South Cell at Woy Woy Waste Management Facility

Technical Report 5 – Noise and Vibration Impact Assessment

Central Coast Council

06 December 2023

→ The Power of Commitment

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S4	0	Chris Gordon	Marco Velasco		David Gamble		06/12/23

GHD Pty Ltd | ABN 39 008 488 373

GHD Tower, Level 3, 24 Honeysuckle Drive

Newcastle, New South Wales 2300, Australia

T +61 2 4979 9999 | **F** +61 2 4979 9988 | **E** ntlmail@ghd.com | **ghd.com**

Executive summary

The project

Central Coast Council (Council) is proposing to develop a new 'South Cell' at the existing Woy Woy Waste Management Facility (WMF) ('the project'). The project would optimise the remaining landfill air space at the WMF and ensure that the WMF remains open for as long as possible to accept putrescible waste from the Local Government Area (LGA). The construction of the proposed new South Cell is required to be completed and able receive waste when the current tipping area reaches capacity in mid to late 2024.

The project is deemed regionally significant development and is subject to approval by the Hunter and Central Coast Regional Planning Panel under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report

This Noise and Vibration Impact Assessment report has been prepared on behalf of Council to support the environmental impact statement (EIS) for the project and responds to the Secretary's Environmental Assessment Requirements (SEARs) dated 24 August 2023.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.6 and the assumptions and qualifications contained throughout the report.

Background monitoring

Sensitive receivers and land uses potentially affected from noise and vibration impacts associated with the project were identified. Noise monitoring was undertaken at two representative receptor locations to the project site to determine existing background noise levels. Noise and vibration criteria were established for the surrounding sensitive receivers and land uses.

Impacts from the project during construction

An assessment of potential noise impacts during the construction phase has been undertaken against the Interim Construction Noise Guideline during standards hours. Predicted noise levels during all stages are predicted to result in noise levels below the Noise Management Level (NML) at all receivers. In addition:

– No sensitive receivers have been identified within the safe working distances for vibratory intensive work. As such, no adverse (structural damage or human comfort) vibration impacts are anticipated.
– Mitigation measures to reduce the risk of the noise impacts during these works have been recommended in Chapter 7 and should be incorporated into the Contractor's Construction Environmental Management Plan (CEMP).

Due to the separation distance between the project site and the nearest sensitive receivers, vibration impacts form the construction and operation of the project site are not anticipated.

Based on the predicted numbers of additional vehicles for the construction of the project site, traffic noise impacts are anticipated to remain within 2 dB of current levels, and therefore additional mitigation measures are not required.

Impacts from the project during operation

Noise modelling was undertaken using CadnaA (v 2023) to predict operational noise levels at sensitive receivers and assessed against the NPI project noise trigger levels during the day period based on typical worst-case operating conditions. All assessed receivers are predicted to receive noise levels below the project noise trigger levels established.

Based on the predicted numbers of additional vehicles for the operation of the project site, traffic noise impacts are anticipated to remain within 2 dB of current levels, and therefore additional mitigation measures are not required.

Mitigation and management measures

Although noise impacts from the construction and operation of the project site achieve the relevant noise goals, mitigation and management measures have been provided which are best practice and should be implemented to minimise potential noise and vibration impacts where reasonable and feasible.

Abbreviations and acronyms

Abbreviation	Definition
AGL	Above ground level
AS	Australian Standards
AWS	Automatic weather station
BS	British Standards
°C	Degrees Celsius
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline (TfNSW, 2016)
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the 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 low and high frequencies.
DCNG	Draft Construction Noise Guideline (EPA, 2021)
DEC	Department of Environment and Conservation NSW
DECC	Department of Environment and Climate Change NSW
DECCW	Department of Environment and Climate Change and Water NSW
DIN	German Institute for Standardisation (Deutsches Institut für Normung)
DP	Deposited Plan
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EPA	Environment Protection Authority NSW
GHD	GHD Pty Ltd
ICNG	Interim Construction Noise Guideline (DECC, 2009)
ISO	International Organization for Standardisation (Organisation internationale de normalisation)
km	Kilometre
$L_{A1(1min)}$	The noise level exceeded for 1 per cent of the time over a 1 minute period, used to denote maximum noise levels
m	Metre
m/s	Metres per second
NCA	Noise Catchment Area
NML	Noise Management Level
NPI	Noise Policy for Industry (EPA, 2017)
NSW	New South Wales
RBL	Rating Background Noise Level
RNP	Road Noise Policy (DECCW, 2011)
RSD	Regionally significant development
SEARs	Secretary's Environmental Assessment Requirements
SPL	Sound Pressure Level
SSD	State Significant Development

Abbreviation	Definition
SWL	Sound Power Level
µPa	Micropascals
VDV	Vibration Dose Value

Glossary of Terms

Term	Definition
A-weighting	The human ear responds more to frequencies between 500 Hz and 8 kHz and is less sensitive to very low-pitch or high-pitch noises. The frequency weightings used in sound level measurements are often related to the response of the human ear to ensure that the meter better responds to what you actually hear.
Noise-enhancing weather conditions	Weather effects that enhance noise (i.e. wind and temperature inversions) that occur at a site for a significant period of time (i.e. light winds, up to and including 3 m/s, occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. This is described using the Leq descriptor.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L90 descriptor.
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Construction footprint	Defined as the area that would be directly affected by construction of the project. It includes: – The location of project infrastructure and immediate surrounds – The area that would be directly disturbed by the movement of construction plant and machinery, and the location of the temporary, construction compounds and laydown areas that would be used during construction
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build. Reasonableness relates to the application of judgement in arriving at a decision, considering the following factors: – Noise mitigation benefits (amount of noise reduction provided, number of people protected) – Cost of mitigation (cost of mitigation versus benefit provided) – Community views (aesthetic impacts and community wishes) – Noise levels for affected land uses (existing and future levels, and changes in noise levels)
Ground-borne vibration	Vibration transmitted from a source to a receptor via the ground.
Hertz	The measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz.
Maximum noise event	The loudest event or events within a given period of time. This is generally described using the L_{max} descriptor.
Meteorological conditions	Wind and temperature inversion conditions.
Most-affected location	Location(s) that experience (or would likely experience) the greatest noise impact from the construction works and operations under consideration. In determining these locations, existing background noise levels, noise source location(s), distance and any shielding between the construction works (or proposed works) and the residences and other sensitive land uses need to be considered.

Term	Definition
Noise management level	The NML as defined by the ICNG. To be measured and assessed at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the residential property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most affected point within 30 m of the residence.
Noise sensitive land use	Land uses that are sensitive to noise, such as residential areas.
Non-compliance	Development is in non-compliance with its noise consent/ licence conditions if the monitored noise levels exceed its statutory noise limit (exceptions may be given if the noise level exceeds by less than 2 dB).
Octave	A division of the frequency range into bands, the upper frequency limit.
One third-octave	Single octave bands divided into three parts.
Project noise trigger level	Target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive criteria or amenity criteria. Which of the two criteria is the most stringent is determined by measuring the level and nature of existing noise in the area surrounding the actual or proposed noise generating facility.
Proponent	Central Coast Council
Project site	Lot 110 DP 755251, Nagari Road, Woy Woy, NSW
Rating Background Level	The RBL is defined by the Noise Policy for Industry (NPI) as the overall, single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). This is the level used for assessment purposes.
Resonance	Resonance describes the phenomenon of increased amplitude that occurs when the frequency of a periodically applied force is equal or close to a natural frequency of the system on which it acts.
Study area	Land in the vicinity of, and including, the project site. The ‘study area’ is the wider area surrounding the project site.
Temperature inversion	An atmospheric condition in which temperature increases with height above the ground.
Z-Weighting (or Linear-weighted)	Zero-weighting or Linear-weighting indicates no weighting filter has been applied and refers to a flat frequency response for sound level meters.

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1. Introduction

1.1 Overview

Central Coast Council (Council) owns and operates the existing Woy Woy Waste Management Facility (WMF) located on Nagari Road, Woy Woy. The WMF is the primary waste disposal facility for the southern Central Coast community and has operated since 1974. The WMF operates in accordance with Environment Protection Licence (EPL) No. 6053. The EPL permits resource recovery, waste disposal (application to land) and waste storage and authorises landfilling of up to 100,000 tonnes per year of putrescible and non-putrescible general solid waste, tyres and asbestos.

Key components of the existing WMF include:

– Weighbridge and office/education centre
– Current active landfill cell and tipping area
– Transfer station
– Garden organics (GO) facility
– Excavation and stockpiling area
– Stormwater and leachate management infrastructure

In 2020 Council commissioned the 'Woy Woy Waste Management Facility – Development Strategy' (SMEC, 2020) (the 'Development Strategy') to guide the future use and development of the facility. The Development Strategy identified the existing excavation and stockpile area at the southern end of the WMF as the location for the next waste cell (known as the new 'South Cell').

Council is now proposing to develop the new South Cell to optimise the remaining landfill air space at the WMF and ensure that the WMF remains open for as long as possible to accept putrescible waste from the Local Government Area (LGA).

The construction of the proposed new South Cell is required to be completed and able to receive waste when the current tipping area reaches capacity in mid to late 2024. Construction would commence following receipt of planning approval and be completed in two stages. Each stage is expected to take four to six months.

The project is deemed regionally significant development (RSD) and is subject to approval by the Hunter and Central Coast Regional Planning Panel under the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

This report has been prepared by GHD Pty Ltd (GHD) as part of the environmental impact statement (EIS) for the project. The EIS has been prepared to support the application for approval of the project and address the environmental assessment requirements of the Secretary of the NSW Department of Planning and Environment (the SEARs) dated 24 August 2023.

1.2 The project

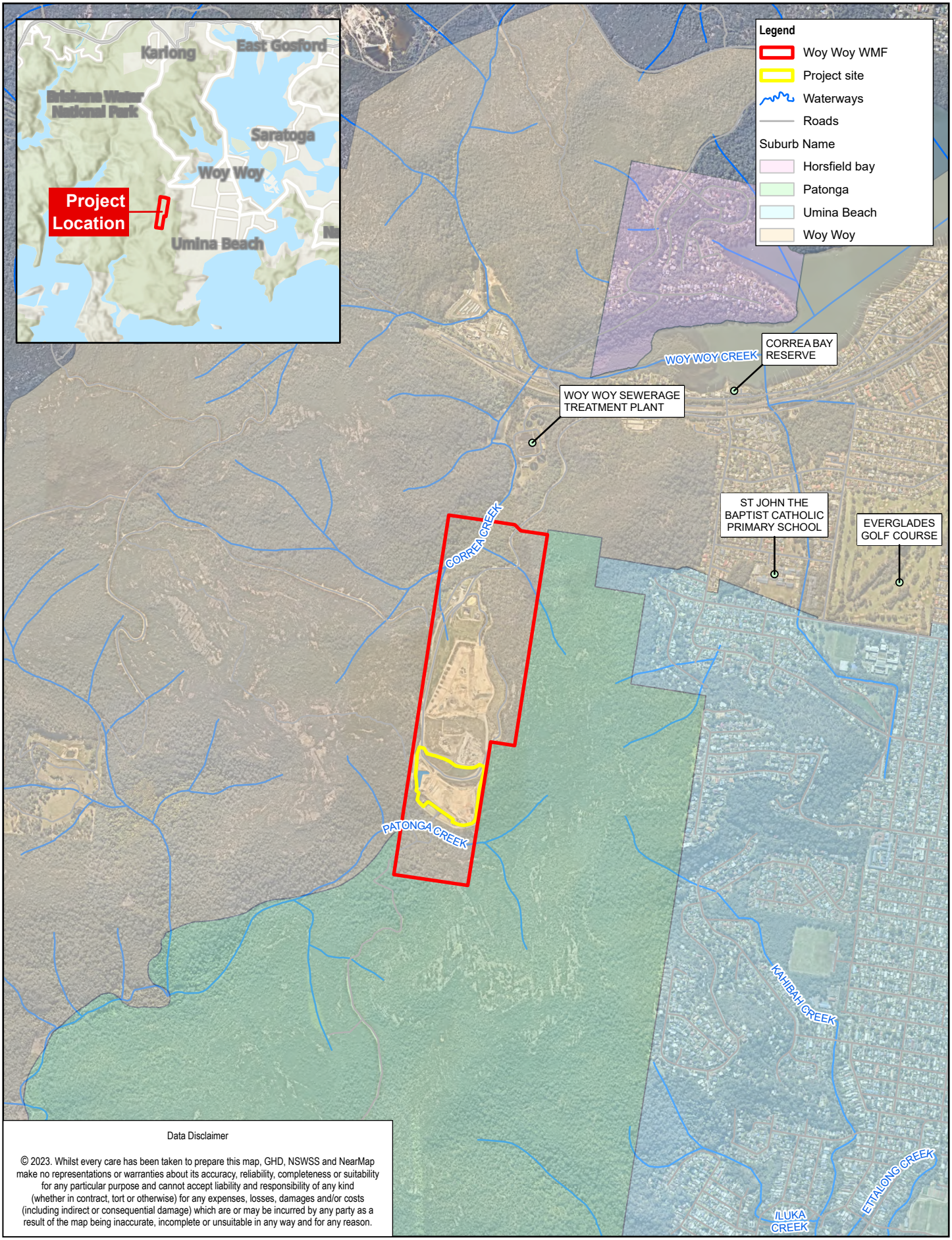
1.2.1 Location

The project would be located within the existing Woy Woy WMF. The WMF is about 10 kilometres south of Gosford across Brisbane Water, within the Central Coast LGA.

The WMF consists of:

– Lot 110 DP 755251
– Lot 1 DP 126813
– Lot 1 DP 654885

The project site is about five hectares in area and located on the southern portion of the WMF. It comprises part of Lot 110 DP 755251.



Data Disclaimer

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Metres

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Grid: GDA 1994 MGA Zone 56

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Revision No. **0**
Date **4/09/2023**

Site location

FIGURE 1.1

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Data source: GHD: Site Boundary (2023), Survey Data (2023). World Topographic Map: Esri, HERE, Garmin, Foursquare, METI/NASA, USGS
World Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS
Nearmap WMS Server: . Created by: dbbanatin

1.2.2 Key features

Key features of the project include:

– Cell construction including excavation and earthworks to form the base of the cell and lining installation
– Development of associated access, stormwater and leachate management infrastructure
– Continuation of current landfilling operations in the new cell location
– Capping, closure and rehabilitation

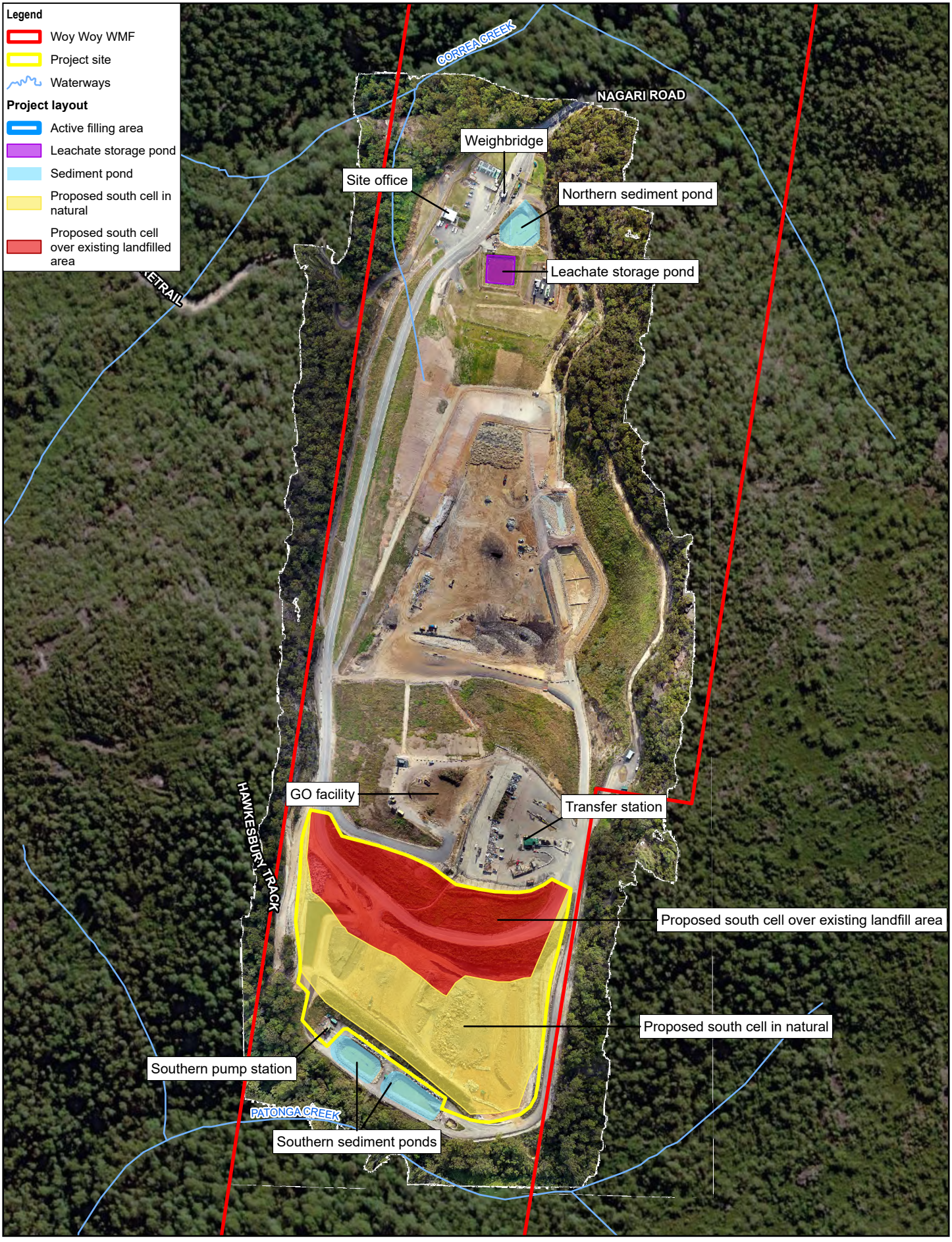
The project is expected to provide up to approximately an additional 920,000 cubic metres of airspace or 7.7 years of filling capacity (based on current filling rates). It is also expected to generate additional cell construction and cover materials for the ongoing landfilling operations.

No change is proposed to the existing approved annual disposal capacity or waste types as per EPL 6053.

The other existing operations (weighbridge and office/education centre, transfer station, GO facility etc) at the WMF would continue to be operated in conjunction with the project.

Further information on the project is provided in the EIS.

The project site layout is shown in Figure 1.2.



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

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Project layout

Project No. **12595244**
Revision No. **0**
Date **11/10/2023**

FIGURE 1.2

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Data source: LPI: DCDB / DTDB, 2023; Aerial Imagery: World Imagery: Maxar. Created by: dbbanatin

1.2.3 Construction overview

Construction of the project would be subject to the methods proposed by the construction contractor, but is expected to involve the following:

– Site establishment: establishment of site environmental controls including sediment and erosion controls
– Earthworks: excavation and grading along the base of the landfill cell in accordance with the requirements of the *Environmental Guidelines: Solid waste landfills* (NSW EPA, 2016)
– Lining and gravel placement: installation of basal, batter and sidewall liners systems
– Development of ancillary infrastructure including access roads, leachate and water management infrastructure

Construction is expected to take about three months to complete.

– The construction activities would be carried out during the following hours, consistent with the recommended standard hours of the *Interim Construction Noise Guideline* (NSW EPA, 2009)
– 7 am to 6 pm Monday to Friday
– 8 am to 1 pm Saturdays
– No work on Sundays or Public Holidays

The construction workforce is expected to range between five and ten workers per day.

