.*

L5.4 For the purpose of condition L5.3:

- The meteorological data to be used for determining meteorological conditions is the data recorded at the closest or most representative of climatic conditions to noise monitoring points in condition P1.3, using EPA Point 27 (W1) or EPA Point 28 (W2) or EPA Point 29 (W3) meteorological stations.*
- Stability category temperature inversion conditions are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy (EPA 2000).*

Note: The weather station must be designed, commissioned, and operated in a manner to obtain the necessary parameters required under the above condition.

L5.5 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC6172.1 and AS IEC6172.2-2004, or other noise monitoring equipment accepted by the EPA in writing.

5.3.2 Development consent SSD-5145

Schedule 3 of the Development Consent SSD-5145 specifies the following in relation to operation noise for CES:

NOISE

Operational Noise Criteria

1. Until the automated coal recovery and train loading system required by condition 8 of Schedule 2 is in use, the Applicant must ensure that the operational noise generated by the development (including maintenance activities) does not exceed the criteria in Table 2 at any residence on privately-owned land.

Table 2 Operational Noise Criteria

Receiver	Noise Limit (dB(A))				
	Morning Shoulder ($L_{Aeq}(15 \text{ min})$)	Day ($L_{Aeq}(15 \text{ min})$)	Evening ($L_{Aeq}(15 \text{ min})$)	Night ($L_{Aeq}(15 \text{ min})$)	Night ($L_{A1}(1 \text{ min})$)
NC2	36	36	35	35	45
NC3, Residences around NC6	40	40	39	39	45
23	-	37	37	37	45
26	-	36	36	36	45
All other residences on privately-owned land	-	35	35	35	45
		Day ($L_{Aeq}(1 \text{ hour})$)			
NC6 (school), when in use	-	45 (external to school building)	-	-	-

Notes to Table 2:

- The receiver locations in Table 2 are shown in Figures 1 and 2 of Appendix 4.
- Criteria for the Morning Shoulder period only applicable where these have been specifically developed for this period.

Noise generated by the development is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Noise Policy for Industry (EPA, 2017). Appendix 3 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has an agreement with the relevant landowner to exceed the noise criteria in Table 2, and the Applicant has advised the Department in writing of the terms of this agreement.

1. Once the automated coal recovery and train loading system required by condition 8 of Schedule 2 is in use, and thereafter, the Applicant must ensure that the operational noise generated by the development (including maintenance activities) does not exceed the criteria in Table 3 at any residence on privately-owned land.

Table 3 Operational Noise Criteria

Receiver	Noise Limit (dB(A))				
	Morning Shoulder ($L_{Aeq}(15 \text{ min})$)	Day ($L_{Aeq}(15 \text{ min})$)	Evening ($L_{Aeq}(15 \text{ min})$)	Night ($L_{Aeq}(15 \text{ min})$)	Night ($L_{A1}(1 \text{ min})$)
NC2	36	36	35	35	45
NC3, Residences around NC6	40	40	39	39	45
23	-	37	37	37	45
26	-	36	36	36	45
All other residences on privately-owned land	-	35	35	35	45
		Day ($L_{Aeq}(1 \text{ hour})$)			
NC6 (school), when in use	-	45 (external to school building)	-	-	-

Notes to Table 3:

- The receiver locations in Table 3 are shown in Figures 1 and 2 of Appendix 4.
- Criteria for the Morning Shoulder period only applicable where these have been specifically developed for this period.

Noise generated by the development is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Noise Policy for Industry (EPA, 2017). Appendix 3 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has an agreement with the relevant landowner to exceed the noise criteria in Table 3, and the Applicant has advised the Department in writing of the terms of this agreement.

5.3.3 Transitional arrangements

The EPA NSW *Implementation and transitional arrangements for the Noise Policy for Industry (2017)* provides guidance on the transition from the NSW Industrial Noise Policy (2000) to the Noise Policy for Industry (2017):

1. 4. The Noise Policy for Industry (2017) will be used to assess and develop requirements for existing industrial developments/activities under the circumstances and through the processes described in points 5 and 6 below.
2. 5. Modification to a planning approval:
 - a. where the planning authority requires a noise impact assessment to support the modification; or,
 - b. where a significant change to existing plant, equipment or processes is proposed.
3. 6. Environment protection licence review/variation:
 - a. c. where the existing environment protection licence does not include noise requirements and the regulation of noise is warranted (for example, due to complaints or changing land uses) through a pollution reduction program; or,
 - b. d. where there is a change in the activity, or to existing plant, equipment or processes that may require a noise assessment.

Since there is a change in activity/process as a result of proposed operations and the Project requires a noise impact assessment to support the modification, the noise impacts from the Project have transitioned and been assessed from the NSW Industrial Noise Policy (2000) to the Noise Policy for Industry (2017):

5.3.4 Noise policy for industry

The NSW EPA Noise Policy for Industry (NPI) provides guidance on the assessment of operational noise impacts. The guideline includes both intrusive and amenity goals that are designed to protect receptors from noise significantly louder than background level, and to limit the total noise level from all sources near a receptor.

The NPI noise goals are planning levels and are not mandatory limits required by legislation; however, the noise goals assist the regulatory authorities to establish licensing conditions. Where noise goals are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise goals cannot be achieved, negotiation is required between the regulatory authority to evaluate the economic, social and environmental costs and benefits of the development against the noise impacts. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the development.

5.3.4.1 Intrusive noise goals

The intrusive noise goals control the relative audibility of operational noise compared to the background level at residential receptors. The intrusive noise goals are determined by a 5 dB addition to the measured (or adopted) background level. The NPI recommends that the intrusive noise goals for the evening period should not exceed the daytime period and the night-time period should not exceed the evening period. The intrusive noise goals are only applicable to residential receptors.

5.3.4.2 Amenity noise goals

The amenity noise goals limit the total level of extraneous noise for all receptor types and is based on the overall acoustic characteristics of the receptor area and the existing level of noise, excluding other sources that are uncharacteristic of the usual noise environment. Residential receptors are characterised into 'urban', 'suburban', 'rural' or other categories based on noise criteria specific to land use and associated activities.

5.3.4.3 Corrections for annoying noise characteristics

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level. The NPI outlines correction factors that are to be applied to the source noise level at the receiver before comparison with the project specific noise levels, to account for the additional annoyance caused by these modifying factors. Table 5.13 sets out the corrections to be applied.

Table 5.13 Modifying factors corrections

Factor	Assessment/ measurement	When to apply	Correction ^[2]	Comments
Tonal noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2:2007 – Annex D).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: – 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz – 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz – 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB ^[2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.

Factor	Assessment/ measurement	When to apply	Correction ^[2]	Comments
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: - Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period - Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dBA positive adjustment applies for the daytime period.	2 or 5 dB ^[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level.	The source noise heard at the receiver varies by more than 5 dBA and the intermittent nature of the noise is clearly audible.	5 dB	Adjustment to be applied for night-time only.
Duration	Single-event noise duration may range from 1.5 min to 2.5 h.	One event in any assessment period.	0 to 20 dBA	The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3).
Maximum adjustment	Refer to individual modifying factors.	Where two or more modifying factors are indicated.	Maximum correction of 10 dBA ^[2] (excluding duration correction).	

Notes:

Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

Table 5.14 One-third octave low-frequency noise threshold

Hz/dBZ	One-third octave $L_{Zeq,15-min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dBZ	92	89	86	77	69	61	54	50	50	48	48	46	44

Notes:

dBZ = decibel (Z frequency weighted).

For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to five metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler, 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.

Low-frequency noise corrections only apply under the standard and/or noise-enhancing meteorological conditions.

Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.

Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or environment protection licence, and at locations nominated in the development consent or licence.

Intermittent noise: noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dBA; for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.

Correction for duration: this is applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aeq,15min}$ equivalent noise criterion is shown in Table C3 for the duration of the event. This adjustment is designed to account for unusual and one-off events and does not apply to regular and/or routine high-noise level events.

Table 5.15 Adjustment for duration

Allowable duration of noise (one event in any 24-hour period)	Allowable exceedance of $L_{Aeq,15min}$ equivalent project noise trigger level at receptor for the period of the noise event, dBA	
	Daytime and evening (7:00 am – 10:00 pm)	Night-time (10:00 pm – 7:00 am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

Note: Where the duration of the noise event is smaller than the duration of the project noise trigger level (that is, less than 15 minutes) the allowable adjusted project noise trigger level becomes:

$$10\log_{10}\left(10^{\frac{PNTL}{10}} \times \left(\frac{900 - \text{duration}}{900}\right)\right) + \left(10^{\frac{PNTL + \text{allowable exceedance (Table C3)}}{10}} \times \text{duration}\right)$$

Maximum correction: the maximum correction to be applied to the predicted or the measured level where two or more modifying factors are present. The maximum adjustment is 10 dBA where the noise contains two or more modifying factors (excluding the duration correction).

5.3.4.4 Sleep disturbance

5.3.4.4.1 NSW 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:

- $L_{Aeq,15min}$ 40 dBA or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater, a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- The distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development.
- Whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods).

- Current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

5.3.4.4.2 NSW Road Noise Policy

The RNP (DECCW 2011) provides additional information on sleep disturbance and concludes that:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep.
- One or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to significantly affect health and wellbeing.

It is generally accepted that internal noise levels in a dwelling, with the windows partially open, are 10 dB lower than external noise levels. Therefore, the RNP (DECCW 2011) is suggesting that short term external noise events of 60 dBA to 65 dBA are unlikely to cause sleep disturbance and that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to significantly affect health and wellbeing.

5.3.4.4.3 World Health Organisation Guidelines for Community Noise

The World Health Organisation (WHO) discusses the effects of environmental noise in non-industrial environments in its Guideline for Community Noise (WHO, 1999). This guideline examines aspects such as sleep disturbance, annoyance and speech intelligibility and provides guidance for protecting people from adverse effects induced by excessive noise.

For intermittent noise, it is necessary to take into account the maximum sound pressure level as well as the number of noise events. The WHO guideline recommends 45 dBA L_{max} internal guideline value for intermittent noise where this level is exceeded no more than 10-15 times per night.

5.3.5 Operational road traffic noise goals

The RNP provides traffic noise target levels for sensitive receptors in the vicinity of existing roads and traffic generating developments. Table 5.16 provides the relevant goals for residential land uses affected by a traffic generating developments to identify potential traffic noise impacts and the subsequent need for reasonable and feasible mitigation measures.

Table 5.16 Road traffic noise assessment goals for residential land uses

Road category	Type of development	Day 7.00 am to 10.00 pm	Night 10.00 pm to 7.00 am
Freeway/arterial/sub-arterial roads	Existing residence affected by additional traffic on arterial roads generated by land use developments	$L_{Aeq(15 \text{ hour})}$ 60 (external)	$L_{Aeq(9 \text{ hour})}$ 55 (external)
Local roads	Existing residence affected by additional traffic on local roads generated by land use developments	$L_{Aeq(1 \text{ hour})}$ 55 (external)	$L_{Aeq(1 \text{ hour})}$ 50 (external)

Note: 1: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2021) for sensitive developments near busy roads (see **Appendix C10** of the RNP for details).

Note 2: Sub-arterial roads previously designated as 'collector roads' in the Environmental goals for road traffic noise.

Section 2.4 of the RNP (DECCW 2011) states that in addition to the assessment goals presented in Table 5.16, any increase in the traffic noise level at a location due to a proposed development or traffic generating development must be considered. Residences experiencing increases in total traffic noise level above the relative increase goals should also be considered for mitigation. Table 5.17 shows relative increase goals for residential land uses. It is relevant to note for projects where the main subject road is a local road, the relative increase criterion does not apply.

Table 5.17 Relative Increase Goals for Residential Land Uses

Road category	Type of Project/development	Total traffic noise level increase – dBA	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq, (15 \text{ hour})} + 12 \text{ dB}$ (external)	Existing traffic $L_{Aeq, (9 \text{ hour})} + 12 \text{ dB}$ (external)

In Table 5.17 above, the ‘existing’ traffic noise level refers to the level from all road categories which would occur for the relevant ‘no build’ option. Where the existing $L_{Aeq(period)}$ road traffic noise level is found to be less than 30 dBA, it is deemed to be 30 dBA.

Section 3.4 of the RNP (DECCW 2011) also states:

- Where existing traffic noise levels are above the noise assessment goals, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment goals. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase goals.
- In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.
- 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’.

If road traffic noise from The Proposal 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 as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.

5.4 Construction noise and vibration

5.4.1 Airborne noise

Based on the noise monitoring results presented in Appendix D the construction noise management levels (CNMLs) that apply to nearby sensitive receptors are presented in Table 5.18.

Table 5.18 Project specific construction noise criteria, dBA

Receptor type	Construction noise management levels, $L_{Aeq} (15\text{min})$				
	Standard construction hours		Outside standard construction hours		
	Noise affected	Highly noise affected	Day	Evening	Night
All Residential	45	75	40	40 ²	40 ²
Commercial	70 (external)				
Industrial	75 (external)				
Educational Facility	55 (external) ¹ or 45 (internal)				
Place of worship	55 (external) ¹ or 45 (internal)				

Notes:

1. External noise management level is based on a 10 dB noise reduction through an open window.

2. In determining project-specific construction noise criteria from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific construction noise levels, the construction noise level for evening is set at no greater than the construction noise level criteria for daytime. The construction noise level criteria for night-time should be no greater than the construction noise level criteria for day or evening, as per NPI (Section 2.3).

5.4.2 Ground-borne noise

Groundborne noise is noise radiated into a room caused by structural vibration, due to, for example, underground works using road headers and tunnel boring machines. As no work of this nature is proposed, groundborne noise due to construction activities is not assessed further in this report.

5.4.3 Construction traffic noise

The following roads have been identified to be impacted during the construction phase of the Project:

- Gradwells Road

Airborne construction traffic noise will be assessed as per Section 5.1.2.3.

5.4.4 Airborne vibration

The CNVG (TfNSW 2023) does not provide limits for impacts associated with airborne vibration due to construction activities as they are typically rare. For this reason, airborne vibration due to construction activities is not assessed further in this report.

5.4.5 Ground-borne vibration

Ground-borne construction vibration impacts onto sensitive receptors will be assessed against the human comfort criteria presented in Table 5.5 and Table 5.6 and structural damage criteria presented in Table 5.7, Table 5.8 and Table 5.9.

Vibration onto underground assets will be assessed against a criterion of 25 mm/s for intermittent vibration and 15 mm/s for continuous vibration.

5.5 Operational – existing superseded Industrial Noise Policy (2000)

The existing operational noise management levels associated with CES are provided in Table 5.19, as detailed in Development Consent SSD-5145, EPL 365 and Northern Region Noise Management Plan.

Table 5.19 Project specific operational noise management levels

Receiver ²	Day L _{Aeq} (15 minute)	Evening L _{Aeq} (15 minute)	Night L _{Aeq} (15 minute)	Night L _{A1} (1 minute)
R1 (23)	37	37	37	45
R2 (26)	36	36	36	45
R3 (22)	35	35	35	45
R4 (28)	35	35	35	45
R5 (32)	35	35	35	45
R6 (31)	35	35	35	45
R7 (35)	35	35	35	45
R8 (30)	35	35	35	45
R9 (33)	35	35	35	45
R10	35	35	35	45

Receiver ²	Day L _{Aeq} (15 minute)	Evening L _{Aeq} (15 minute)	Night L _{Aeq} (15 minute)	Night L _{A1} (1 minute)
R11	35	35	35	45
All other residences on privately-owned land	35	35	35	45

Note 1: Day is defined as the period from 7:00 am to 6:00 pm. Evening is defined as the period from 6:00 pm to 10:00 pm. Night-time is defined as 10:00 pm to 7:00 am.

Note 2: The numbers in brackets are the corresponding receiver ID references from EPL 365, Development Consent SSD-5145 and Northern Region Noise Management Plan.

5.6 Operational – proposed NSW noise policy for industry (2017)

The proposed operational Project Specific Noise Goals (PSNG) for all residential receptors are based on the rating background noise levels determined from unattended noise monitoring at location M1 (see Appendix D).

With consideration to the NPI 'Noise amenity Area' Classification, the residential receptors identified in this assessment have been classified as urban residential (as previously defined in the SLR (2014) report).

The PSNG are outlined in Table 5.20 and reflect the most stringent noise level requirements derived from the intrusive and amenity noise goals.

Table 5.20 Operational noise goals, dBA – sensitive residential receptors

Sensitive receptors	Period ¹	Rating background noise level (RBL) – LA90	Adopted background level (ABL) – LA90	Intrusiveness noise level (INL) ² L _{Aeq} (15minute)	Amenity noise level (ANL) ³ L _{Aeq} (15minute)	Project specific noise goals L _{Aeq} (15minute)
All residential	Day	35	35	40	58	40
	Evening	40	35 ⁵	40 ⁴	48	40
	Night	39	35 ⁵	40 ⁴	43	40

Notes:

- Day is defined as 7:00 am to 6:00 pm, Evening is defined as 6:00 pm to 10:00 pm and Night is defined as 10:00 pm to 7:00 am.
- Intrusiveness noise level is $L_{Aeq,(15minute)} = RBL + 5$.
- Amenity noise level (ANL) is urban ANL (Table 2.2 NPI) minus 5 dBA plus 3 dBA to convert from a period level to a 15-minute level.
- In determining project-specific construction noise criteria from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific intrusive noise levels, the intrusive noise level for evening is set at no greater than the intrusive noise level criteria for daytime. The intrusive noise level criteria for night-time should be no greater than the intrusive noise level criteria for day or evening, as per NPI (Section 2.3).

5.6.1 Sleep disturbance

The noise goals for protecting the amenity of surrounding receptors in regard to sleep disturbance are presented in Table 5.21.

Table 5.21 Sleep disturbance goals

Sensitive receptors	Period ¹	Rating background noise level (RBL)	Sleep disturbance goals (dBA)	
			L _{Aeq} (15minute) ²	L _{AFmax} ³
All residential	Night	35 ⁴	40	52

Notes:

- Night is defined as 10:00 pm to 7:00 am.
- $L_{Aeq,(15minute)} = RBL + 5$ or 40 dBA whichever is greater as per NPI (Section 2.5).
- $L_{AFmax} = RBL + 15$ or 52 dBA whichever is greater as per NPI (Section 2.5).

4. In determining project-specific sleep disturbance noise criteria from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific sleep disturbance noise levels, the RBL's for the night-time should be no greater than the RBL's noise level for day or evening, as per NPI (Section 2.3).

Should the sleep disturbance noise levels from the Project exceed the external noise goals presented in Table 5.21 a detailed assessment will be undertaken and guidance taken from the RNP (DECCW 2011) and WHO recommendations to minimise sleep disturbance as presented in sections 5.3.4.4.2 and 5.3.4.4.3.

5.6.2 Operational traffic noise

Operational traffic noise target levels for sensitive receptors in the vicinity of the Project are presented in Table 5.22.

Table 5.22 Project specific road traffic noise assessment goals for residential land uses

Road Name	Road Category	Type of development	Day 7.00 am to 10.00 pm	Night 10.00 pm to 7.00 am
Gradwells Road	Local roads	Existing residence affected by additional traffic on local roads generated by land use developments	L _{Aeq} (1 hour) 55 (external)	L _{Aeq} (1 hour) 50 (external)

5.6.3 Airborne vibration

The CNVG (TfNSW 2023) does not provide limits for impacts associated with airborne vibration due to operational activities as they are typically rare. For this reason, airborne vibration due to operational activities is not assessed further in this report.

5.6.4 Ground-borne vibration

Ground-borne operational vibration impacts onto sensitive receptors will be assessed against the human comfort criteria presented in Table 5.5 and Table 5.6 and structural damage criteria presented in Table 5.7, Table 5.8 and Table 5.9. Vibration onto underground assets will be assessed against a criterion of 25 mm/s for intermittent vibration and 15 mm/s for continuous vibration.

6 Construction noise and vibration impact assessment

6.1 Methodology

The methodology for the construction noise and vibration assessment included:

- A list of likely construction activities and machinery was established for the Project. Representative sound power levels for the selected equipment were obtained from relevant standards, guidelines, and historical measurement data.
- Noise and vibration propagation calculations were carried out for the anticipated activities.
- Where predicted noise and vibration levels are predicted to exceed the construction objectives, reasonable and feasible mitigation measures are provided to minimise impacts.

6.2 Construction hours

Most construction would be undertaken within the recommended standard construction hours in accordance with the Interim Construction Noise Guideline (DECC, 2009) as follows:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 1:00 pm
- No work on Sundays or public holidays

Some construction activities may be undertaken from time to time outside the recommended standard construction hours, which may include:

- Work determined to comply with the relevant noise management level at the nearest sensitive receiver.
- The delivery of materials or plant and machinery outside approved hours as required by the NSW Police or other authorities for safety reasons.
- Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm.
- Situations where agreement is reached with affected receptors.
- Work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.

6.3 Construction stages

Key construction activities are provided in Table 6.1.

Table 6.1 Construction staging methodology

Stage	Stage
CS01	Civil works
CS02	Infrastructure development

6.4 Construction noise

6.4.1 Noise prediction method

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling (Version 9), to predict noise emissions from the construction of the Project.

The noise model inputs and assumptions for this assessment are provided in Table 6.2.

Table 6.2 Construction noise modelling parameters

Modelling component	Assumption
Noise model	SoundPLAN version 9
Prediction algorithm	CONCAWE
Terrain	Terrain contours: Centennial supplied 0.5 m Digital Elevation Model (data capture date: 2011).
Modelling period	Typical worst case 15 minute period of operation where each item of equipment is running at full power.
Meteorology	Refer to Table 6.3
Ground absorption coefficient	G=1 (soft) was applied across the model.
Receiver heights	1.5 m above building ground level (ground floor)

6.4.1.1 Construction atmospheric conditions

The noise levels have been predicted for atmospheric conditions presented in Table 7.10.

Table 6.3 Construction weather parameters used for the proposed noise modelling

Scenario	Period ¹	Air temperature (degrees C)	Relative humidity (%)	Wind velocity	Wind direction	Atmospheric stability class
All Scenarios	Day	20	65	0.5 m/s winds	Worst-case source to receiver	D

Note 1: Day is defined as the period Monday to Friday: 7:00 am to 6:00 pm, Saturday: 8:00 am to 1:00 pm and No work on Sundays or public holidays

6.4.2 Assumptions

Key construction scenarios have been considered in this assessment. Assumed equipment and noise levels are provided in Table 6.4. Relevant considerations for this assessment are summarised in the following sections.

The different construction scenarios represent different equipment noise levels and give an idea how noise levels may change with construction activities being carried out. The construction noise is assessed assuming that each piece of construction equipment is operating concurrently for each scenario. This is considered to represent the upper end of possible noise levels.

Construction equipment would likely move about the site altering noise impacts with respect to the identified receptors. During any given period, the construction plant and equipment is assumed to operate at maximum sound power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time and certain types of construction machinery would be present at the point nearest to the receiver for only brief periods during construction activities.

6.4.3 Activity sound power levels

Major noise generating plant and their corresponding sound power levels that have been assumed to be used during construction are presented in Table 6.4.

Although it is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time, the assessment of the proposed works assumes that all equipment associated to an activity/scenario is operating simultaneously. This approach has been adopted to identify worst case impacts and any associated mitigation measures.

Table 6.4 Construction equipment sound power levels

ID	Activity	Equipment	No of items in one 15 min period	Sound Power Level (dBA)	Equivalent Sound Power Level (dBA)
CS01	Initial site clearing	Tree mulcher	1	121	124
		Chain saw	1	119	
		Excavator	1	110	
		Bulldozer D9	1	116	
		Tracked loader	1	112	
CS02	Civil works	Bulldozer	1	116	128
		Scraper	1	110	
		Excavator (tracked) with hydraulic hammer	1	127	
		Grader	1	113	
		Road truck	1	108	
		Roller (large pad foot)	1	109	
		Water cart	1	107	
CS02	Infrastructure development	Excavator (tracked)	1	110	123
		Tracked loader	1	112	
		Elevated work platform	1	95	
		Road truck	1	108	
		Scissor Lift	1	98	
		Crane	1	108	
		Concrete pump	1	109	
		Concrete truck	1	109	
		Impact/Rattle gun	1	116	
		Compressor	1	109	
		Welding equipment	1	110	
		Diesel electric generators	1	103	
		Angle grinders	1	114	
		Hand tools (powered)	1	102	
		Hammer drill	1	116	

Notes:

1. Equipment sound power levels are sourced from BS5228-2009 and Transport for New South Wales construction and maintenance noise estimator (August 2022).

6.4.3.1 Modifying factor corrections

The ICNG (DEC 2009) recommends a 5 dBA penalty to be applied to the noise source sound power level (SWL) for plant items that have special audible characteristics. Plant items and activities that have proven to be particularly annoying to nearby residents include:

- Use of ‘beeper’ style reversing or movement alarms, particularly at night-time
- Use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work
- Grinding metal, concrete or masonry
- Rock drilling

- Line drilling
- Vibratory rolling
- Rail tamping and regulating
- Bitumen milling or profiling
- Jackhammering, rock hammering or rock breaking
- Impact piling

Since the proposed construction works do include some of the previously mentioned annoying activities, specific plant items have had penalties applied to the sound power levels presented in Table 6.4.

6.4.4 Construction noise impacts

Construction noise levels have been predicted at the sensitive receptors within the study area with consideration to the acoustic requirements of the ICNG. Table 6.5 provides the predicted noise levels at individual receptors.

The predicted L_{Aeq} construction noise contours level along with the noise management levels (NML) are provided in Appendix H. The noise modelling assumes that the items of equipment in the scenario are operating at maximum capacity simultaneously at the closest distance between the construction works and the receiver. As such, the predicted noise levels are often highly conservative and actual noise levels are likely to be lower than those the levels presented below for much of the time.

As shown in Table 6.5, all predicted construction noise impacts are below the highly noise affected management level during all construction scenarios at all assessment receptor locations. However, reasonable and feasible mitigation strategies will be implemented to minimise construction noise impacts, as presented in Section 8.

Table 6.5 Construction noise impact model results, dBA

Construction Scenario	Receptor ID	Prediction results $L_{Aeq(15minute)}$ dBA – Day (Calm) ¹	Noise Management Level $L_{Aeq(15minute)}$ dBA	
			Noise affected	Highly noise affected
CS01 – Initial site clearing	R1 (23) ²	30	45	75
	R2 (26) ²	33		
	R3 (22)	37		
	R4 (28)	43		
	R5 (32) ²	41		
	R6 (31)	39		
	R7 (35)	34		
	R8 (30)	38		
	R9 (33)	31		
	R10 ²	35		
	R11	36		
CS02 - Civil works	R1 (23) ²	37	45	75
	R2 (26) ²	40		
	R3 (22)	43		
	R4 (28)	49		
	R5 (32) ²	47		
	R6 (31)	46		
	R7 (35)	41		
	R8 (30)	44		
	R9 (33)	38		

Construction Scenario	Receptor ID	Prediction results $L_{Aeq(15minute)}$ dBA – Day (Calm) ¹	Noise Management Level $L_{Aeq(15minute)}$ dBA	
			Noise affected	Highly noise affected
CS03 - Infrastructure development	R10 ²	42	45	75
	R11	43		
	R1 (23) ²	31		
	R2 (26) ²	34		
	R3 (22)	37		
	R4 (28)	43		
	R5 (32) ²	41		
	R6 (31)	39		
	R7 (35)	35		
	R8 (30)	38		
	R9 (33)	31		
	R10 ²	35		
	R11	36		

- Note 1: Day is defined as the period Monday to Friday: 7:00 am to 6:00 pm, Saturday: 8:00 am to 1:00 pm and No work on Sundays or public holidays
- Note 2: Receptor location has negotiated noise agreement in place with Centennial.
- Note 3: Numbers in brackets correspond to sensitive receptor identifiers from Appendix 4, Figure 2 of SSD-5145
- Note 4: Numbers shown in bold are where noise levels are predicted to exceed the 'noise affected' construction noise management level.

6.4.5 Construction traffic noise

The following assumptions were made in relation to construction traffic:

- Peak construction hour traffic will coincide with peak hour general traffic.
- 16 light vehicles will arrive at construction site in the AM peak hour (typically around 6:00 am – 7:00 am).
- 16 light vehicles will depart construction site in the PM peak hour (typically around 5:00 pm – 6:00 pm).
- Up to 2 heavy vehicles will arrive and depart from the site during both the AM and PM peak hour.
- Resulting in 18 vehicle movements in both the AM and PM peak hour to or from the site.

6.4.5.1 Existing traffic

Existing traffic volumes were obtained from the Statement of Environmental Effects (SLR, 2017). The predicted peak hour 2027 volumes are summarised in Table 6.6.

Table 6.6 Gradwells Road Existing Traffic Volumes - 2027

Direction	Peak period	Light Vehicles	Heavy Vehicles	Total	Speed
Northbound	AM Peak (600 – 700)	54	0	54	80
	PM Peak (1700 – 1800)	54	0	54	
Southbound	AM Peak (600 – 700)	54	0	54	
	PM Peak (1700 – 1800)	54	0	54	

6.4.5.2 Construction traffic noise impacts

Change in road traffic noise levels due to construction of the Project are presented in Table 6.7.

Table 6.7 Change in road traffic noise levels due to construction traffic – Gradwells Road - 2027

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	54	0	54	0	80
	Southbound	54	0	54	0	
Additional traffic	Northbound	16	2	0	0	
	Southbound	0	0	16	2	
Change in noise levels		1.1		1.1		

The results indicate that the relative increases in road traffic noise levels associated with the construction of the Project are predicted to be less than 2 dBA. These changes are compliant with the guidance contained in the RNP (DECCW 2011).

6.5 Construction vibration

6.5.1 Ground-borne vibration

6.5.1.1 Vibration prediction

Energy from equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- The efficiency of the energy transfer mechanism of the equipment (i.e. impulsive, reciprocating, rolling or rotating equipment).
- The frequency content.
- The impact medium stiffness.
- The type of wave (surface or body).
- The ground type and topography.

The construction vibration assessment is based on methods and information presented in:

- Environmental Noise Management Manual (Roads and Traffic Authority 2001).
- British Standard BS 5228-2:2009 Code of practice for noise and vibration on construction and open sites – Part 2: Vibration.
- British Standard BS 6472:1992 Evaluation of human exposure to vibration in buildings (1–80 Hz).
- Construction Noise and Vibration Strategy ST-157/4.1 (Transport for NSW, 2019).
- Assessing Vibration: A Technical Guideline (DEC 2006).

The assessment of vibration levels from intermittent construction sources is described in *Assessing Vibration: A Technical Guideline* (DEC 2006), which is based on BS 6472:1992. The assessment evaluates vibration dose value, which incorporates the magnitude of vibration and the length of time the source of the vibration operates. For construction, the vibration impact on a receiver can be predicted and compared to the *Assessing Vibration: A Technical Guideline* vibration dose value criteria at various receiver types for day and night periods.

BS 6472:1992 provides a method to calculate the estimated vibration dose value using root-mean-square (r.m.s.) vibration velocity. The estimated vibration dose value (eVDV) is calculated as:

$$\text{eVDV} = 0.07 \times V_{\text{rms}} \times t^{0.25} \text{ (m/s}^{1.75}\text{)}$$

Where t= duration of the event.