Further information on the construction of the project is provided in the EIS.

1.3 Secretary's Environmental Assessment Requirements

The specific SEARs addressed in this report are summarised in Table 1.1.

Table 1.1 SEARs relevant to this assessment

Requirement	Where addressed in this report
A description of all potential noise and vibration sources during construction and operation, including road traffic noise	Chapter 6
A noise and vibration assessment in accordance with the relevant Environment Protection Authority guidelines	Chapter 6
A description and appraisal of noise and vibration mitigation and monitoring measures.	Chapter 7

1.4 Purpose of this report

A noise and vibration impact assessment has been undertaken to assess the potential impact of noise and vibration on the identified nearby sensitive receivers during both construction and operation of the Woy Woy Waste Management Facility expansion project. The report:

– Addresses the SEARs listed in Table 1.1
– Assesses the noise and vibration impacts from construction and operation of the project
– Recommends measures to mitigate and manage the potential impacts identified

The specific SEARs addressed in this report are summarised in Table 1.1.

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

– Conduct a review of the following documentation, to ensure requirements of the development are in line with the relevant regulations:
    - Proposed architectural design documentation.

- Council's Local Environment Plan and Development Control Plan
- Environment Protection Authority's *Noise Policy for Industry* (2017)
- Department of Environment, Climate Change and Water's *Road Noise Policy* (2011)

– Desktop review to identify potential external noise sources and sensitive receivers surrounding the project site, from aerial photography.
– Determine the Rating Background Level (RBL) and Project Noise Trigger Levels (PNTLs) at the nearest noise sensitive receivers with consideration to relevant legislation and guidelines.
– Determine noise emissions sound power levels for various external noise sources. Sound power levels of all acoustically significant existing plant and equipment were obtained from the manufacturer data. Where information could not be obtained, GHD made conservative assumptions using past project experience and the GHD noise source database.
– Develop a noise model utilising the ISO 9613 prediction methodology within CadnaA modelling software.
– Provide design recommendations to achieve Project Noise Trigger Levels (PNTLs).

1.5 Assumptions

The following assumptions were made during the preparation of this report:

– This report is an assessment of noise from the proposed private heavy vehicle access road construction and operation only and does not include cumulative impacts from other sources that may be in the area of works.
– The report has only assessed noise emissions from the proposed south cell that would connect to the existing Nagari road. Noise emissions from any potential Nagari Road intersection has not been assessed as part of this report.
– Equipment was modelled to be operating continuously for a 15-minute assessment window representing the typical worst-case construction activity for noise throughout the daytime periods in accordance with assumed scenarios.
– Baseline noise monitoring was undertaken at two locations in the area. Background noise at this location is considered representative for the nearby sensitive receivers.
– Construction equipment Sound Power Levels (Lw) and spectral characteristics have been adopted from available GHD databases, Environmental noise management manual (ENMM), British standards 5228-2009 and references.
– Additional assumptions have been used in the assessment are documented in the relevant sections.

1.6 Limitations

This report: has been prepared by GHD for Central Coast Council and may only be used and relied on by Central Coast Council for the purpose agreed between GHD and Central Coast Council as set out in this report.

GHD otherwise disclaims responsibility to any person other than Central Coast Council 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. 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, Woy Woy Waste Management Facility to support assessment of operational 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 would 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 Woy Woy Waste Management Facility, (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 Central Coast Council 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. Legislative and policy context

The assessment was undertaken in accordance with the SEARs and with reference to the requirements of relevant legislation, policies and/or assessment guidelines, including:

- **Interim Construction Noise Guideline** (ICNG) (DECC, 2009): Used for the assessment of noise associated with construction phases of the project
- **NSW Road Noise Policy** (RNP) (DECCW, 2011): Used for the assessment of traffic generation from the project.
- **Noise Policy for Industry** (NPI) (EPA, 2017): Used for the assessment of operational noise impacts.
- **Assessing Vibration: A Technical Guideline** (DEC, 2006): Used for the assessment of project ground vibration impacts.
- **DIN 4150-3 Structural Vibration – effects of vibration on structures** (German Standards, 2016): Used for the determination of suitable vibration intensity thresholds for structures.

3. Sensitive receivers

Noise sensitive receivers are defined in the *Noise Policy for Industry* (NPI) based on the type of occupancy and activities performed in the surrounding land uses. Sensitive noise and vibration receivers could include:

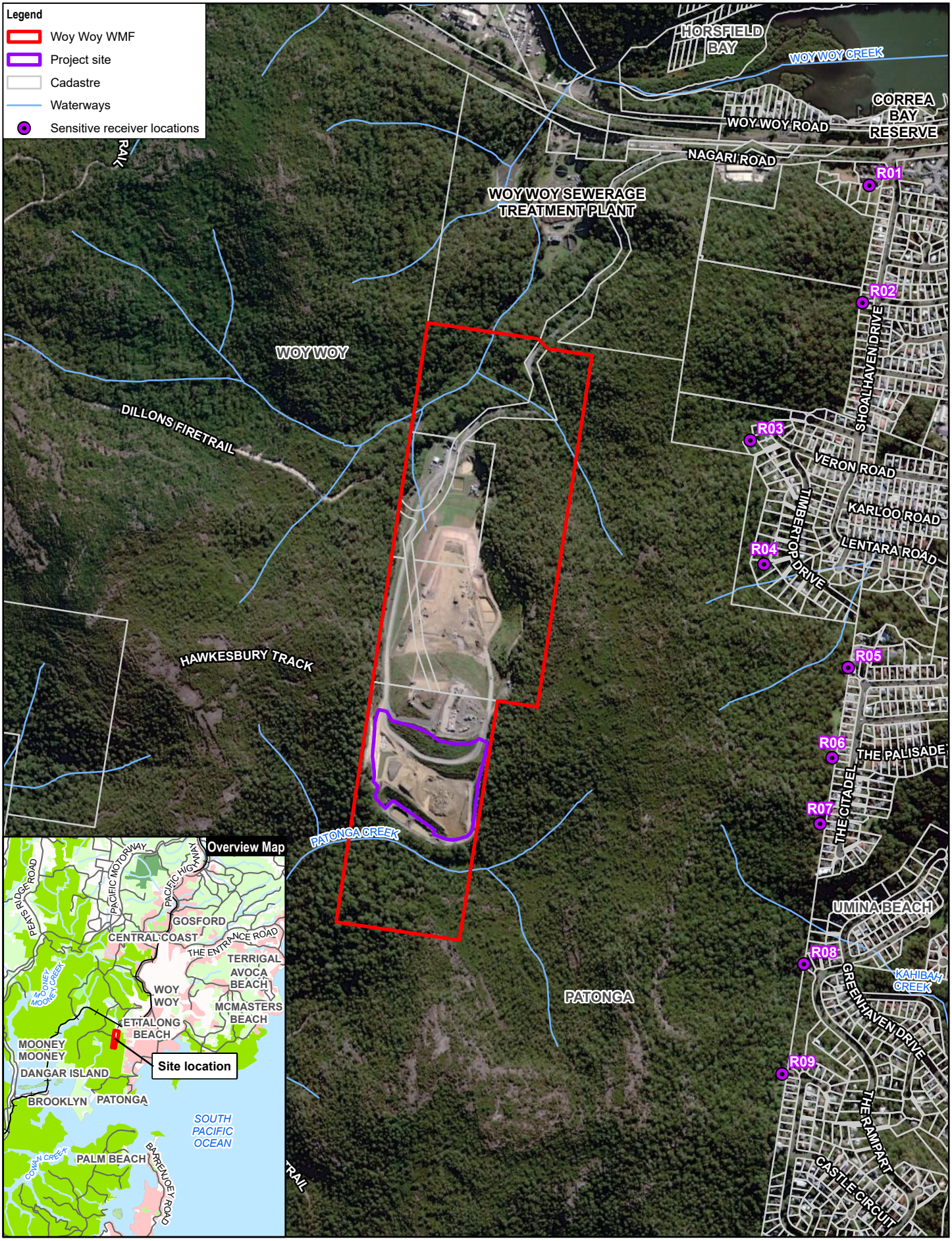
– Residences
– Educational facilities
– Hospitals and medical facilities
– Places of worship
– Passive and active recreational areas such as parks, sporting fields, golf courses (note that these recreational areas are only considered sensitive when they are in use or occupied)
– Commercial or industrial premises
– Community centres
– Hotels, motels, caretaker's quarters, holiday accommodation and permanent resident caravan parks

Within the study area, nine potentially most-affected receivers have been selected to represent all sensitive receivers within the wider community. The sensitive receivers are shown in Figure 3.1. Note there are no non-residential receivers closer to the project site than the residential receivers. Compliance with the more stringent residential criteria should result in compliance at all non-residential locations.

These key receivers are provided below in Table 3.1.

Table 3.1 Key residential sensitive receivers

ID	Address	Type	Distance from nearest project site boundary
R01	2 Shoalhaven Dr, Woy Woy	Residential	1,475 m
R02	34 Shoalhaven Dr, Woy Woy	Residential	1,250 m
R03 (M1)	6 Timbertop Drive, Umina Beach	Residential	850 m
R04	52 Timbertop Drive, Umina Beach	Residential	800 m
R05	11 The Sanctuary, Umina Beach	Residential	1,000 m
R06	12 The Citadel, Umina Beach	Residential	950 m
R07 (M2)	32 The Citadel, Umina Beach	Residential	975 m
R08	10 The Rampart, Umina Beach	Residential	975 m
R09	17 The Bastien, Umina Beach	Residential	1,050 m



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Metres

Map Projection: Transverse Mercator
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Sensitive receivers and noise monitoring locations

Project No. **12595244**
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Date **17/07/2023**

FIGURE 4.1

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Data source: LPI: DCDB / DTDB, 2023; Aerial Imagery: World Imagery: Maxar. Created by: pfield

4. Effects of meteorology on noise levels

Certain meteorological conditions, such as night-time temperature inversions or source-to-receiver winds, may increase noise levels depending on the location of the receiver relative to the noise source. Such refraction of sound waves would 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 receptor.

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 receivers 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 noise impact assessment has used the Option 1 approach and assumed a source to receptor wind and temperature inversion conditions to represent a conservative assessment of noise impacts.

5. Existing acoustic environment

5.1 General methodology

An ambient noise survey was conducted to characterise and quantify the existing acoustical environment in the area surrounding the project site. A combination of unattended and operator attended noise monitoring was undertaken at two (2) locations (M1 and M2) surrounding the project site considered representative of the most sensitive receivers. The noise monitoring locations are shown in Figure 3.1.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of *AS IEC 61672.1: 2019 Electroacoustics - Sound level meters – Specifications*" and carries current NATA or manufacturer calibration certificates as shown in Appendix A.

Instrument calibration checks were performed on the noise monitoring equipment using a sound level calibrator (SVAN-SV36-106878) with a sound pressure level of 94 dB(A) at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers and sound level meters were found to be within the acceptable tolerance of ± 0.5 dB(A).

5.2 Unattended noise monitoring

Unattended background noise monitoring was undertaken with consideration to AS 1055 – 1997 *Acoustics – Description and Measurement of Environmental Noise*, the NPI (EPA, 2017) and *Approved methods for the measurement and analysis of environmental noise in NSW* (EPA, 2022).

The unattended noise monitoring was conducted from Thursday 8 June 2023 to Thursday 22 June 2023 at the unattended monitoring locations as shown in Table 5.1. The purpose of the monitoring was to determine background noise levels for the noise assessment. The noise logger was located in an area that was considered representative of the local background and ambient noise levels. The monitoring location was 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.

The noise monitoring location and equipment details are summarised in Table 5.1. The instrument was programmed to accumulate 1 second interval and 15-minute summary environmental noise data continuously for the entire monitoring period.

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 Gosford Automatic Weather Station (AWS) (Station ID 061425).

Table 5.1 Noise monitoring location and equipment details

Location	Measurement period	Equipment details	Equipment settings	Photo
M1 – 6 Timbertop Drive, Umina Beach	11:15 am 08/06/2023 to 12:00 pm 22/06/2023	SVAN 977 Serial number 45751	A-weighted Fast time response 15 minute intervals	
M2 – 32 The Citadel, Umina Beach	12:30 pm 08/06/2023 to 12:30 pm 22/06/2023	SVAN 977 Serial number 97528	A-weighted Fast time response 15 minute intervals	

5.2.1 Summary of unattended noise monitoring results

Rating background levels and ambient noise levels recorded are summarised in Table 5.2 and Table 5.3. Daily noise level charts for the entire monitoring period are presented Appendix B and Appendix C.

A detailed description of the acoustic terms can be found in the glossary at the start of this report.

Observations and measured noise data indicate that ambient and background noise levels are typical of a suburban area influenced by local road noise.

Table 5.2 Summary of noise monitoring results – M1, dB(A)

Date	Assessment background level (ABL) 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
Thursday-8-Jun-23	40	-	-	46	-	-
Friday-9-Jun-23	37	-	-	46	-	-
Saturday-10-Jun-23	37	34	27	52	46	36
Sunday-11-Jun-23	38	36	26	46	44	38
Monday-12-Jun-23	37	-	-	49	-	-
Tuesday-13-Jun-23	38	32	-	45	39	-
Wednesday-14-Jun-23	35	33	21	48	40	39
Thursday-15-Jun-23	35	31	22	46	39	39
Friday-16-Jun-23	36	32	26	46	41	37
Saturday-17-Jun-23	37	33	24	48	44	33
Sunday-18-Jun-23	34	26	21	54	38	37
Monday-19-Jun-23	35	31	21	45	38	40
Tuesday-20-Jun-23	36	35	30	49	41	40
Wednesday-21-Jun-23	36	33	27	47	41	39
Thursday-22-Jun-23	39	-	-	49	-	-
Rating Background Level (RBL) and Leq Overall	**37**	**33**	**25**	**49**	**42**	**38**

Note 1: Daytime 7.00 am to 6.00 pm, Evening 6.00 pm 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 pm to 10.00 pm, Night-time 10.00 pm to 8.00 am.

Note 2: Periods where invalid data has been excluded due to adverse weather.

Table 5.3 Summary of noise monitoring results – M2, dB(A)

Date	Assessment background level (ABL) 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
Thursday-8-Jun-23	34	-	-	45	-	-
Friday-9-Jun-23	33	-	-	45	-	-
Saturday-10-Jun-23	27	30	30	44	35	37
Sunday-11-Jun-23	32	31	27	46	36	35
Monday-12-Jun-23	31	-	-	45	-	-
Tuesday-13-Jun-23	31	28	-	44	37	-
Wednesday-14-Jun-23	31	26	20	43	35	36
Thursday-15-Jun-23	27	25	30	45	34	35
Friday-16-Jun-23	28	28	27	47	37	39
Saturday-17-Jun-23	30	27	22	43	34	27
Sunday-18-Jun-23	27	27	21	45	37	36
Monday-19-Jun-23	30	27	24	43	38	38
Tuesday-20-Jun-23	31	34	40	44	38	45
Wednesday-21-Jun-23	28	30	29	45	35	36
Thursday-22-Jun-23	33	-	-	48	-	-

Date	Assessment background level (ABL) 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
Rating Background Level (RBL) and Leq Overall	**31**	**28**	**27**	**45**	**36**	**39**

Note 1: Daytime 7.00 am to 6.00 pm, Evening 6.00 pm 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 pm to 10.00 pm, Night-time 10.00 pm to 8.00 am.

Note 2: Periods where invalid data has been excluded due to adverse weather.

All noise levels reported in Table 5.2 and Table 5.3 are free field measurements.

5.2.2 Operator attended noise monitoring.

In addition to the unattended noise monitoring, operator attended noise measurements were conducted during the day period at the unattended noise monitoring locations M1 and M2 (refer to Table 5.1). The purpose of these surveys was to identify noise sources typical of the area and to qualify the unattended noise logging results.

Operator attended noise measurements were conducted during the day period on 8 June 2023 using a Svan 977 integrating sound level meter (S/N 45751 and 97528). The operator attended noise survey consisted of 1 x 15-minute measurement at M1 and M2 monitoring locations.

The results of the operator attended noise measurements are given in Table 5.4. Ambient noise levels given in Table 5.4 include all noise sources such as traffic, insects, and birds.

The tables provide the following information:

– Monitoring location
– Date and start time.
– Wind velocity (m/s) and Temperature (ºC) at the measurement location
– Typical maximum (L_{AF}) and contributed noise levels.

Table 5.4 Operator attended noise survey results

Location	Date/Start time/Period/ Weather	Primary Noise Descriptor dB(A) re 20 µPa)					Description of Noise Emission, LAF (dB(A))
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
M1	Date: 08/06/2023 Time: 10:58 to 11:13 am Period: Day Wind: Calm Temperature: 18 ºC	70	51	46	41	44	Dogs: 45-50 Birds: 40-52 Helicopter: 48-52 Resident: 46-53 Local road: 46-50 Distant traffic: 42-46 Aircraft: 44-56
M2	Date: 08/06/2023 Time: 12:07 to 12:22 pm Period: Day Wind: Calm Temperature: 18 ºC	66	51	42	34	40	Dogs: 38-51 Aircraft: 36-49 Train horn: 45 Birds: 35-39, 45-54 Local road: 36-43 Distant road < 35

Results of operator attended noise surveys indicate that natural noise sources and road traffic are the main contributors to the ambient noise environment during the daytime period at logger locations M1 and M2.

5.3 Operational noise goals

The SEARs incorporate and consolidate the assessment requirements of the Department of Planning and Environment for Development Consent Applications and the Environment Protection Authority for EPL applications

for their consideration during the planning approval phase of the project. The Development Consent and/or EPL would generally contain conditions stipulating environmental noise limits for noise from the project site. The WMF operates in accordance with EPL No. 6053, which does not contain any noise conditions.

In addition, the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Protection of the Environment Operations Act 1997* (POEO Act) require that authorities examine and take into account matters affecting the environment when making decisions about development and activities.

5.3.1 Noise Policy for Industry

The NPI provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable mitigation measures. This enables the EPA to regulate noise emissions from scheduled premises under the POEO Act.

The objectives of Project Noise Trigger Levels (PNTL) for industry are to balance the need for industrial activity with the community's desire to minimise intrusive noise.

It should be noted that the audibility of a noise source does not necessarily equate to disturbance at an assessment location. To ensure these objectives are met, the EPA provides two separate noise trigger levels: intrusiveness and amenity. The intrusiveness noise levels apply over 15 minutes in any period (day, evening or night) and aim to control the relative audibility of operational noise compared to the background level at residential receivers.

The amenity noise level limits the total level of extraneous noise for all receiver types and is assessed over the entire assessment period (day, evening or night). Both the intrusiveness and amenity noise levels are calculated and the lower of the two in each time period is set as the PNTL. For the purposes of assessment to standardise the approach the NPI recommends that the $L_{Aeq(15min)} = L_{Aeq(period)} + 3$ dBA unless an alternative approach can be justified.

5.3.2 Intrusiveness noise level

The intrusiveness noise level is determined by a 5 dB addition to the RBL with a minimum intrusiveness noise level of 35 dBA for the evening and night period and 40 dBA for the day period. The NPI recommends that the intrusiveness noise level for the evening and day period should not exceed the daytime period. The intrusiveness noise levels are only applicable to residential receivers.

5.3.3 Project amenity noise level

The recommended amenity noise level applies to all industrial noise in the area which when combined should remain below the recommended amenity noise level. The recommended amenity noise level represents the total industrial noise at a receiver location and a Project Amenity Noise Level is set at 5 dBA below the recommended amenity noise level.

Residential receiver areas are characterised into 'urban', 'suburban', 'rural' or other categories based on land uses and the existing level of noise from industry and road traffic. With consideration to the NPI 'noise amenity area' classification, the residential receivers identified are classified as 'Suburban Residential' as per the NPI.