The eVDV from construction equipment has been estimated, with assumptions discussed in this section.

With regards to frequency the *Assessing Vibration: A Technical Guideline* states the following:

‘Over the frequency range of 8 to 80 Hz, z-axis velocity requires no frequency weighting in order to determine annoyance or disturbance response (no weighting over frequency range 2–80 Hz for x- and y-axis vibration). At frequencies below 8 Hz, the use of unweighted velocity is more strict than the requirements of BS 6472.’

Furthermore, to estimate r.m.s. vibration velocity from available PPV values for given plant items, a sinusoidal waveform has been assumed. This PPV is also based on the conservative maximum propagation between the typical ranges of $d^{-0.8}$ and $d^{-1.6}$. Considering these assumptions, the assessment of human comfort vibration impacts using eVDV calculated from velocity is conservative in nature.

An additional assumption of operating time of vibration generating equipment is required to calculate the eVDV. The construction methodology is not known to this level of detail at this stage. The nature of the works would typically result in intermittent vibration levels at any given location as equipment moves within the site (e.g. an excavator passing up and down the work area). Therefore, a cumulative duration of one hour for a given plant item during the 15-hour day period has been assumed. The 15-hour day period is as per that provided in the *Assessing Vibration: A Technical Guideline*, where daytime is defined as 7:00 am to 10:00 pm and night time is defined as 10:00 pm to 7:00 am. No significant vibration generating activities are proposed for the night time period.

Although the anticipated general construction methodology is known (refer to Table 6.4), there are some specific details of the construction methodology for the proposal is yet to be defined. Details such as the operating duration of vibration generating equipment in certain areas, are not yet known. This information would be determined during construction planning. As a result, estimating the vibration dose values from construction sources requires a broad range of assumptions described above. *Assessing Vibration: A Technical Guideline* notes that velocity values can be used as a screening method. In addition, velocity values are widely available for typical construction equipment, and are more likely to be routinely measured in relation to potential building damage. Therefore, PPV is presented alongside VDV as a screening method to assess human comfort impacts from construction vibration, with consideration given to the guidance in BS 5228-2:2009, which provides level categories that relate to human perception of vibration.

6.5.1.2 Potential impacts of individual equipment

Table 6.8 outlines typical vibration levels for different plant activities sourced from the *Environmental Noise Management Manual* (RTA 2001), *British Standard BS 5228-2: 2009 Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration* and the *Construction Noise and Vibration Strategy ST-157/4.1* (Transport for NSW, 2019).

As stated in the *Environmental Noise Management Manual* (RTA 2001), it can be assumed that the vibration level of a source is inversely proportional to the distance source-receiver. Field variations show that the distance relationship generally varies between $d^{-0.8}$ and $d^{-1.6}$, rather than d^{-1} . The figures below are based on the conservative assumption of a maximum propagation between the typical ranges of $d^{-0.8}$ and $d^{-1.6}$ unless otherwise stated.

The potential vibration levels due to the construction works at various distances are shown in Table 6.8.

Table 6.8 Predicted construction vibration levels

Vibration source	Distance to Source/Peak Particle Velocity (mm/s)			
	10 m	20 m	50 m	100 m
Vibratory Roller > 300 kN (> 18 tonnes)	15.6	9.0	4.3	2.5
Large Hydraulic Hammer (1600 kg – 18 to 34t excavator)	14.1	8.1	3.9	2.2
Dozer	4.0	2.3	1.1	0.6
Backhoe	1.0	0.6	0.3	0.2

6.5.1.3 Potential for structural damage

Predicted safe working buffer distances to comply with the cosmetic damage, standard dwelling and heritage building structural damage criteria were calculated for typical vibration values and listed in Table 6.9. This table is based on advice given in *BS 7385-2:1993 Evaluation and measurement for vibration in buildings*.

While vibration may be amplified in multi-level buildings through the structure to the upper floors, the buffer distances provided in Table 6.9 are based on *German Standard DIN 4150 (2016) Part 3: Structural Vibration in Buildings: Effects on Structures* and are applicable at a building's foundation where "if these values are complied with, damage that reduces the serviceability of the building will not occur". DIN 4150-3 (2016) specifies higher acceptable values for upper floors by a multiple of three to four compared to the base value for standard dwellings used in this assessment, therefore these buffers are considered appropriate for multi-level buildings of typical construction.

Table 6.9 Vibration buffer distances – structural damage

Activity	Structural damage			
	Heritage building/structure DIN 4150-3 criteria (2.5 mm/s) – long term vibration	Heritage building/structure DIN 4150-3 criteria (3.0 mm/s) – short term vibration	Standard dwellings DIN 4150-3 criteria (5.0 mm/s)	Buildings used for commercial purposes, industrial buildings, and buildings of similar design DIN 4150-3 criteria (10 mm/s) – long term vibration
Vibratory Roller > 300 kN (> 18 tonnes)	99.0	79.0	42.0	21.0
Large Hydraulic Hammer (1600 kg – 18 to 34t excavator)	87.0	70.0	37.0	19.0
Dozer	18.0	15.0	9.0	6.0
Backhoe	6.0	6.0	4.0	3.0

Using the *DIN 4150-3:1999-02 Structural Vibration – Part 3: Effects of vibration on structures* criteria, structural vibration impacts are summarised as follows:

The following was found with consideration to structural damage vibration buffers:

- The nearest structure is an electrical tower which is 30 metres away from the area of disturbance, which is outside of the structural safe working distance for an industrial type 'building'.
- No other sensitive receptors were identified within the structural damage safe working distances for any criteria or activity.

6.5.1.4 Potential for human comfort and perception

Predicted safe working buffer distances to comply with the human comfort, and human perception were calculated for typical vibration values and listed in Table 6.10 and Table 6.11 for residential receptors and non-residential receptors respectively. These are based on advice given in *BS 5228-2:2009 Code of practice for noise and vibration on construction and open sites – Part 2: Vibration* and the *Assessing Vibration: A Technical Guideline* (DEC 2006). The various criteria buffers are interpreted as follows:

- The BS 5228-2.2009 criteria represents a level at which "It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents".
- The 'preferred' *Assessing Vibration: A Technical Guideline* vibration dose values represent a goal at which there is low probability of adverse comment or disturbance to building occupants.

- For ‘maximum values’ the Assessing Vibration: A Technical Guideline states: “Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community.”

As a guide for multi-level receptors, adoption of the preferred value buffers in Table 6.10 and Table 6.11 is anticipated to typically protect against exceedances of the acceptable maximum human comfort values.

Table 6.10 Vibration buffer distances – human comfort and perception, residential receptors

Equipment	Human comfort criteria based on BS 5228-2.2009 (1.0 mm/s)	Human comfort based on AVTG vibration dose value ($\text{m/s}^{1.75}$)			
		Day preferred value $0.2 \text{ m/s}^{1.75}$	Day maximum value $0.4 \text{ m/s}^{1.75}$	Night preferred value $0.13 \text{ m/s}^{1.75}$	Night maximum value $0.26 \text{ m/s}^{1.75}$
Vibratory Roller > 300 kN (> 18 tonnes)	311	700	295	515	217
Large Hydraulic Hammer (1600 kg – 18 to 34t excavator)	274	616	259	453	191
Dozer	57	128	54	94	40
Backhoe	10	23	10	17	9

Table 6.11 Vibration buffer distances – human comfort and perception, non-residential receptors

Equipment	Human comfort criteria based on BS 5228-2.2009 (1.0 mm/s)	Human comfort based on AVTG vibration dose value ($\text{m/s}^{1.75}$)			
		Day preferred value $0.4 \text{ m/s}^{1.75}$	Day maximum value $0.8 \text{ m/s}^{1.75}$	Night preferred value $0.4 \text{ m/s}^{1.75}$	Night maximum value $0.8 \text{ m/s}^{1.75}$
Vibratory Roller > 300 kN (> 18 tonnes)	311	295	124	127	54
Large Hydraulic Hammer (1600 kg – 18 to 34t excavator)	274	259	109	112	47
Dozer	57	54	23	24	10
Backhoe	10	10	7	7	5

Using both the BS 5228-2.2009 and AVTG criteria, no sensitive receptors were identified within the structural damage safe working distances for any criteria or activity.

6.5.1.5 Vibration damage to utilities

Safe working buffer distances to comply with vibration criteria for underground assets are presented Table 6.12. Buffers are based on the identified vibration intensive construction equipment.

Table 6.12 *Vibration buffer distances (m) – underground assets*

Equipment	Peak particle velocity, mm/s			
Vibration limit	15 ¹	20 ²	25 ³	50 ⁴
Vibratory Roller > 300 kN (> 18 tonnes)	17.0	14.0	12.0	8.0
Large Hydraulic Hammer (1600 kg – 18 to 34t excavator) ⁵	-	12.0	11.0	7.0
Dozer	5	4	4	3
Backhoe ⁵	-	2	2	1
Notes: 1. British Standard BS 5228 continuous vibration criterion for underground services. 2. APA criterion for underground gas pipelines. 3. Energex criterion for underground assets. British Standard BS 5228 intermittent vibration criterion for underground services. 4. Telstra criterion for underground assets. 5. Plant items are intermittent vibration sources. Buffers have not been calculated for continuous vibration criteria.				

The location of underground utilities will be identified during detail design and construction phase. A Before You Dig (BYD) survey should be done prior to construction work commencing on site to locate all utilities. Once the location of utilities is known, due care should be taken to avoid the use of vibration intensive equipment within the buffer areas. Less vibration intensive equipment should also be sourced prior to commencing work, if required.

7 Operational noise impact assessment

7.1 Operational noise modelling

7.1.1 Modelling methodology

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling software (Version 9) to predict noise levels from the Project.

The CONCAWE prediction method is specially designed to incorporate the influence on noise propagation of distance, topography, ground and air absorption, and atmospheric conditions.

7.1.2 Acoustically significant noise sources

Sound power levels (SWL) for acoustically significant items of plant and equipment operating at the CES have been obtained from onsite GHD measurements. Where this was not possible data were obtained from manufacture data where possible. The L_{Aeq} and L_{Amax} sound power levels of relevant plant and equipment utilised for the purpose of predicting noise emission levels are provided in Table 7.1 and shown in Figure 7.1.

Table 7.1 Cooranbong Entry Site sound power levels

Plan/Equipment	Sound power level L_{Aeq} dBA	Sound power level L_{Amax} dBA	Source
Cooranbong Entry Site			
Coal Handling Plant (CHP)	103	106	GHD Measurements
Rotary Breaker	102	109	GHD Measurements
Rotary Breaker Drivehead House	103	108	GHD Measurements
Site conveyors enclosed (per 1 m)	77	81	GHD Measurements
Vent Fan	100	103	GHD Measurements
100,000t ROM Stockpile			
Front End Loader 1 loading coal into haul truck in a 15 minute period.	99	124	GHD Measurements
Front End Loader 2 loading coal into haul truck in a 15 minute period.	99	124	GHD Measurements
Dozer - PR766 or CAT D09 equivalent	113	124	GHD Measurements
Dozer - PR776 or CAT D10 equivalent with sound suppression kit	114	125	Manufacturer Data
1200t Truck Loading Bin			
Haul truck loaded with coal via the automatic loader	99	123	GHD Measurements
Haul Road			
Coal Haul Truck	100	108	GHD Measurements
South Drift			
South drift drivehead house	97	101	GHD Measurements
South drift Conveyor	82	95	GHD Measurements

Plan/Equipment	Sound power level L _{Aeq} dBA	Sound power level L _{Amax} dBA	Source
Servicing Shed			
Compressors	98	99	GHD Measurements
Eraring Energy Operations			
Final Product Bin Drivehead house	104	108	GHD Measurements
Final Product Bin	101	102	GHD Measurements
Eraring Conveyor – semi enclosed (per 1 m)	84	94	GHD Measurements

7.1.3 Haul road traffic generation

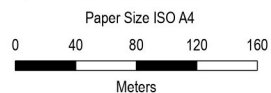
The existing hourly haul road traffic generation associated with coal haulage from the CES is summarised in Table 7.2.

Table 7.2 Hourly haul road traffic generation – existing operation

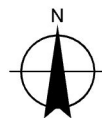
Vehicle Type	Location	Vehicles Per hour (one-way movements)
Volvo FH16 or equivalent truck with Side Tipper Trailer	Transport coal from bin	11 Trucks to be loaded per hour, including driving in and off site.
	Transport coal from Stockpile	5 Trucks to be loaded per hour, including driving in and off site.



DRAFT



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

Project No. 12600696
Revision No. B
Date 18/10/2024

Acoustically significant noise sources

FIGURE 8.1

7.2.1 Existing noise mitigation measures

Table 7.3 provides the existing noise mitigation currently implemented onsite.

Table 7.3 Acoustic mitigation

Mitigation Measure	Implemented
Negotiated noise agreements with receptors R1(23), R2(26), R5(32) and R10	Yes
Acoustic cladding on the Rotary Breaker and Coal Handling Plant buildings	Yes
Acoustic barrier installed on eastern side (side of sensitive receivers) of CES truck loading bin	Yes
Maximising the use of truck loading bin, where possible	Yes
The use of an onsite real-time noise monitor and Centennial Northern Regional Noise Trigger Action Response Plan	Yes
Ongoing quarterly attended compliance noise monitoring	Yes
Onsite AWS weather station	Yes
Site inspections and observation of unusually noisy equipment	Yes
Noise Management Plan	Yes

7.2.1.1 Proposed Noise Mitigation Measures

A number of noise mitigation measures are proposed for the Project. These include:

- Lining of haul road truck trays with sound dampening material.
- Application of sound attenuation kit on PR776 (or equivalent) dozer.

The above proposed noise mitigation measures are included into the operational noise modelling (refer to Section 7.4).

7.3 Calibrated noise model

7.3.1 Modelling inputs and assumptions

The noise modelling inputs and assumptions used for the calibrated model predictions are summarised in Table 7.4.

Table 7.4 Noise model inputs and assumptions

Inputs and assumptions	Data incorporated into noise model
Noise model software	SoundPlan version 9
Prediction algorithm	Conservation of Clean Air and Water Europe (CONCAWE).
Operational scenario	Refer to Table 7.5
Sound power levels	Refer to Table 7.1
Terrain resolution	Terrain contours: Centennial supplied 0.5 m Digital Elevation Model (data capture date: 2011)
Calibration point	Carpark - real-time noise monitor location
Noise sensitive receptor height (above ground level)	Ground floor: 1.5 m receiver height
Façade correction	Free field conditions
Ground absorption	G=1 (soft) was applied across the model
Atmospheric conditions	Refer to Table 7.6

7.3.2 Existing operational scenario

The existing CES operational scenario modelled during each period are summarised Table 7.5. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (x) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period. It should be noted that the operational scenarios modelled are likely to represent acoustically worst-case scenarios.

Table 7.5 Existing typical operational scenario (

Plan/Equipment	Day
Cooranbong Entry Site	
Coal Handling Plant (CHP)	✓
Rotary Breaker	✓
Rotary Breaker Drivehead House	✓
Site Conveyors	✓
Vent Fan	✓
100,000t ROM Stockpile	
Front End Loader loading coal into haul truck	✓
1200t Truck Loading Bin	
Haul truck loaded with coal via the automatic loader	✓
Haul Road	
Coal Haul Truck	✓
South Drift	
South drift drivehead house	✓
South drift Conveyor	✓
Servicing Shed	
Compressors	✓
Eraring Energy Operations	
Final Product Bin Drivehead house	✓
Final Product Bin	✓
Eraring Conveyor	✓

7.3.3 Existing atmospheric conditions

The CES noise levels have been predicted for atmospheric conditions presented in Table 7.6.

Table 7.6 Weather parameters used for calibrated noise modelling

Scenario	Period ¹	Air temperature	Relative humidity	Wind velocity	Wind direction	Atmospheric stability class
Baseline calibration model existing operations	Daytime	20°C	65%	Calm	Calm	D

Note 1: Day is defined as the period from 7:00 am to 6:00 pm.

7.3.4 Noise model validation

The model validation process compares the modelled CES noise levels with measured CES noise levels to determine any variation between the measured and modelled values at each monitoring location.

The purpose of model validation is to demonstrate that the noise model produced for the existing situation, using the CONCAWE algorithm, is an accurate representation of the real world within the limitations of the prediction algorithm and to identify potential errors associated with the geospatial data and modelling approach.

A comparison of the modelled and monitored results at the onsite real-time noise monitor location within the carpark are shown in Table 7.7.

Table 7.7 Noise model calibration results, dBA

Scenario	Calibration point	Measured - GHD (07/09/2022)	SoundPlan Predictions	Difference (dB)
		L _{Aeq}	L _{Aeq}	L _{Aeq}
Baseline calibration model existing operations	Carpark - real-time noise monitor	52	52.4	0.4

7.3.5 Validation discussion

The difference between the measured and predicted noise levels for the noise model presented in Table 7.7 are within 0.4 dBA. The validation results indicate that the modelled predictions correlate very well with the measured results and the model is validated for future assessment purposes.

7.4 Proposed stockpile operation noise model

7.4.1 Modelling inputs and assumptions

The noise modelling inputs and assumptions used for the model predictions are summarised in Table 7.8.

Table 7.8 Noise model inputs and assumptions

Inputs and assumptions	Data incorporated into noise model
Noise model software	SoundPLAN Version 9.
Prediction algorithm	Conservation of Clean Air and Water Europe (CONCAWE).
Operational scenarios	Model 1: Dozer (PR776) with sound kit (top of stockpile) day, Dozer (PR766) (bottom of stockpile) Day/Evening/Night, 2 x FEL during the day, 1 x FEL at evening/night and Truck sound dampening lining in trays.
Sound power levels	Refer to Table 7.1
Terrain resolution	Terrain contours stockpile options: Centennial supplied Terrain contours outside of CES area: Centennial supplied 0.5 m Digital Elevation Model (data capture date: 2011).
Noise sensitive receptor ID	Refer to Table 3.1
Noise sensitive receptor height (above ground level)	Ground floor: 1.5 m receiver height
Façade correction	Free field conditions
Ground absorption	G=1 (soft) was applied across the model.
Atmospheric conditions	Refer to Table 7.10

7.4.2 Proposed operational scenarios

The proposed CES operational scenarios modelled during each period are summarised in Table 7.9. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (x) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period. It should be noted that the operational scenarios modelled are likely to represent acoustically worst-case scenarios.

Table 7.9 Proposed typical operational scenario

Plan/Equipment	Day	Evening	Night
Cooranbong Entry Site			
Coal Handling Plant (CHP)	✓	✓	✓
Rotary Breaker	✓	✓	✓
Rotary Breaker Drivehead House	✓	✓	✓
Site Conveyors (per 1m)	✓	✓	✓
Vent Fan	✓	✓	✓
100,000t ROM Stockpile			
Front End Loader 1 loading coal into lined haul truck	✓	✓	✓
Front End Loader 2 loading coal into lined haul truck	✓	x	x
Dozer 1 PR766 (proposed operation) – bottom of stockpile	✓	✓	✓
Dozer 2 PR776 (proposed operation) with sound suppression kit – top of stockpile (stockpile height 42m)	✓	x	x
1200t Truck Loading Bin			
Line haul truck loaded with coal via the automatic loader	✓	✓	✓
Haul Road			
Coal Haul Truck	✓	✓	✓
South Drift			
South drift drivehead house	✓	✓	✓
South drift Conveyor	✓	✓	✓
Servicing Shed			
Compressors	✓	✓	✓
Eraring Energy Operations			
Final Product Bin Drivehead house	✓	✓	✓
Final Product Bin	✓	✓	✓
Eraring Conveyor (per1m)	✓	✓	✓

7.4.3 Atmospheric conditions

The noise levels have been predicted for atmospheric conditions presented in Table 7.10.

Table 7.10 Weather parameters used for the proposed noise modelling

Scenario	Period ¹	Air temperature (degrees C)	Relative humidity (%)	Wind velocity	Wind direction	Atmospheric stability class
All Scenarios	Day	20	65	0.5 m/s winds	Worst-case source to receiver	D
				3 m/s winds	ESE	

Scenario	Period ¹	Air temperature (degrees C)	Relative humidity (%)	Wind velocity	Wind direction	Atmospheric stability class
				3 m/s winds	SE	
				3 m/s winds	SSE	
				3 m/s winds	S	
	Evening	16	85	0.5 m/s winds	Worst-case source to receiver	D
	Night	13	91	0.5 m/s winds	Worst-case source to receiver	D
	Night	13	91	2 m/s drainage winds	Worst-case source to receiver	F

Note 1: Day is defined as the period from 7:00 am to 6:00 pm. Evening is defined as the period from 6:00 pm to 10:00 pm. Night-time is defined as 10:00 pm to 7:00 am.

7.4.4 Predicted overall noise levels

Overall predicted $L_{Aeq(15\text{ min})}$ noise levels from operation of the Project are provided in Table 7.11.

Numbers in bold show where noise levels are predicted to exceed the Project Specific Noise Goals.

Table 7.11 Proposed stockpile operational noise model results, dBA

Scenario	Receptor ID	Prediction results L _{Aeq(15minute)} dBA								Criteria L _{Aeq(15minute)} dBA
		Day (Calm)	Evening (Calm)	Night (Calm)	Prevailing winds – Day				Night (temperature inversion)	
					ESE	SE	SSE	S		
Model 1: Option 1	R1 (23) ³	40	40	40	35	34	34	34	42	40
	R2 (26) ³	39	39	39	34	33	32	32	41	40
	R3 (22)	29	27	28	26	24	24	23	30	40
	R4 (28)	36	35	35	31	29	29	29	38	40
	R5 (32) ³	37	36	36	31	30	29	29	39	40
	R6 (31)	31	28	28	27	25	24	24	30	40
	R7 (35)	30	28	28	26	24	23	23	31	40
	R8 (30)	36	35	35	31	29	29	29	38	40
	R9 (33)	28	25	25	27	23	22	21	28	40
	R10 ³	38	37	37	32	31	30	30	40	40
	R11	31	31	31	28	25	24	24	34	40

Note 1: Day is defined as the period from 7:00 am to 6:00 pm. Evening is defined as the period from 6:00 pm to 10:00 pm. Night-time is defined as 10:00 pm to 7:00 am.

Note 2: Noise from all sources that contribute to the total noise from the Site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness, intermittent, low frequency etc).

Note 3: Receptor location has negotiated noise agreement in place with Centennial.

7.4.5 Sleep disturbance analysis

In assessing sleep disturbance, typical noise levels of acoustically significant plant and equipment used at the proposed plant were put into the noise model. L_{Aeq} and L_{Amax} noise level predictions presented in Table 7.12 were made at the nearest residential locations under worst-case weather conditions at night.

Numbers in bold show where noise levels are predicted to exceed the sleep disturbance criteria.

Table 7.12 Proposed stockpile Sleep disturbance noise model results, dBA

Scenario	Receptor ID	Night (temperature inversion) Prediction results		Criteria	
		L_{Aeq} dBA	L_{Amax} dBA	L_{Aeq} dBA	L_{Amax} dBA
Model 1: Option 1	R1 (23) ³	42	47	40	52
	R2 (26) ³	41	42		
	R3 (22)	30	33		
	R4 (28)	38	38		
	R5 (32) ³	39	40		
	R6 (31)	30	31		
	R7 (35)	31	33		
	R8 (30)	38	38		
	R9 (33)	28	32		
	R10 ³	40	41		
	R11	34	30		

Note 1: Night-time is defined as 10:00 pm to 7:00 am.

Note 2: Noise from all sources that contribute to the total noise from the Site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness, intermittent, low frequency etc).

Note 3: Receptor location has negotiated noise agreement in place with Centennial.

7.4.6 Prediction results discussion

7.4.6.1 Model 1 prediction results discussion

The following summary is provided for the prediction results presented in Table 7.11 and Table 7.12:

Operational noise

- During calm conditions predicted noise levels are compliant with project noise trigger levels at all sensitive receptors.
- During prevailing wind conditions predicted noise levels are compliant with project noise trigger levels at all sensitive receptors.
- Negligible 1 dB to 2 dB exceedance of the project noise trigger levels at location R1(23) and R2(26) during night time temperature inversions conditions.
- Receptor locations R1(23) and R2(26) has a negotiated noise agreement in place with Centennial.

Sleep disturbance

- Negligible 1 dB to 2 dB exceedance of the project noise trigger levels at location R1(23) and R2(26) during night time temperature inversions conditions.
- Receptor locations R1(23) and R2(26) has a negotiated noise agreement in place with Centennial.

7.5 Operational traffic noise impacts

There will be no change to the existing approved operational offsite traffic volumes as a result of the Project.

7.6 Operational vibration impacts

The main vibration generating equipment to be used at the site will include trucks, frontend loaders and dozers during operation of the Project.

The amplitude of vibrations from operational equipment diminishes with distance from the source. This attenuation of vibration is due to both geometrical spreading and dissipation of energy within the ground. *Construction Vibrations and Their Impact on Vibration-Sensitive Facilities* (Amick & Gendreau, ASCE, 2000) provides a common generic model of vibrations as a function of distance developed by Wiss (1981), as shown in Figure 7.2.

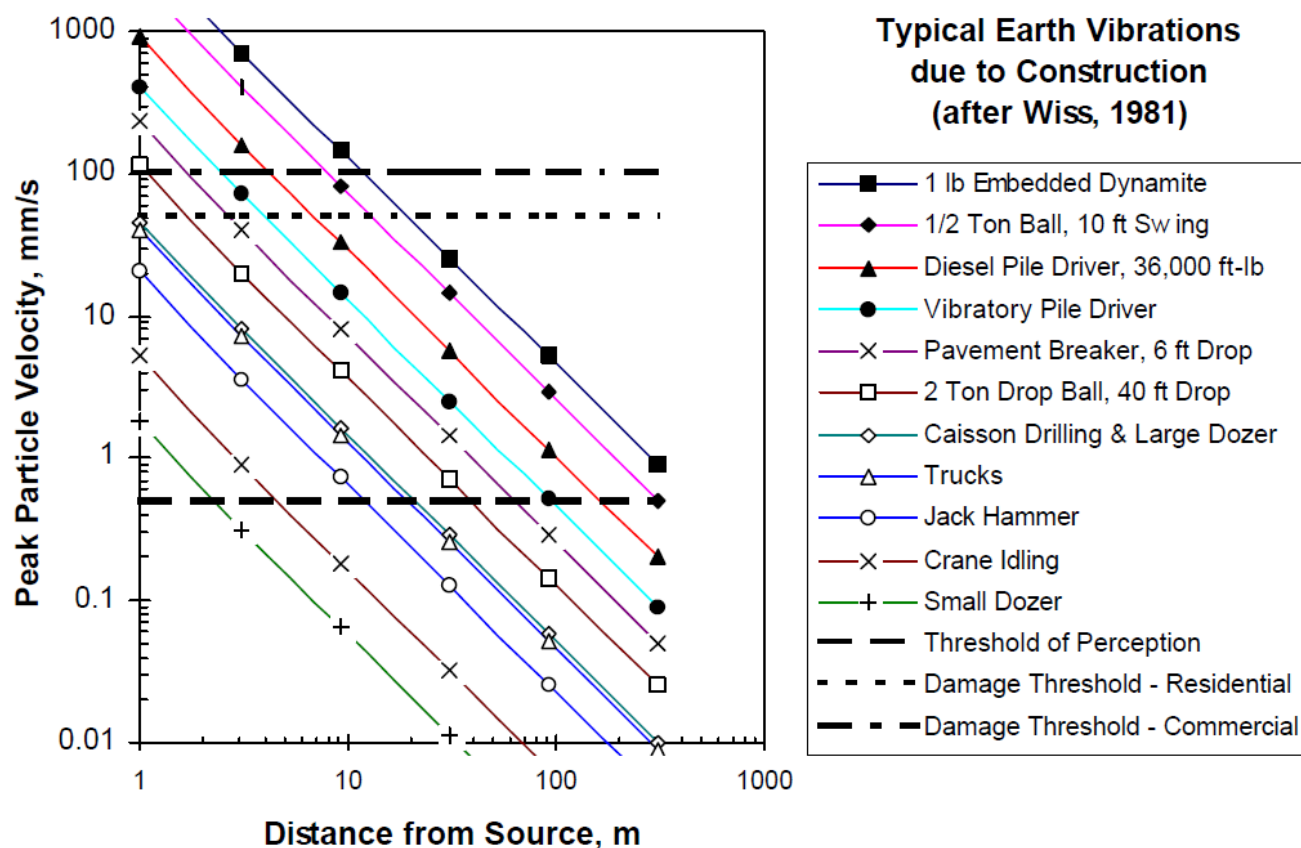


Figure 7.2 Construction Vibrations as a Function of Distance, after Wiss (1981)

Source: Construction Vibrations and Their Impact on Vibration-Sensitive Facilities (Amick & Gendreau, ASCE, 2000)

Given the separation distance between the Project and the nearest potentially affected residential locations (greater than 940 m between the proposed infrastructure and the nearest residence) vibration levels from activities at the Project are predicted to be negligible and below levels of human perception at the nearest residences. Consequently, vibration generated at the Project site will be significantly below the criteria for “minimal risk of cosmetic damage” at the nearest residences.

8 Noise mitigation and management recommendations

8.1 Construction

A suite of reasonable and feasible mitigation measures will be adopted to minimise Project construction noise, including community consultation, site inductions (with guidance on how to minimise noise and vibration), consideration of noise levels in sourcing construction equipment and the preparation of a Construction Environmental Management Plan (CEMP).

8.1.1 In-principal noise and vibration control

In principle, there are three approaches to controlling construction noise and vibration:

- Control at the source
- Control on the source-to-receptor pathway
- Control at the receptor

8.1.1.1 Control at the source

Control at the source is considered the most cost-effective in the reduction of noise and vibration levels and as such should be given highest priority when considering mitigation options. The solutions available include:

- Substitution of equipment:
 - Substitution involves where reasonably practicable the use of less noisy or vibration-generating equipment. This should be considered at the beginning of the construction phase, prior to any work being carried out. Equipment should be selected to meet the needs of the proposal or process it is required for and not be excessive.
- Modification of existing equipment:
 - Modification of equipment involves the addition of acoustic treatments to parts of the machinery. These include but are not limited to improved mufflers, stiffening of panels and surface coating of resonance dampening material. These options would often require discussion with the supplier and manufacturer of the equipment.
- Use and siting of equipment:
 - Plant should always be used in accordance with the manufacturer's instructions. Where possible the location of equipment should be away from noise-sensitive areas. This includes taking into consideration the emission direction of equipment and directing this away from noise sensitive receptors. Plant used intermittently should be shut down during the intervening periods or throttled down to a minimum. Dropping of material from height should be limited where possible, particularly the loading and unloading of scaffolding.
- Regular and effective maintenance.
 - Maintenance should be carried out to ensure equipment is running at optimal conditions.

8.1.1.2 Control along the path

There are two ways of mitigating noise along the transmission path:

- Increasing the distance between the source and receptor.
- Where distance is limited, screening of noise may be considered. In some circumstances it may also be possible to enclose the equipment during the operation.

Table 8.1 provides typical noise attenuation provided by noise control methods.

Table 8.1 Typical attenuations for source to receptor noise control methods

Control by	Nominal noise reduction possible, in total A-weighted sound pressure level LpA dB
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum of 15
Enclosure	Normally 15 to 25, maximum of 50

8.1.1.3 Control of noise at the receptor

Reasonable and feasible mitigation measures at the receptors for this proposal are limited to effective community consultation.

8.1.2 Standard mitigation and management measures

The ICNG provides the following (refer to Table 8.2) relevant standard actions and mitigation that should be reviews and implemented where feasible and reasonable to reduce the impacts of construction noise activities onsite. The mitigation and management measures in the following table are recommended for consideration by the construction contractor to reduce potential construction noise and vibration impacts.

Noise management and mitigation measures that are adopted for the Project will be documented in a CEMP. The CEMP will be completed prior to the commencement of construction.

Table 8.2 Noise mitigation measure

Noise mitigation measure	
Use quieter methods	Turn off plant that is not being used. Examine, and implement where feasible and reasonable, alternative work practices which generate less noise – for example electric equipment instead of diesel or petrol powered equipment.
Use quieter equipment	Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber wheeled tractors can be less noisy than steel tracked tractors.
Operate plant in a quiet and efficient manner	Reduce throttle setting and turn off equipment when not being used.
Maintain equipment	Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers. Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified. For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals.
Location of plant	Place as much distance as possible between the plant or equipment and residences and other sensitive land uses. Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times.
Alternatives to reversing alarms	Avoid use of reversing alarms by designing site layout to avoid reversing, such as by including drive through for parking and deliveries. Install where feasible and reasonable less annoying alternatives to the typical 'beeper' alarms taking into account the requirements of the Occupational Health and Safety legislation; examples are smart alarms that adjust their volume depending on the ambient level of noise and multifrequency alarms that emit noise over a wide range of frequencies.
Maximise shielding	Use temporary site buildings and materials stockpiles as noise barriers. Use natural landform as a noise barrier – place fixed equipment in cuttings, or behind earth berms. Note large reflecting surfaces on and off site that might increase noise levels, and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.

8.1.3

8.1.3 Vibration

No residential receptors are predicted to experience vibration levels above the British Standard and AVTG daytime maximum human comfort criteria during construction. As such, no additional mitigation measures for vibration are required.

8.2 Operational

Operational noise levels are not predicted to exceed the relevant guidelines at the closest residential receptors under calm and prevailing wind weather conditions.

A negligible exceedance of 1 dB to 2 dB is predicted for operational noise levels during night-time temperature inversion conditions. However, the affected residential receptor locations have negotiated noise agreements in place with Centennial. As such, additional operational noise mitigation or management measures are not required.

9 Conclusion

A noise and vibration impact assessment has been completed for the Project. This has been completed in accordance with the relevant legislation, policies and guidelines to predict the Project impacts on noise and vibration at the nearest sensitive receivers and assess compliance with the relevant criteria.

This assessment has led to the conclusions below, which are subject to the limitations outlined in Section 1.

9.1 Construction noise

- Noise from construction of the Project is predicted to exceed the noise affected NMLs during the civil works at a number of nearby sensitive receptors.
- All predicted construction noise impacts are below the highly noise affected management level during all construction scenarios at all assessment receptor locations.
- The construction noise modelling assumes that the items of equipment in the scenario are operating at maximum capacity simultaneously at the closest distance between the construction works and the receiver. As such, the predicted noise levels are often highly conservative and actual noise levels are likely to be lower than those the levels presented below for much of the time.
- Recommended measures to mitigate construction noise are presented in Section 8.
- The relative increases in road traffic noise levels due to construction of the Project are predicted to be less than 2 dB which is compliant with the guidance contained in the RNP (DECCW 2011).

9.2 Construction vibration

- No existing sensitive receivers were identified within the structural damage safe working distances for any criteria or activity.
- No sensitive receivers were identified to potentially experience vibration levels above the British Standard and AVTG daytime human comfort criteria during the access road construction activities.

9.3 Operation noise

- Noise modelling indicated that noise levels from operation of the Project would comply with project noise trigger levels at all nearby sensitive receivers under all modelled meteorological conditions. However, negligible exceedances during the night-time temperature inversion have been predicted.
- Noise modelling indicated that during sleep disturbance worst-case temperature inversion conditions negligible exceedances are predicted noise levels.
- Receptor locations with negligible exceedances have negotiated noise agreement in place with Centennial.
- There will be no change to the existing approved operational offsite traffic conditions as a result of the Project.
- Standard measures to mitigate noise are presented in Section 8.

9.4 Operational vibration

- No operational vibration impacts are anticipated given the distance between the nearest sensitive receivers to the Project.

10 References

- Amick & Gendreau, ASCE (2000), *Construction Vibrations and Their Impact on Vibration-Sensitive Facilities*.
- Centennial Coal Noise Management Plan – Northern Region July 2022.
- Development Consent SSD 5145.
- Environmental Protection License (EPL) 365.
- NSW Environmental Protection Authority, 2017. *New South Wales Noise policy for Industry*.
- Australian Standard AS 2436 (2010) *Guide to Noise Control on Construction, Maintenance and Demolition Site*.
- Australian Standard AS IEC 61672.1 (2019), *Electroacoustics - Sound level meters Specifications*.
- British Standard BS 5228-2 (2009) *Code of practice for noise and vibration control on construction and open sites*.
- British Standard BS 6472-1 (2008), *Guideline to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*.
- British Standard BS 7385-2 (1993) *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels*.
- Department of Environment and Conservation (2006), *Assessing Vibration: a technical guideline*.
- Department of Environment, Climate Change and Water (2011), *New South Wales Road Noise Policy*.
- Department of Transport Welsh Office (1988), *Calculation of Road Traffic Noise (CoRTN)*.
- Environmental Protection Agency (2009), *Interim Construction Noise Guideline*.
- Environmental Protection Agency (2017), *New South Wales Noise Policy for Industry*.
- German Standard DIN 4150-3 (2016), *Vibrations in buildings – Part 3: Effects on structures*.
- GHD (2024), *Noise and Vibration Assessment Cowarra Water Supply Scheme*.
- Roads and Traffic Authority (2001), *Environmental Noise Management Manual*.
- SLR (2017) *Northern Coal Logistics Project, Development Consent SSD-5145 - Section 96(1A) Modification - Statement of Environmental Effects*, dated 27 October 2017).
- SLR (2014) Northern Coal Services, Northern Coal Logistics Project, Noise and Vibration Impact Assessment.
- Transport for NSW (2023), *Construction Noise and Vibration Guideline*.
- Transport for NSW (2019), *Construction Noise and Vibration Strategy*.
- Wiss (1981), *Construction Vibrations: State-of-the-Art*.

Appendices

Appendix A

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE No: **SLM51124**

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2270

Serial No: 3030991

Mic. Type: B&K 4189

Serial No: 3334399

Pre-Amp. Type: B&K ZC0032

Serial No: 24448

Filter Type: 1/3 Octave

Test No: F051125

Owner: GHD Pty Ltd

Leve 3, 24 Honeysuckle Drive
Newcastle NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

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

CONDITIONS OF TEST:

Ambient Pressure 1005 hPa ± 1 hPa

Date of Receipt : 02/09/2024

Temperature 24 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$

Date of Calibration : 06/09/2024

Relative Humidity 38 % $\pm 5\%$

Date of Issue : 06/09/2024

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

CHECKED BY: *KAB*

AUTHORISED

SIGNATURE: *Hein Soc*

Accredited for compliance with ISO/IEC 17025 - Calibration

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

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

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


Acu-Vib Electronics
ACOUSTICS AND VIBRATIONS

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



WORLD RECOGNISED
ACCREDITATION
Accredited Laboratory
No. 9262
Acoustic and Vibration
Measurements

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	Clause	Result
<i>Absolute Calibration</i>	10	Pass
<i>Acoustical Frequency Weighting</i>	12	Pass
<i>Self-Generated Noise</i>	11.1	Observed
<i>Electrical Noise</i>	11.2	Observed
<i>Long Term Stability</i>	15	Pass
<i>Electrical Frequency Weightings</i>	13	Pass
<i>Frequency and Time Weightings</i>	14	Pass
<i>Reference Level Linearity</i>	16	Pass
<i>Range Level Linearity</i>	17	Not Applicable
<i>Toneburst</i>	18	Pass
<i>Peak C Sound Level</i>	19	Pass
<i>Overload Indicator</i>	20	Pass
<i>High Level Stability</i>	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:

Tests performed	Clause	Result
<i>Test of relative attenuation at filter midband frequency</i>	10	Pass
<i>Linear operating range including range control if fitted</i>	11	N/A
<i>Test of lower limit of linear operating range</i>	12	Pass
<i>Measurement of relative attenuation (filter shape)</i>	13	Pass

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

A full technical report is available on request.

CERTIFICATE OF CALIBRATION

CERTIFICATE No: **C38843**

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV 36 Serial No: 106878
Class: 1
Owner: GHD Pty Ltd

Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure 1000 hPa ± 1 hPa
Temperature 24 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$
Relative Humidity 53 % $\pm 5\%$

Date of Receipt : 20/02/2024
Date of Calibration : 22/02/2024
Date of Issue : 22/02/2024

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

CHECKED BY:

AUTHORISED
SIGNATURE:

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
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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%.

Acu-Vib Electronics
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Head Office & Calibration Laboratory
Unit 14, 22 Hudson Avenue, Castle Hill NSW 2154
(02) 9680 8133
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No. 9262
Acoustic and Vibration
Measurements

The Calibrator described in this report has been tested to the requirements of the standard IEC 60942-[Ed 4]:2017-11.

The tests described in Annex B of the standard (Periodic tests) were carried out under the environmental conditions listed above to the following clauses:

Clause	Test description
B4.6	Sound Pressure Level (By comparison with a reference calibrator).
B4.7	Frequency (By measurement with a calibrated frequency meter).
B4.8	Total distortion and noise. (By measurement with a calibrated Noise and Distortion meter).

Notes:

1. The calibrator was calibrated with the main axis vertical and facing down.
2. No corrections have been made for atmospheric pressure, temperature, or humidity.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 μ Pa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	94.03 dB	1000.00 Hz	0.79 %
Level2:	NA	N	113.99 dB	1000.00 Hz	0.20 %
Uncertainty			± 0.11 dB	$\pm 0.05\%$	$\pm 0.20\%$
Uncertainty (at 95% c.l.) k=2					

Parameter	Class 1		Class 2	
	250 Hz	1 kHz	250 Hz	1 kHz
Nominal Frequency	250 Hz	1 kHz	250 Hz	1 kHz
Output dB SPL	0.25 dB	0.25 dB	0.40 dB	0.40 dB
Frequency Hz	0.7 % (1.75 Hz)	0.7 % (7 Hz)	1.7 % (4.25 Hz)	1.7 % (17 Hz)
THD&N	2.5 %	2.5 %	3.0 %	3.0 %

Tolerance limits from AS/IEC60942 (edition 4)

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CERTIFICATE OF CALIBRATION

CERTIFICATE No: **SLM50422**

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: Svantek
Type No: SVAN 977B **Serial No:** 45748
Mic. Type: ACO 7052E **Serial No:** 52113
Pre-Amp. Type: SV 12L **Serial No:** 30275
Filter Type: 1/3 Octave **Test No:** F050423
Owner: GHD Pty Ltd
Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

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

CONDITIONS OF TEST:

Ambient Pressure	1023 hPa ± 1 hPa	Date of Receipt :	02/07/2024
Temperature	23 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$	Date of Calibration :	05/07/2024
Relative Humidity	48 % $\pm 5\%$	Date of Issue :	05/07/2024

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

CHECKED BY:

AUTHORISED

SIGNATURE:

Hein Soe

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The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	Clause	Result
<i>Absolute Calibration</i>	10	Pass
<i>Acoustical Frequency Weighting</i>	12	Pass
<i>Self-Generated Noise</i>	11.1	Observed
<i>Electrical Noise</i>	11.2	Observed
<i>Long Term Stability</i>	15	Pass
<i>Electrical Frequency Weightings</i>	13	Pass
<i>Frequency and Time Weightings</i>	14	Pass
<i>Reference Level Linearity</i>	16	Pass
<i>Range Level Linearity</i>	17	Pass
<i>Toneburst</i>	18	Pass
<i>Peak C Sound Level</i>	19	Pass
<i>Overload Indicator</i>	20	Pass
<i>High Level Stability</i>	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:

Tests performed	Clause	Result
<i>Test of relative attenuation at filter midband frequency</i>	10	Pass
<i>Linear operating range including range control if fitted</i>	11	Pass
<i>Test of lower limit of linear operating range</i>	12	Pass
<i>Measurement of relative attenuation (filter shape)</i>	13	Pass

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

A full technical report is available on request.

CERTIFICATE OF CALIBRATION

CERTIFICATE No: **SLM51113**

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: Svantek
Type No: SVAN 977A **Serial No:** 92124
Mic. Type: ACO 7052E **Serial No:** 59424
Pre-Amp. Type: SV 12L **Serial No:** 42564
Filter Type: 1/3 Octave **Test No:** F051116
Owner: GHD Pty Ltd
Leve 3, 24 Honeysuckle Drive
Newcastle NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

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

CONDITIONS OF TEST:

Ambient Pressure	1010 hPa ± 1 hPa	Date of Receipt :	18/06/2024
Temperature	22 °C $\pm 1^\circ$ C	Date of Calibration :	05/09/2024
Relative Humidity	35 % $\pm 5\%$	Date of Issue :	05/09/2024

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

CHECKED BY: *[Signature]*

**AUTHORISED
SIGNATURE:**

[Signature]
Hein Soe

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Measurements

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	Clause	Result
<i>Absolute Calibration</i>	10	Pass
<i>Acoustical Frequency Weighting</i>	12	Pass
<i>Self-Generated Noise</i>	11.1	Observed
<i>Electrical Noise</i>	11.2	Observed
<i>Long Term Stability</i>	15	Pass
<i>Electrical Frequency Weightings</i>	13	Pass
<i>Frequency and Time Weightings</i>	14	Pass
<i>Reference Level Linearity</i>	16	Pass
<i>Range Level Linearity</i>	17	Pass
<i>Toneburst</i>	18	Pass
<i>Peak C Sound Level</i>	19	Pass
<i>Overload Indicator</i>	20	Pass
<i>High Level Stability</i>	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:

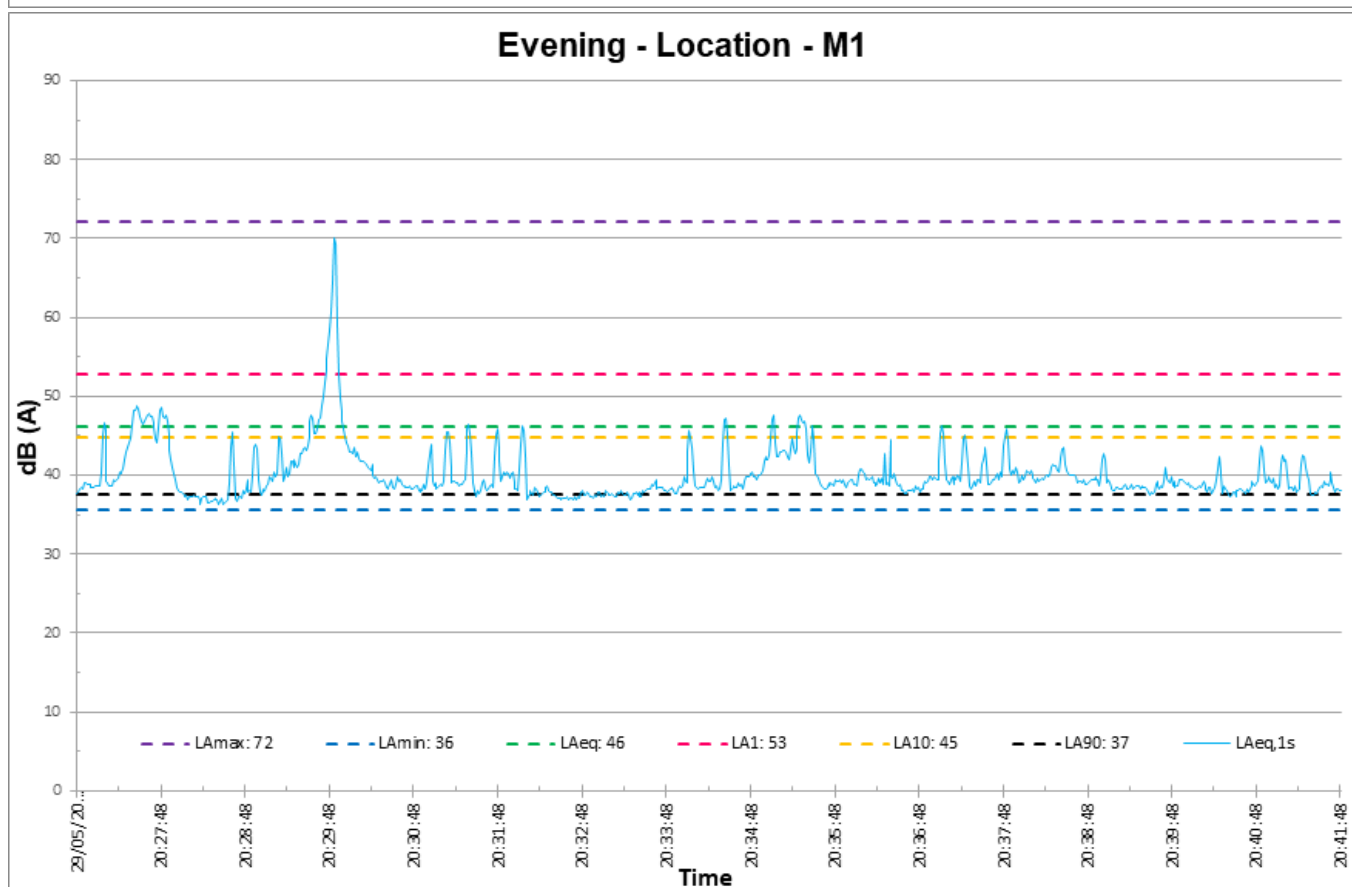
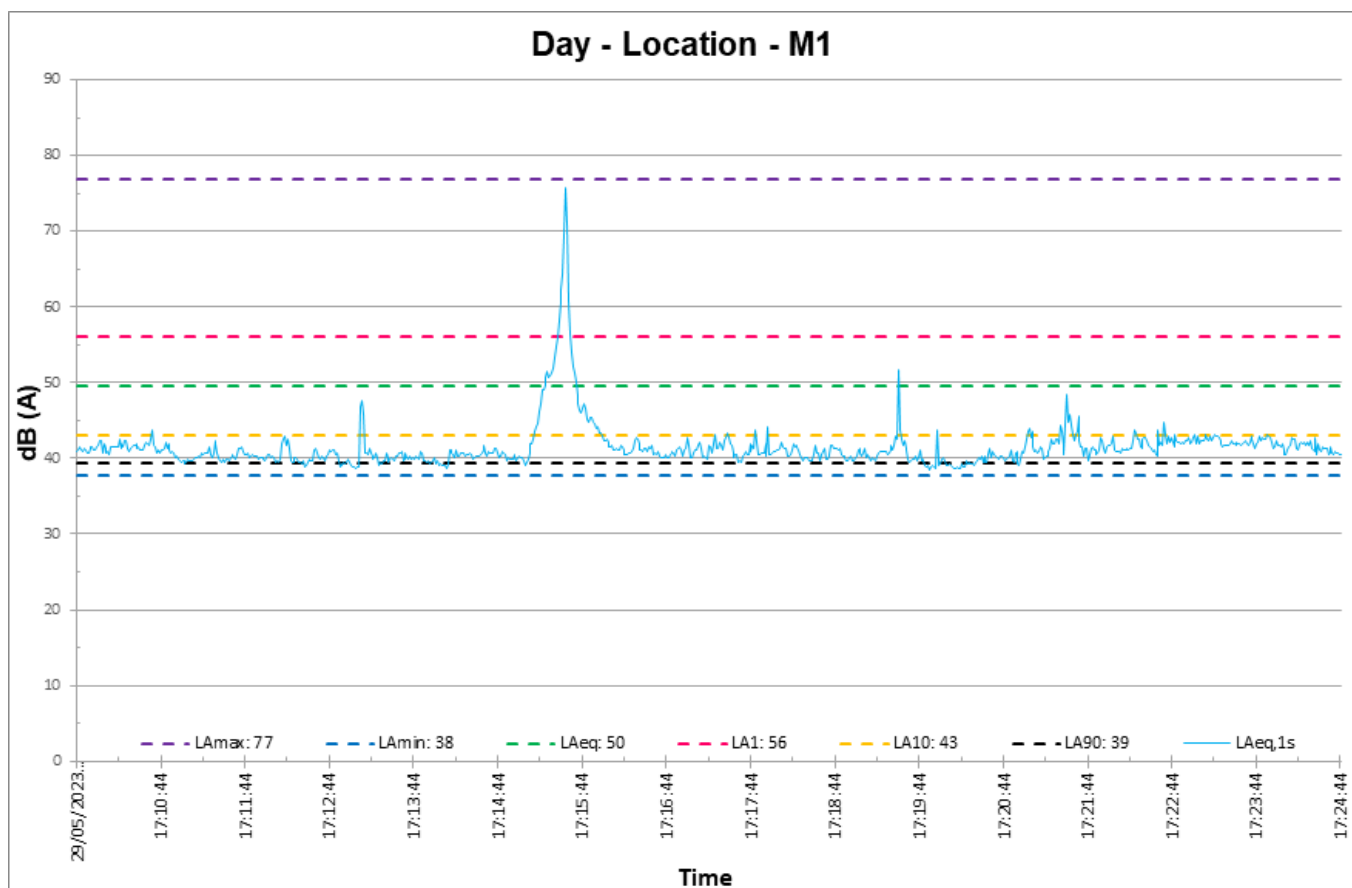
Tests performed	Clause	Result
<i>Test of relative attenuation at filter midband frequency</i>	10	Pass
<i>Linear operating range including range control if fitted</i>	11	Pass
<i>Test of lower limit of linear operating range</i>	12	Pass
<i>Measurement of relative attenuation (filter shape)</i>	13	Pass

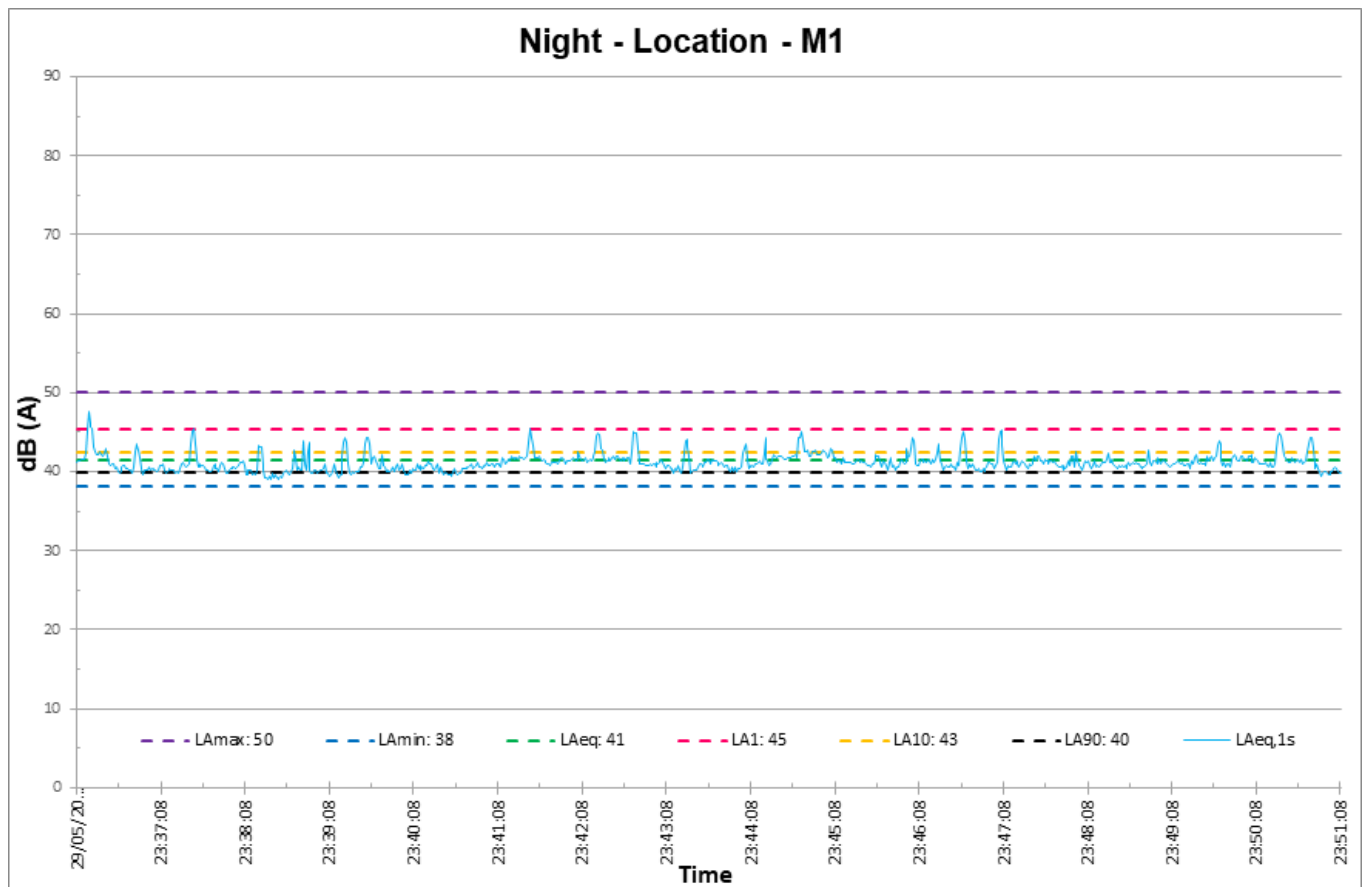
The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

A full technical report is available on request.

Appendix B

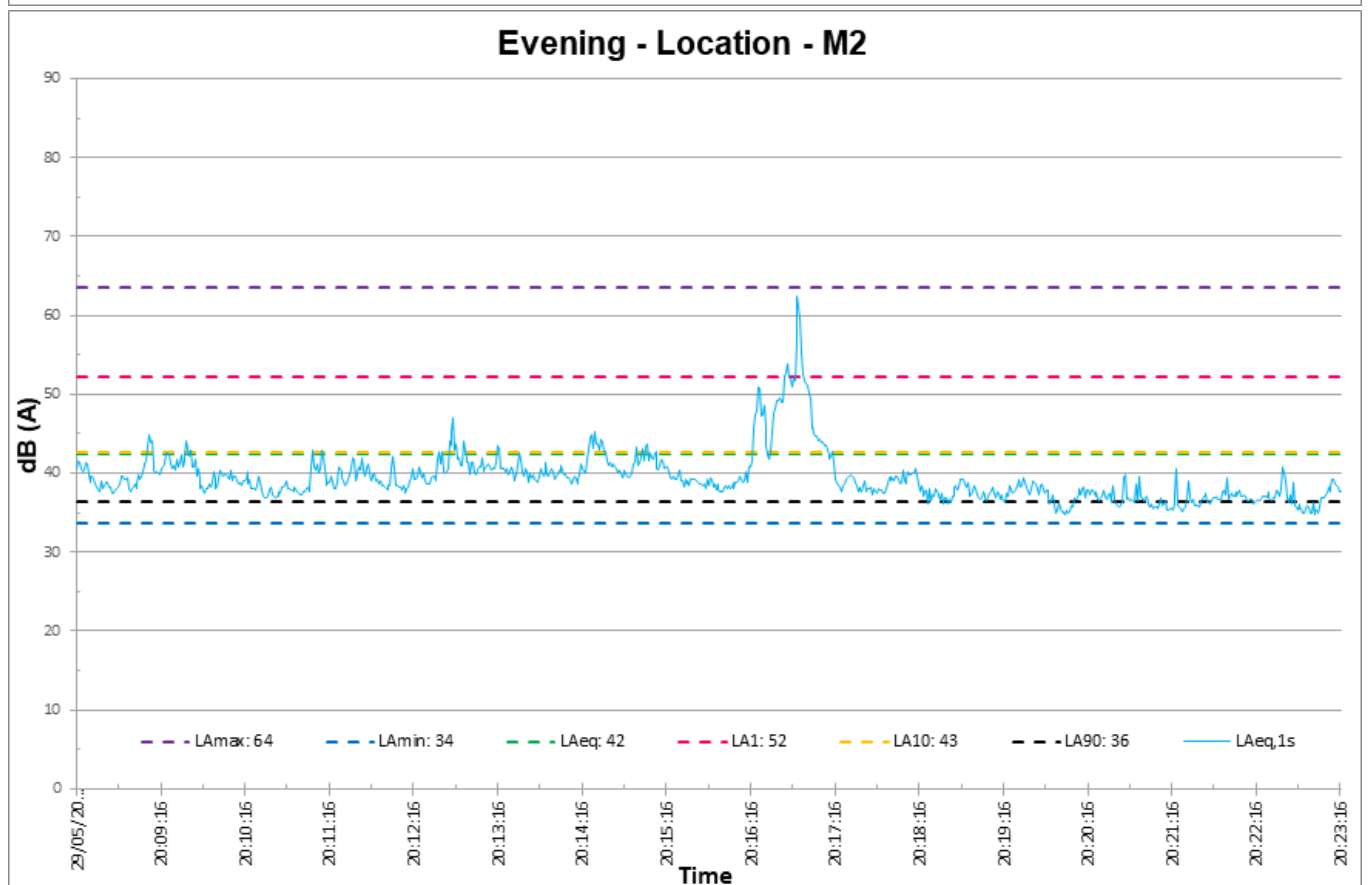
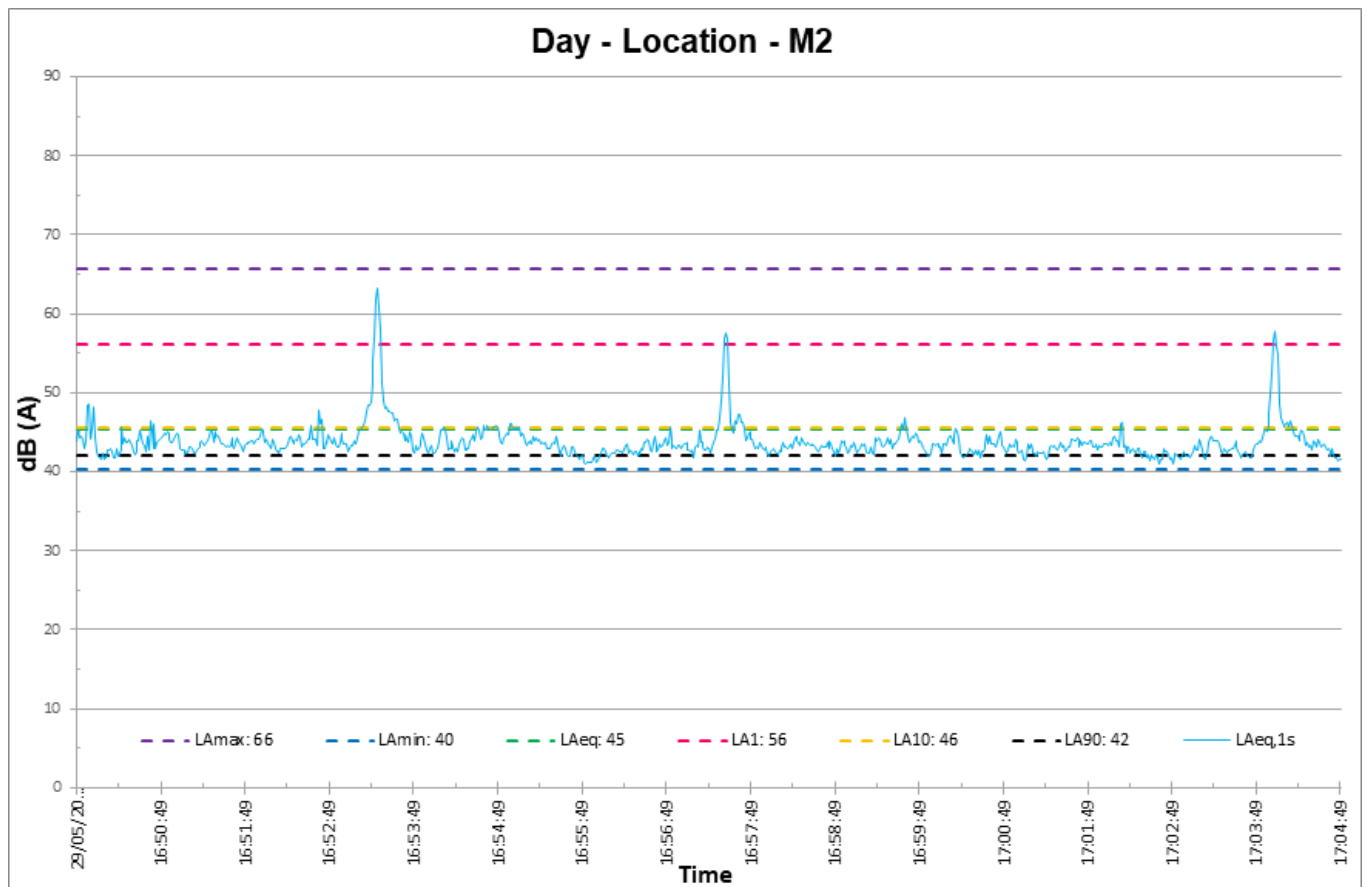
Attended noise monitoring charts – M1