5.3.4 Summary of project noise trigger levels

Based on the NPI, a summary of the PNTLs for residential land uses are presented in Table 5.5. All identified residential receivers have been classified as 'suburban residential'. Compliance with the residential PNTLs ensure compliance with the less-stringent non-residential PNTLs.

For a residence, the project noise trigger level and maximum noise levels are to be assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most affected point within 30 m of the residence, but not closer than 3 m to a reflective surface and at a height of between 1.2–1.5 m above ground level.

In assessing amenity noise levels at commercial or industrial premises, the noise level is to be assessed at the reasonably most-affected point on or within the property boundary.

Table 5.5 Project noise trigger levels for suburban residential receivers

Receiver	Assessment period	Rating Background Level (RBL), $L_{90,T}$-dBA[2]	Intrusive noise level, $L_{Aeq(15min)}$	Project amenity noise level[1] $L_{Aeq(15min)}$	Project noise trigger level, $L_{Aeq(15min)}$) dBA
Receivers R01 to R04	Day	37	42	53	42
	Evening	33	38	43	38
	Night	30 (25)	35	38	35
Receivers R05 to R09	Day	35 (31)	40	53	40
	Evening	30 (28)	35	43	35
	Night	30 (27)	35	38	35

Notes:

1. Project amenity noise level (ANL) is rural ANL (Table 2.1) minus 5 plus 3 dB(A) to convert from a period level to a 15-minute level.
2. Numbers in brackets are the measured RBLs. The measured level is below the minimum assumed RBLs outlined in Section 2.4 of the Noise Policy for Industry, and therefore the minimums have been used to establish the intrusive noise level.

5.3.5 Modifying factor corrections

The NPI requires that corrections for annoying characteristics are applied if the noise sources contain tonal, intermittent or low frequency characteristics, which have the potential to increase annoyance. The modifying factor adjustments are detailed in Table 5.6. At this point in time it is assumed that no equipment operating on-site has any annoying characteristics.

Table 5.6 NPI modifying factor corrections

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	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 above 400 Hz – 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive – 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dBA[2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted $L_{eq,T}$ levels over same time period. Correction to be applied if the difference between the two levels 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 for the evening/night period. – Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dBA and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted noise levels applies for the evening/night period and a dBA positive adjustment for the daytime period.	5 dBA[2]
Intermittent noise	Subjectively assessed	When the night-time noise level drops to that of the background noise level with a noticeable change in noise level of at least 5 dBA.	5 dBA

Notes:

1. Where two or more modifying factors are present the maximum correction is limited to 10 dBA.
2. Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

5.4 Construction noise goals

As part of this project, there would be a number of elements which would fall under an assessment in accordance with the *Interim Construction Noise Guideline* (ICNG). This includes bulk earthworks phase, gravel and lining placement phase.

5.4.1 ICNG construction hours

The ICNG provides guidance for assessment and management of construction noise. The guideline recommends standard hours for project activities 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.

Where practical, and subject to the final construction timetable, it is assumed that construction would be carried out during the standard construction hours only.

The ICNG acknowledges that the following activities have justification to be undertaken outside the standard construction hours assuming all feasible and reasonable mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

– The delivery of oversized plant, equipment and materials that police or other authorities determine require special arrangements to transport along public roads
– Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
– Maintenance and repair of public infrastructure where disruption to essential services or considerations of worker safety do not allow work within standard hours
– Public infrastructure works that shorten the length of the project and are supported by the affected community
– Works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
– Works which maintain noise levels below the noise management levels outside of the recommended standard construction hours.

Works requires outside standard construction hours would be identified during construction planning and nearby residents would be notified before works begin.

5.4.2 Noise management levels

The construction noise management levels (NMLs) represent a noise level that, if exceeded, would require management measures including:

– Reasonable and feasible work practices
– Contact with the residences to inform them of the nature or works to be carried out, the expected noise levels, and durations and contact details.

The management measures are aimed at reducing noise impacts at the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level at all times. The noise affected construction NMLs are not intended as a noise limit but rather a level at which noise management is required.

Table 2 in the ICNG provides recommended NML for residential receivers, which are detailed in Table 5.7.

Table 5.7 Residential construction noise management levels, dBA (ICNG, 2009)

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
Recommended standard hours	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 $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 75 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 relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: – Times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or mid-afternoon for works near residences). – If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected: RBL + 5 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 measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

5.4.3 Sleep disturbance

No construction works are proposed during the night period (10:00 pm to 7:00 am Monday to Saturday and 10:00 pm on Saturday to 8:00 am on Sunday). If activities are required to be undertaken during these times it would be limited to activities which are not audible at the nearest sensitive receptor, or discreet events which need to be undertaken outside standard hours for safety reasons.

As such, no sleep disturbance impacts are anticipated during the construction phases of the project.

5.4.4 Noise management levels

The noise management levels (NMLs) at sensitive receivers in the study area are summarised in Table 5.8 and have been based on the RBLs presented in Table 5.2 and Table 5.3.

Table 5.8 Project specific noise management levels

Sensitive receptor type	Construction Noise Management Levels, $L_{Aeq(15min)}$	
	Standard construction hours	
	Noise affected	Highly noise affected
Residential – R01 to R04	47	75
Residential – R05 to R09	45	75

5.5 Traffic noise

The RNP provides traffic noise target levels for residential receivers in the vicinity of existing roads and are applied to road upgrades. For this assessment, these levels are also applied to traffic associated with construction works to identify potential construction traffic impacts and the potential for reasonable and feasible mitigation measures. The RNP road types are based on the functional roles shown in Table 5.9.

Table 5.9 Road Categories from RNP

Road category	Functional role	Public roads used by project
Local roads	Provide vehicular access to abutting property and surrounding streets. Provide a network of the movement of pedestrians and cyclists and enable social interaction in a neighbourhood. Should connect, where practicable, only to sub-arterial roads.	– Railway Street and Nagari Road

The application notes for the RNP state that "*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*."

If the road traffic noise increase from the project is within 2 dB of current levels, then the objectives of the RNP are met and no specific mitigation measures are required. Mitigation should be applied when road traffic noise levels increase by 2 dB *and* the controlling noise criterion in Table 5.10 are exceeded at the façade of the residence.

Table 5.10 Road traffic noise criteria, dBA

Development type	Applicability to assessment	Day 7:00 am to 10:00 pm	Night 10:00 pm to 7:00 am
Existing residence affected by additional traffic on local roads generated by land use developments	– Railway Street and Nagari Road	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$

5.6 Construction vibration

5.6.1 Human comfort

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 VDVs, as outlined in *Assessing Vibration: A Technical Guideline*, are listed in Table 5.11.

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 then can be justified. For values beyond the maximum value, the proponent should negotiate with the affected community.

Table 5.11 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 am to 10 pm and night-time is 10 pm to 7 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 5.12.

Table 5.12 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 would 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.

5.6.2 Structural damage to standard and heritage structures

Vibrations as a result of construction work relating to the project are considered as a short-term vibration impact and criteria have been established accordingly.

The minimum working distances for structural (cosmetic) damage used for this assessment have been based on *DIN 4150-3 Structural Vibration – effects of vibration on structures* (German Standards, 2016) levels from ground borne vibration which enables the likelihood of building damage from ground vibration to be assessed. Experience has shown that if these values are complied with, damage that reduces the serviceability of the building would not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Measured values exceeding those listed in Table 5.13 do not necessarily lead to damage; should they be significantly exceeded; however, further investigations may be necessary.

The vibration levels in this standard are adopted as building damage criteria and are presented Table 5.13 for industrial premises, domestic premises, and heritage structures.

No heritage structures have been identified within 250 metres of the project footprint. At this distance no vibration impacts to heritage structures are anticipated.

Table 5.13 DIN 4150-3:2016 guideline values for short term vibration velocity

Line	Type of building	Guideline values for velocity, (mm/s)		
		Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[3]
1	Offices and industrial premises	20	20-40	40-50
2	Domestic houses and similar construction	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 (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10

Notes:

1. Values referred to are at the base of the building.
2. At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.
3. At frequencies above 100 Hz the values given in this column may be used as minimum values.

6. Noise and vibration impacts

6.1 Operational noise impacts

It has been assumed that all activity associated with the project would be conducted during daytime hours. The operational scenario assessed is the typical daily operation of the WMF.

Note that the entire landfill footprint has been included in the model ensuring that a worst-case scenario has been modelled.

6.1.1 Noise modelling methodology

The following factors have been considered in the noise modelling methodology:

– The Sound Power Level (SWL) of external industrial noise sources either modelled as a point source, a line source, or an area source.
– External moving point sources (e.g., external truck movements, staff vehicles)
– External fixed-point sources or area sources (e.g. fixed plant)
– Terrain topography
– Absorption from the ground coverage
– Atmospheric absorption
– The operating times of the relevant noise sources and the frequency of vehicle movements
– Noise enhancing meteorological conditions.

The ISO 9613-2:1996 prediction methodology was utilised within CadnaA noise modelling software (Version 2023), to predict noise emissions.

The noise model inputs and assumptions for this assessment are provided in Table 6.1.

Table 6.1 Noise modelling parameters

Modelling component	Assumption
Noise model	CadnaA v 2023
Prediction algorithm	*ISO 9613 – 2 Acoustics – Attenuation of sound during propagation outdoors*
Modelling period	Typical worst case 15-minute period of operation where each significant item of equipment is running at full power
Meteorology	ISO 9613 considers the presence of a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation
Ground absorption coefficient	G = 0.75 representing vegetative grassland areas (75%) and non-porous ground (25%)
Atmospheric absorption	Based on a default temperature of 10°C and an average humidity of 70%
Receiver heights	1.5 m above building ground level (ground floor)
Ground elevation data	Digital Elevation Model (DEM) of Australia derived from LiDAR 5 Metre Grid Contours extracted based on 3 m intervals between contour lines (0 m to 57 m) Site contours – Survey provided by Barry Hunt Associates, dated 10 December 2022

6.1.2 Equipment noise level estimates

The primary noise generating equipment used in the noise model are based on conservative estimates of similar equipment used for similar projects. The sound power levels, equipment type and location of each item of equipment modelled is presented in Table 6.2.

The noise generating equipment would be relocated from the existing South Cell to the new cell. There would be no change to the equipment on the project site. The items of equipment in Table 6.2 was provided by the client. Sound power levels (SWLs) have been estimated using British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.*

The combined SWL is based on all equipment operating for 100 % of the time during any 15 minute period. It is not expected that the equipment listed above would operate simultaneously under normal circumstances, therefore this modelling scenario is considered to represent a conservative case.

Table 6.2 Operational equipment Sound Power Levels

Scenario	Equipment	Model numbers	Equipment SWL, dB(A)	Combined SWL
OS1	Loader x 2	Hitachi ZW220-5	112	127 dBA
		Liebherr L550 XPower		
	Excavator x 5	Kobelco SK210LC-10	116	
		Komatsu HB215LC_1MO		
		Sennebogen 821R E Series		
		Komatsu PC200-8 C73654		
		Komatsu PC200-8 C73654		
	Dump Truck x 2	Komatsu HM300-2	117	
	Water Cart	Isuzu FXZ 240-350 6X4	117	
	Landfill Compactor	TANA E520	120	

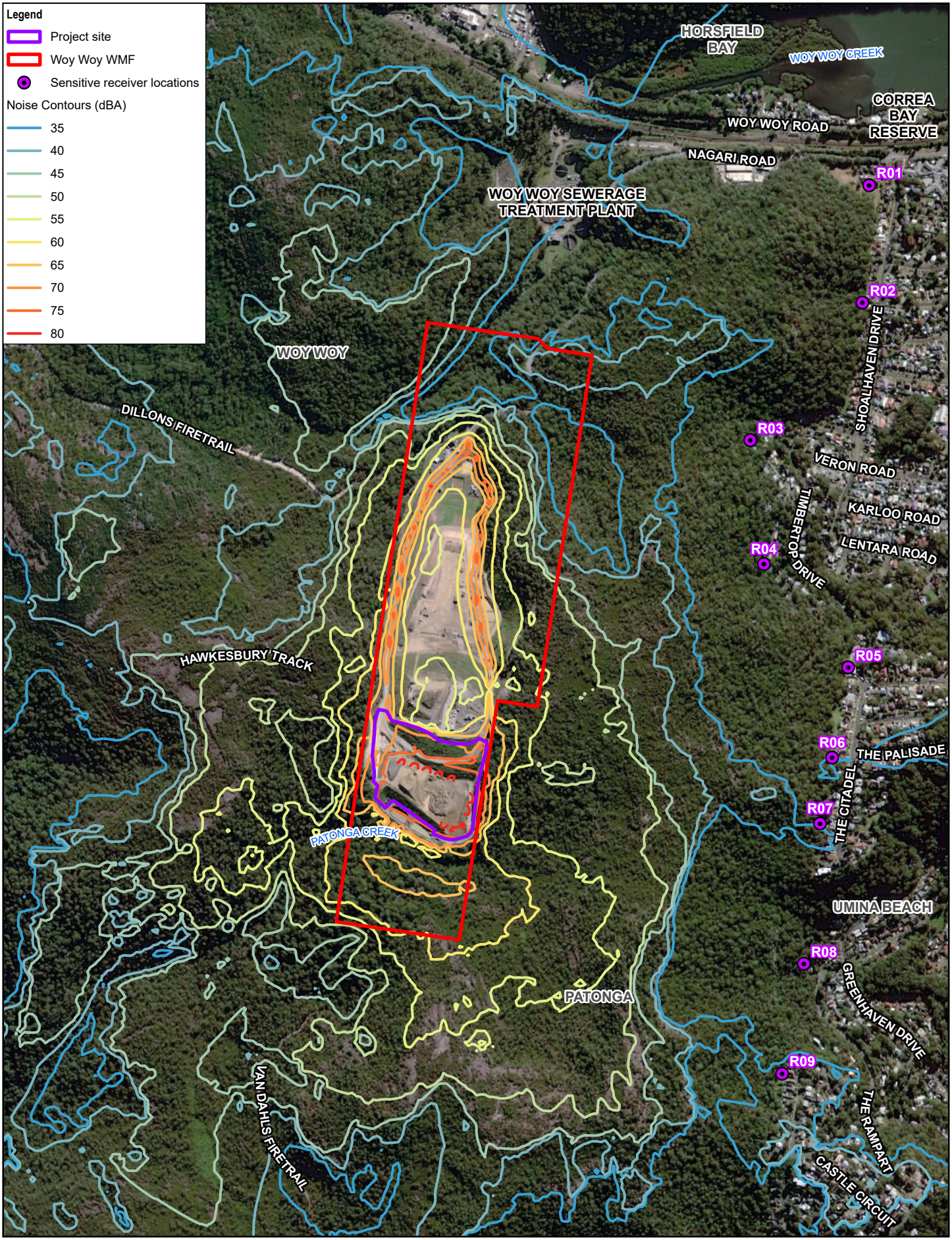
6.1.3 Predicted noise levels

The predicted $L_{Aeq(15min)}$ noise levels at the most-affected sensitive receivers are presented in Table 6.3. The noise modelling indicates compliance is predicted at all sensitive receptor locations for the daytime period. L_{Aeq} noise contours at 1.5 m above ground for day operations are presented in Figure 6.1.

The levels presented in Table 6.3 assume all equipment is being used simultaneously and is considered conservative. Noise levels are likely to be less than this for the majority of the time.

Table 6.3 Predicted $L_{Aeq(15min)}$ noise levels at sensitive receivers, dBA

ID	Address	NPI Project noise trigger level, $L_{Aeq(15min)}$, dBA Daytime period	Predicted $L_{Aeq(15min)}$ noise level, dBA Daytime period	Complies?
R01	2 Shoalhaven Dr, Woy Woy	42	24	Yes
R02	34 Shoalhaven Dr, Woy Woy	42	24	Yes
R03	6 Timbertop Drive, Umina Beach	42	28	Yes
R04	52 Timbertop Drive, Umina Beach	42	29	Yes
R05	11 The Sanctuary, Umina Beach	40	31	Yes
R06	12 The Citadel, Umina Beach	40	35	Yes
R07	32 The Citadel, Umina Beach	40	32	Yes
R08	10 The Rampart, Umina Beach	40	29	Yes
R09	17 The Bastien, Umina Beach	40	36	Yes



Paper Size ISO A4

0 80 160 240 320

Metres

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

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Central Coast Council
South Cell at Woy Woy WMF
Noise Impact Assessment

Predicted noise contours - Typical operations

Project No. **12595244**
Revision No. **0**
Date **4/09/2023**

FIGURE 7.1

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Print date: 04 Sep 2023 - 13:51

Data source: LPI: DCDB / DTDB, 2023; Aerial Imagery: World Imagery: Maxar. Created by: pfield

6.2 Sleep disturbance impacts

The NPI states that where the subject development/premises night-time noise levels at a residential location exceed:

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

a detailed maximum noise level event assessment should be undertaken. Since there are no activities anticipated for the night-time assessment period, sleep disturbance impacts are not expected to occur.

6.3 Construction noise impacts

Information was provided by the project team regarding the proposed construction scenarios and equipment for the construction activities associated with the project. The most significant impacts are expected to occur during grading and sealing of the access road. It has been assumed that all construction activity associated with the project would be conducted during the recommended standard construction hours. The main construction scenarios envisaged and assessed are as follows:

– Construction Scenario 1 – Ground works and excavation, which includes bulk earthworks and construction of landfill cells.
– Construction Scenario 2 – Construction of main structures, which includes gravel and lining placement phase

6.3.1 Construction equipment

The noise levels for the construction equipment have been sourced from the following sources:

– Australian Standard AS2436 – *Guide to Noise Control on Construction, Maintenance and Demolition Site* (2010)
– NSW Roads and Maritimes Services – *Construction Noise and Vibration Guideline* (2016)
– GHD measurements of similar equipment

The anticipated plant and equipment to be used for each construction scenario is shown in Table 6.4 and Table 6.5, along with corresponding sound power levels used in the noise model.

Table 6.4 Construction stage one equipment

Scenario	Project element	Equipment	Quantity	Duration	Equipment SWL, dB(A)	Combined SWL
CS1	Ground works and excavation	Large excavator w/ rock hammer and standard bucket attachments	1	100%	113	118 dBA
		Dump truck	2	100%	111	
		Smooth drum roller	1	100%	107	
		Large bulldozer	1	100%	113	
		Water cart	1	100%	108	

Table 6.5 Construction stage two equipment

Scenario	Project element	Equipment	Quantity	Duration	Equipment SWL, dB(A)	Combined SWL
CS2	Construction of main structures	Telehandler	1	100%	106	114 dBA
		Large excavator w/ r standard bucket attachment	1	100%	106	
		Posi-track	1	100%	104	
		Dump truck	2	100%	111	

6.3.2 Noise modelling assumptions and parameters

Acoustic modelling was undertaken using CadnaA noise modelling software to predict the effects of construction noise generated by the proposed works. General parameters used in the model are listed in Table 6.6.

Table 6.6 Noise modelling parameters

Variable	Parameter used
Calculation method	ISO 9613- 2:1996
Meteorology	ISO 9613 considers the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation
Ground elevation data	Digital Elevation Model (DEM) of Australia derived from LiDAR 5 Metre Grid Contours extracted based on 3 m intervals between contour lines (0 m to 57 m) Site contours – Survey provided by Barry Hunt Associates, dated 10 December 2022
Receiver heights	1.5 m above building ground level
Ground absorption	G = 0.75 representing vegetative grassland areas (75%) and non-porous ground (25%)

6.3.3 Predicted noise levels

Construction noise levels have been predicted at the sensitive receivers within the study area with consideration to the acoustic requirements of the ICNG. The predicted $L_{Aeq(15min)}$ noise levels at the most-affected sensitive receivers are presented in Table 6.7. The noise modelling assumes that all pieces 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 most of the time.

Reasonable and feasible mitigation measures are recommended in Chapter 7 to reduce any potential noise impacts at sensitive receivers with consideration to the following:

– the effectiveness of the mitigation measures
– whether the measures are considered reasonable and feasible

Construction noise contours for each scenario are shown in Figure 6.2 and Figure 6.3

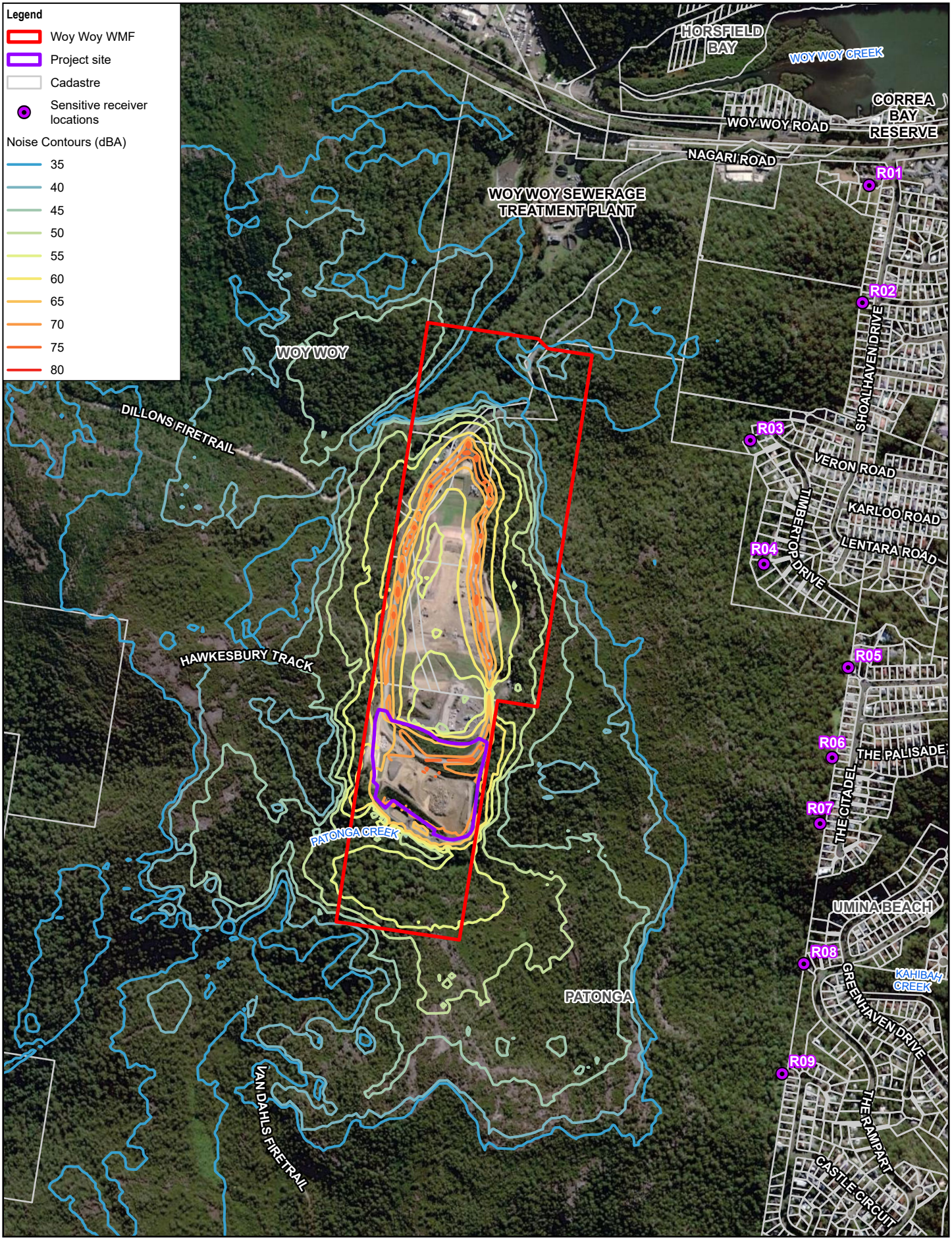
Table 6.7 Summary of construction noise levels – Standard construction hours (day)

RID	Address	NML, $L_{Aeq(15min)}$ dBA Standard hours	Predicted $L_{Aeq(15min)}$ noise level, dBA		Complies?
			CS1	CS2	
R01	2 Shoalhaven Dr, Woy Woy	47	16	15	Yes
R02	34 Shoalhaven Dr, Woy Woy	47	17	16	Yes
R03	6 Timbertop Drive, Umina Beach	47	21	20	Yes
R04	52 Timbertop Drive, Umina Beach	47	22	20	Yes
R05	11 The Sanctuary, Umina Beach	45	22	20	Yes
R06	12 The Citadel, Umina Beach	45	25	23	Yes
R07	32 The Citadel, Umina Beach	45	23	21	Yes
R08	10 The Rampart, Umina Beach	45	20	17	Yes
R09	17 The Bastien, Umina Beach	45	25	23	Yes

Predictive modelling indicates that at all receivers in the study area, predicted noise levels for all assessed scenarios are predicted to be below noise management levels (NML) during worst case conditions with all equipment operating simultaneously. Notwithstanding this, the application of reasonable and feasible mitigation

measures at the source is considered best practice and should be implemented where reasonable and feasible. Mitigation measures are discussed further in Chapter 7 with consideration to the following:

– The effectiveness of the mitigation measures
– Whether the measures are considered reasonable and feasible



Paper Size ISO A4

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Metres

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

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Central Coast Council
South Cell at Woy Woy WMF
Noise Impact Assessment

CS1 Predicted noise contours - Ground works and excavation

Project No. **12595244**
Revision No. **0**
Date **4/09/2023**

FIGURE 7.2

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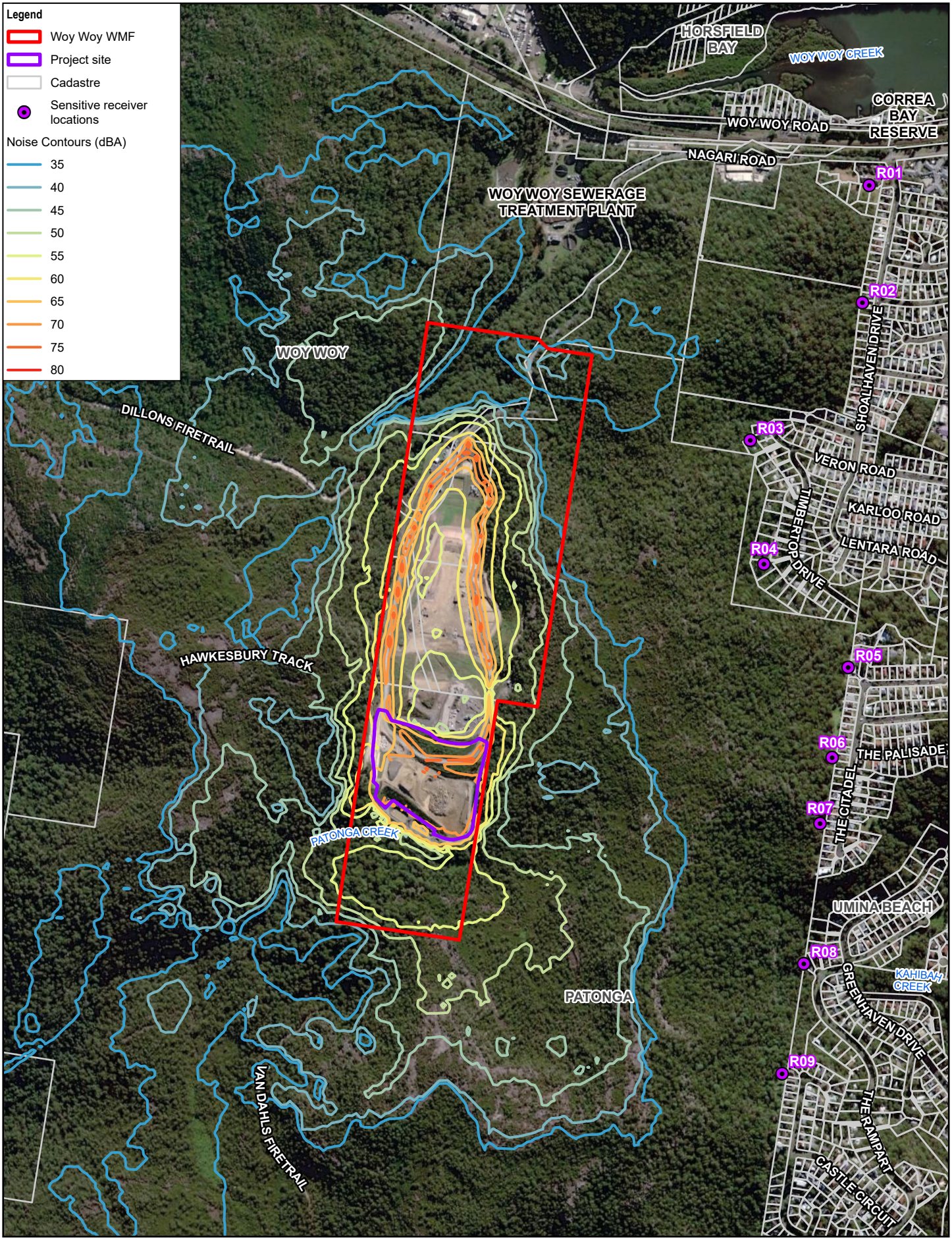
Print date: 04 Sep 2023 - 13:51

Data source: LPI: DCDB / DTDB, 2023; Aerial Imagery: World Imagery: Maxar. Created by: pfield



Paper Size ISO A4

0 80 160 240 320

Metres

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

N

GHD

Central Coast Council
South Cell at Woy Woy WMF
Noise Impact Assessment

CS2 Predicted noise contours - Construction of main structures

Project No. **12595244**
Revision No. **0**
Date **4/09/2023**

FIGURE 7.3

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Print date: 04 Sep 2023 - 13:51

Data source: LPI: DCDB / DTDB, 2023; Aerial Imagery: World Imagery: Maxar. Created by: pfield

6.4 Project vibration impacts

6.4.1 Vibration modelling methodology

The method for the vibration assessment included:

– Identifying safe working distances to comply with the human comfort and the cosmetic damage criteria. These buffer distances have been adopted from *Construction Noise and Vibration Strategy* (CNVS) (TfNSW 2019).
– Safe working distances for vibration intensive equipment are shown in Table 6.8. The vibratory equipment associated with the project include compactors (or vibratory roller) and excavators with rock hammer attachments.
– Buildings within the safe working distances have been identified for consideration of management measures.

6.4.2 Vibration safe working distances

Safe working distances for vibratory intensive equipment has been sourced from the TfNSW CNVS and are shown in Table 6.8.

Table 6.8 Vibration safe working distances

Equipment	Human comfort (OH&E Assessing Vibration – A Technical Guideline)	Cosmetic damage (BS 7385)
Piling rig – Bored <800 mm	N/A	2 m (nominal)
Piling rig–Hammer (12 t down force)	50 m	15 m
Piling rig – Vibratory (sheet piles)	20 m	2 m to 20 m
Vibratory roller (>18 tonnes)	100 m	25 m
Vibratory roller (13-18 tonnes)	100 m	20 m
Vibratory roller (7-13 tonnes)	100 m	15 m
Vibratory roller (4-6 tonnes)	40 m	12 m
Vibratory roller (2-4 tonnes)	20 m	6 m
Vibratory roller (1-2 tonnes)	15 m	5 m
Small hydraulic hammer 300 kg (5-12t excavator)	7 m	2 m
Medium hydraulic hammer 900 kg (12-18t excavator)	23 m	7 m
Large hydraulic hammer 1600 kg (18-34t excavator)	73 m	22 m
Jackhammer (handheld)	Avoid contact with structure	1 m (nominal)

6.4.3 Human comfort

The most vibration intensive activities associated with the works are anticipated to be excavation works with a medium to large excavator and compacting during bulk earthworks and grading of the access road.

Excavation activities have the potential to exceed the human comfort vibration criteria should these works occur within 73 m of residences. No residences have been identified within 73 m of these vibration intensive works and as such, no adverse vibration impacts are anticipated as a result of the project.

6.4.4 Structural damage

Excavation works have the potential to exceed the cosmetic damage criteria should these works occur within 22 m of a sensitive receptor building. No other sensitive buildings have been identified within 22 m of excavation works.

6.5 Traffic noise impacts along public roads

6.5.1 Existing traffic conditions

GHD has prepared a traffic assessment for the Woy Woy Waste Management Facility (*Technical Report 6 – Traffic Assessment* (GHD, 2023)). Nagari Road is a local road providing direct access/egress to and from the WMF. A gate is located on Nagari Road approximately 500 metres to the west of the railway underpass to control access/egress to and from the WMF. To the east of the rail underpass, Nagari Road changes into Railway Street and connects with Woy Woy Road.

To determine the existing traffic numbers associated with the WMF, weighbridge data for a typical week between Monday 7 November 2022 and Sunday 13 November 2022 was reviewed.

The data indicates that:

– Activity at the WMF currently consists of approximately:
  - 330 inbound and 330 outbound vehicles on a weekday
  - 200 inbound and 200 outbound vehicles on a weekend
– The peak hour of activity on a weekday occurs between 1:00 pm – 2:00 pm with approximately 45 inbound and outbound vehicles
– The peak hour of activity on a weekend occurs between 10:00 am – 11:00 am with approximately 30 inbound and outbound vehicles

A full analysis of the weighbridge data can be found in *Technical Report 6 – Traffic assessment*.

6.5.2 Project traffic generation

6.5.2.1 Construction traffic

For the purposes of this assessment, the highest hourly traffic generation for the project under the peak construction scenario is assumed to be up to 14 vehicle trips in total, which would consist of the following:

– AM peak hour:
  - Two inbound heavy vehicle movements
  - Two outbound heavy vehicle movements
  - Ten inbound light vehicle trips.
– PM peak hour:
  - Two inbound heavy vehicle movements
  - Two outbound heavy vehicle movements
  - Ten outbound light vehicle trips.

Full details of the traffic numbers can be found in *Technical Report 6 – Traffic assessment*.

6.5.2.2 Operational traffic

Based on the predicted growth of the WMF, the data provided in *Technical Report 6 – Traffic assessment* indicates that by 2034 the project and wider growth at the WMF is expected to generate:

– An additional 33 – 39 inbound and outbound vehicles on a weekday.
– An additional 20 – 26 inbound and outbound vehicles on a weekend.
– Up to an additional five inbound and five outbound vehicles per hour on a weekday.
– Up to an additional three inbound and three outbound vehicles per hour on a weekend.

Full details of the traffic numbers can be found in *Technical Report 6 – Traffic assessment*.

6.5.2.3 Construction traffic noise impacts

Based on the additional construction vehicles (4 heavy vehicles and 10 light vehicles during peak times) accessing the WMF when compared to existing traffic numbers, traffic noise impacts due to the construction of the project are anticipated to remain within 2 dB of current levels, and therefore additional mitigation measures are not required.

6.5.2.4 Operational traffic noise impacts

Based on the increase in vehicles accessing the WMF (as detailed in Section 6.5.2.2) when compared to existing traffic numbers, traffic noise impacts due to the operation of the project are anticipated to remain within 2 dB of current levels, and therefore additional mitigation measures are not required.

7. Mitigation measures

It is predicted that activities associated with the project would comply with the NMLs in accordance with the ICNG, and the PNTLs in accordance with the NPI. The measures provided in Table 7.1 are best practice and should be implemented to minimise potential noise and vibration impacts where reasonable and feasible.

Table 7.1 Mitigation measures during the construction phase

Control type	ID	Measure	Timing
Community consultation			
Notification of works	NV1	Notification should be a minimum of 7 calendar days prior to the start works and should include information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods would occur. If there are works outside standard hours, inform closest residents and other sensitive land use occupants within 14 days of commencement. Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent would need to provide notification in languages other than English. A website would also be established for the project to provide information.	Pre-construction
Community relations	NV2	Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied. Maintain good communication between the community and project staff. Consider a regular newsletter with site news, significant project events and timing of different activities. Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.	Pre-construction During construction Operation
Management measures			
Site inductions	NV3	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: – all project specific and relevant standard noise and vibration mitigation measures – relevant licence and approval conditions – permissible hours of work – any limitations on high noise generating activities – location of nearest sensitive receivers – construction employee parking areas – designated loading/unloading areas and procedures – site opening/closing times (including deliveries) – environmental incident procedures	Construction Operation
Schedule activities to minimise noise impacts	NV4	All activities on site should be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 8:00 am to 1:00 pm on Saturday, with the exception of the following activities: – the delivery of oversized plant of structures – emergency work to avoid the loss of life or damage to property, or to prevent environmental harm	Pre-construction During construction

Control type	ID	Measure	Timing
Source mitigation measures			
Construction hours and scheduling.	NV5	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.	Construction
Non-tonal and ambient sensitive reversing alarms	NV6	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	Construction Operation
Reduced equipment power	NV7	Use only the necessary size and power.	Construction Operation
Minimise disturbance arising from delivery of goods to construction sites.	NV8	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise these out of hours movements where possible.	Construction
Engine compression brakes	NV8	Limit the use of engine compression brakes in proximity to residences.	Construction Operation
Maintain equipment	NV10	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.	Construction Operation

8. Conclusion

The noise and vibration impact assessment has established the ambient and background noise and assessed the potential noise impacts associated with the construction and operational phases of the project with respect to the following guidelines:

– Operational phase - *Noise Policy for Industry* (NPI)
– Construction phase - *Interim Construction Noise Guideline* (ICNG)
– Road network - *Road Noise Policy* (RNP)
– Vibration (human comfort) – *Assessing Vibration: A Technical Guideline* (AVTG)
– Vibration (cosmetic damage) - *DIN 4150-3 (2016) Structural Vibration – effects of vibration on structures* and *Construction Noise and Vibration Strategy* (CNVS) (TfNSW 2019).

An assessment of potential noise impacts during the construction phase has been undertaken against the ICNG during standards hours. Predicted noise levels during all stages are predicted to result in noise levels below the Noise Management Level (NML) at all receivers. In addition:

– No sensitive receivers have been identified within the safe working distances for vibratory intensive work. As such, no adverse (structural damage or human comfort) vibration impacts are anticipated.
– Mitigation measures to reduce the risk of the noise impacts during these works have been recommended in Chapter 7.

Due to the separation distance between the project site and the nearest sensitive receivers, vibration impacts form the construction and operation of the project site are not anticipated.

Noise modelling was undertaken using CadnaA (v 2023) to predict operational noise levels at sensitive receivers and assessed against the NPI project noise trigger levels during the day period based on typical worst-case operating conditions. All assessed receivers are predicted to receive noise levels below the project noise trigger levels established.

Based on the predicted numbers of additional vehicles for the construction and operation of the project site, traffic noise impacts are anticipated to remain within 2 dB of current levels, and therefore additional mitigation measures are not required.