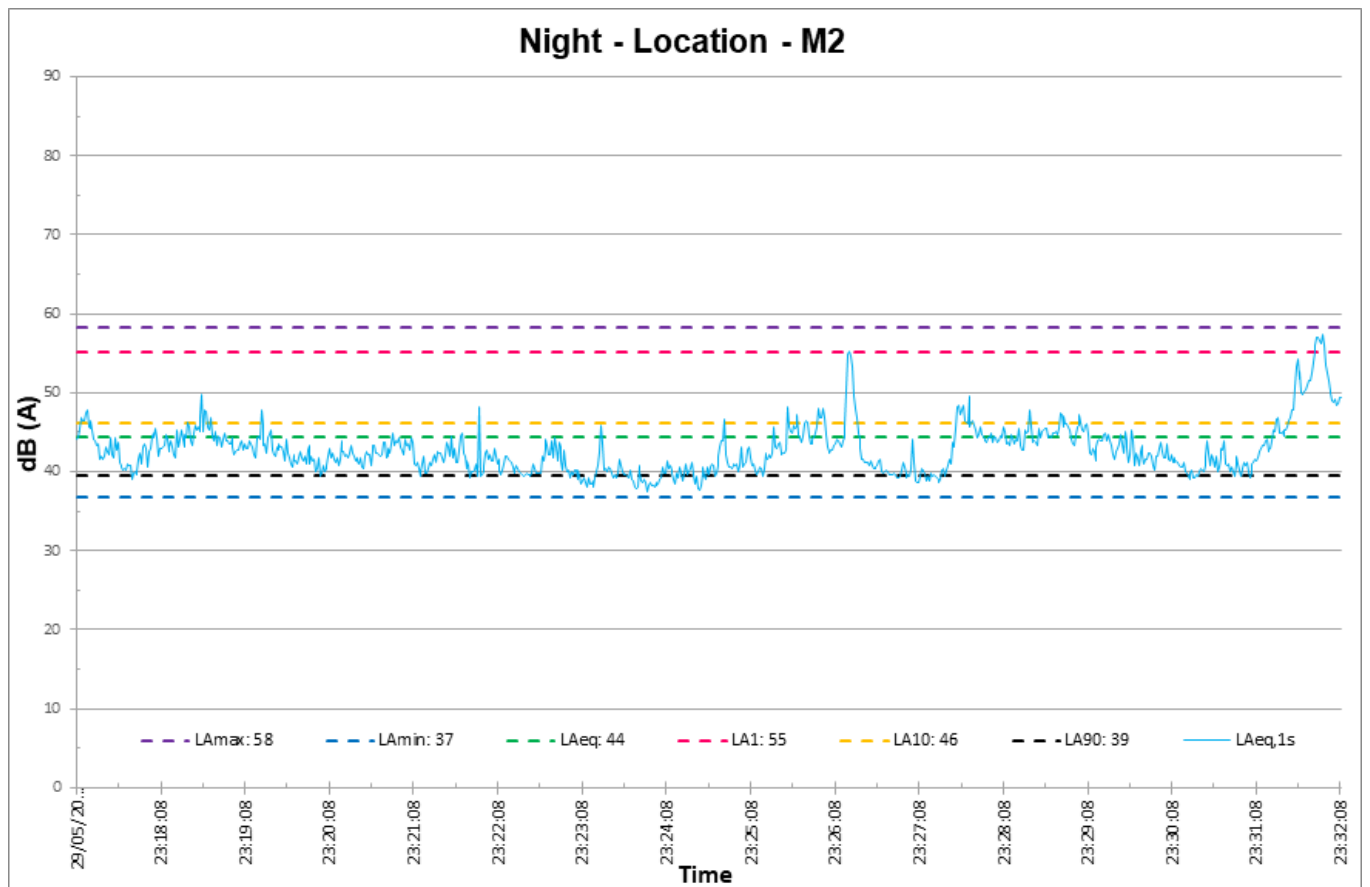




Appendix C

Attended noise monitoring charts – M2





Appendix D

Unattended noise monitoring results summary

Table D.1 Summary of noise monitoring results – M1 (92124) dBA – with Cooranbong Entry Site operations

Date	Rating background level 90 th percentile L _{A90} (15min)			Ambient noise levels, L _{Aeq} (period)		
	Day	Evening	Night	Day	Evening	Night
Monday-29-May-23	38	37	37	52	49	49
Tuesday-30-May-23	34	39	39	74	75	48
Wednesday-31-May-23	35	36	36	73	46	71
Thursday-1-Jun-23	33	41	42	62	51	47
Friday-2-Jun-23	33	43	36	51	51	63
Saturday-3-Jun-23	31	36	37	46	46	45
Sunday-4-Jun-23	39	-	-	49	-	-
Monday-5-Jun-23	39	41	37	50	51	47
Tuesday-6-Jun-23	36	42	42	52	47	49
Wednesday-7-Jun-23	37	42	41	53	49	50
Thursday-8-Jun-23	37	-	-	51	-	-
Friday-9-Jun-23	36	38	40	70	49	46
Saturday-10-Jun-23	30	40	41	47	45	47
Sunday-11-Jun-23	32	40	40	45	48	47
Monday-12-Jun-23	33	36	-	45	46	-
Tuesday-13-Jun-23	36	-	-	53	-	-
Wednesday-14-Jun-23	38	37	37	55	45	49
Thursday-15-Jun-23	31	40	40	64	46	48
Friday-16-Jun-23	31	-	-	73	-	-
RBL and Overall L_{eq}	35	40	39	66	64	60

Note 1 period of exclusion in accordance with the NPI

Table D.2 Summary of noise monitoring results – M1 (92124) dBA – without Cooranbong Entry Site operations

Date	Rating background level 90 th percentile L _{A90} (15min)			Ambient noise levels, L _{Aeq} (period)		
	Day	Evening	Night	Day	Evening	Night
Monday-29-May-23	38	37	37	52	49	49
Tuesday-30-May-23	34	39	39	74	75	48
Wednesday-31-May-23	35	35	36	73	43	44
Thursday-1-Jun-23	33	42	-	63	53	0
Friday-2-Jun-23	36	43	34	49	53	48
Saturday-3-Jun-23	31	36	39	47	48	47
Sunday-4-Jun-23	39	-	-	49	-	-
Monday-5-Jun-23	39	41	37	50	51	45
Tuesday-6-Jun-23	36	42	42	52	47	47
Wednesday-7-Jun-23	37	42	42	52	49	48
Thursday-8-Jun-23	37	-	-	51	-	-
Friday-9-Jun-23	36	41	41	68	50	47
Saturday-10-Jun-23	30	39	40	46	47	46

Date	Rating background level 90 th percentile L _{A90(15min)}			Ambient noise levels, L _{Aeq(period)}		
	Day	Evening	Night	Day	Evening	Night
Sunday-11-Jun-23	32	40	41	45	48	47
Monday-12-Jun-23	33	36	-	45	46	-
Tuesday-13-Jun-23	36	-	-	53	-	-
Wednesday-14-Jun-23	38	37	37	55	42	49
Thursday-15-Jun-23	31	40	39	64	46	44
Friday-16-Jun-23	31	-	-	73	-	-
RBL and Overall L_{eq}	36	40	39	66	64	47

Note 1 period of exclusion in accordance with the NPI

Table D.3 Summary of noise monitoring results – M2 (45748) dBA – with Cooranbong Entry Site operations

Date	Rating background level 90 th percentile L _{A90(15min)}			Ambient noise levels, L _{Aeq(period)}		
	Day	Evening	Night	Day	Evening	Night
Monday-29-May-23	42	36	36	48	43	47
Tuesday-30-May-23	40	40	35	50	46	46
Wednesday-31-May-23	41	36	34	51	44	44
Thursday-1-Jun-23	38	38	33	49	44	41
Friday-2-Jun-23	38	38	30	49	44	41
Saturday-3-Jun-23	36	34	32	48	41	40
Sunday-4-Jun-23	38	-	-	49	-	-
Monday-5-Jun-23	38	38	37	48	43	44
Tuesday-6-Jun-23	38	39	40	48	44	46
Wednesday-7-Jun-23	38	38	38	50	44	45
Thursday-8-Jun-23	43	-	-	54	-	-
Friday-9-Jun-23	40	35	34	48	42	40
Saturday-10-Jun-23	36	39	35	46	42	44
Sunday-11-Jun-23	36	40	38	46	44	43
Monday-12-Jun-23	35	36	-	46	41	-
Tuesday-13-Jun-23	41	-	-	49	-	-
Wednesday-14-Jun-23	42	37	34	49	45	45
Thursday-15-Jun-23	40	39	36	49	45	45
Friday-16-Jun-23	38	-	-	52	-	-
RBL and Overall L_{eq}	38	38	35	49	44	44

Note 1 period of exclusion in accordance with the NPI

Table D.4 Summary of noise monitoring results – M2 (45748) dBA – without Cooranbong Entry Site operations

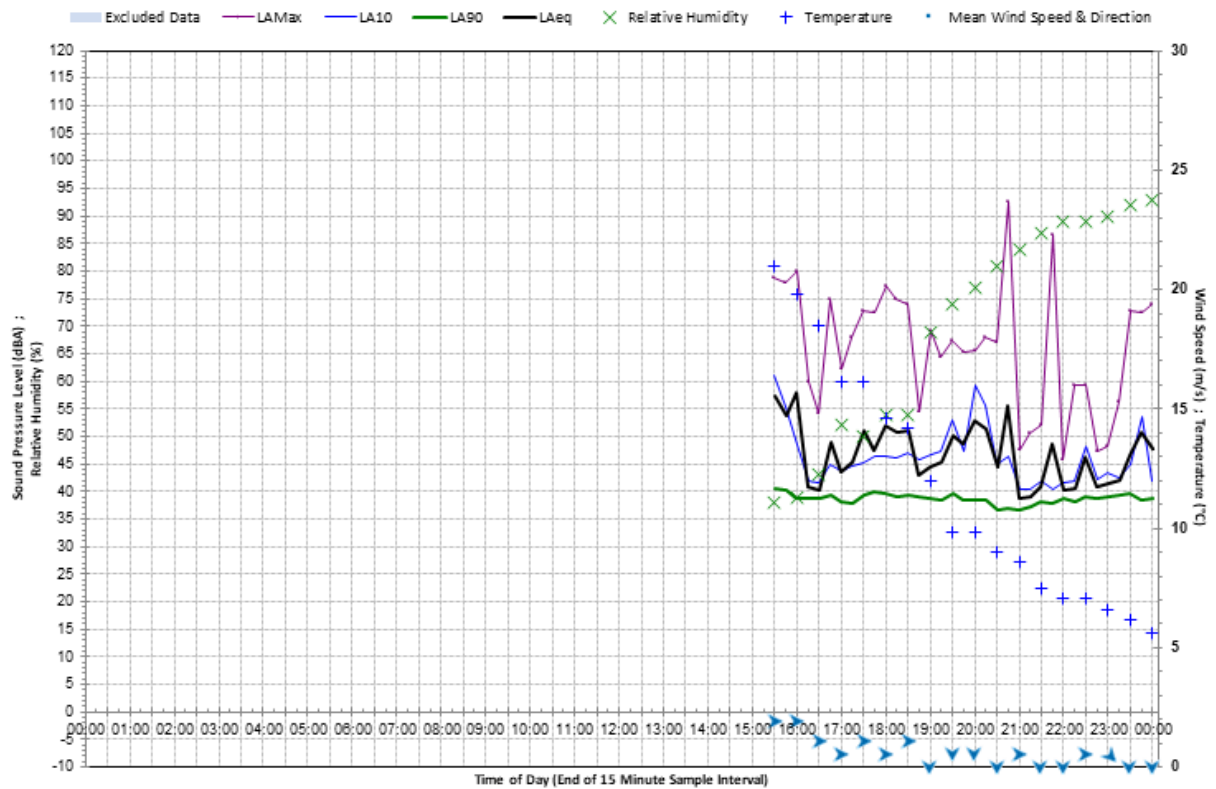
Date	Rating background level 90 th percentile L _{A90} (15min)			Ambient noise levels, L _{Aeq} (period)		
	Day	Evening	Night	Day	Evening	Night
Monday-29-May-23	42	36	36	48	43	47
Tuesday-30-May-23	40	40	35	50	46	46
Wednesday-31-May-23	41	36	35	51	43	41
Thursday-1-Jun-23	38	39	-	49	45	0
Friday-2-Jun-23	38	38	32	48	44	42
Saturday-3-Jun-23	37	34	34	48	42	42
Sunday-4-Jun-23	38	-	-	49	-	-
Monday-5-Jun-23	39	38	37	48	43	42
Tuesday-6-Jun-23	38	39	40	48	44	45
Wednesday-7-Jun-23	38	38	38	50	44	44
Thursday-8-Jun-23	43	-	-	54	-	-
Friday-9-Jun-23	41	41	33	48	45	40
Saturday-10-Jun-23	36	38	35	46	43	43
Sunday-11-Jun-23	36	41	38	47	44	43
Monday-12-Jun-23	35	36	-	46	41	-
Tuesday-13-Jun-23	41	-	-	49	-	-
Wednesday-14-Jun-23	44	38	32	50	45	44
Thursday-15-Jun-23	40	39	36	49	45	41
Friday-16-Jun-23	38	-	-	52	-	-
RBL and Overall L _{eq}	38	38	35	49	44	43

Note 1 period of exclusion in accordance with the NPI

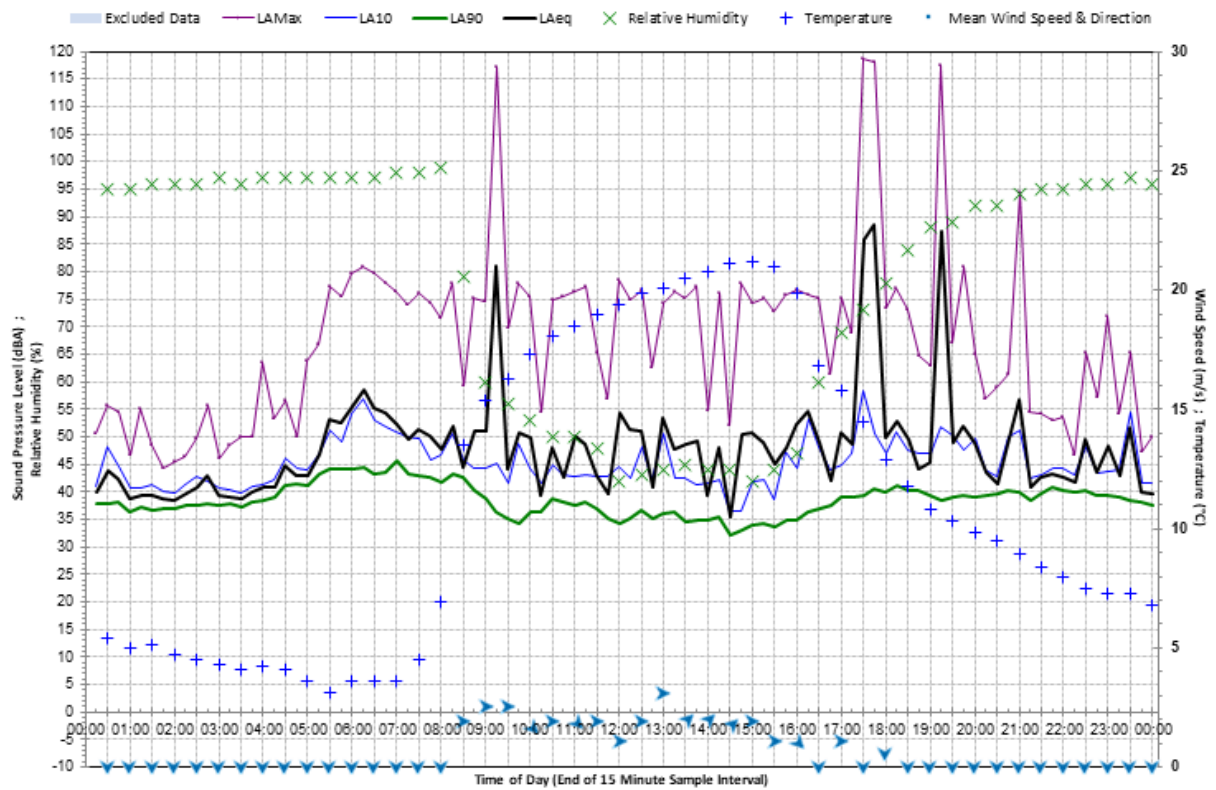
Appendix E

Unattended noise monitoring charts – M1

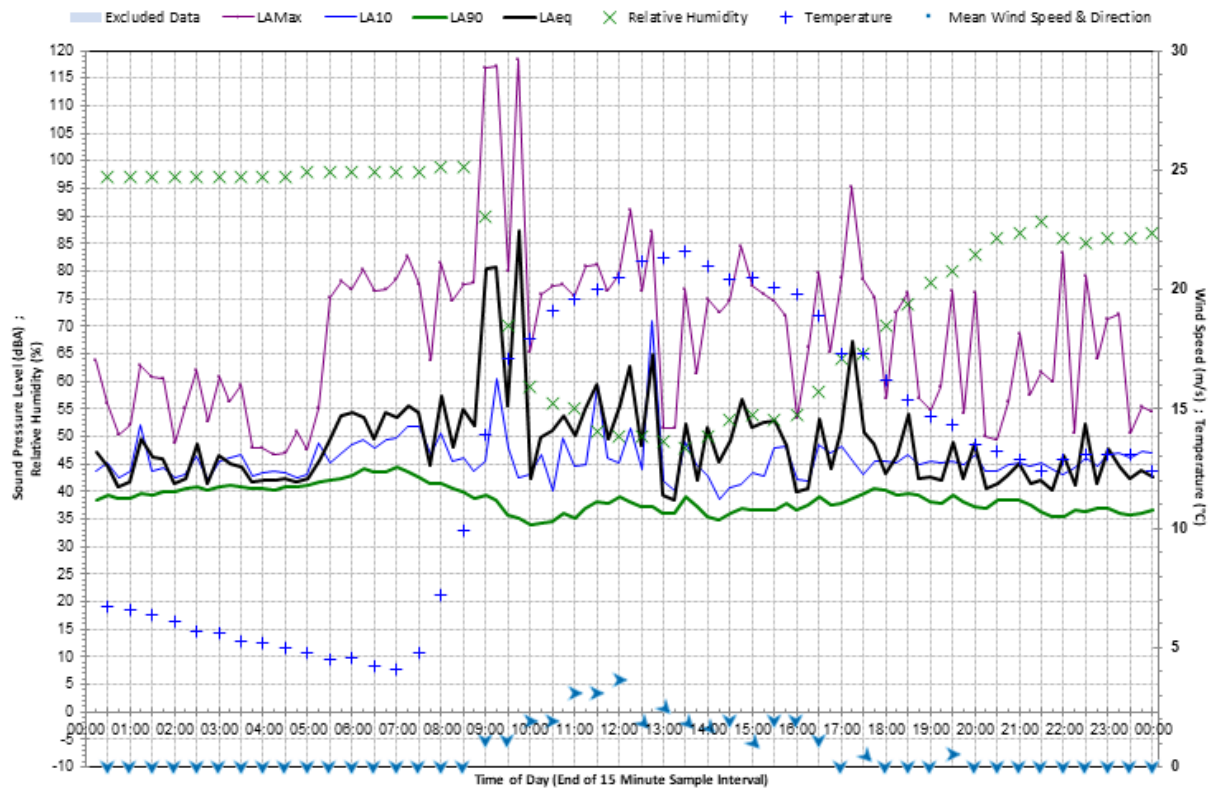
M2 - Statistical Ambient Noise Levels Monday 29 May 2023



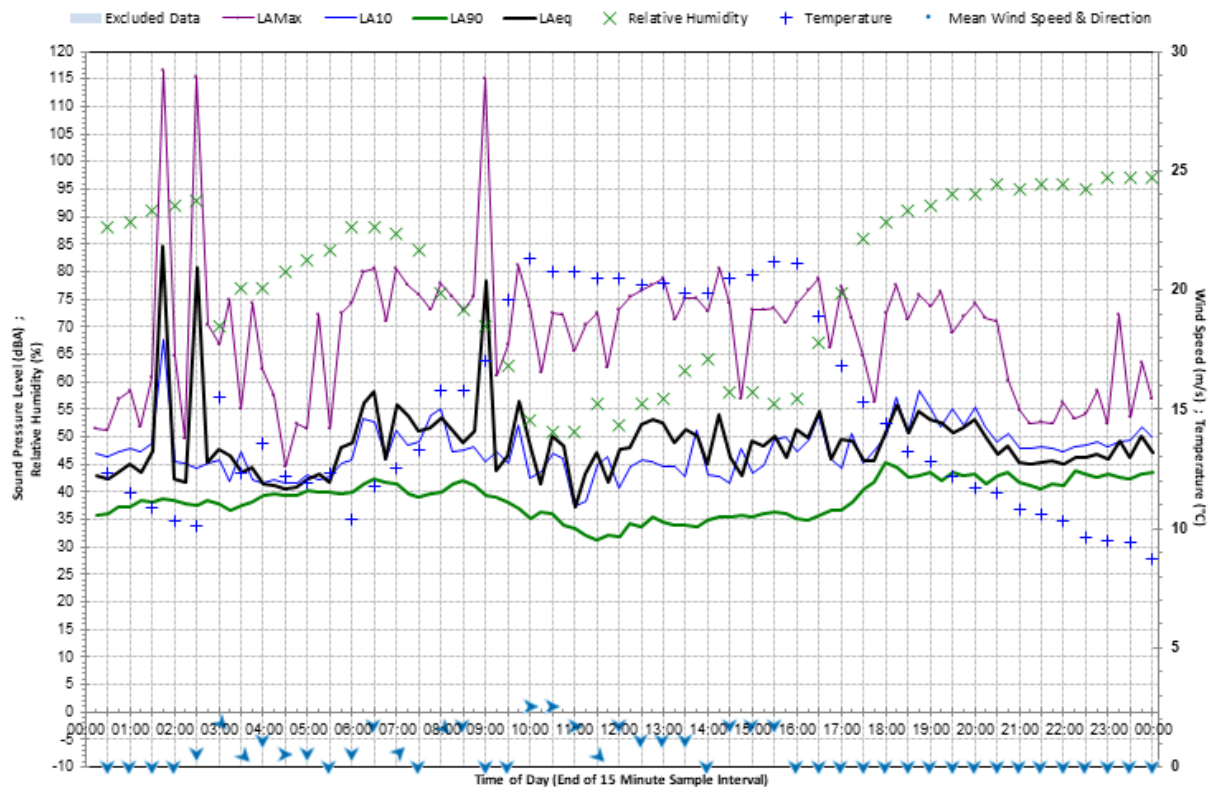
M2 - Statistical Ambient Noise Levels Tuesday 30 May 2023



M2 - Statistical Ambient Noise Levels Wednesday 31 May 2023

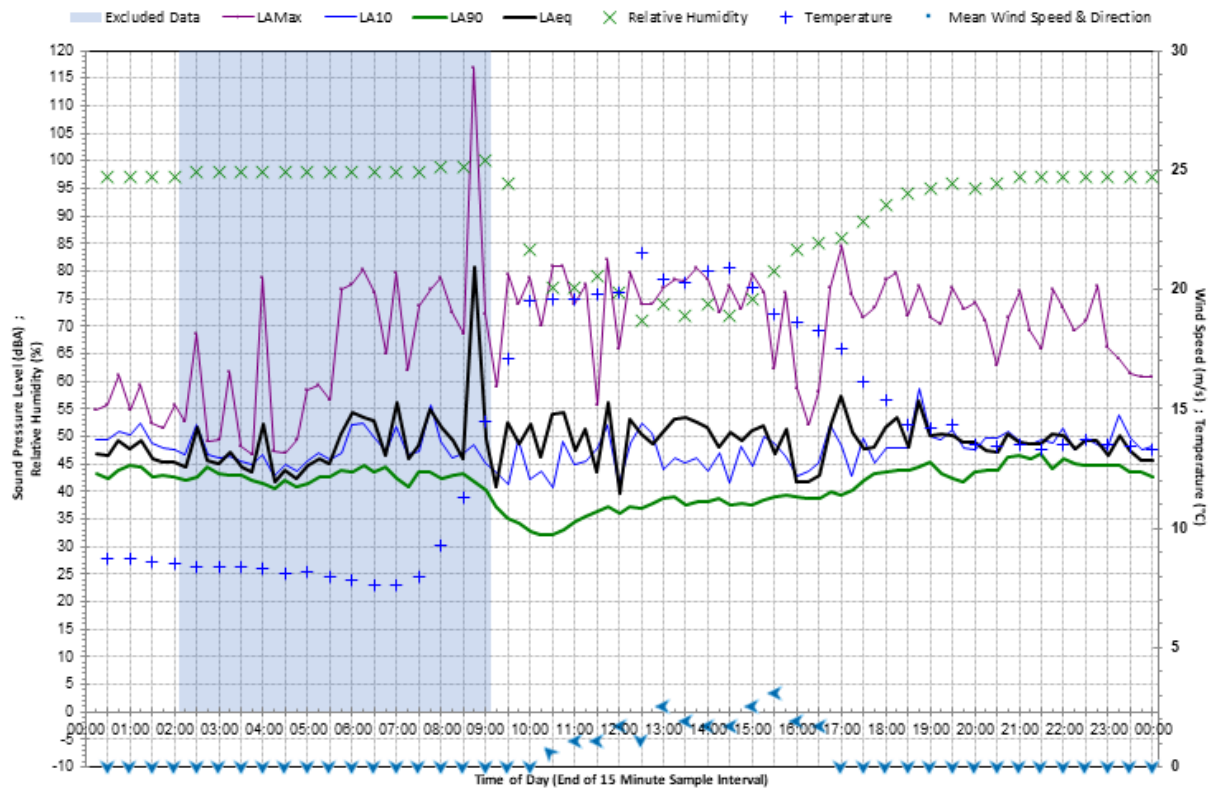


M2 - Statistical Ambient Noise Levels Thursday 1 June 2023



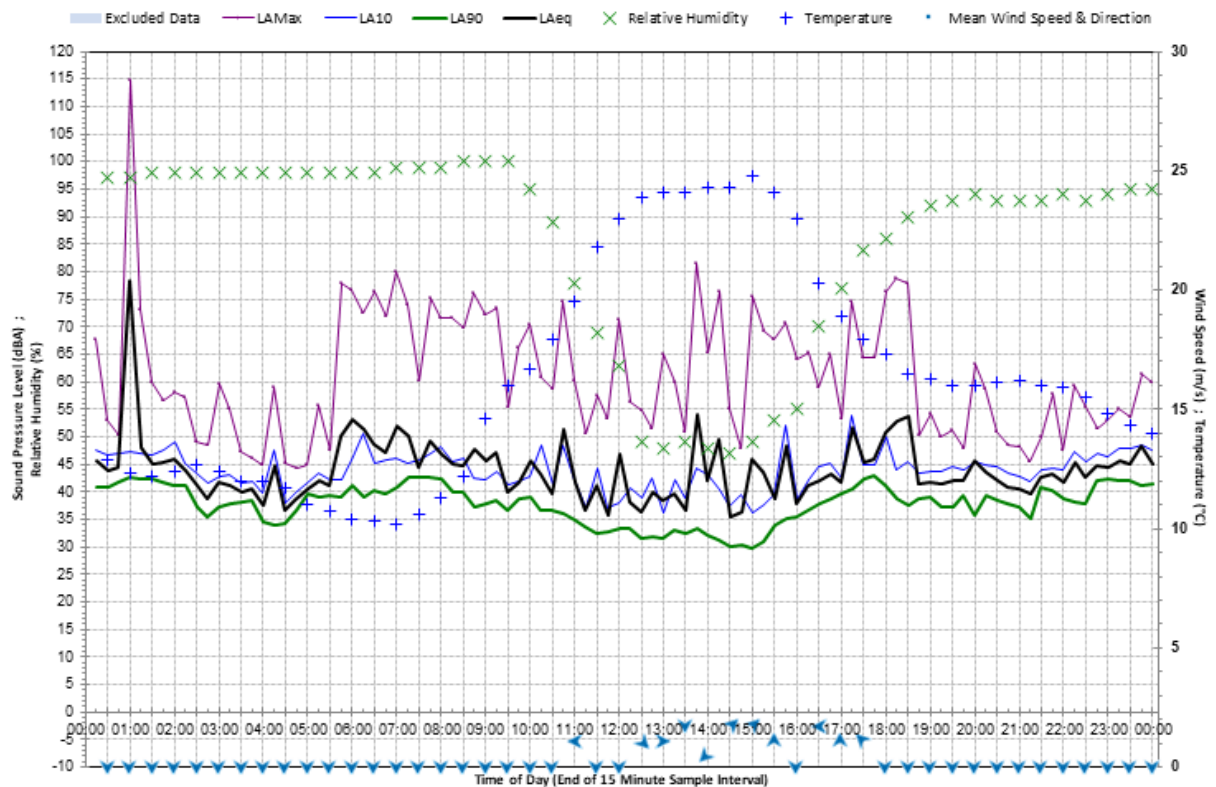
M2 - Statistical Ambient Noise Levels

Friday 2 June 2023

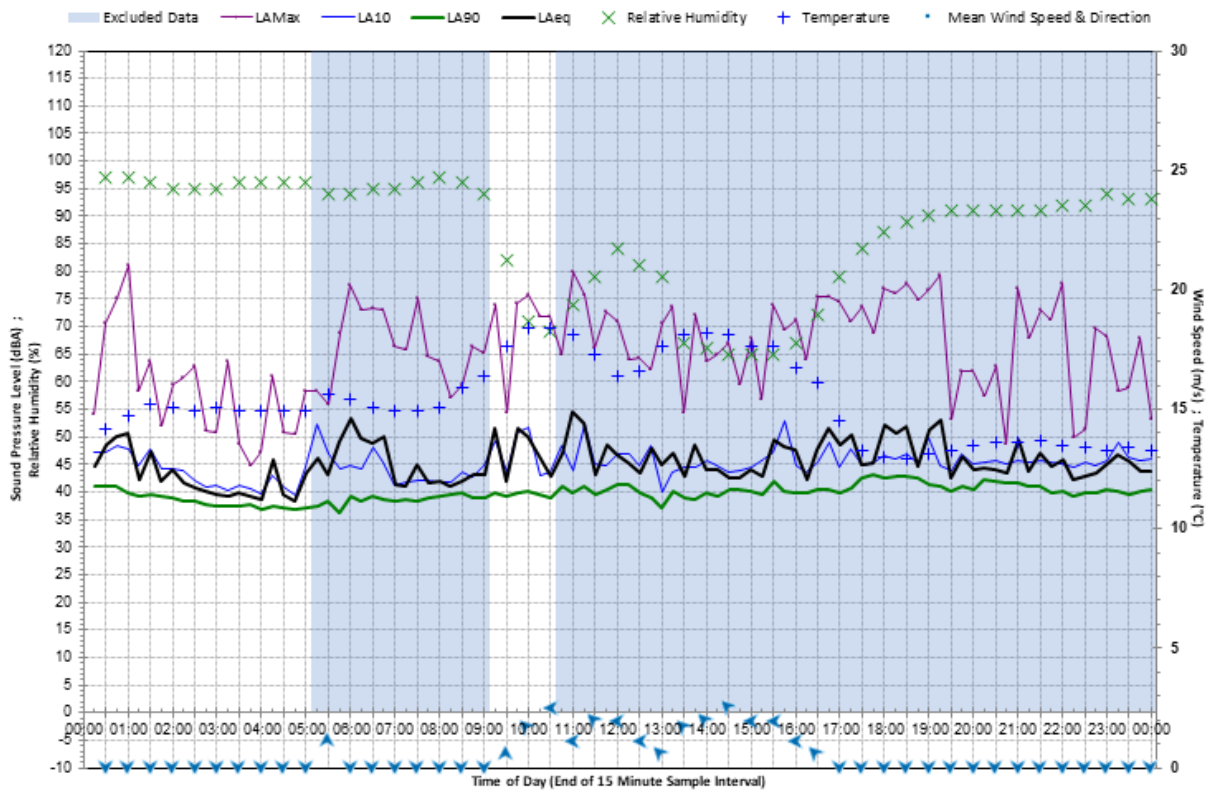


M2 - Statistical Ambient Noise Levels

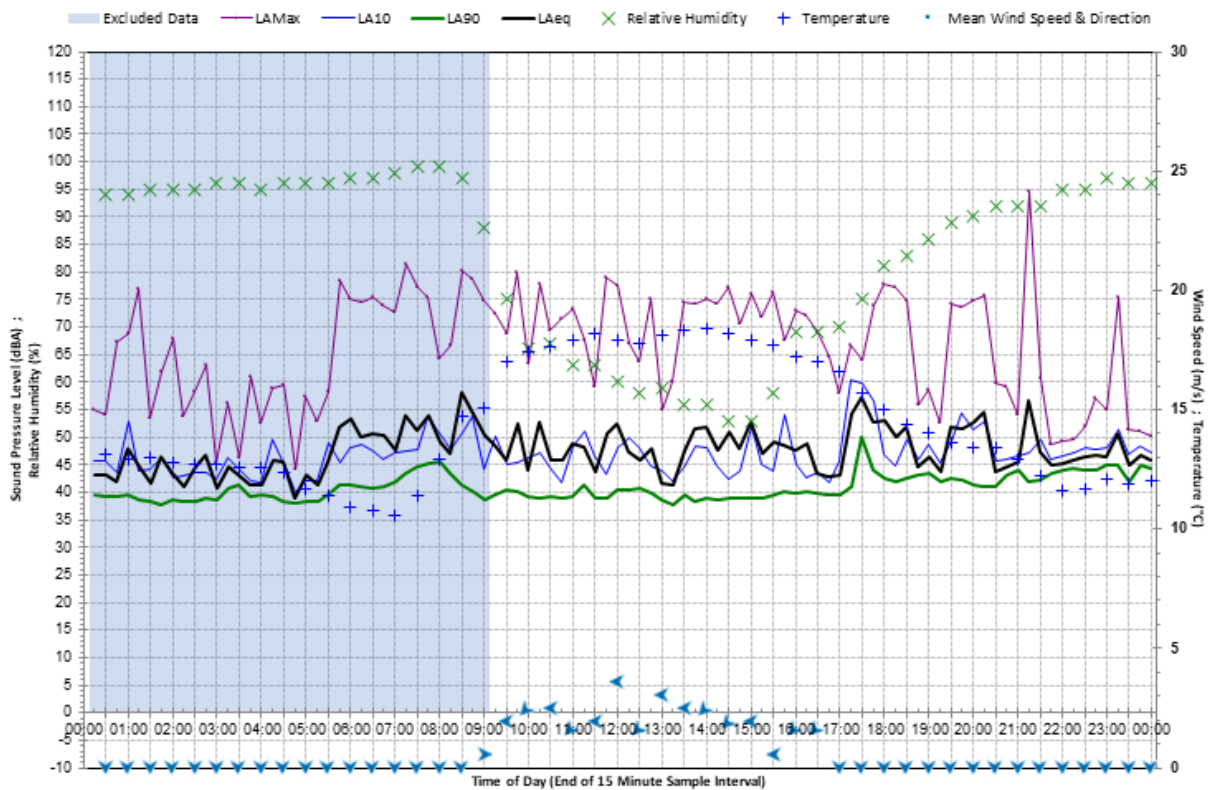
Saturday 3 June 2023



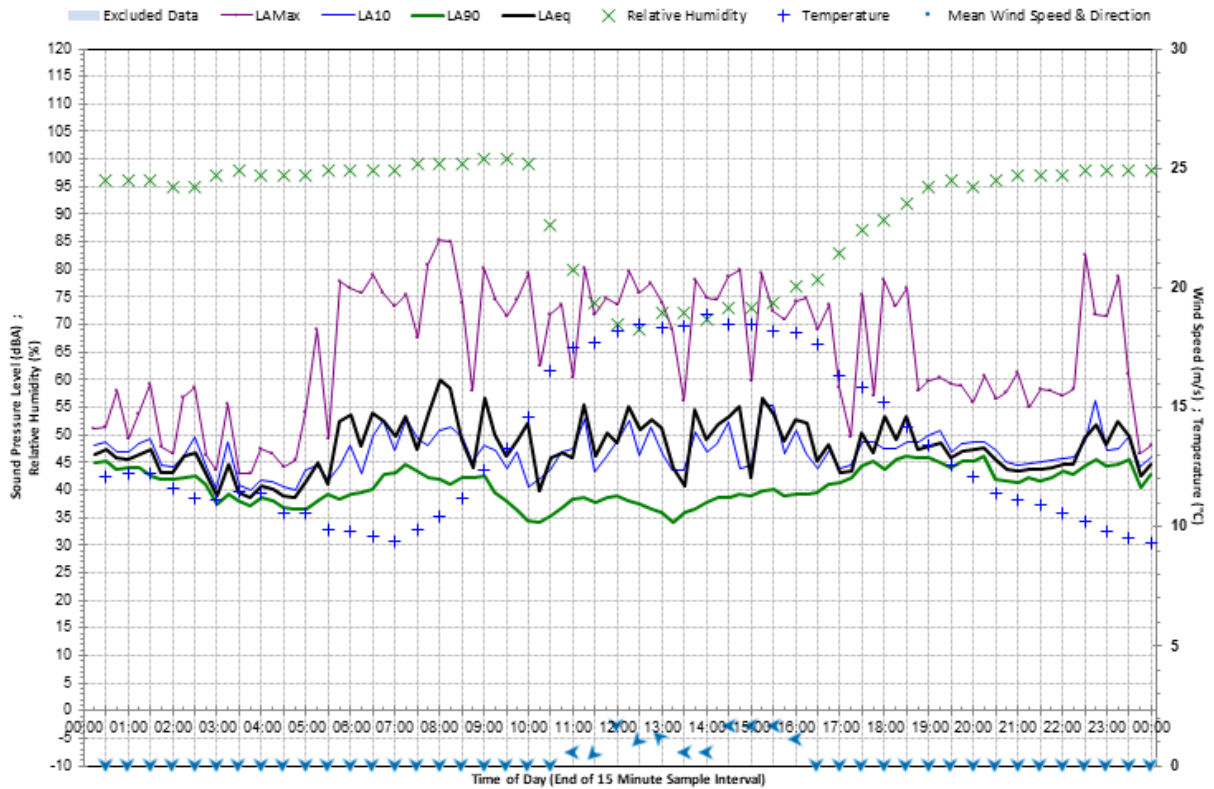
M2 - Statistical Ambient Noise Levels Sunday 4 June 2023



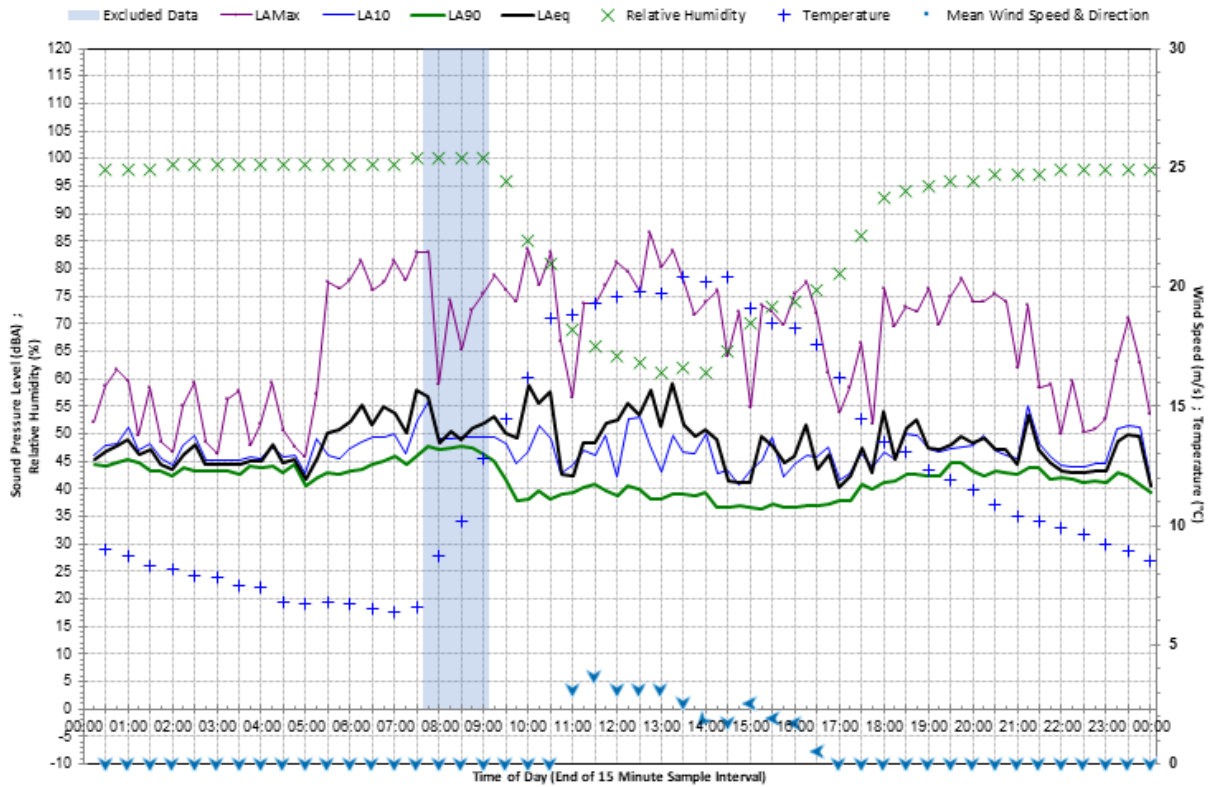
M2 - Statistical Ambient Noise Levels Monday 5 June 2023



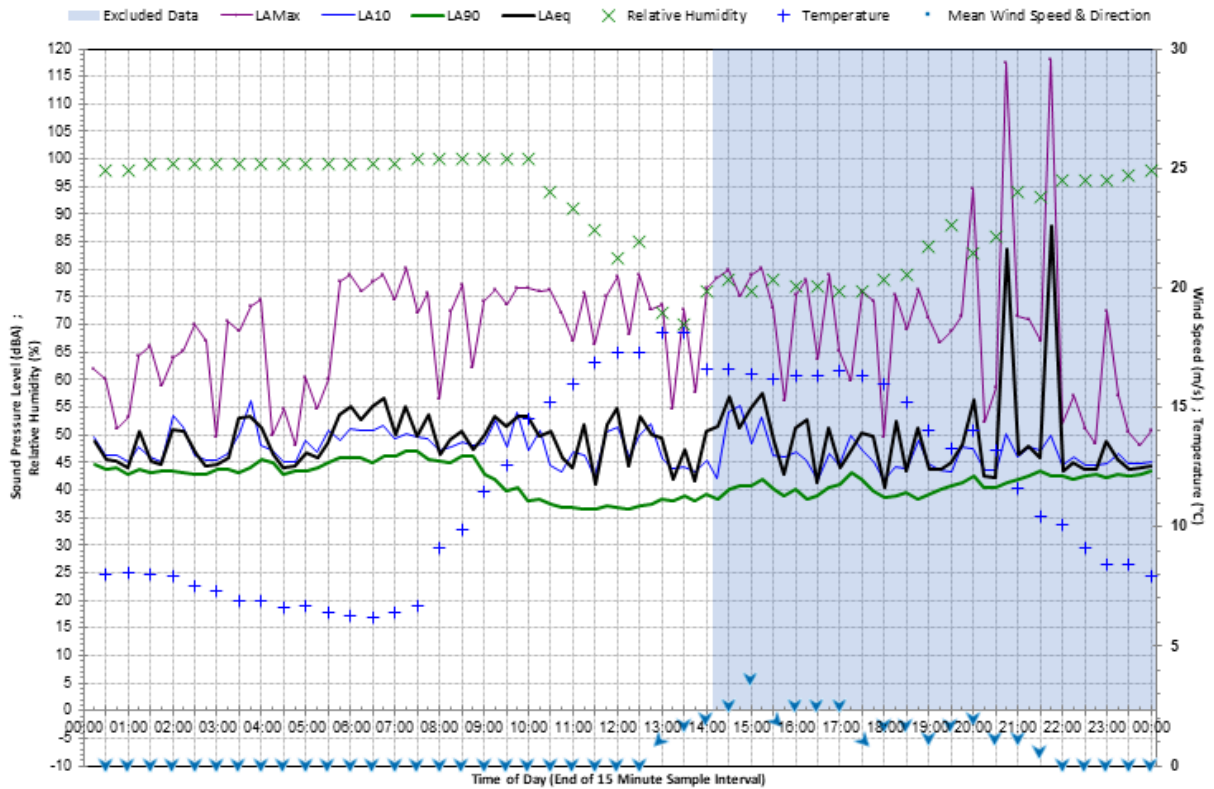
M2 - Statistical Ambient Noise Levels Tuesday 6 June 2023



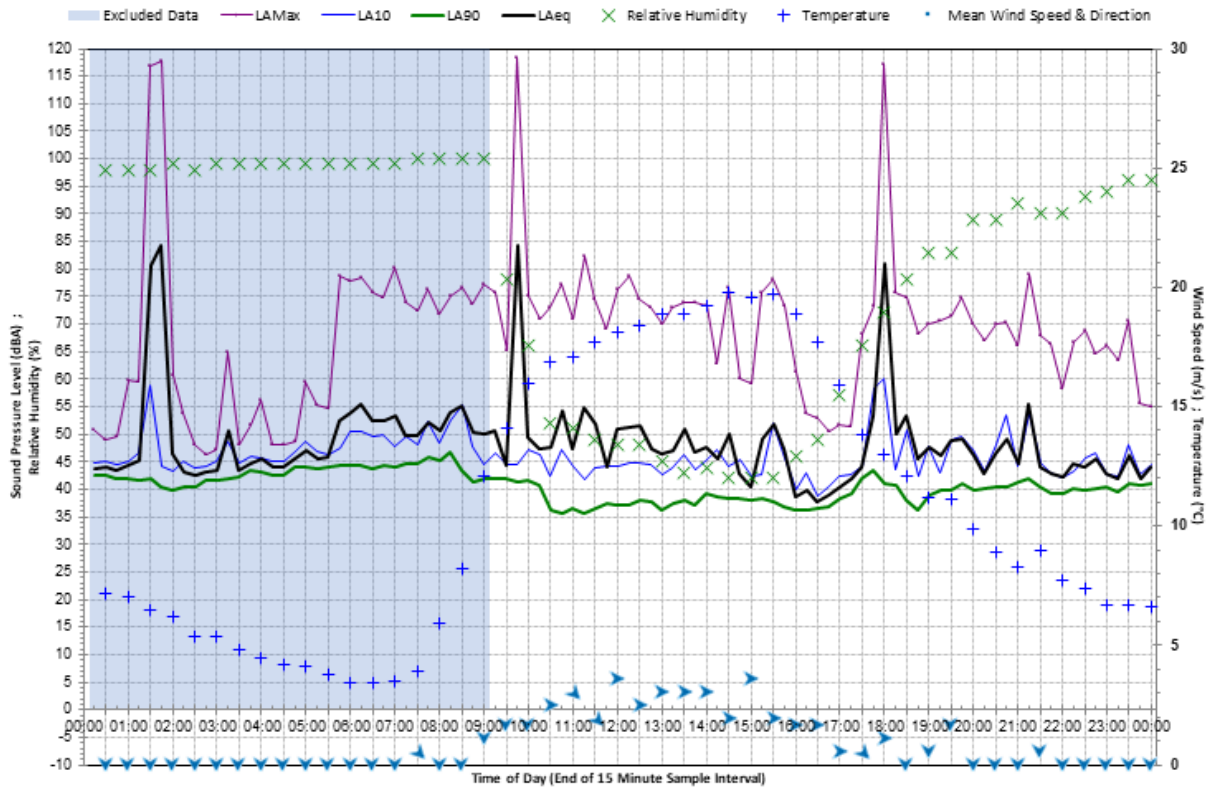
M2 - Statistical Ambient Noise Levels Wednesday 7 June 2023



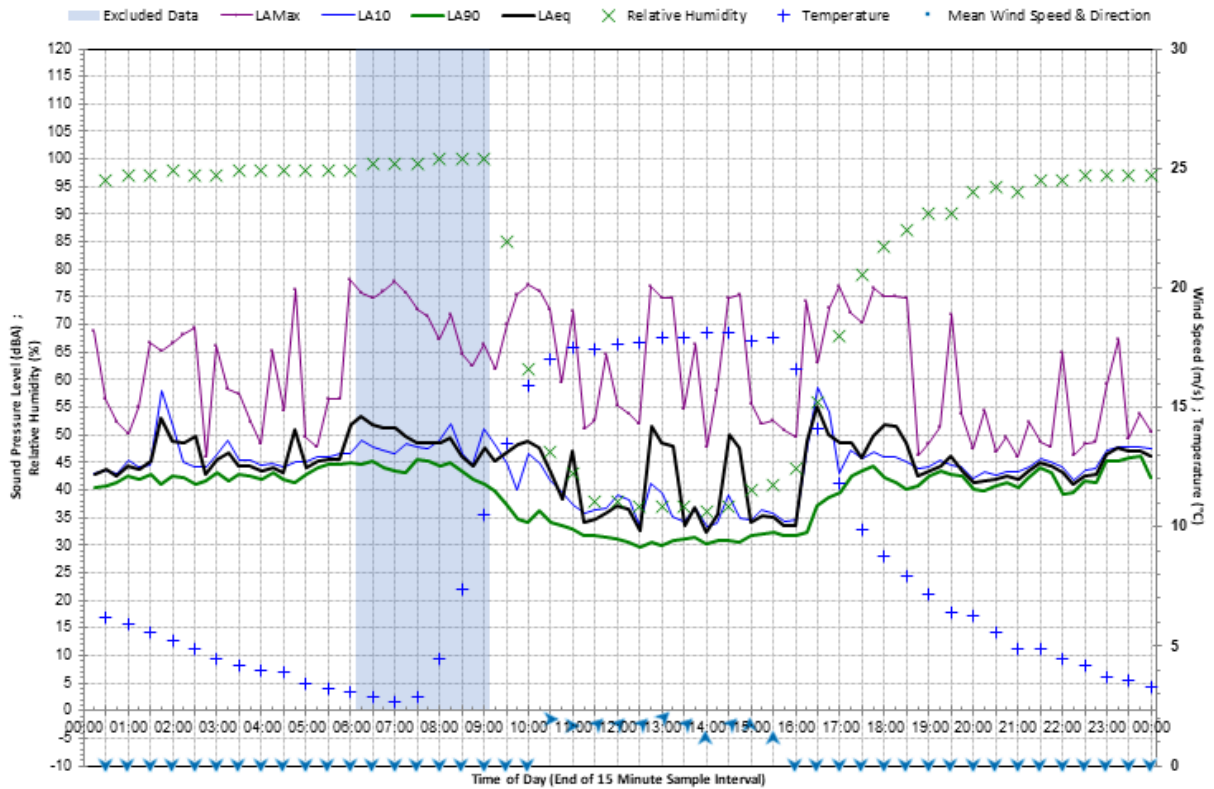
M2 - Statistical Ambient Noise Levels Thursday 8 June 2023



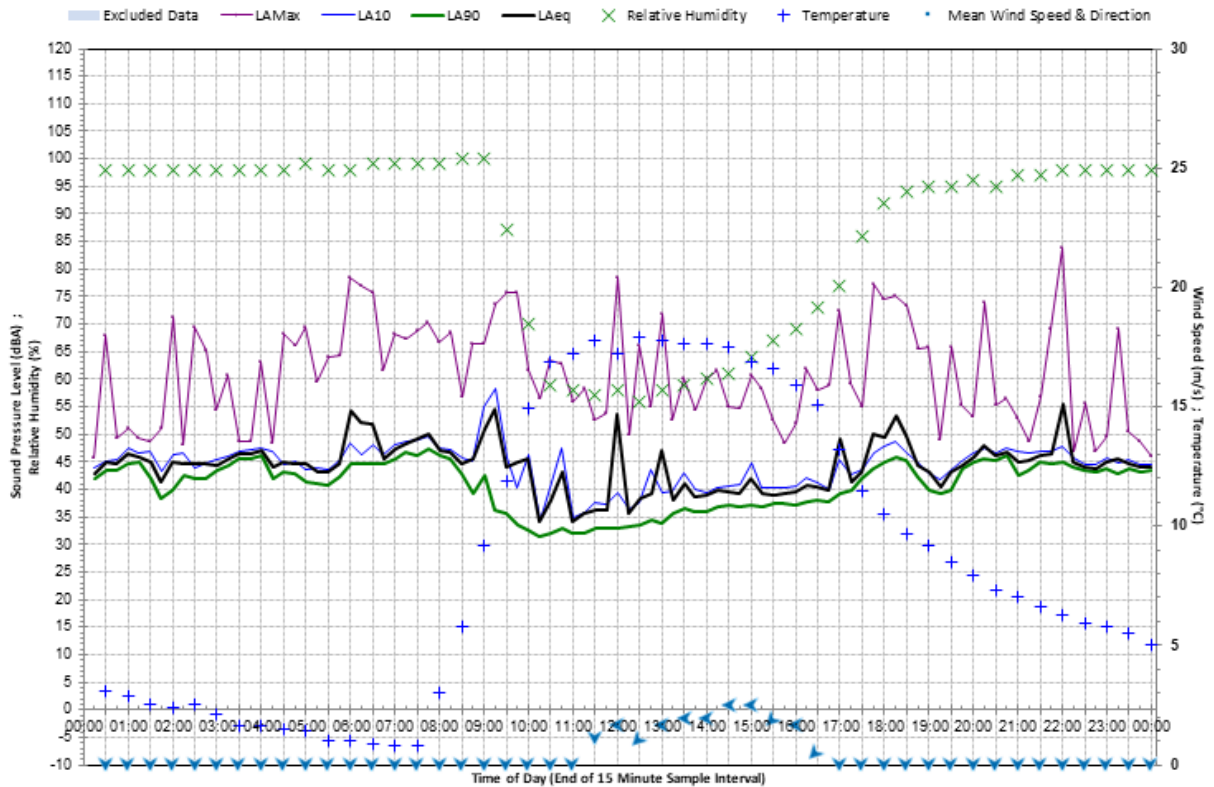
M2 - Statistical Ambient Noise Levels Friday 9 June 2023



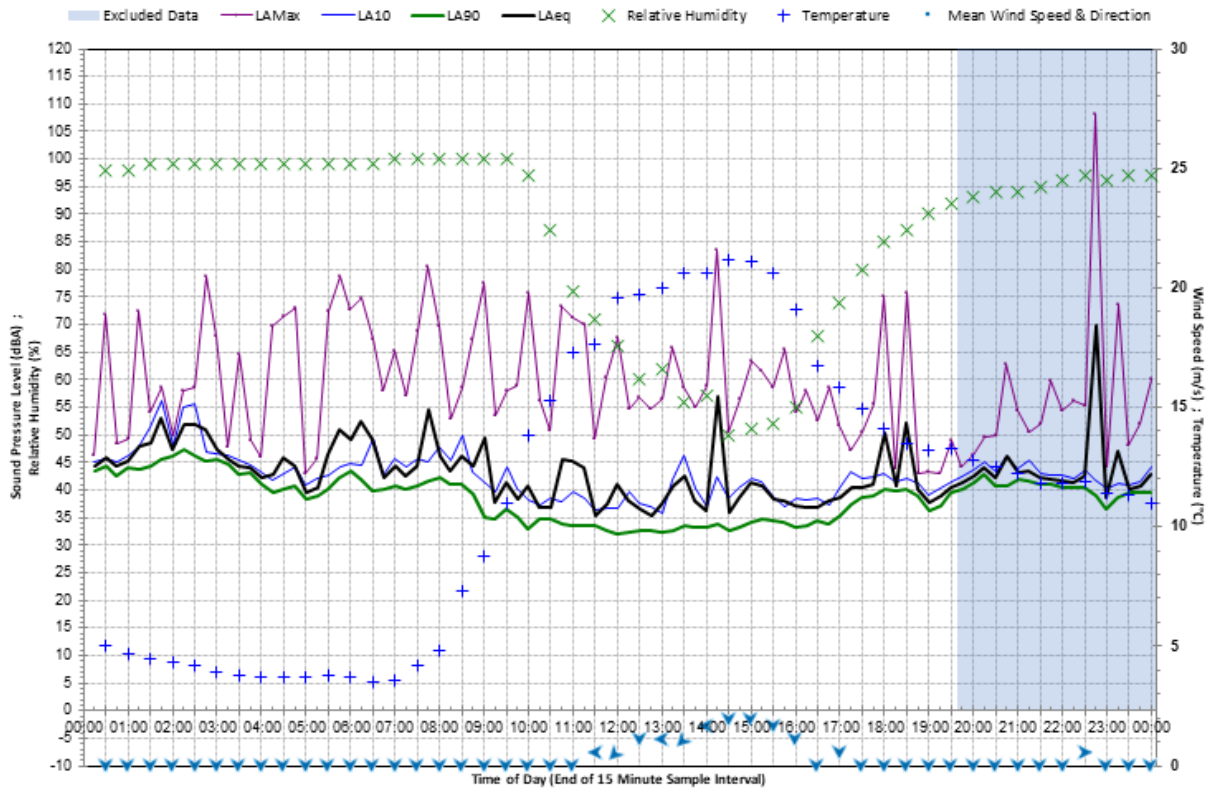
M2 - Statistical Ambient Noise Levels Saturday 10 June 2023



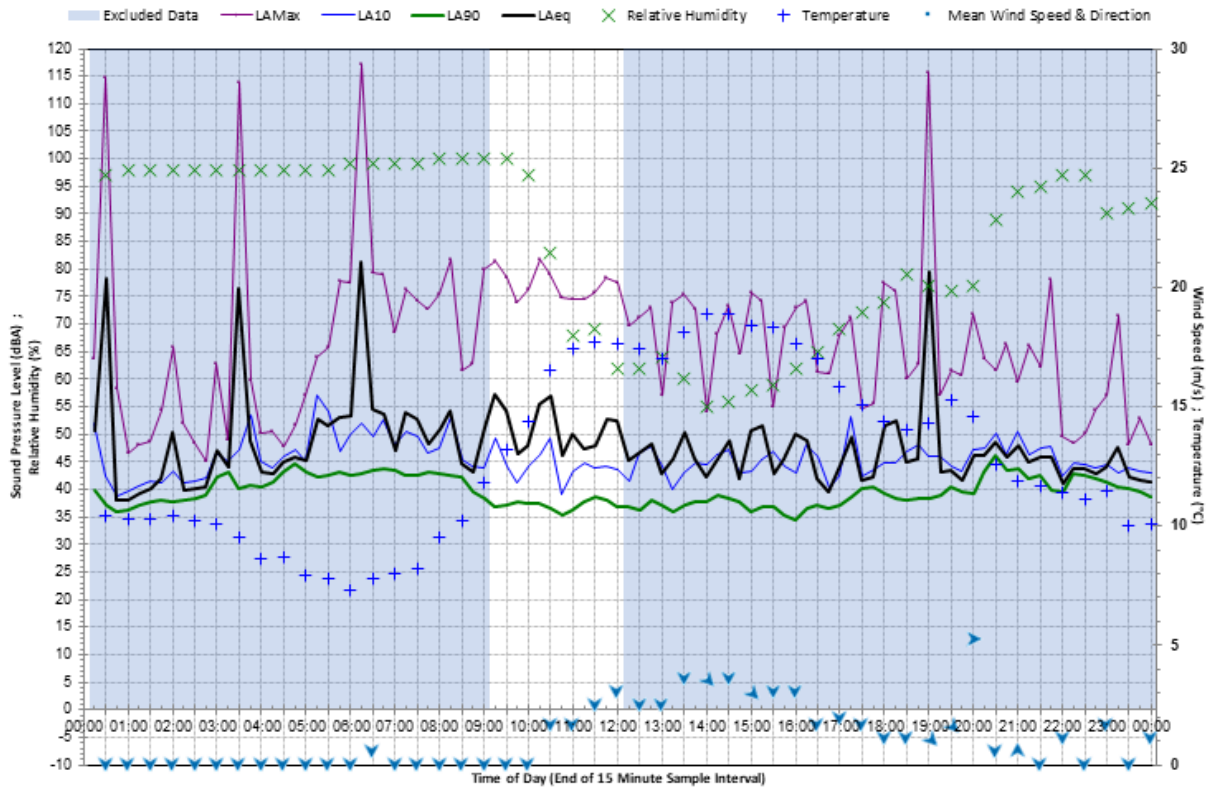
M2 - Statistical Ambient Noise Levels Sunday 11 June 2023