Appendices

Appendix A

Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM36693

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Svantek		
Type No:	SVAN 977B	**Serial No:**	45751
Mic. Type:	7052E	**Serial No:**	62242
Pre-Amp. Type:	SV12L	**Serial No:**	30274
Filter Type:	1/3 Octave	**Test No:**	F036694

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	1009	hPa ±1 hPa	**Date of Receipt :**	04/07/2023
Temperature	21	°C ±1° C	**Date of Calibration :**	10/07/2023
Relative Humidity	37	% ±5%	**Date of Issue :**	10/07/2023

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

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

Jack Kielt

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

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

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

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Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

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

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

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self-Generated Noise	11.1	Observed
Electrical Noise	11.2	Observed
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	Pass
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	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*
Test of relative attenuation at filter midband frequency	10	Pass
Linear operating range including range control if fitted	11	Pass
Test of lower limit of linear operating range	12	Pass
Measurement of relative attenuation (filter shape)	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: SLM37222

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Svantek		
Type No:	SVAN 977C	**Serial No:**	97528
Mic. Type:	MK255	**Serial No:**	21348
Pre-Amp. Type:	SV12L	**Serial No:**	108473
Filter Type:	1/1 Octave	**Test No:**	F037225

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	996	hPa ±1 hPa	**Date of Receipt :**	25/08/2023
Temperature	23	°C ±1° C	**Date of Calibration :**	31/08/2023
Relative Humidity	46	% ±5%	**Date of Issue :**	31/08/2023

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

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

Hein Soe

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

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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%.

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www.acu-vib.com.au

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

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

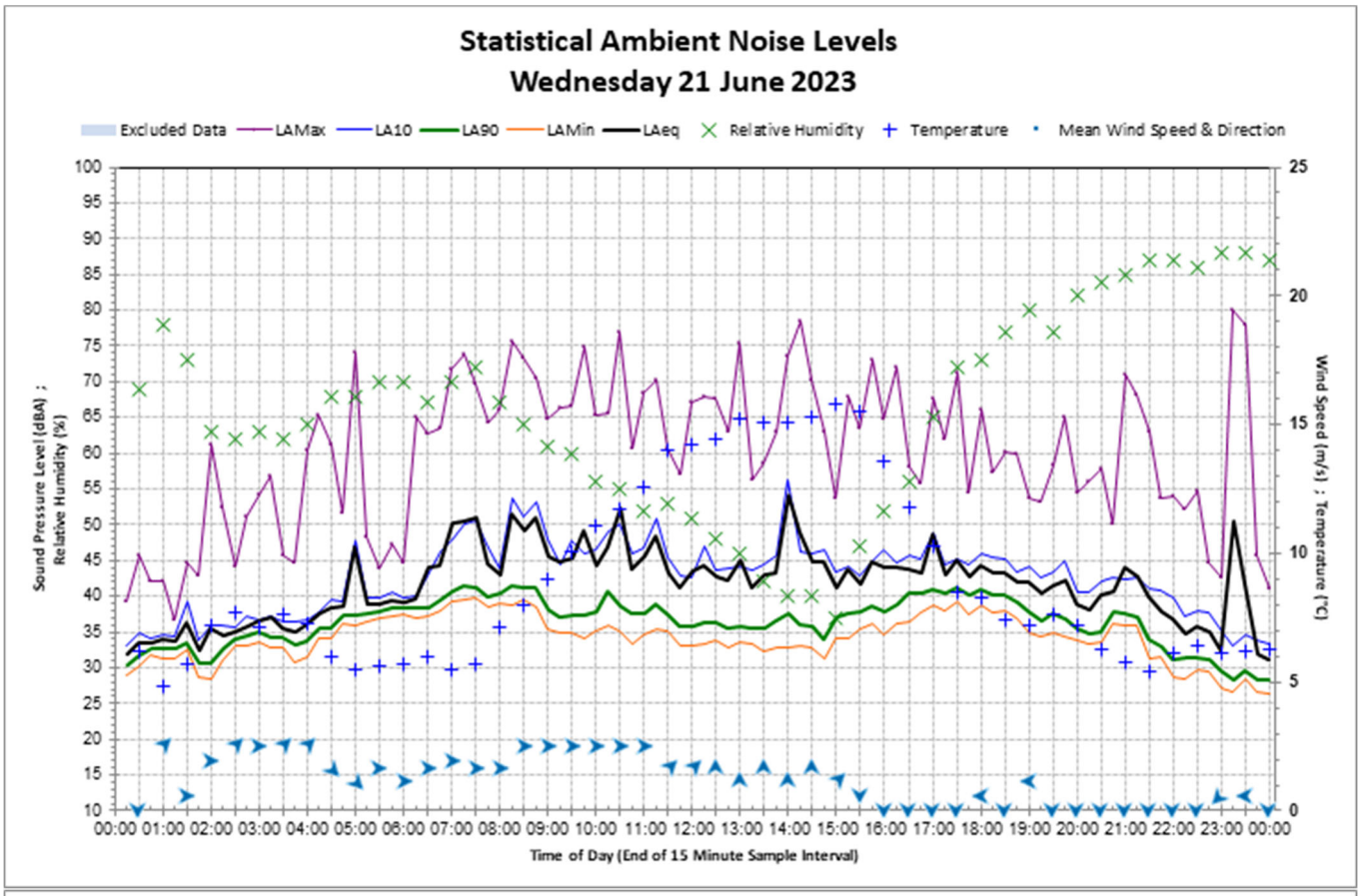
Tests performed	*Clause*	*Result*
Test of relative attenuation at filter midband frequency	10	Pass
Linear operating range including range control if fitted	11	Pass
Test of lower limit of linear operating range	12	Pass
Measurement of relative attenuation (filter shape)	13	Pass

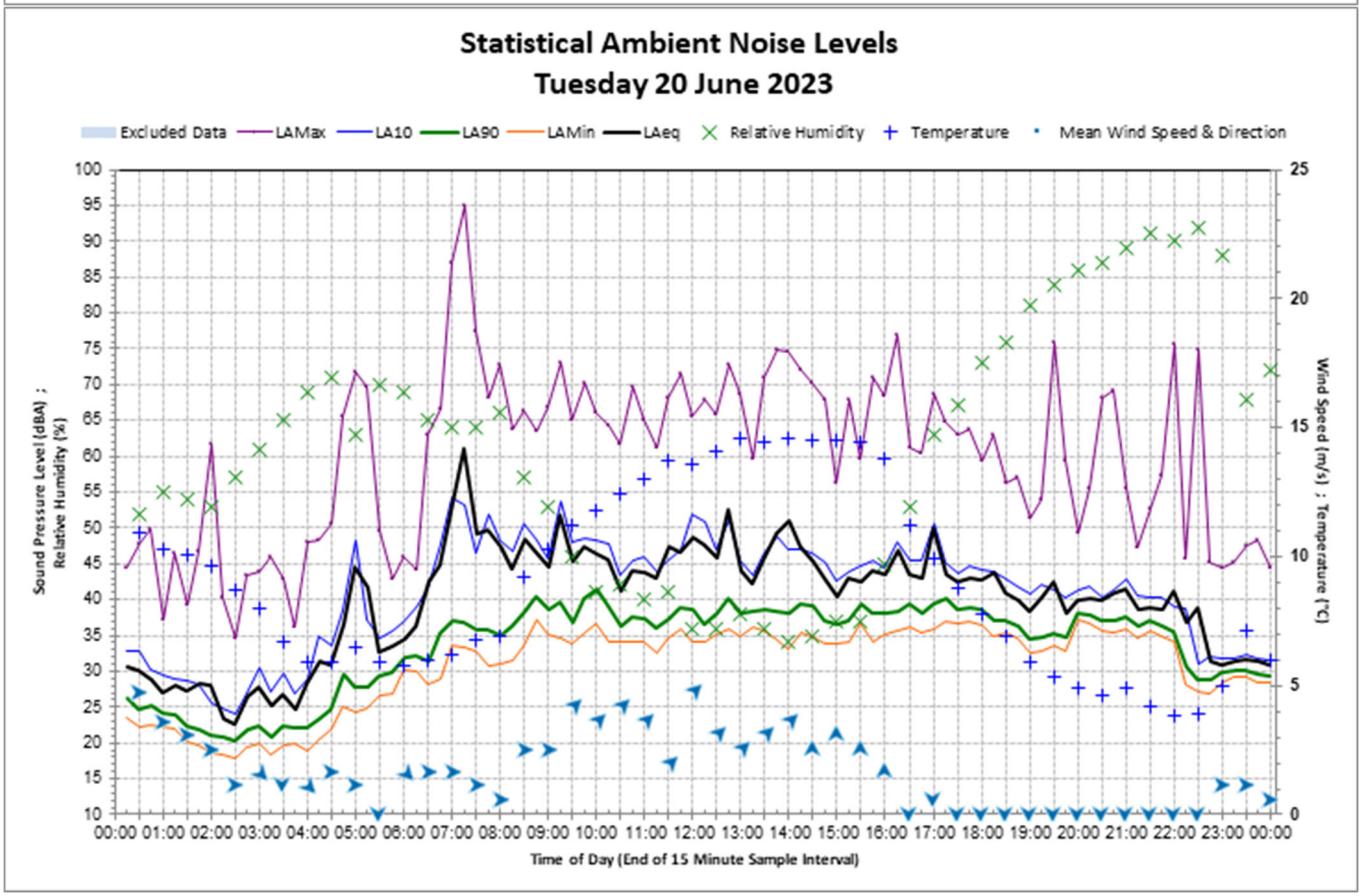
The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform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

A full technical report is available on request.