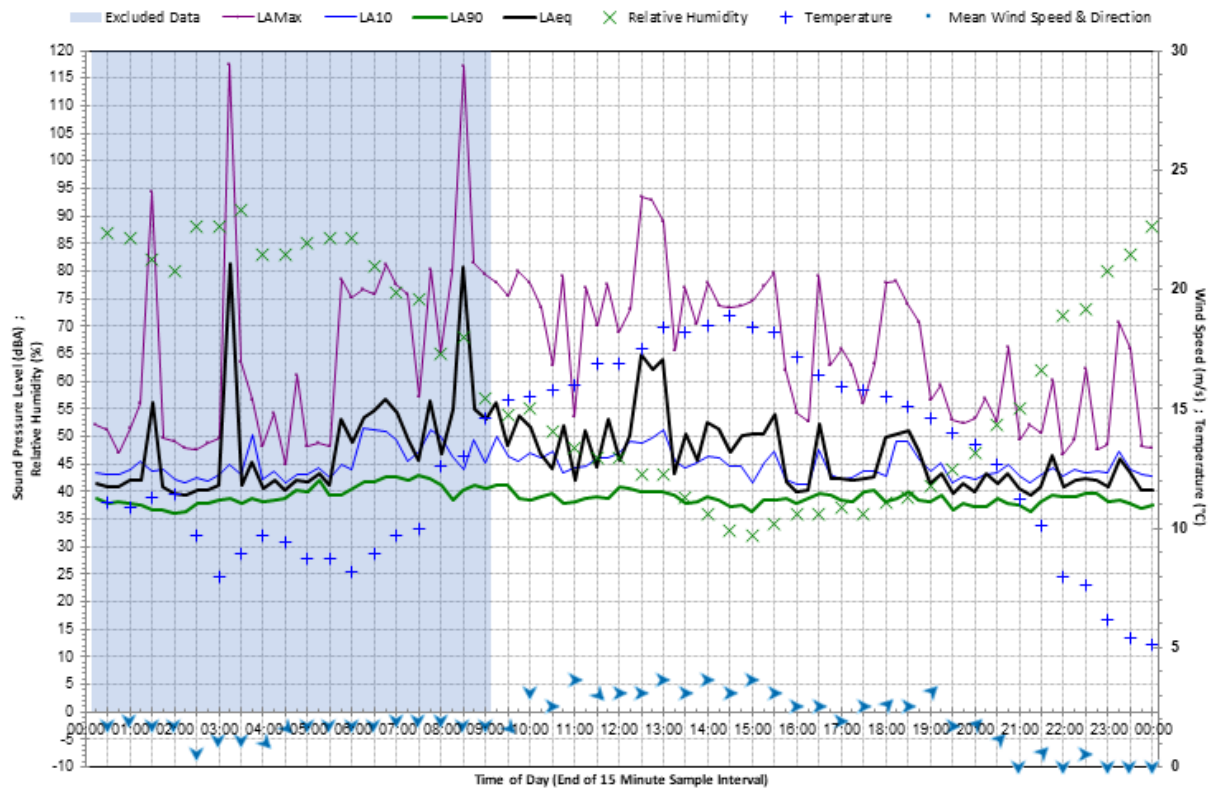
M2 - Statistical Ambient Noise Levels Monday 12 June 2023



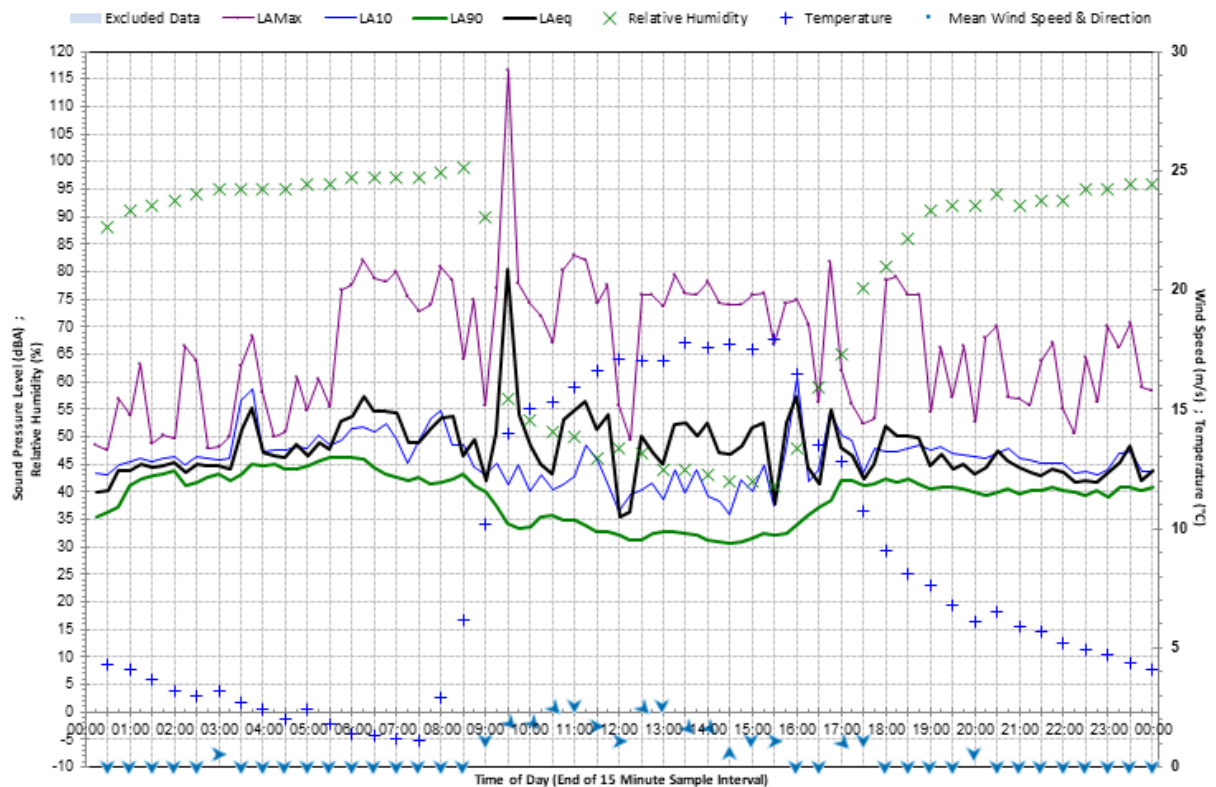
M2 - Statistical Ambient Noise Levels Tuesday 13 June 2023



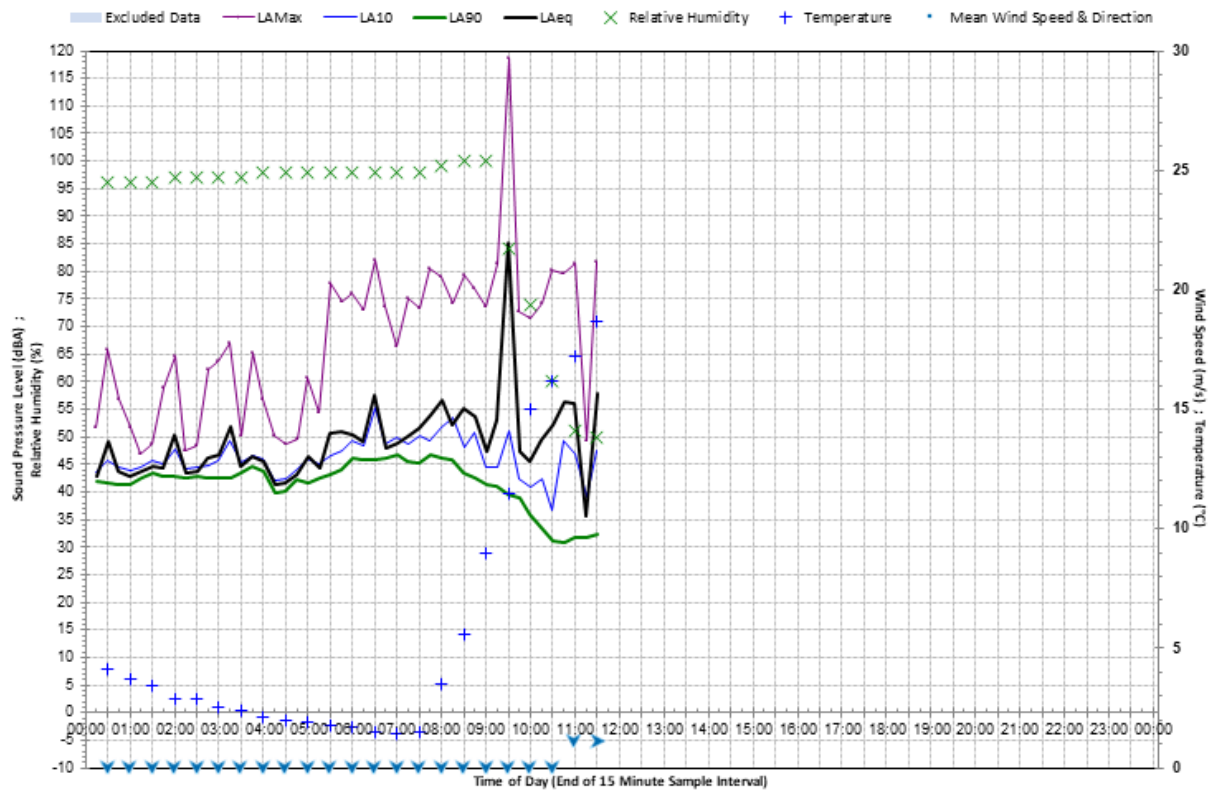
M2 - Statistical Ambient Noise Levels Wednesday 14 June 2023



M2 - Statistical Ambient Noise Levels Thursday 15 June 2023



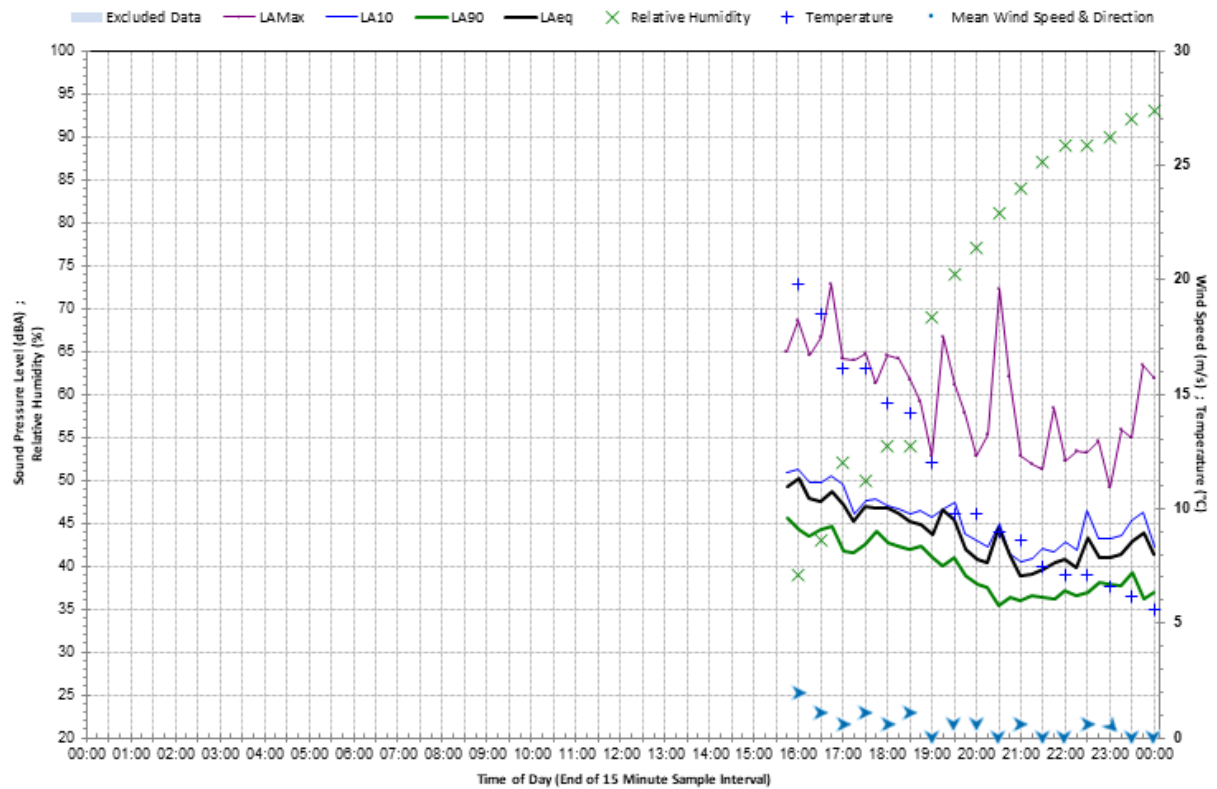
M2 - Statistical Ambient Noise Levels Friday 16 June 2023



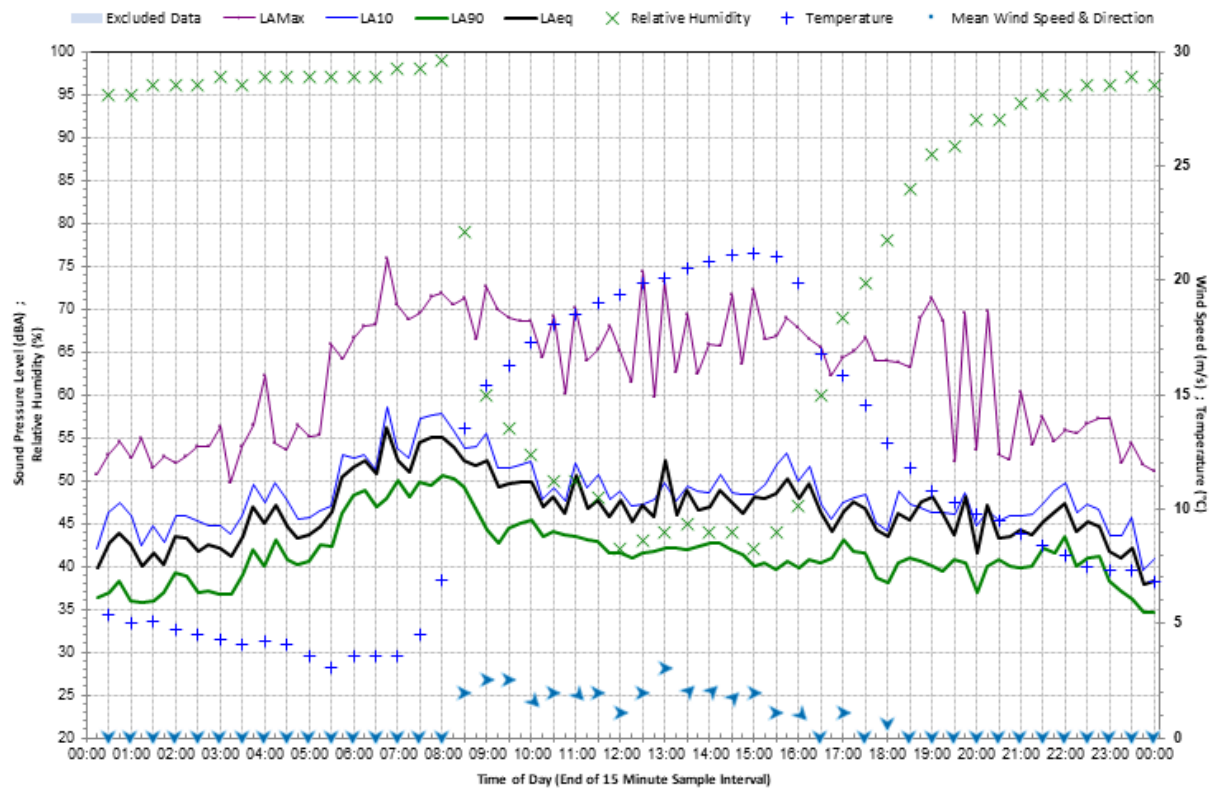
Appendix F

Unattended noise monitoring charts – M2

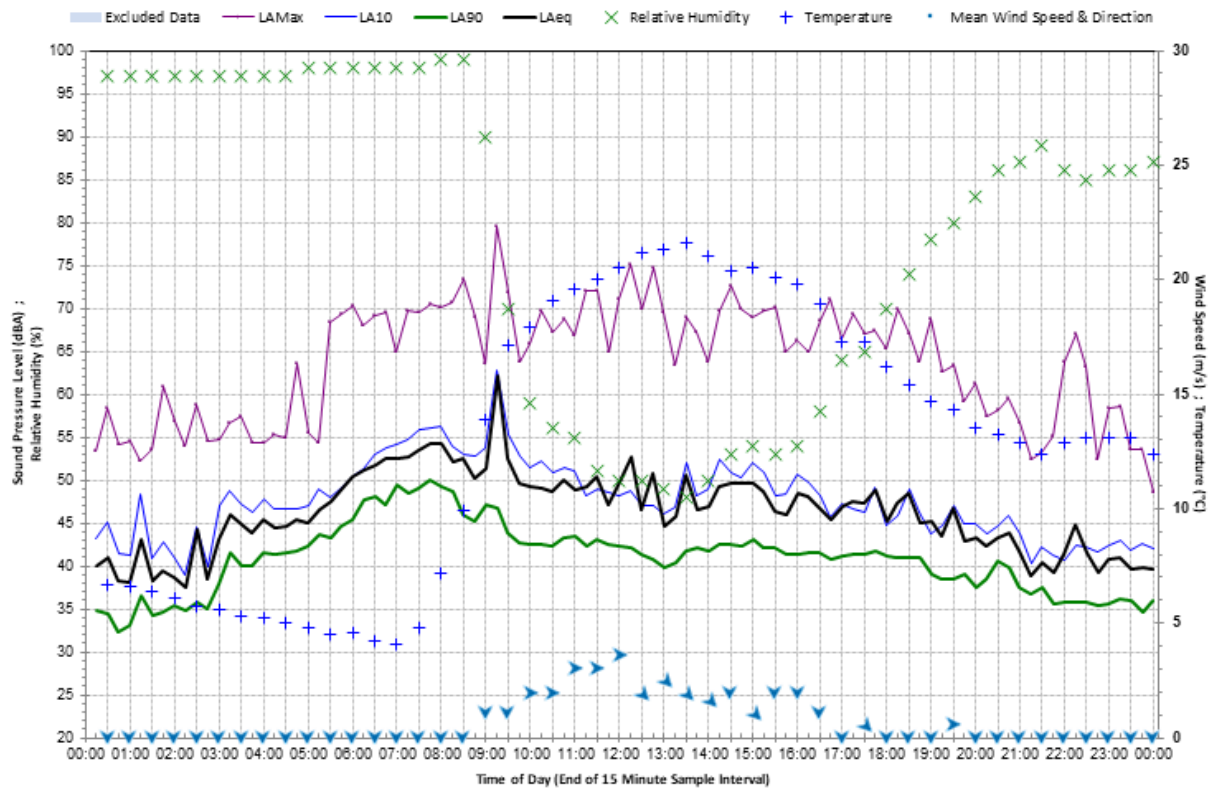
M2 - Statistical Ambient Noise Levels Monday 29 May 2023



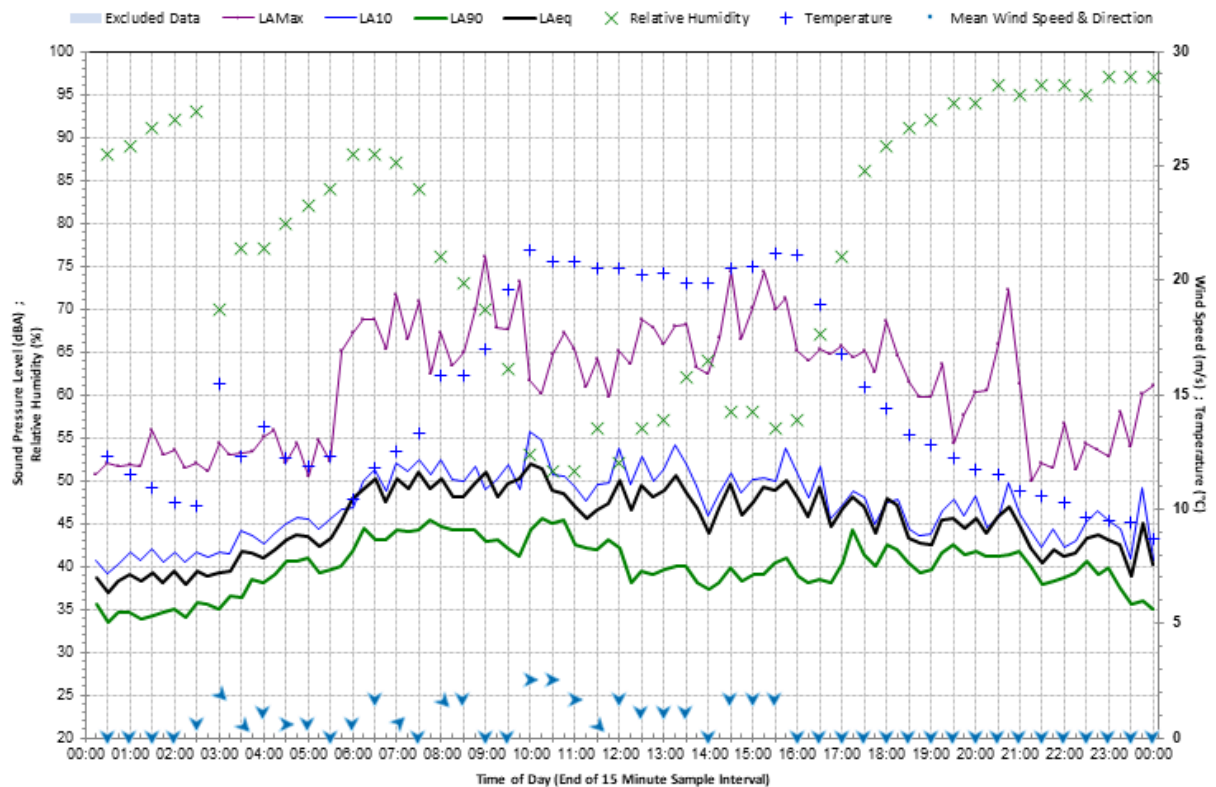
M2 - Statistical Ambient Noise Levels Tuesday 30 May 2023



M2 - Statistical Ambient Noise Levels Wednesday 31 May 2023

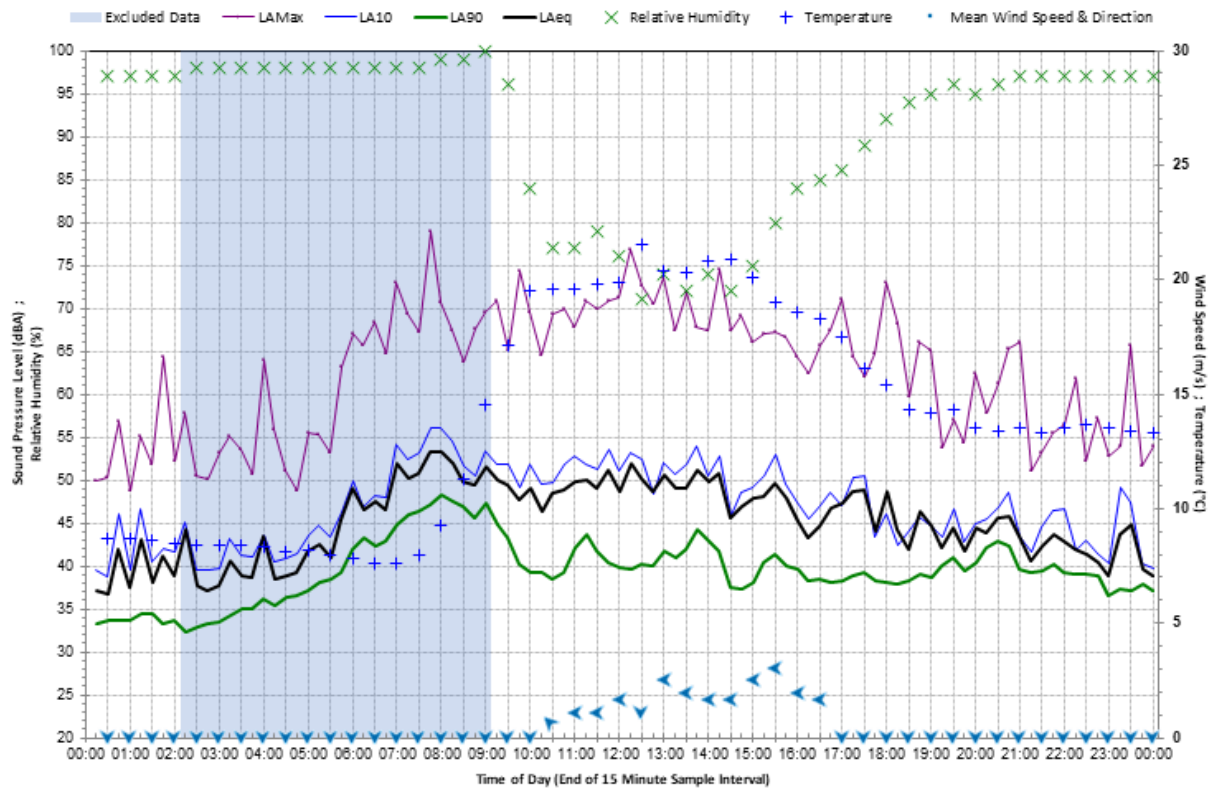


M2 - Statistical Ambient Noise Levels Thursday 1 June 2023



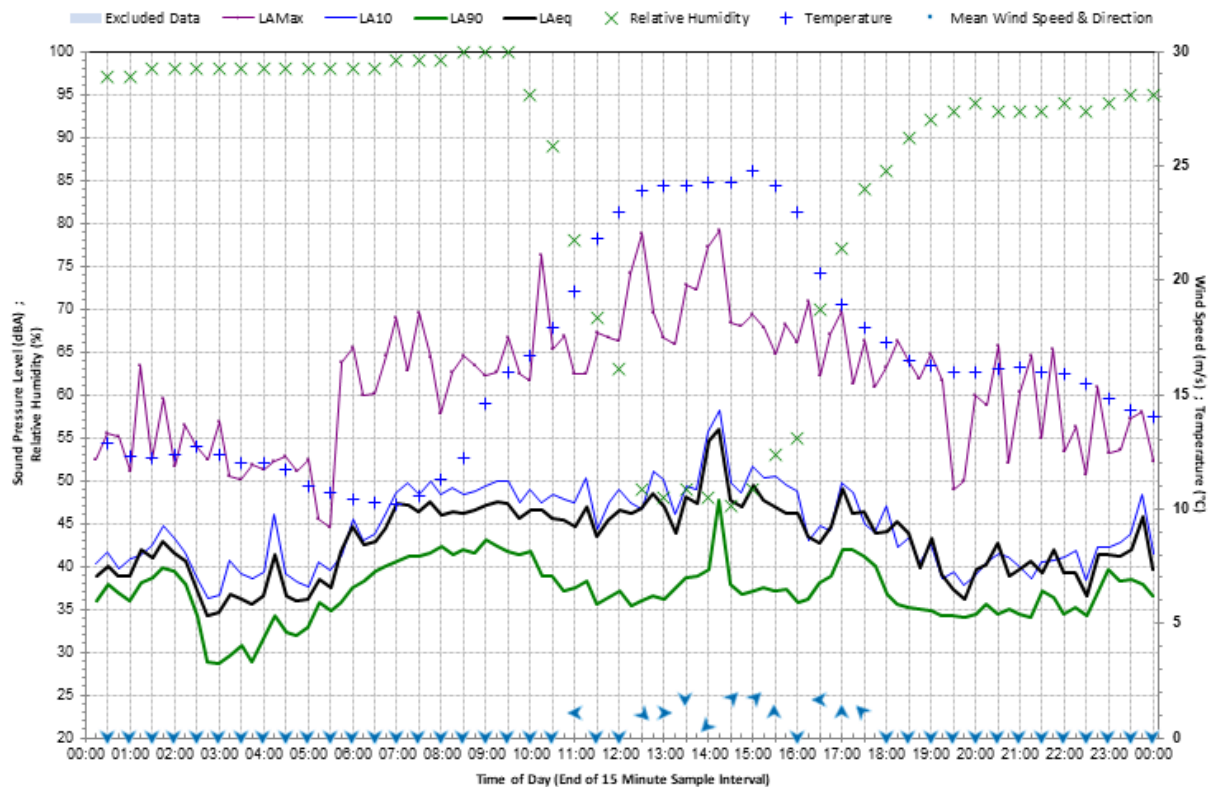
M2 - Statistical Ambient Noise Levels

Friday 2 June 2023

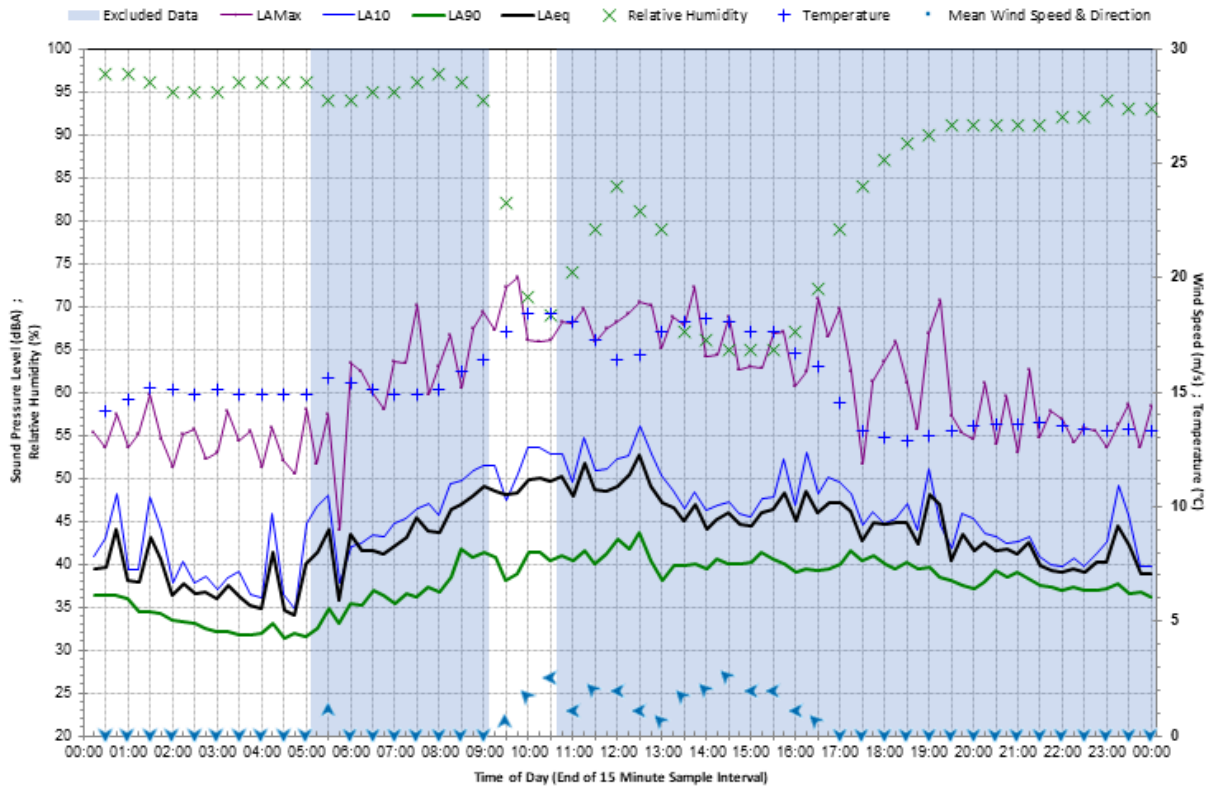


M2 - Statistical Ambient Noise Levels

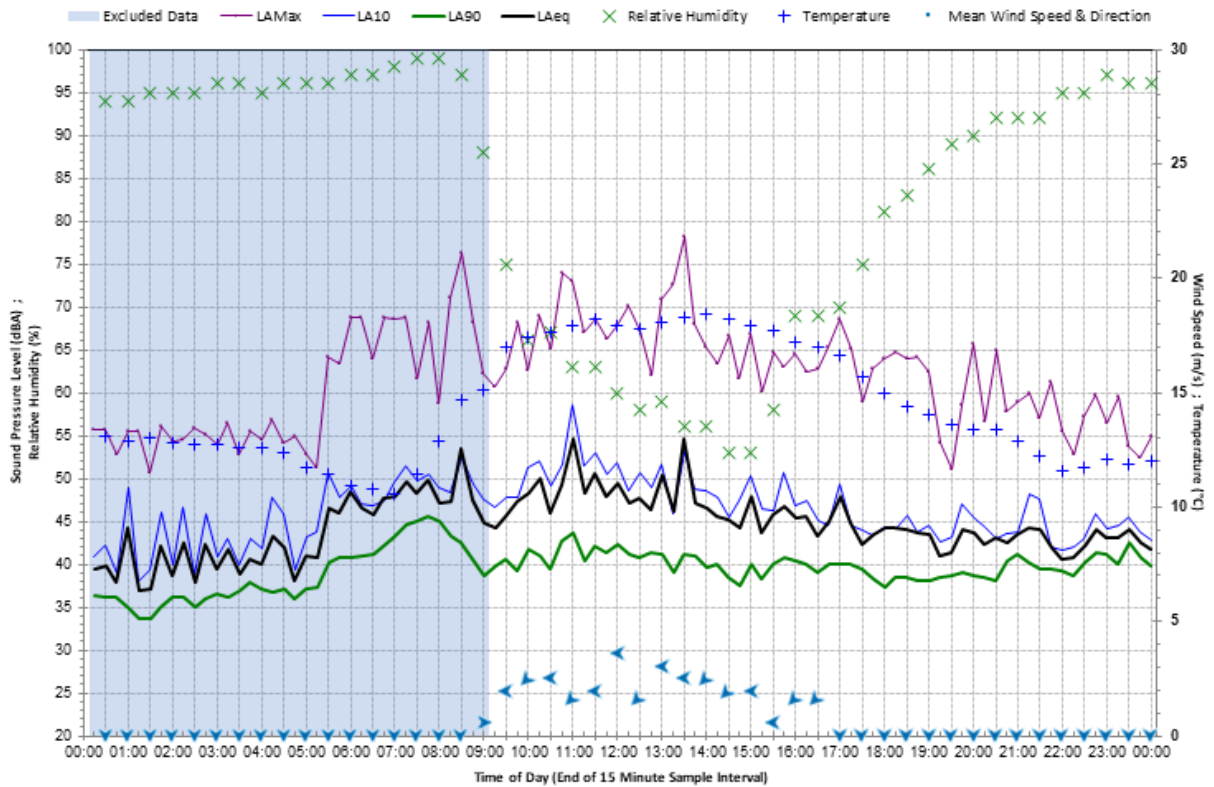
Saturday 3 June 2023



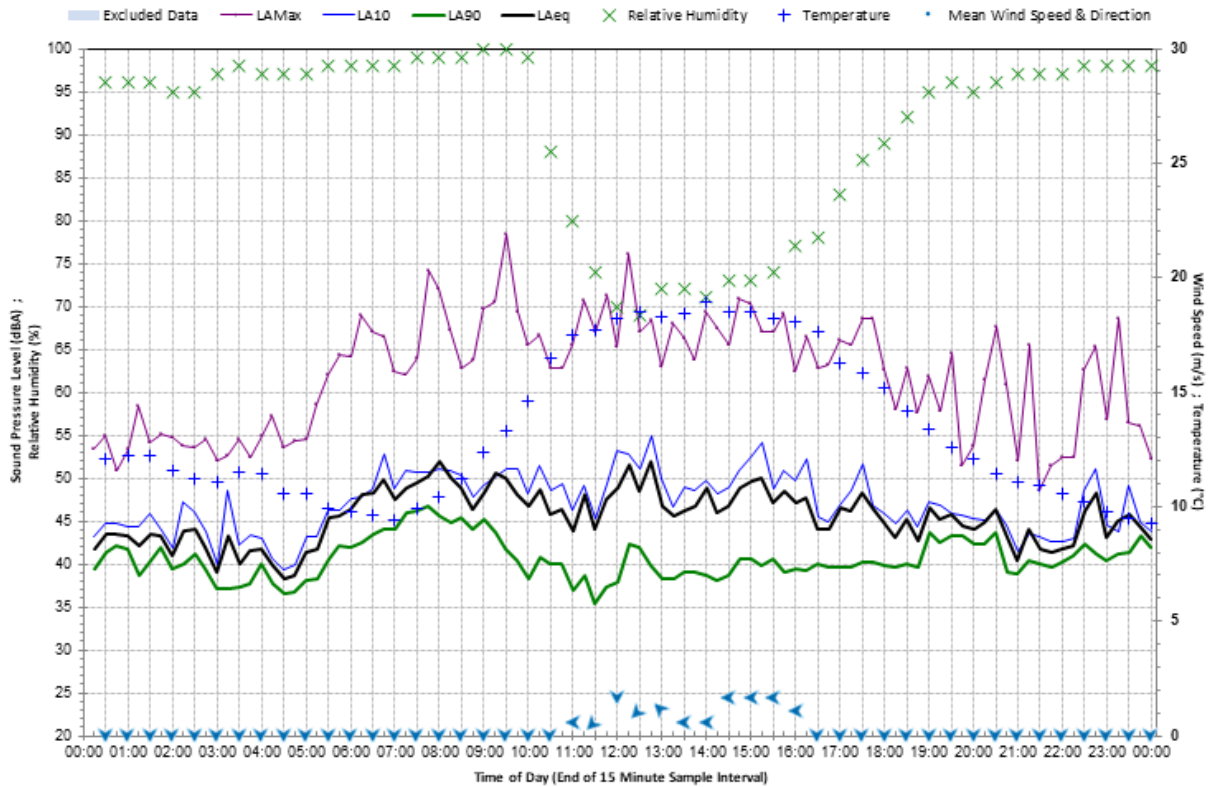
M2 - Statistical Ambient Noise Levels Sunday 4 June 2023



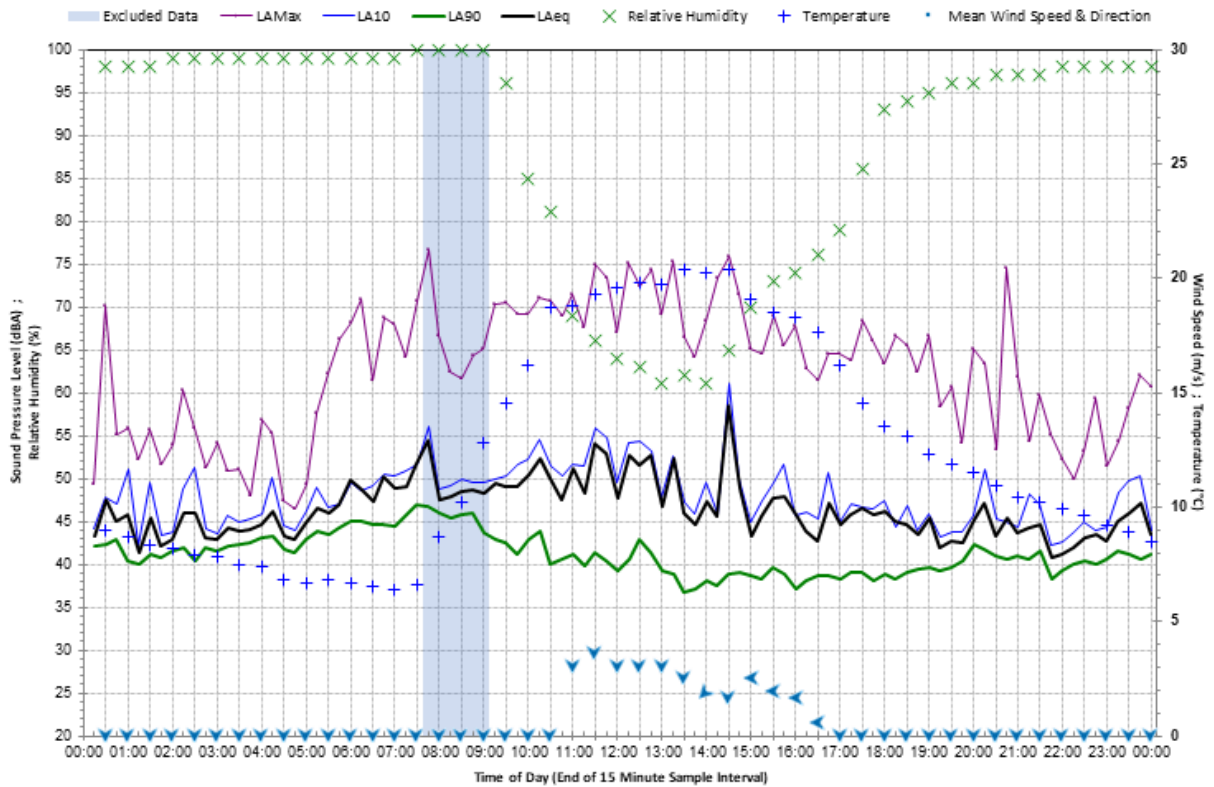
M2 - Statistical Ambient Noise Levels Monday 5 June 2023



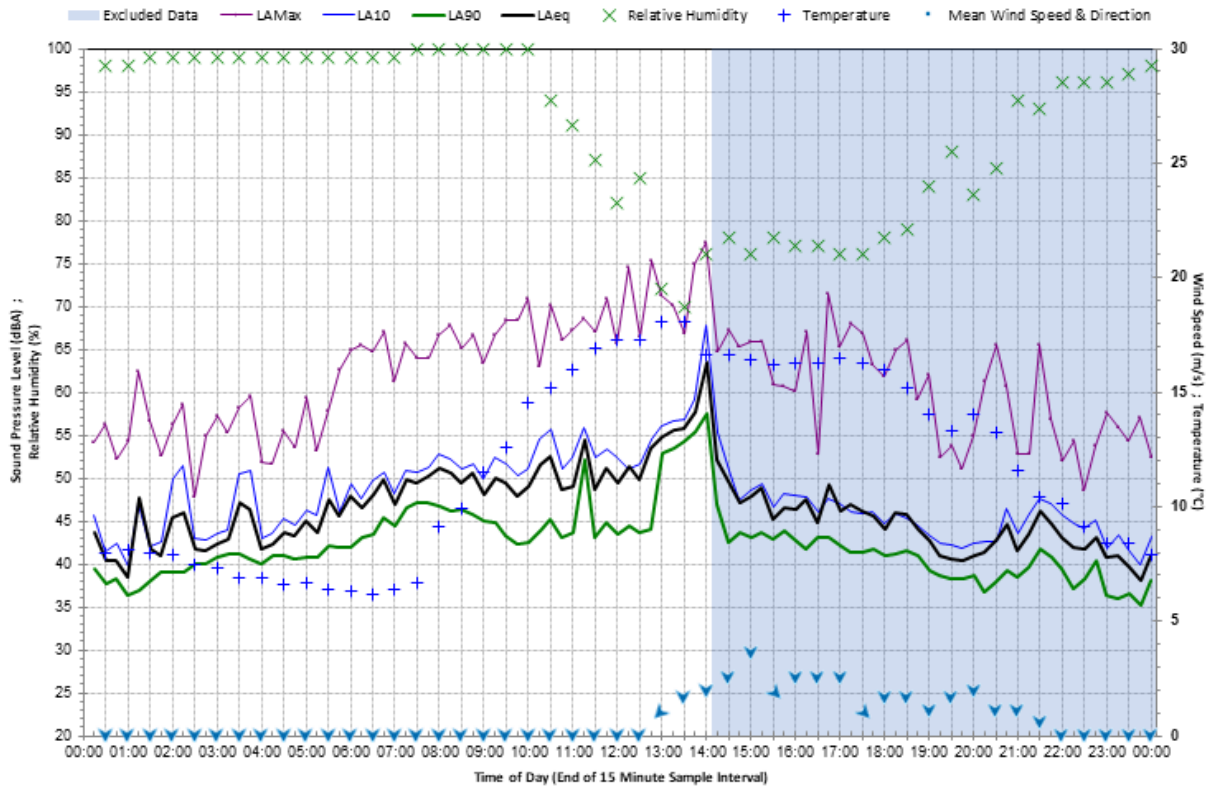
M2 - Statistical Ambient Noise Levels Tuesday 6 June 2023



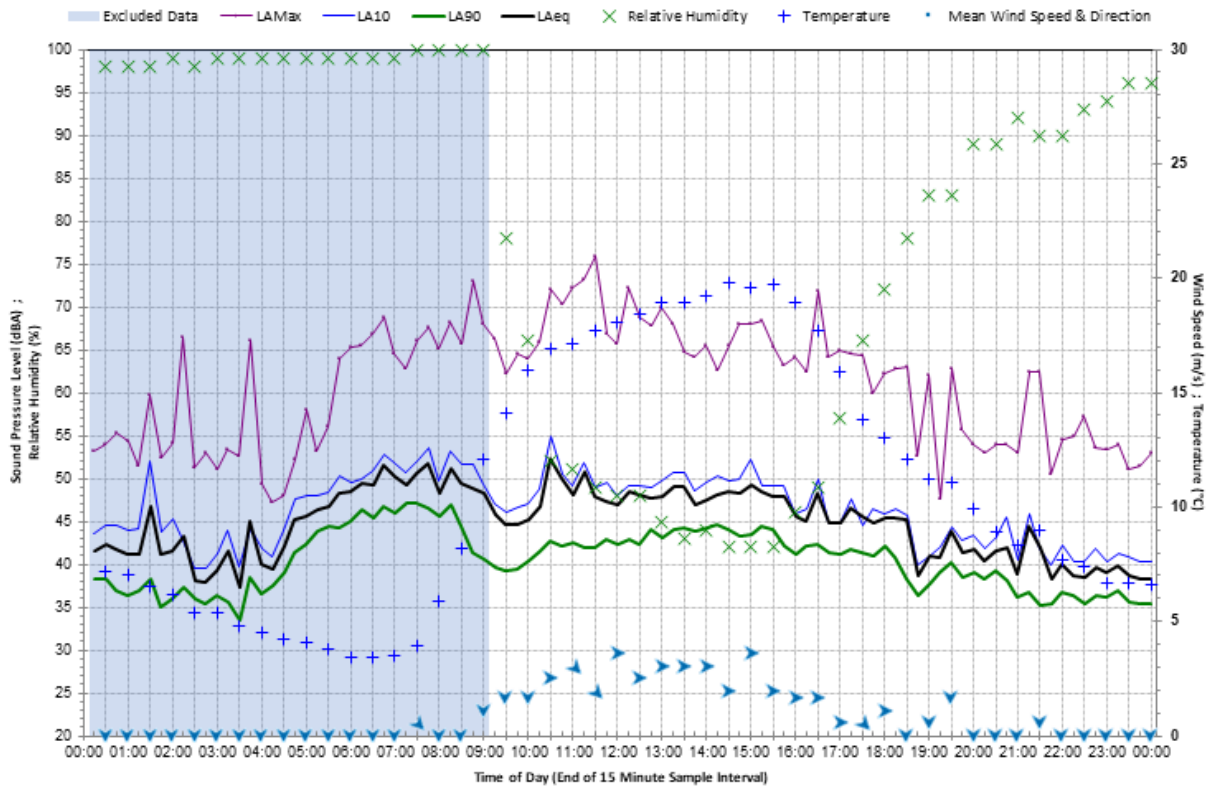
M2 - Statistical Ambient Noise Levels Wednesday 7 June 2023



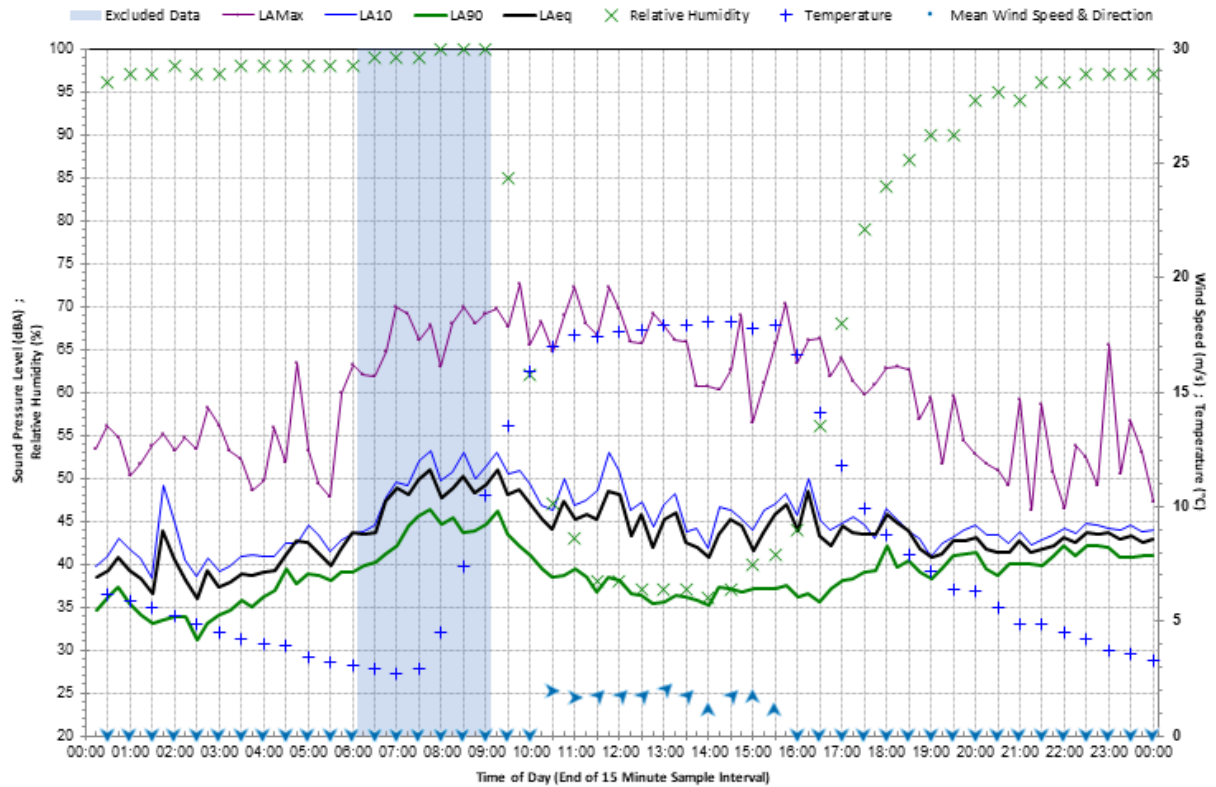
M2 - Statistical Ambient Noise Levels Thursday 8 June 2023



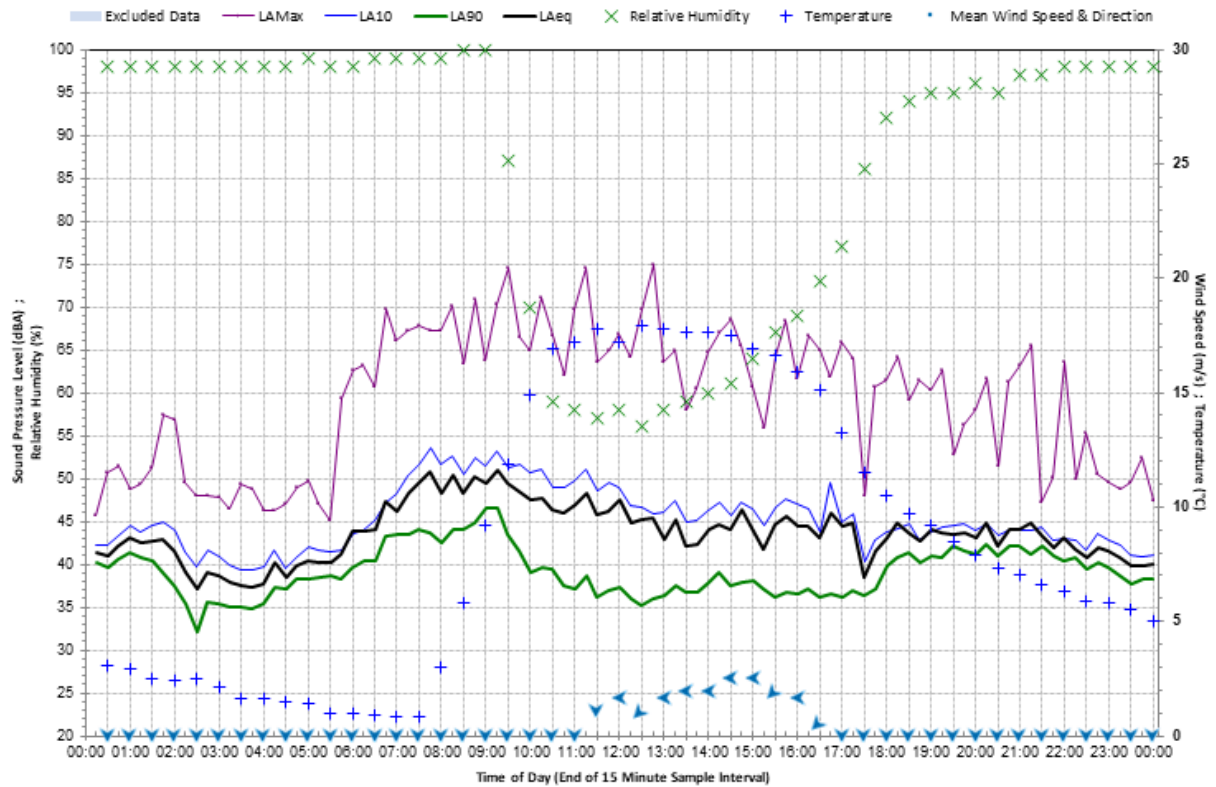
M2 - Statistical Ambient Noise Levels Friday 9 June 2023



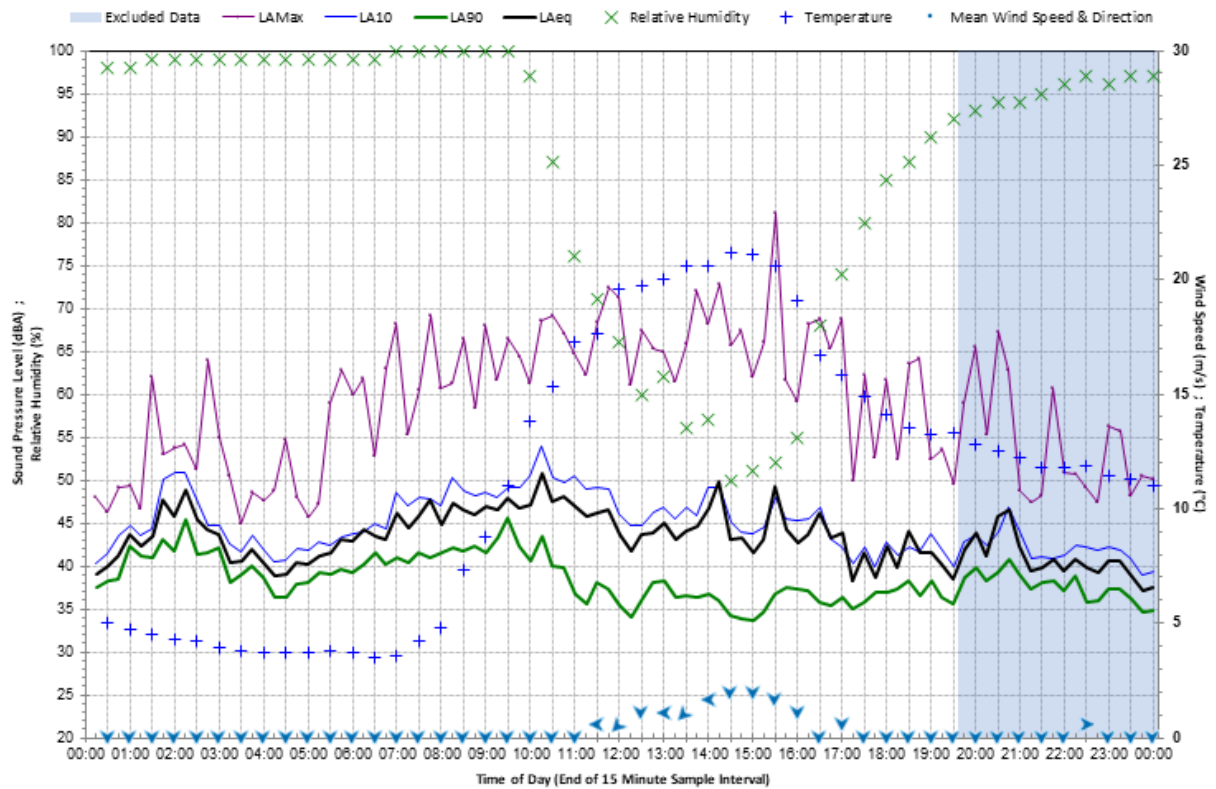
M2 - Statistical Ambient Noise Levels Saturday 10 June 2023



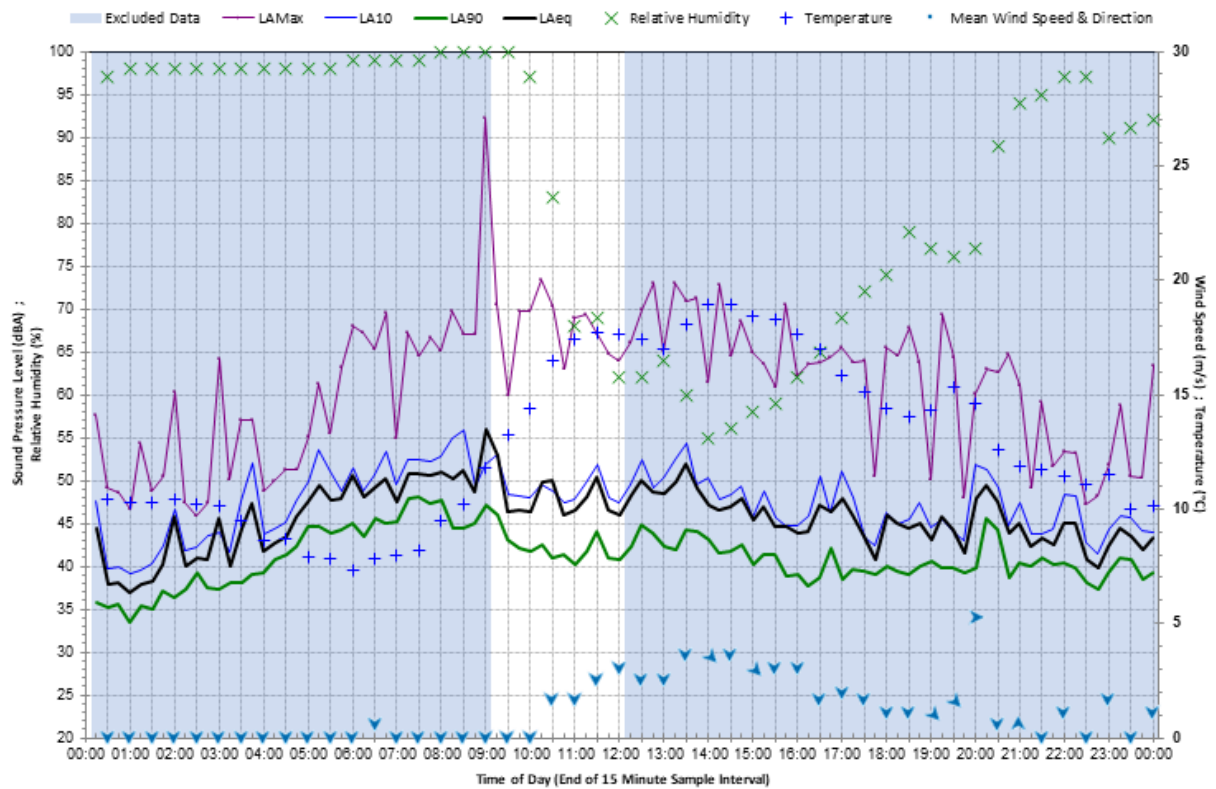
M2 - Statistical Ambient Noise Levels Sunday 11 June 2023