Appendix B

Unattended Monitoring Charts Location – M1


Statistical Ambient Noise Levels
Wednesday 21 June 2023
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 20 June 2023
Excluded Data
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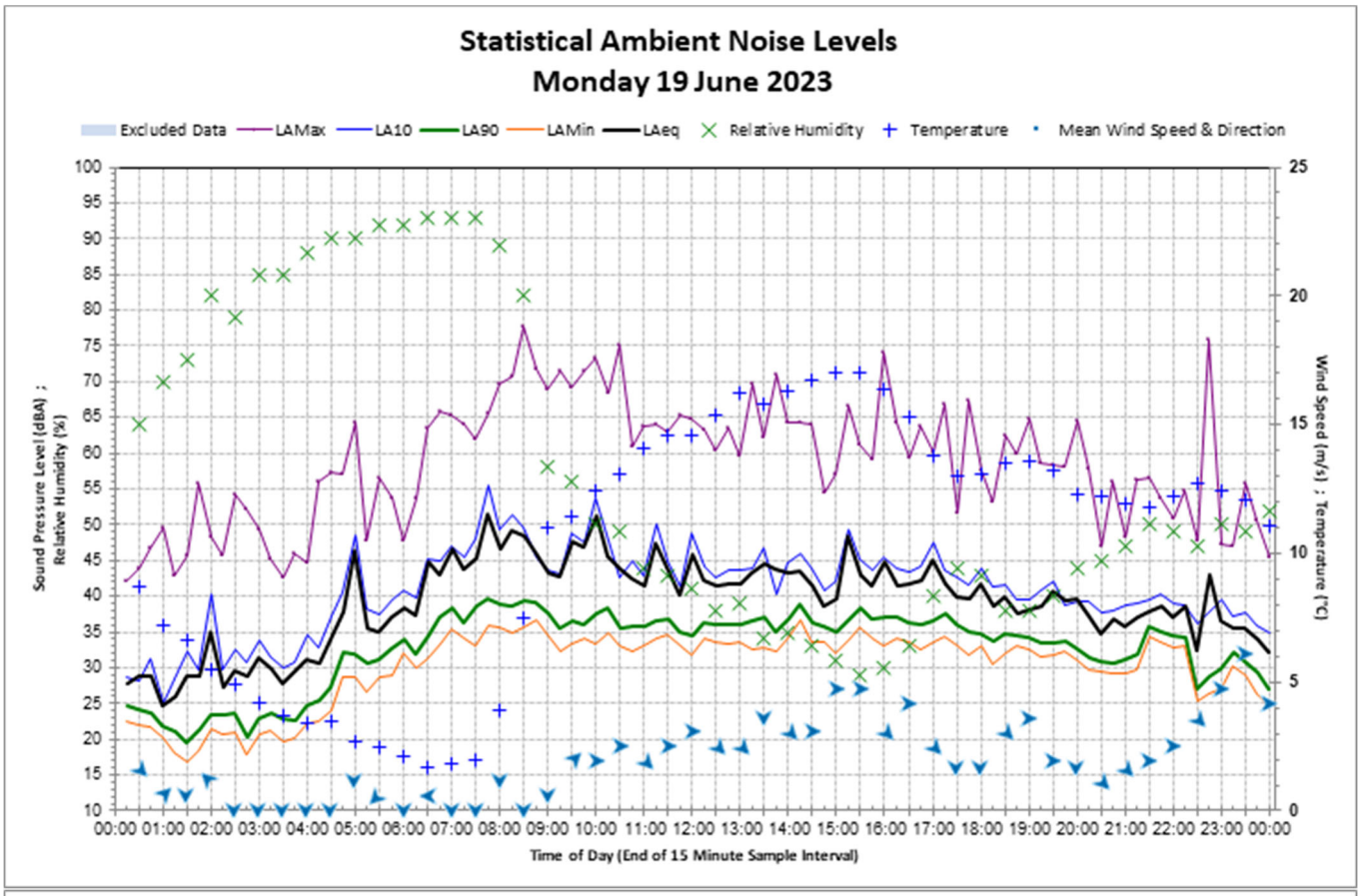
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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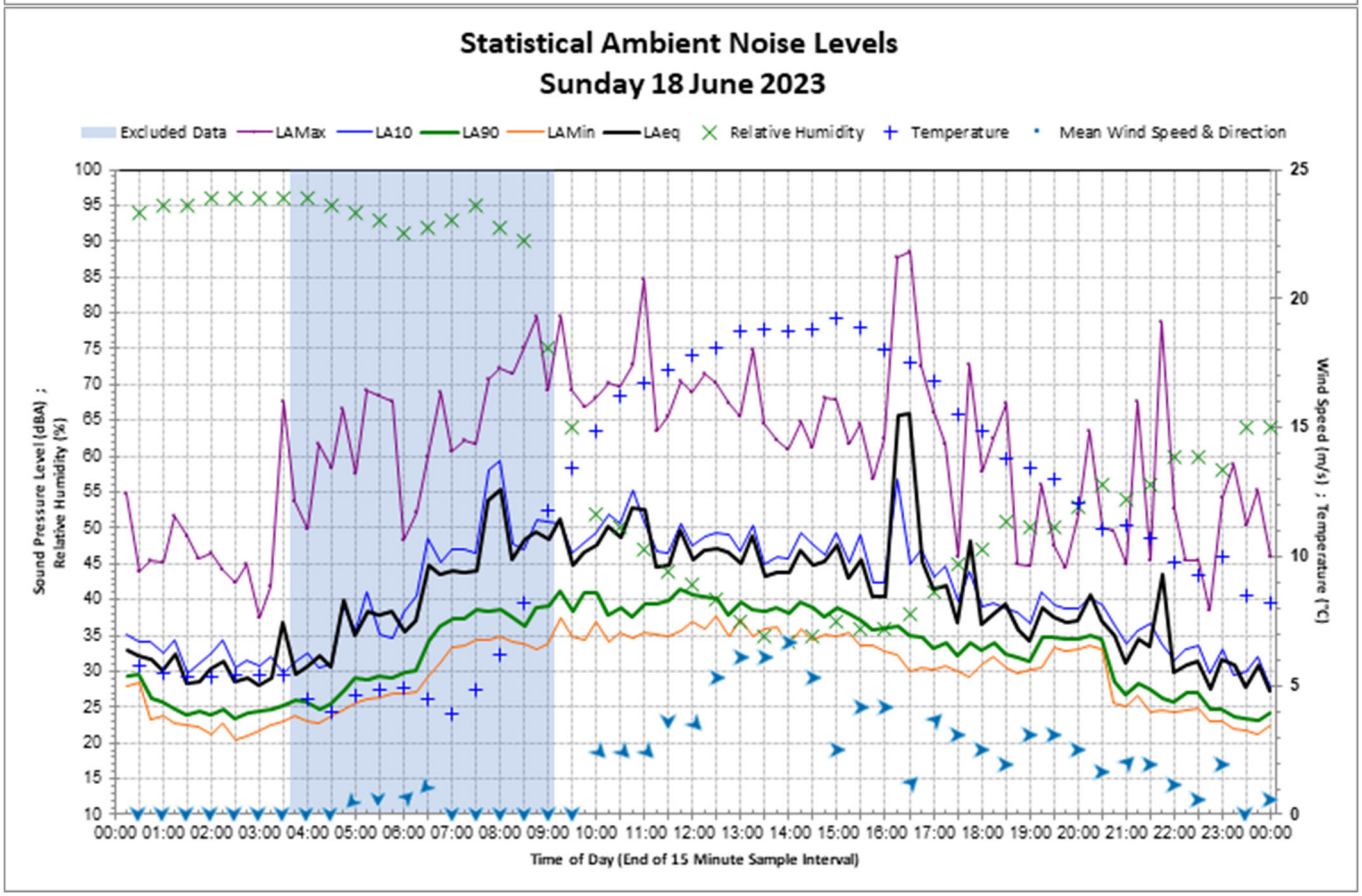
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)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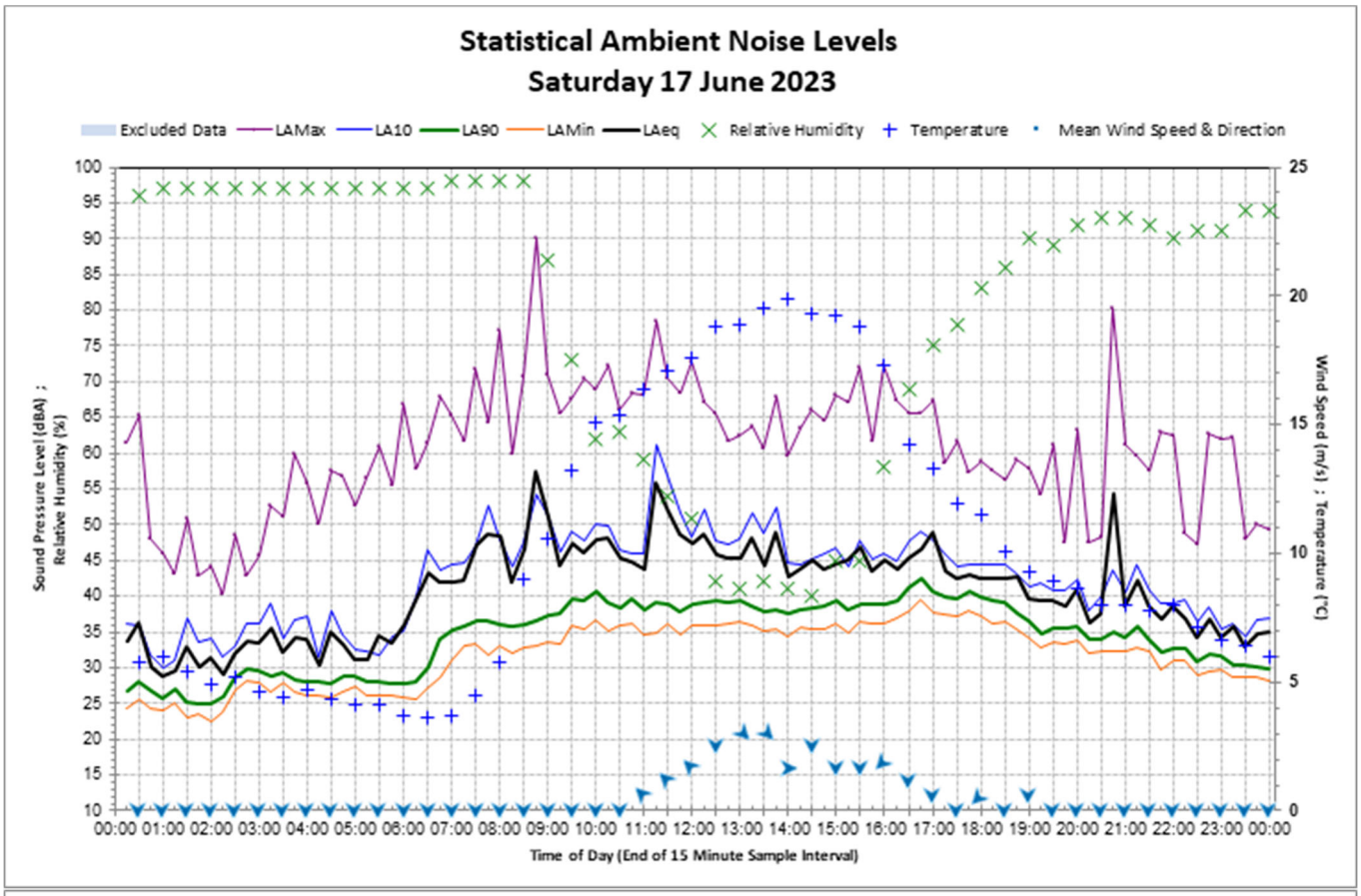
LA90
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)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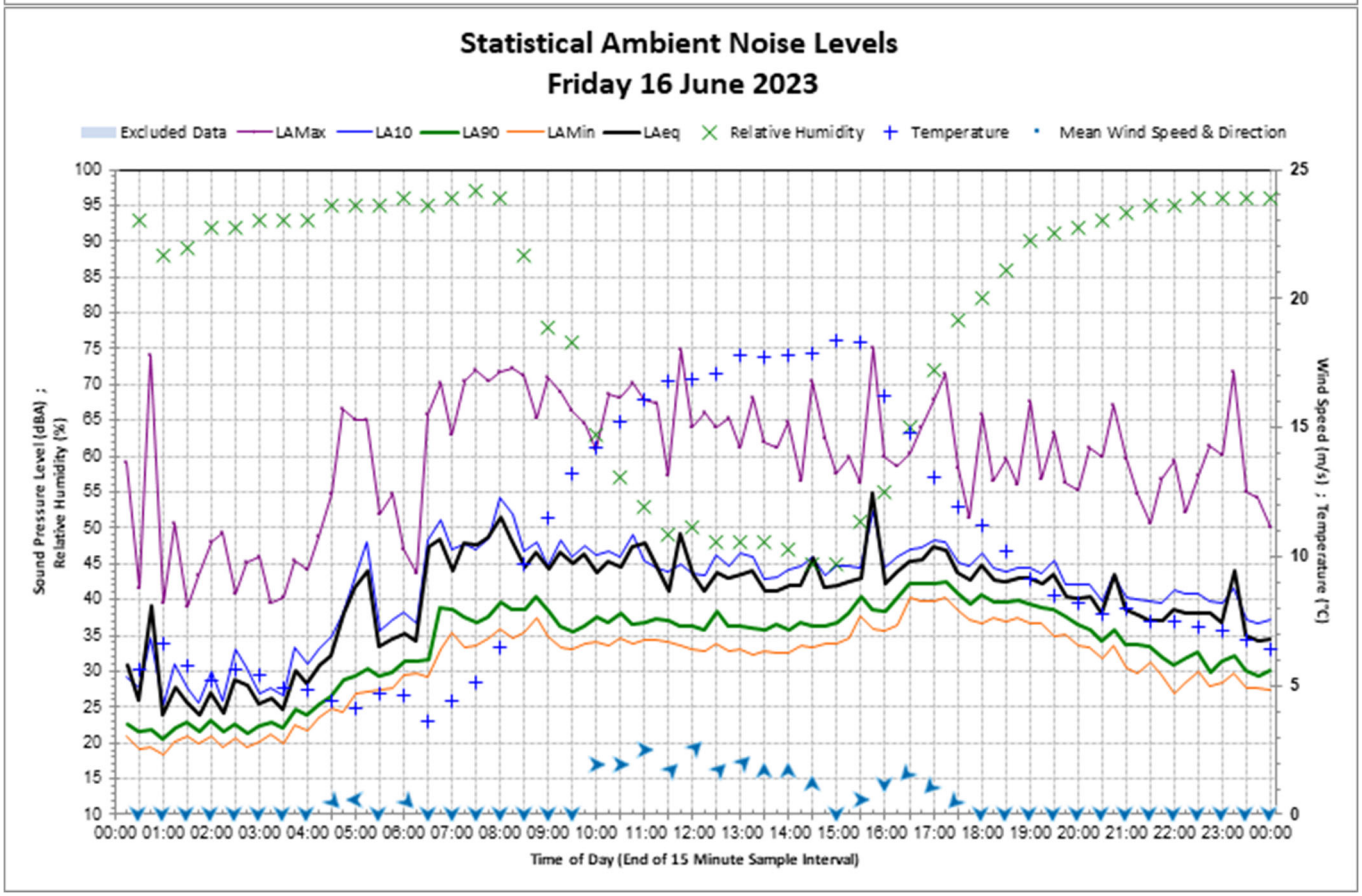
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAeq
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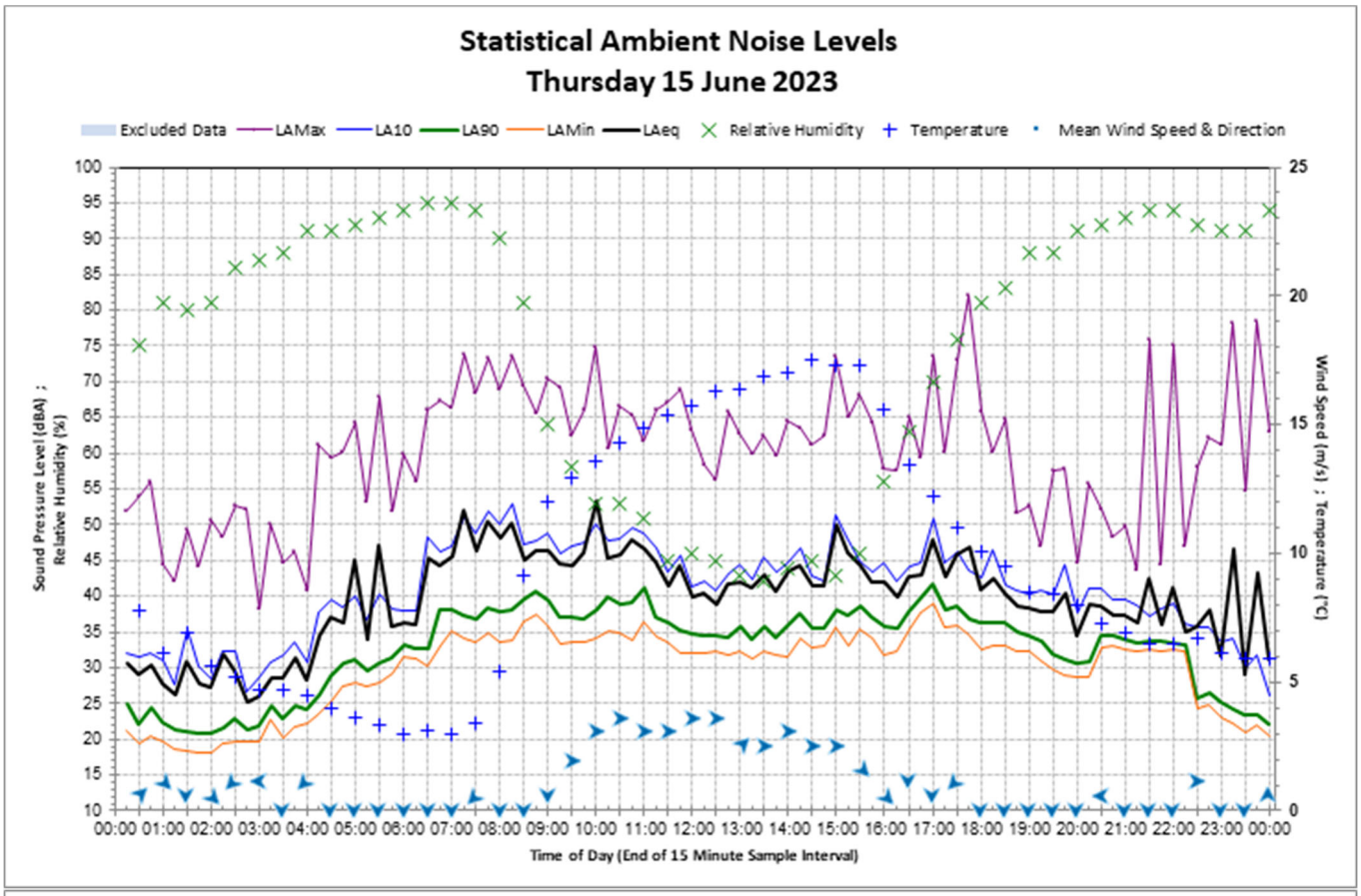
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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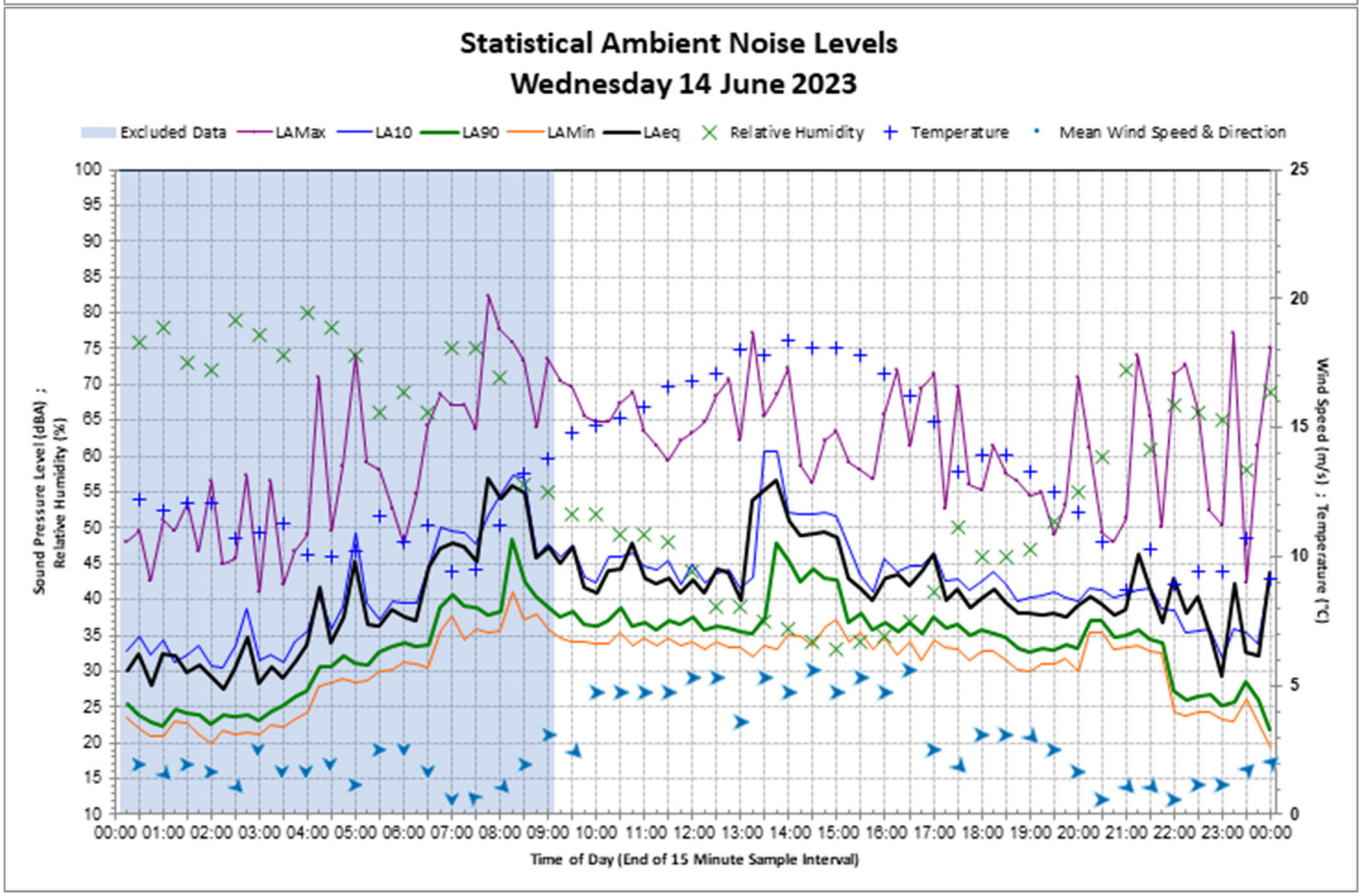
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 14 June 2023
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LAMin
LAeq
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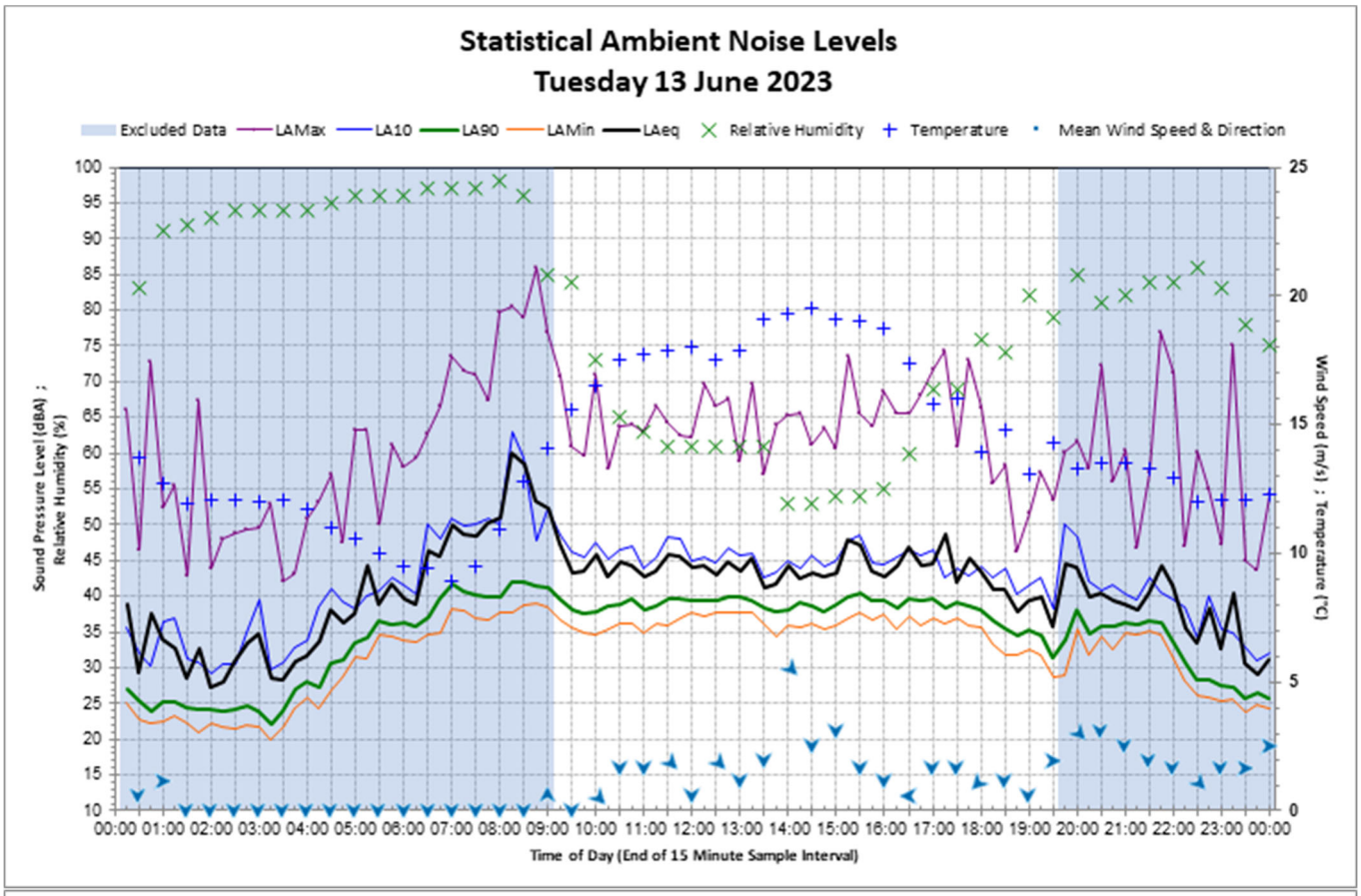
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LA90
LAMin
LAeq
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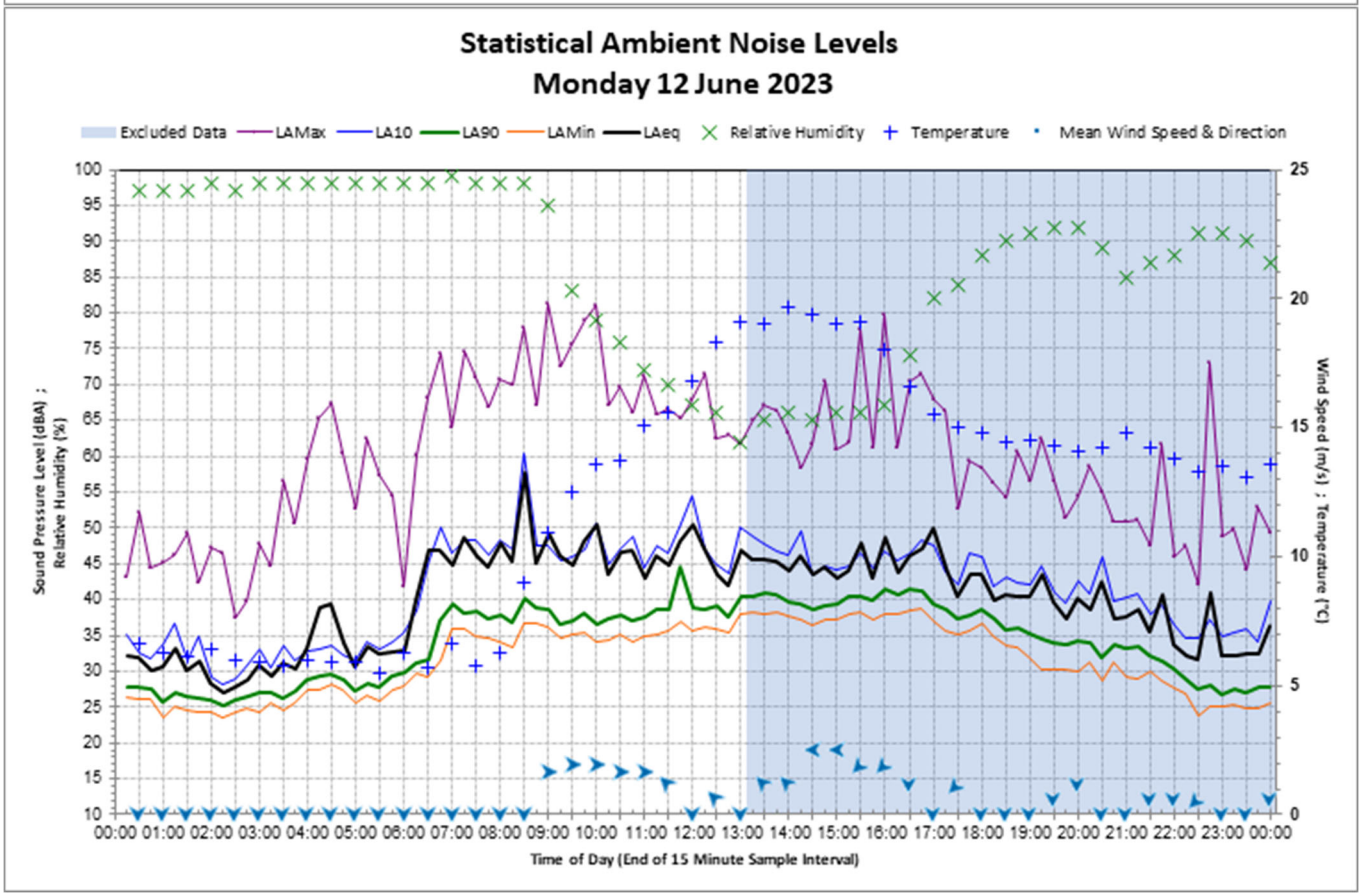
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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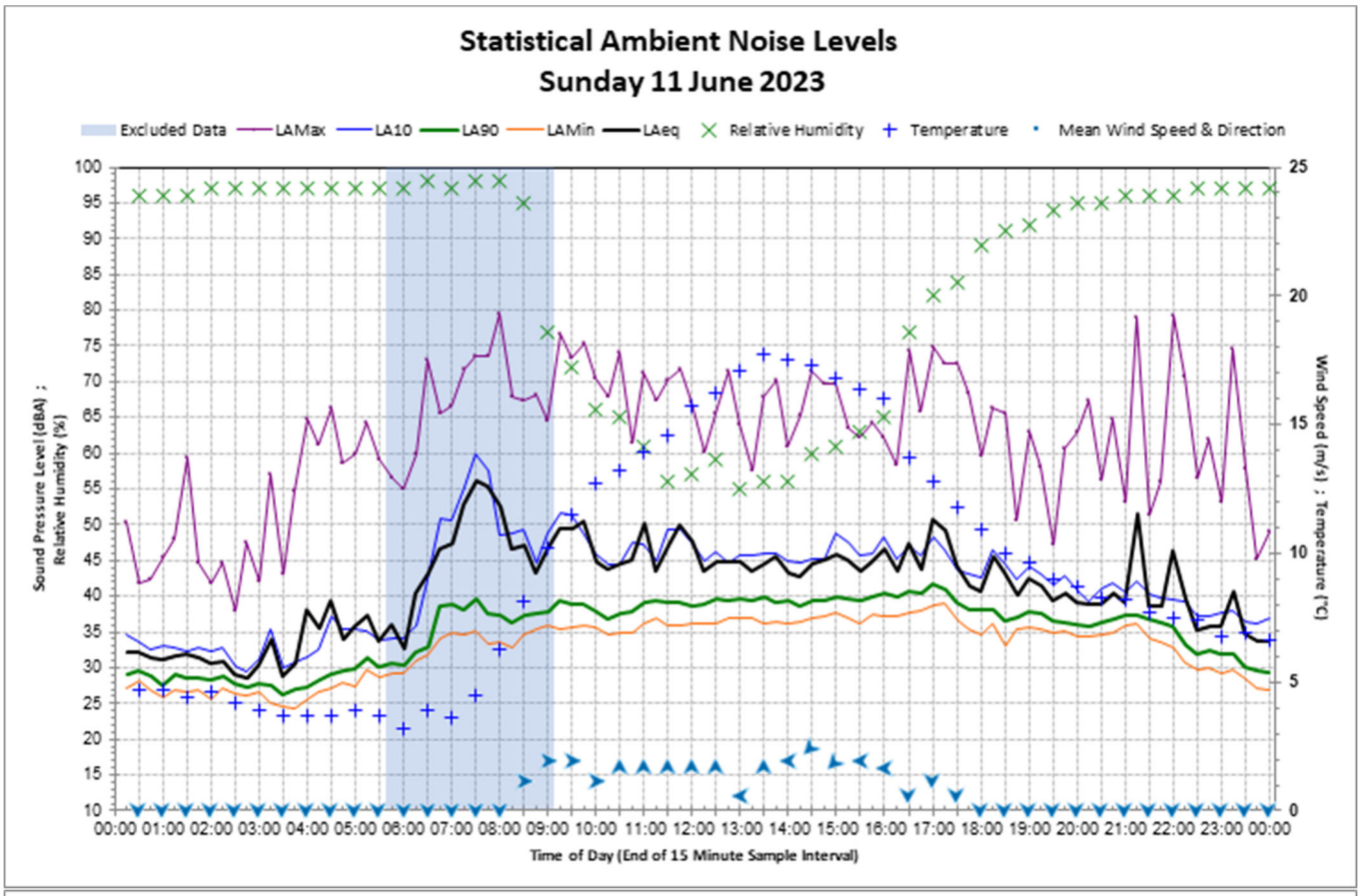
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 11 June 2023
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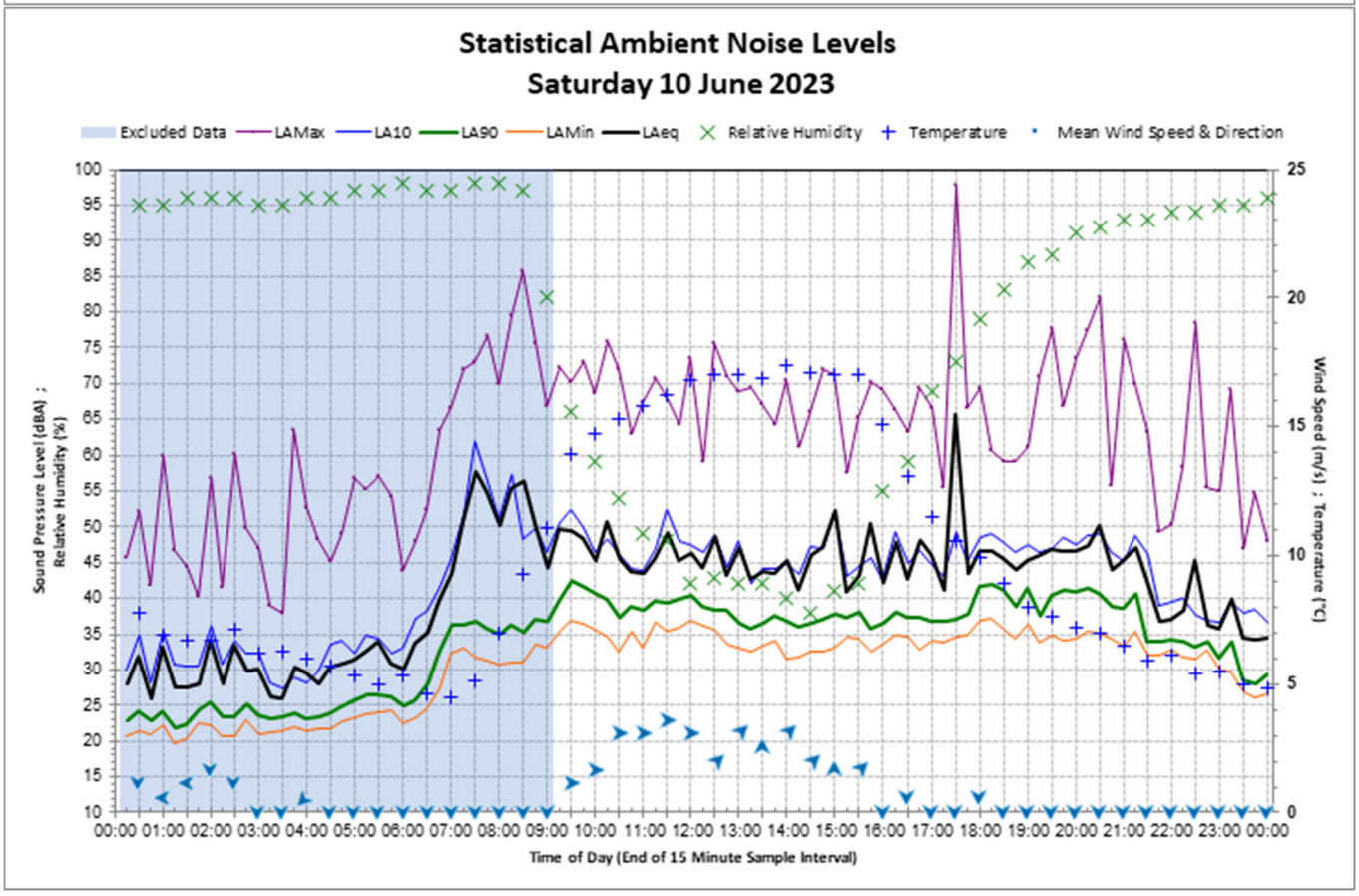
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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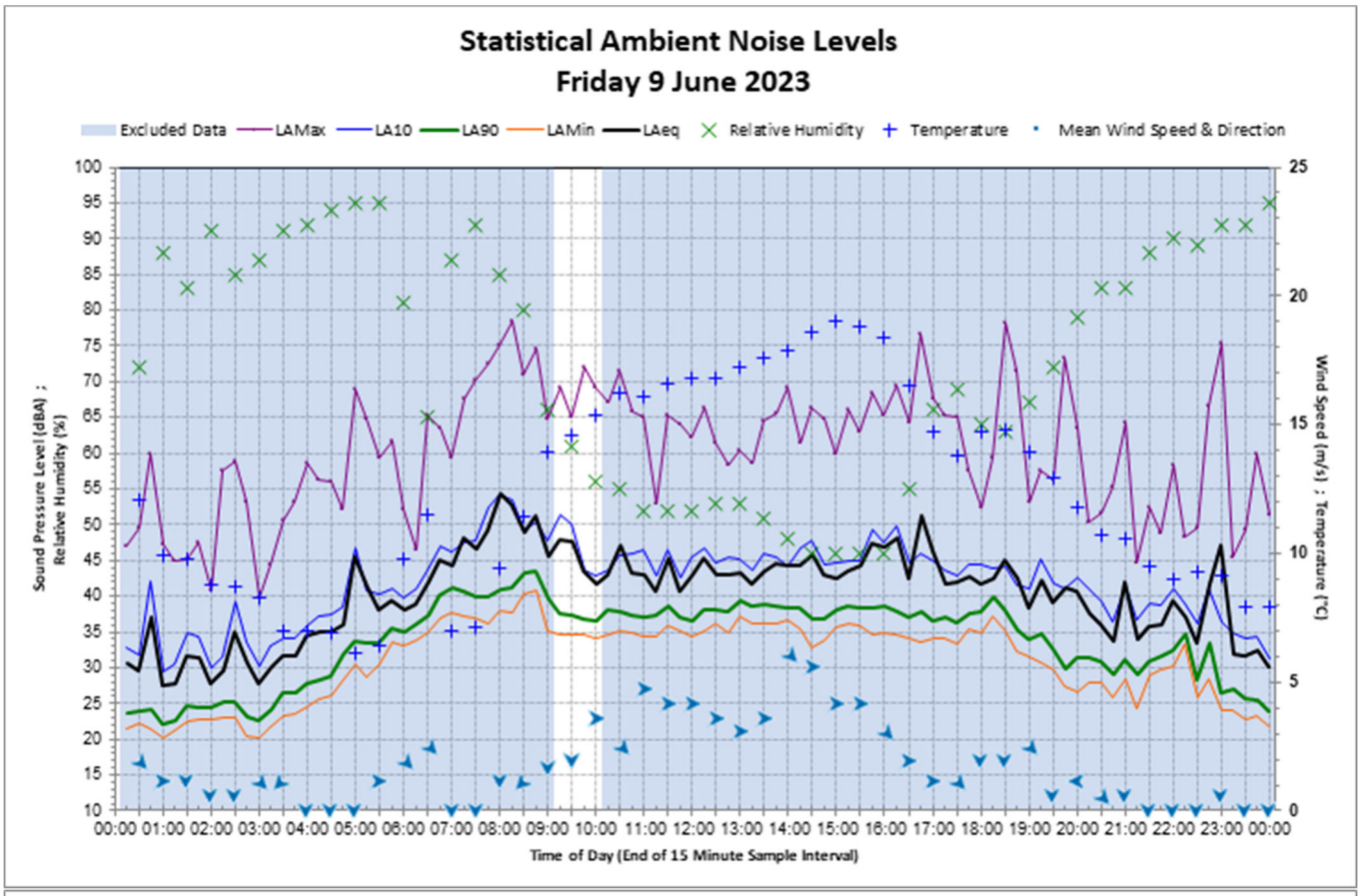
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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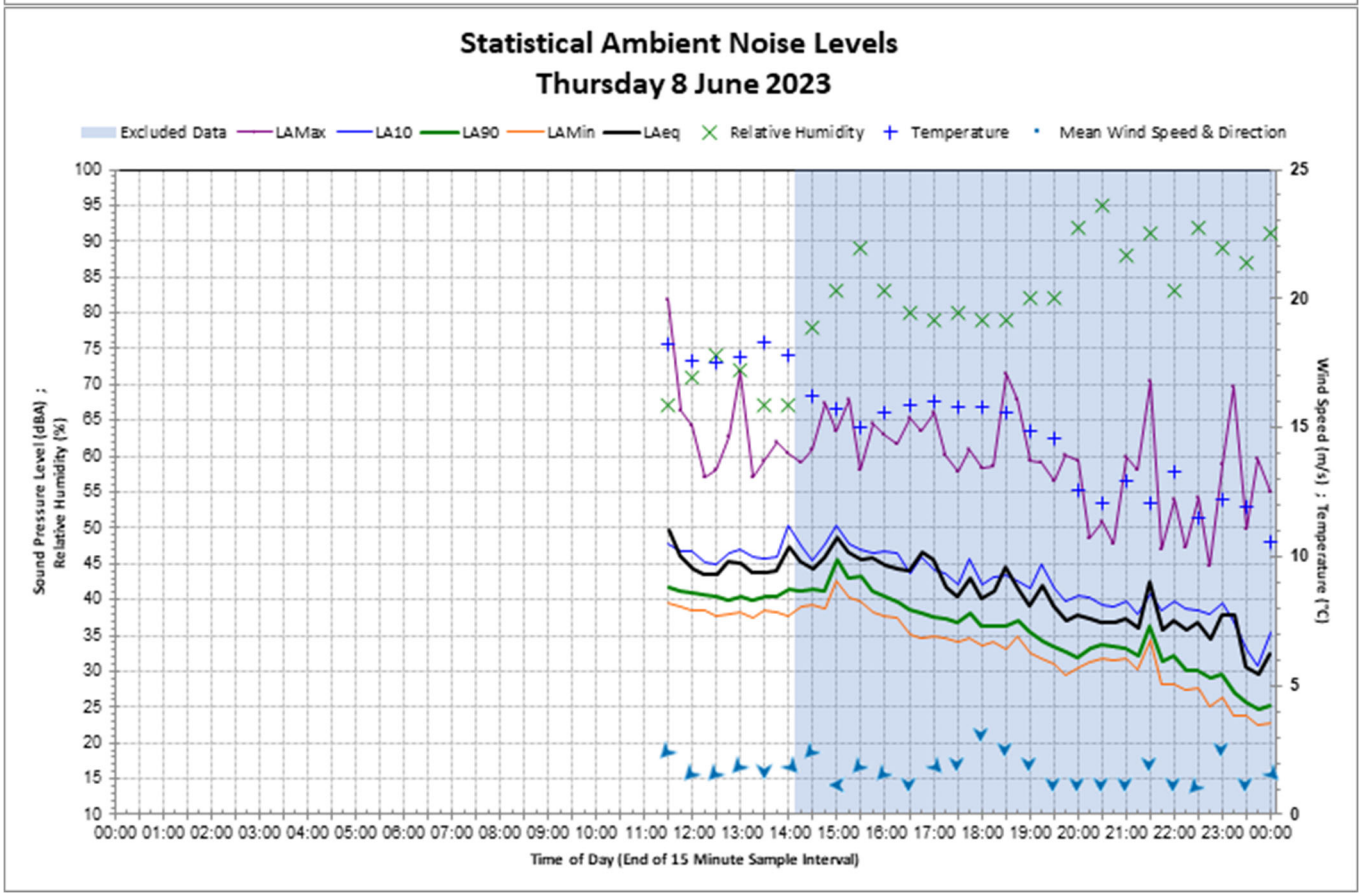
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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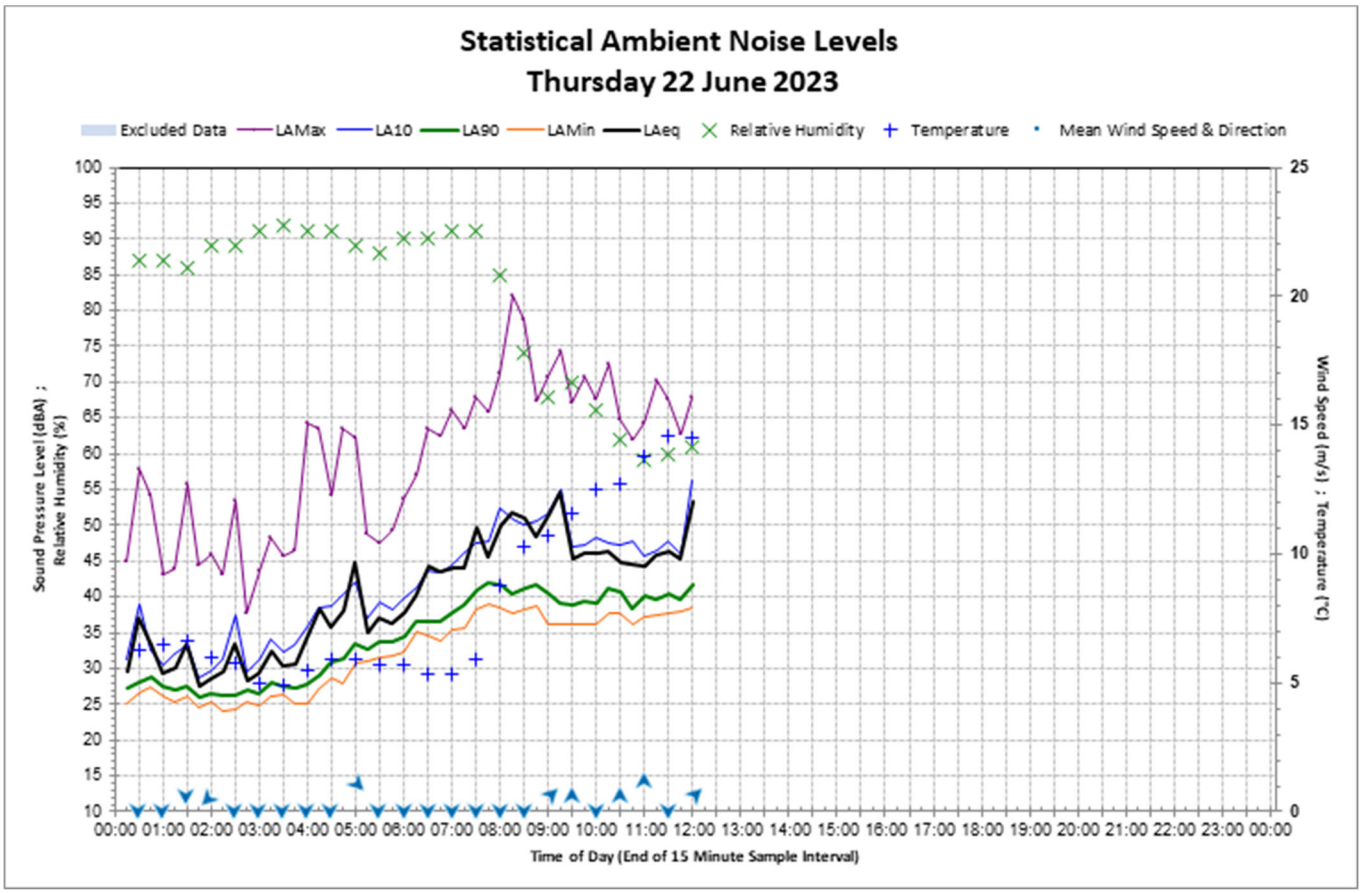
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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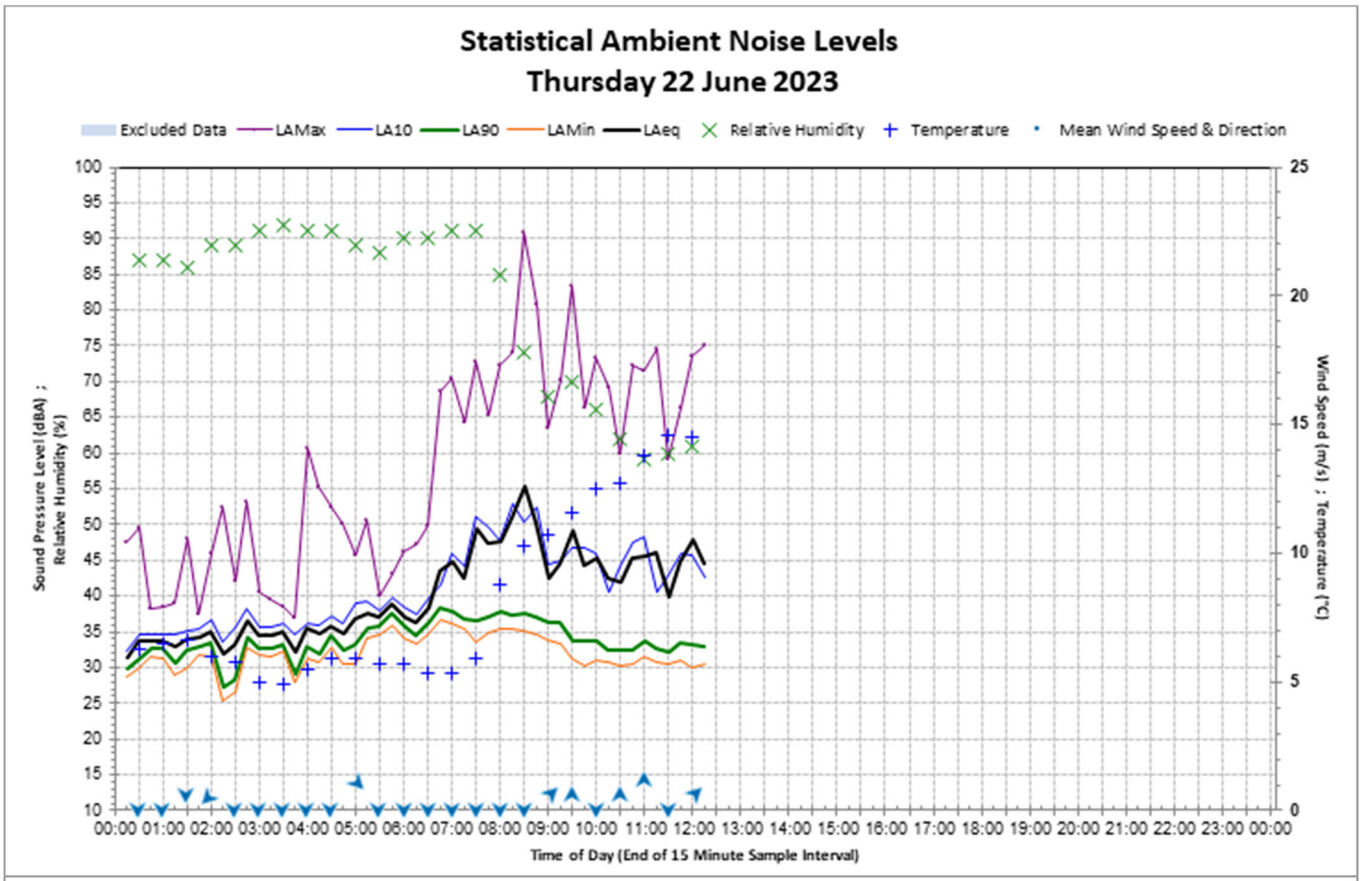
LAMin
LAeq
Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)