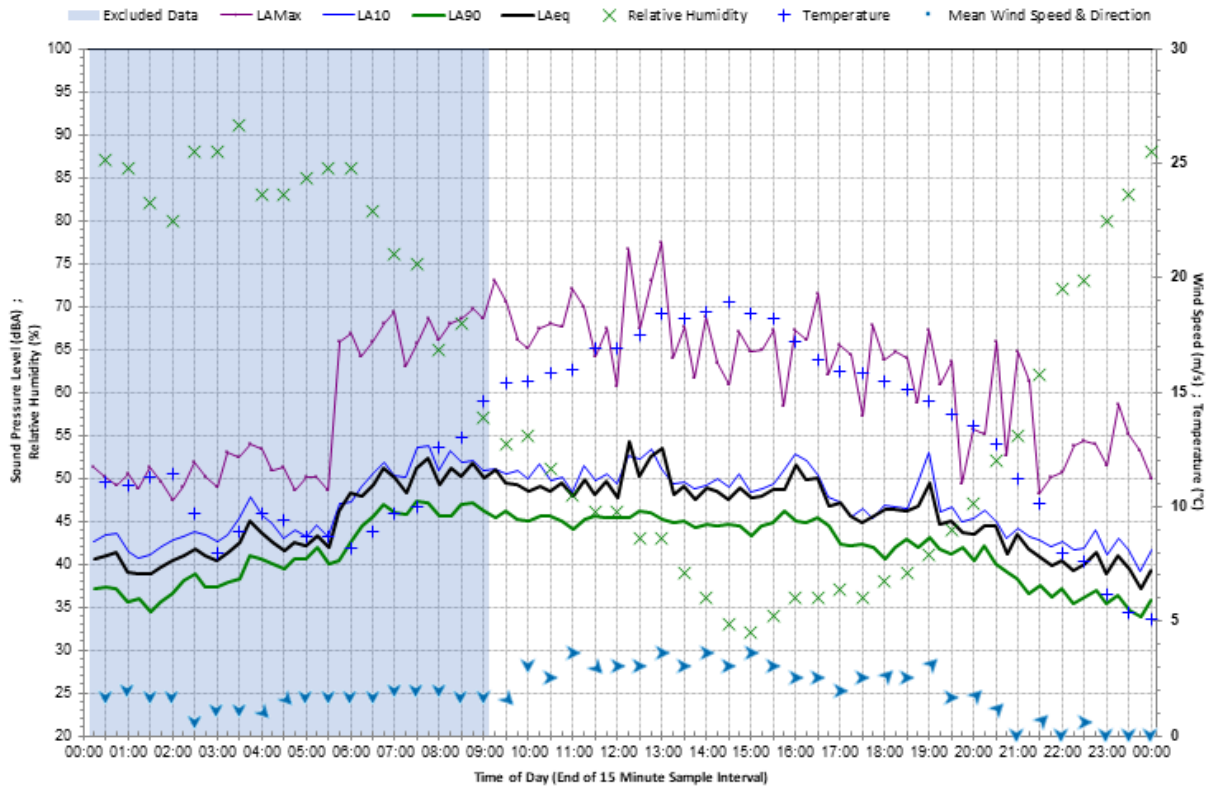
M2 - Statistical Ambient Noise Levels Monday 12 June 2023



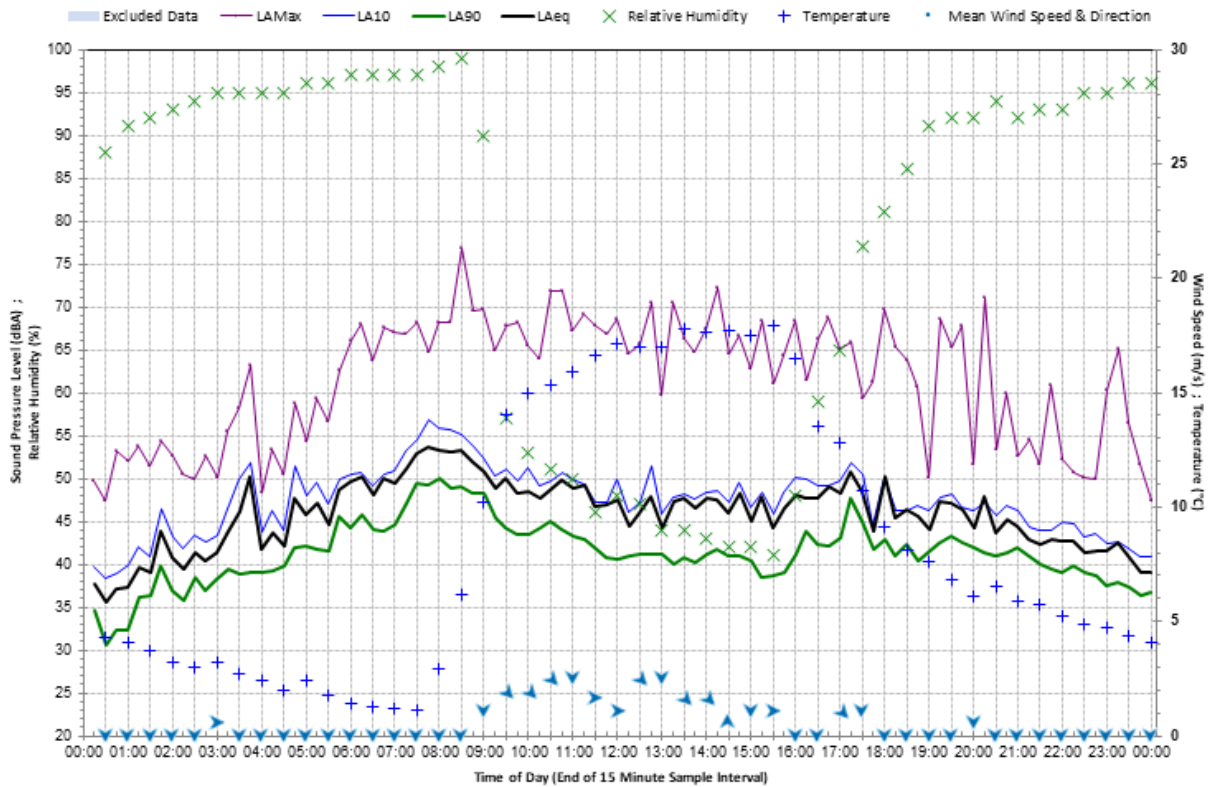
M2 - Statistical Ambient Noise Levels Tuesday 13 June 2023



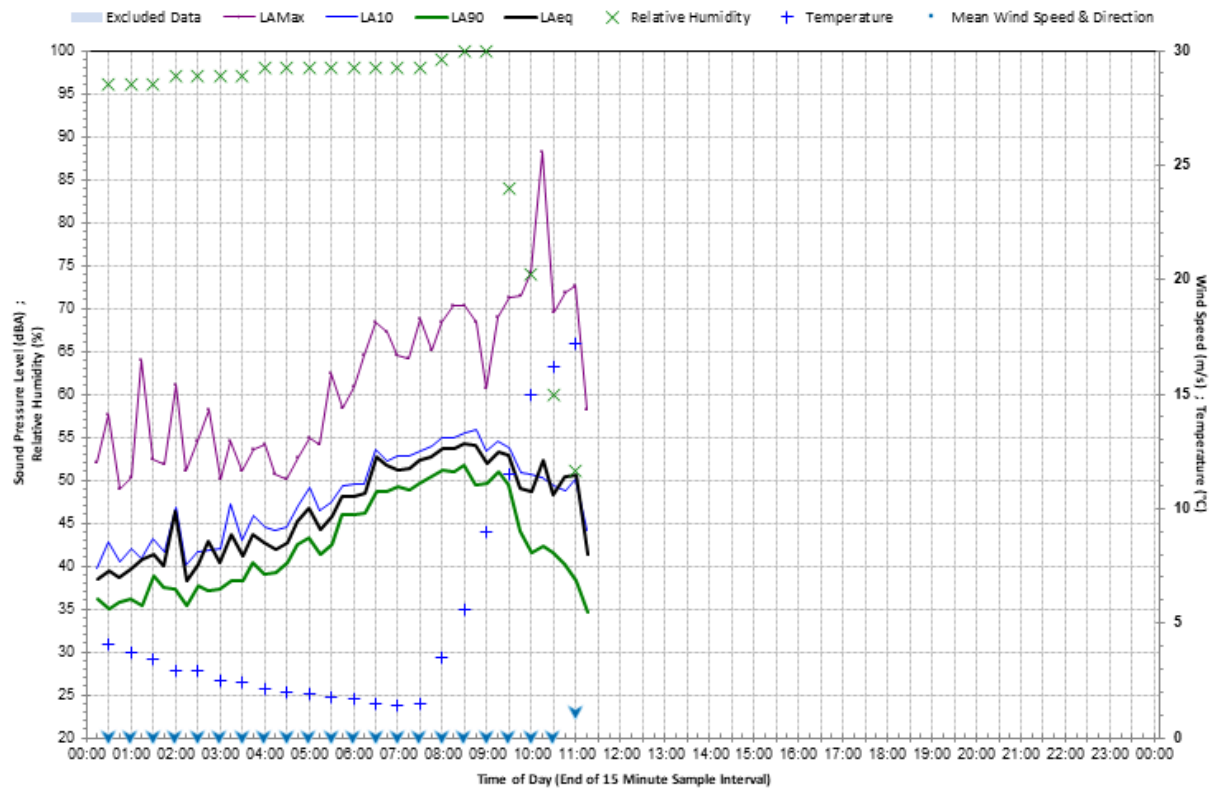
M2 - Statistical Ambient Noise Levels Wednesday 14 June 2023



M2 - Statistical Ambient Noise Levels Thursday 15 June 2023



M2 - Statistical Ambient Noise Levels Friday 16 June 2023



Appendix G

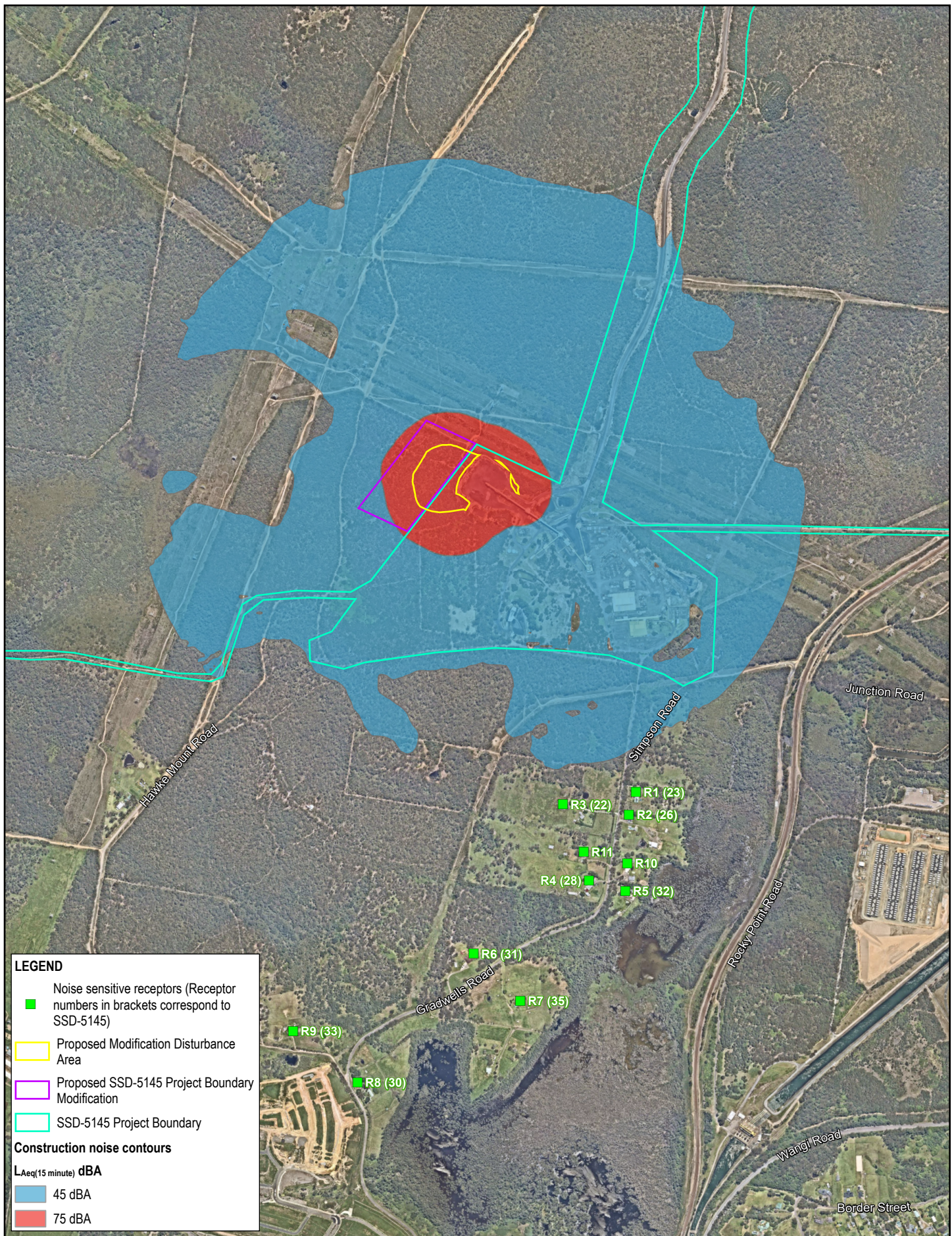
Operational activity log

Date	Feed On	Feed Off
Monday-29-May-23	Nil	Nil
Tuesday-30-May-23	Nil	Nil
Wednesday-31-May-23	17:59	18:24
	19:35	21:15
	22:28	22:38
Thursday-1-Jun-23	00:26	07:43
	2016	00:00
Friday-2-Jun-23	00:00	11:35
	12:18	17:23
	19:22	00:00
Saturday-3-Jun-23	00:00	01:00
	02:27	03:44
	11:38	13:19
	15:33	15:55
	20:44	22:20
	23:30	00:00
Sunday-4-Jun-23	00:00	00:19
	01:43	05:14
	10:17	11:36
	14:00	15:34
	18:12	19:04
	19:48	22:54
Monday-5-Jun-23	00:17	01:24
	14:28	16:12
	21:53	22:40
Tuesday-6-Jun-23	05:14	07:33
	21:53	22:40
Wednesday-7-Jun-23	06:30	08:10
	19:00	20:15
	22:33	23:30
Thursday-8-Jun-23	05:15	06:30
	16:50	17:54
	22:50	00:00
Friday-9-Jun-23	07:25	10:00
	13:45	16:06
	18:30	00:00
Saturday-10-Jun-23	05:00	06:00
	15:16	17:34
	19:30	21:00
	22:21	22:56

Date	Feed On	Feed Off
Sunday-11-Jun-23	00:13	01:00
	04:56	06:30
	06:30	07:22
	17:13	18:50
Monday-12-Jun-23	00:13	00:55
	04:56	06:30
Tuesday-13-Jun-23	Nil	Nil
Wednesday-14-Jun-23	05:13	06:30
	07:36	08:18
	16:08	18:30
	21:35	22:47
Thursday-15-Jun-23	05:17	06:08
Friday-16-Jun-23	00:00	07:00
	15:16	16:25
	22:45	23:46

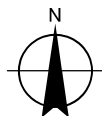
Appendix H

Construction noise contours



Paper Size ISO A4
0 80 160 240 320 400
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

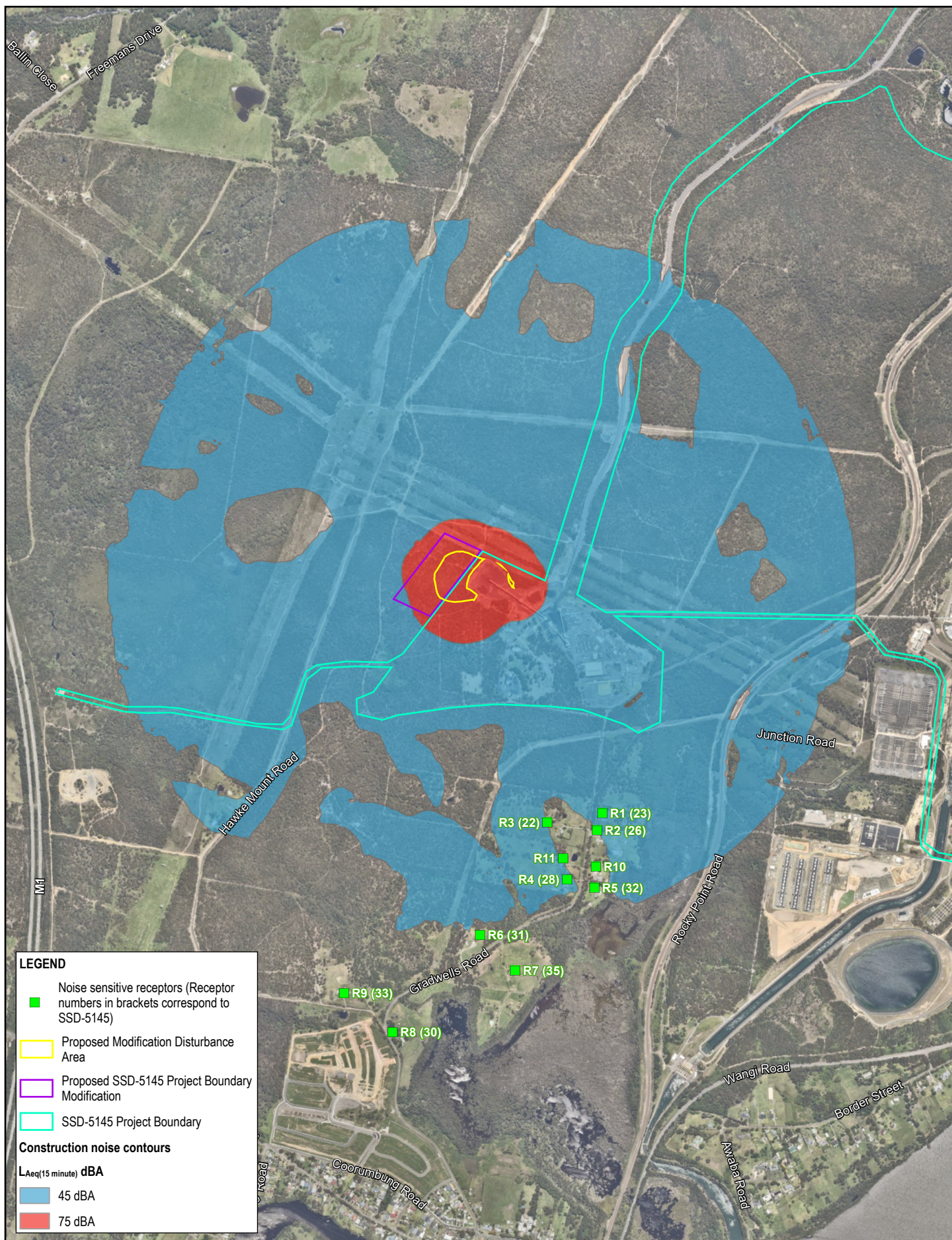


Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

Project No. 12600696
Revision No. 0
Date 18/12/2024

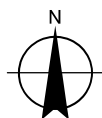
CS01 Initial site clearing –
Daytime (standard hours)

MAP 1



Paper Size ISO A4
0 110 220 330 440 550
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

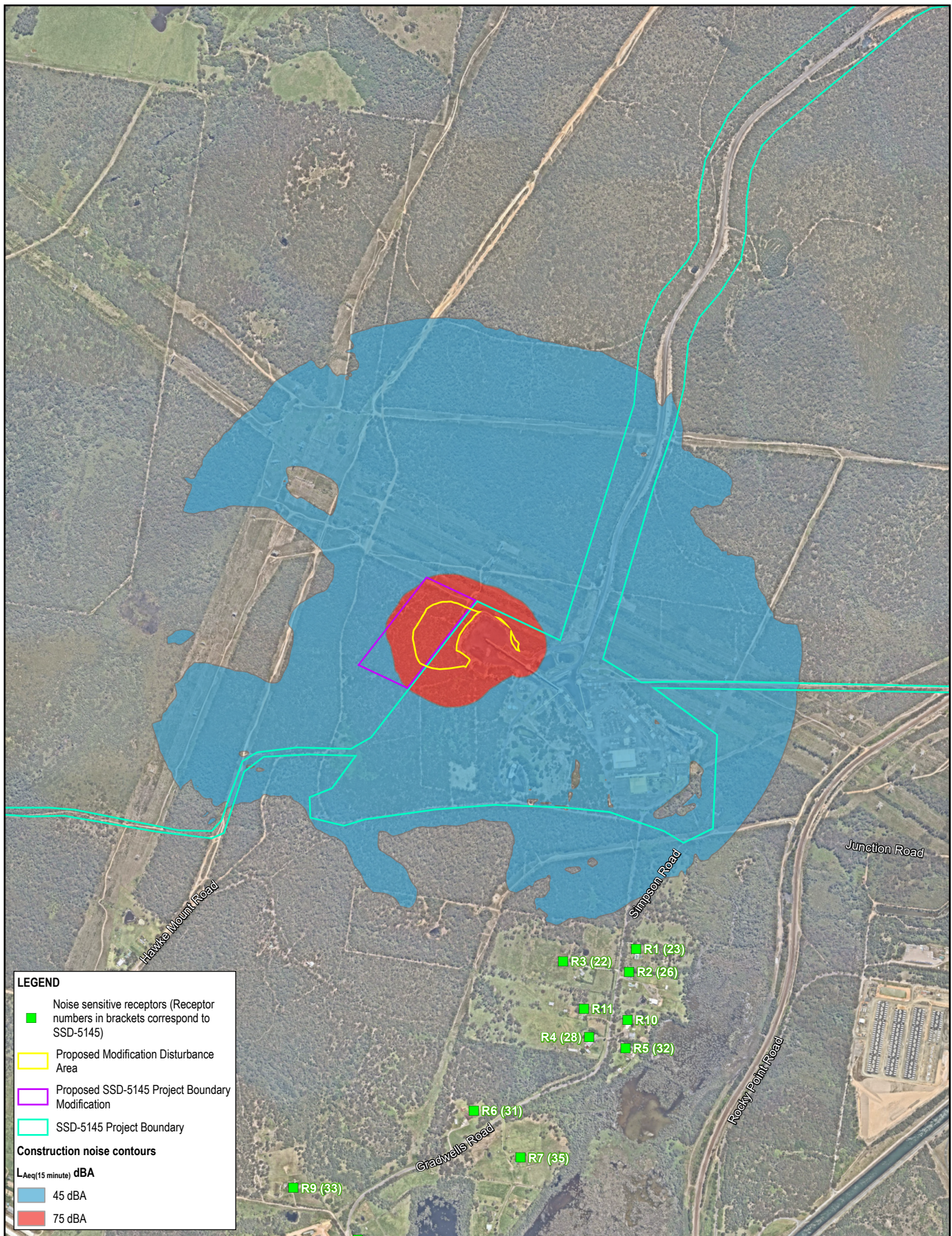


Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

Project No. 12600696
Revision No. 0
Date 18/12/2024

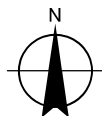
CS02 Civil works -
Daytime (standard hours)

MAP 2



Paper Size ISO A4
0 80 160 240 320 400
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

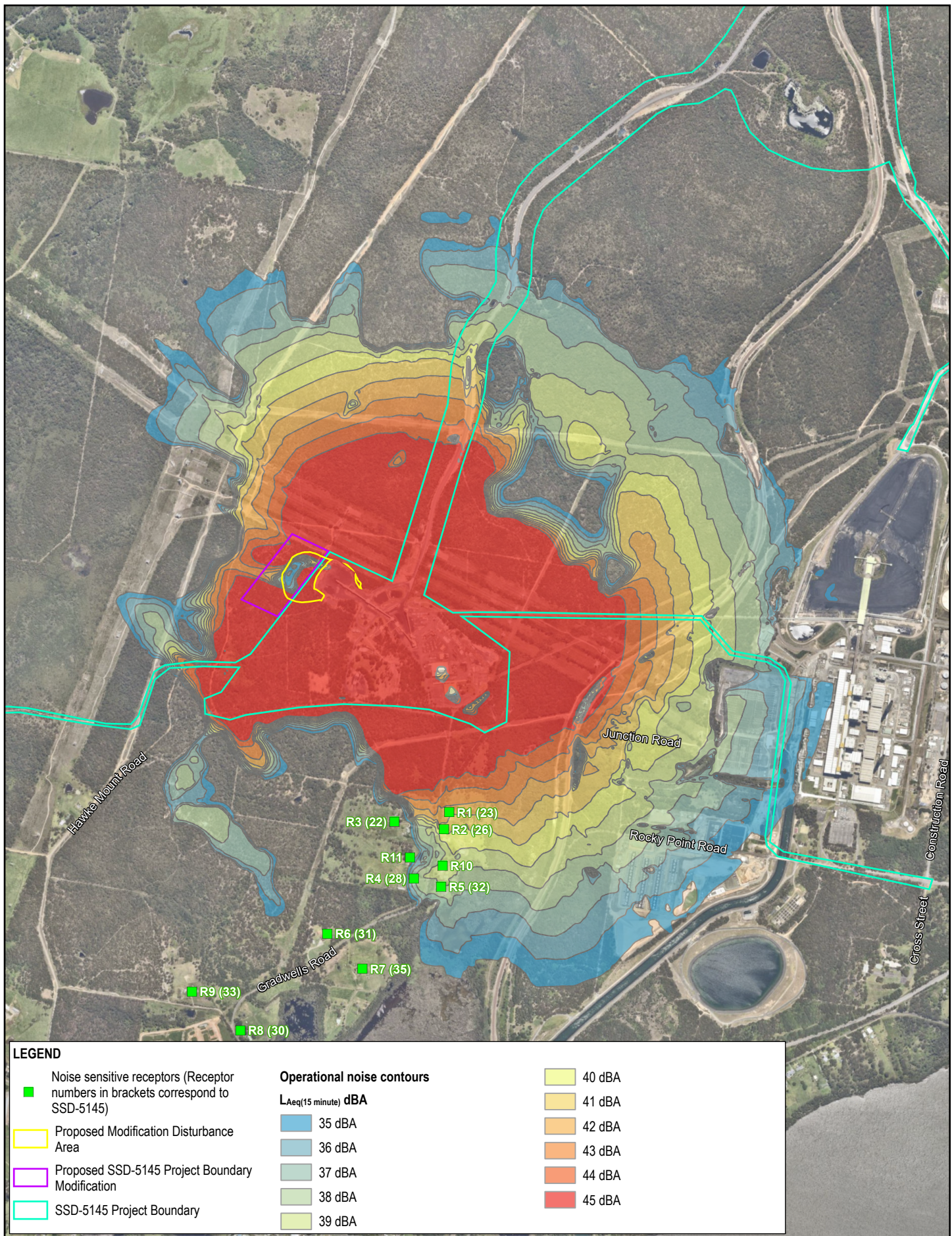
Project No. 12600696
Revision No. 0
Date 18/12/2024

CS03 Infrastructure development -
Daytime (standard hours)

MAP 3

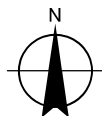
Appendix I

Operational noise contours



Paper Size ISO A4
0 110 220 330 440 550
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

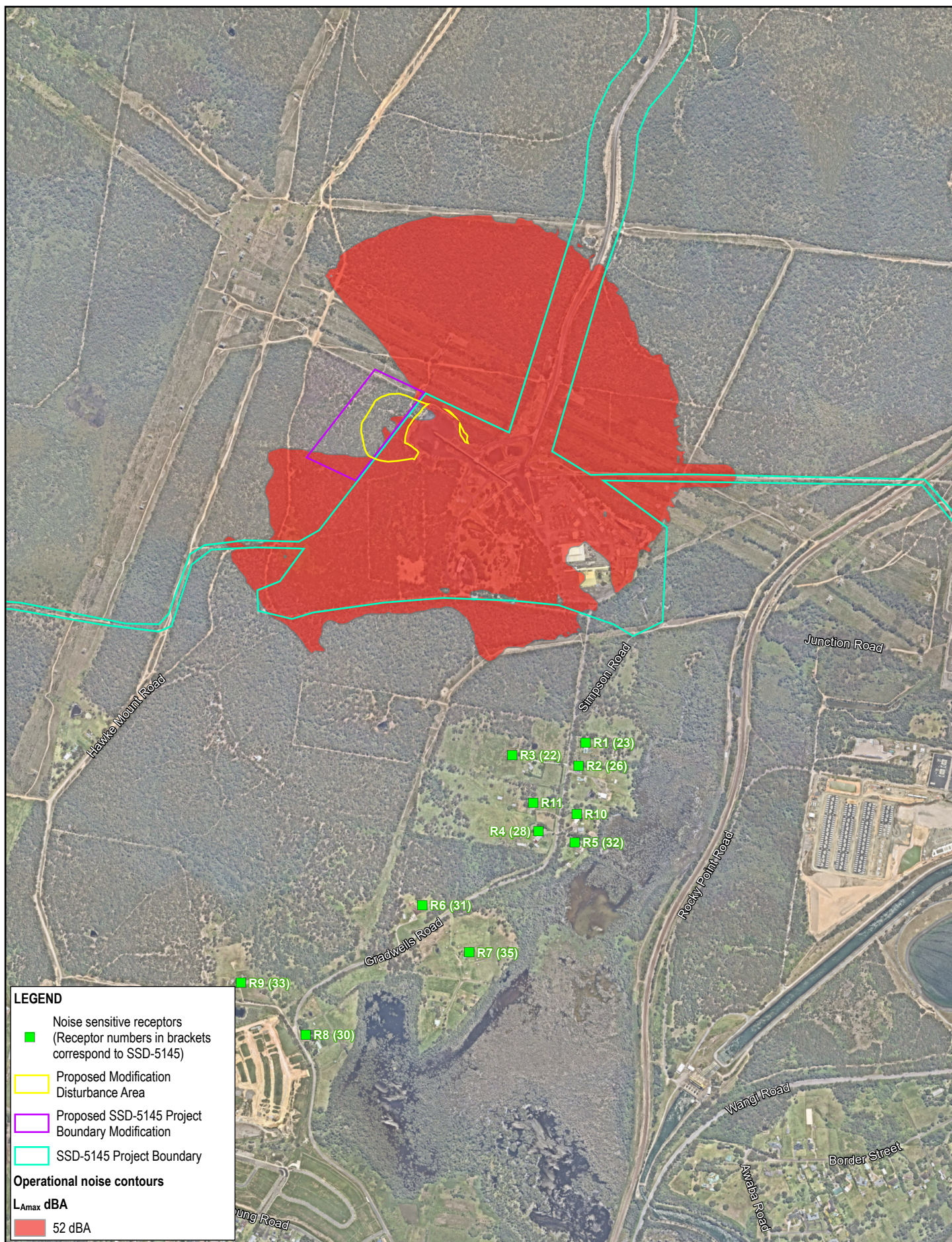


Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

Project No. 12600696
Revision No. 0
Date 18/12/2024

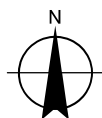
**Model 1 – Operational Night-time
(Temperature Inversion)**

MAP 1



Paper Size ISO A4
0 80 160 240 320 400
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Centennial Coal Pty Limited
Cooranbong Entry Site - Stockpile Extension Project
Noise Impact Assessment

Project No. 12600696
Revision No. 0
Date 18/12/2024

Model 1 – Sleep disturbance Night-time
(Temperature Inversion)

MAP 3



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