Appendix C

Unattended Monitoring Charts Location – M2


Statistical Ambient Noise Levels
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LAMin
LAeq
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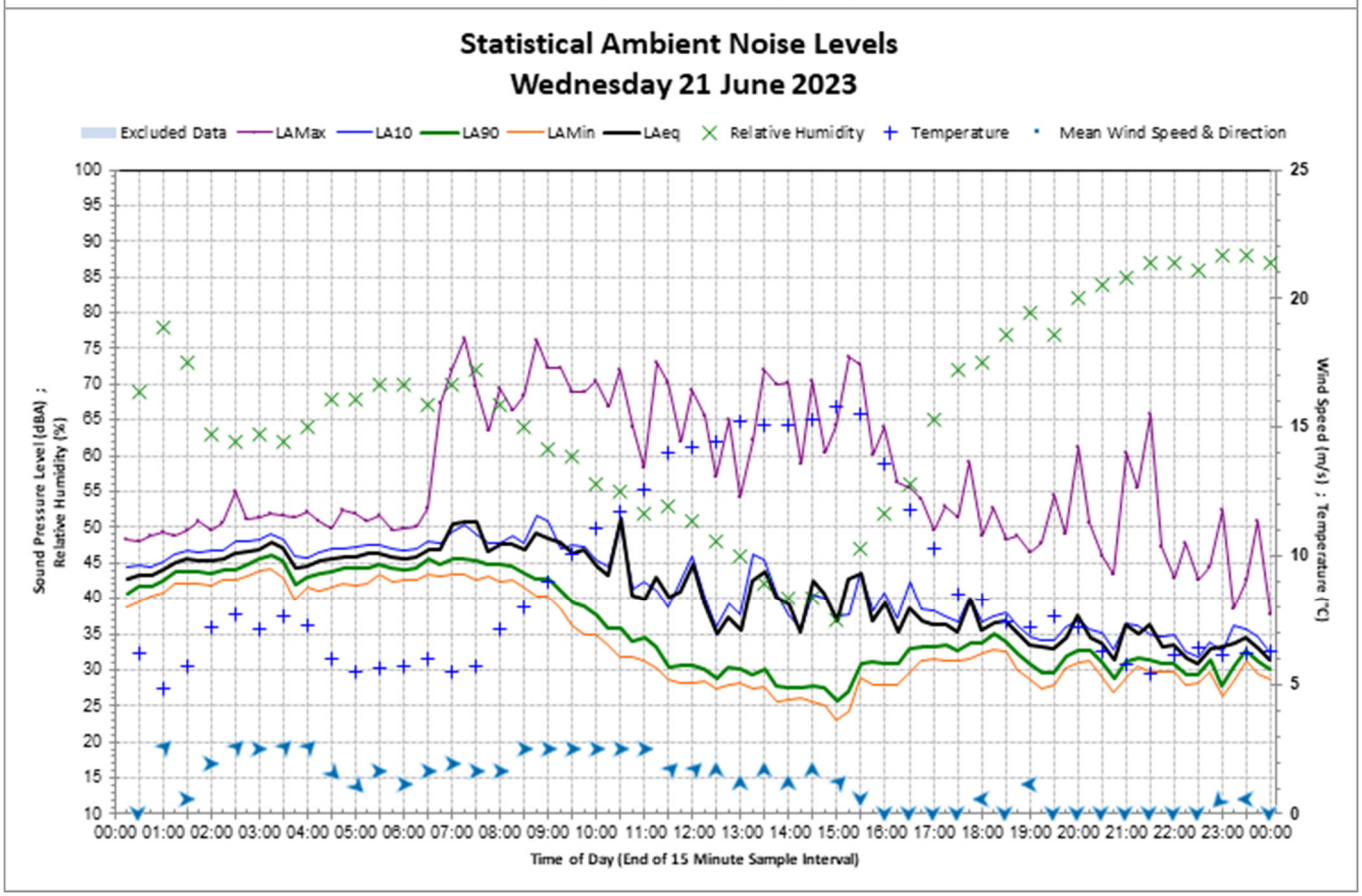
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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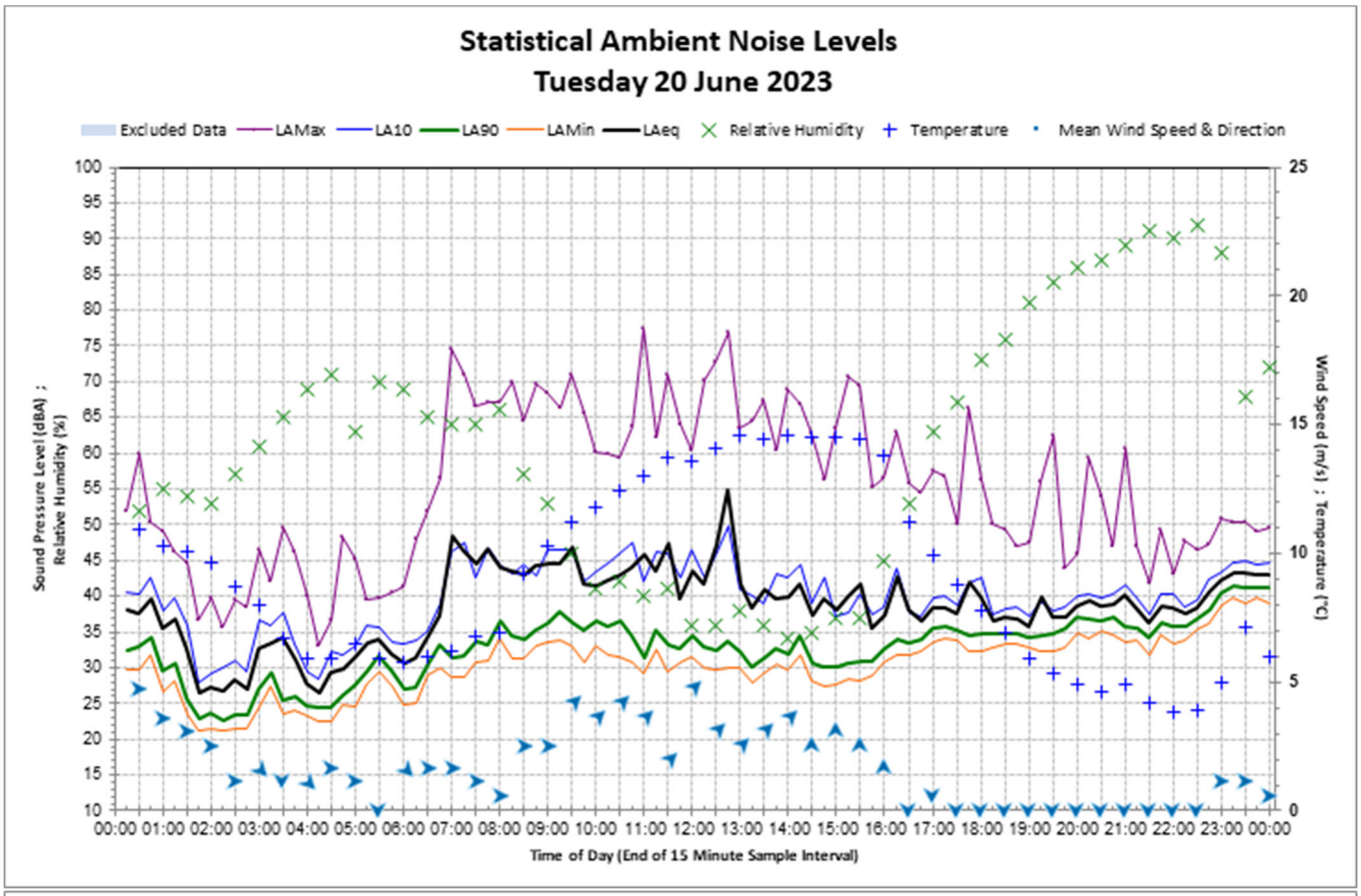
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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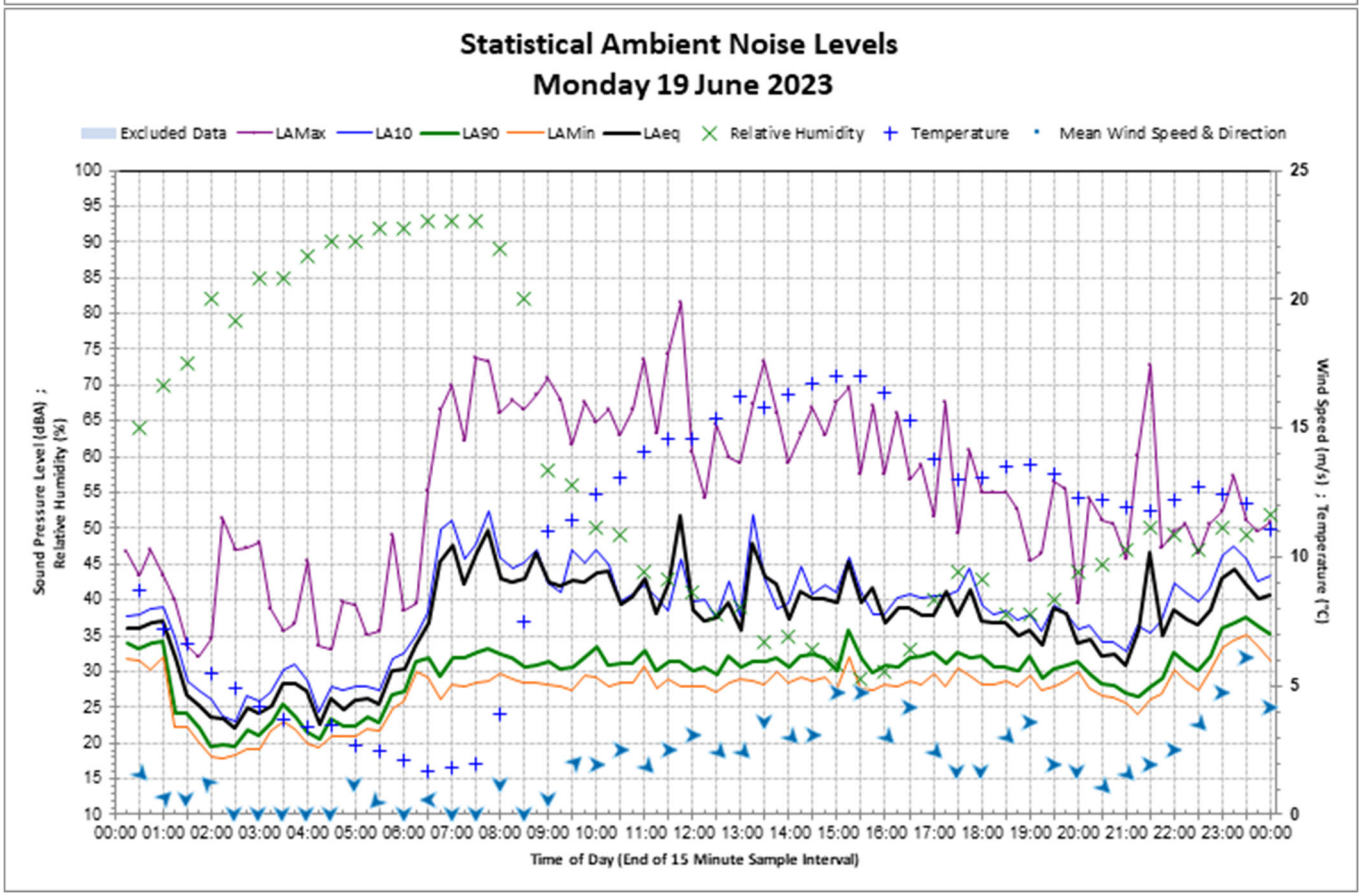
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAMin
LAeq
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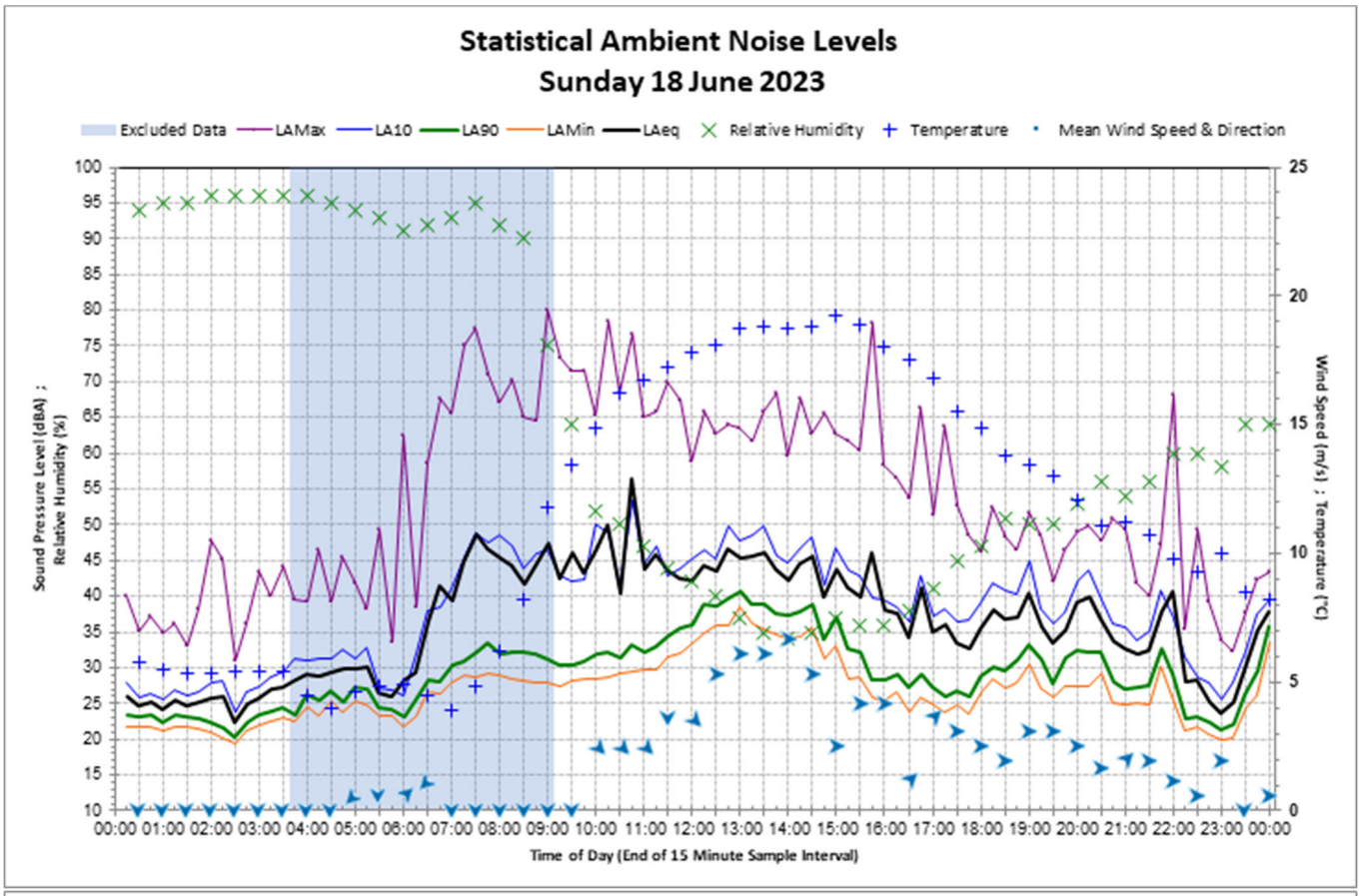
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 18 June 2023
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LAMin
LAeq
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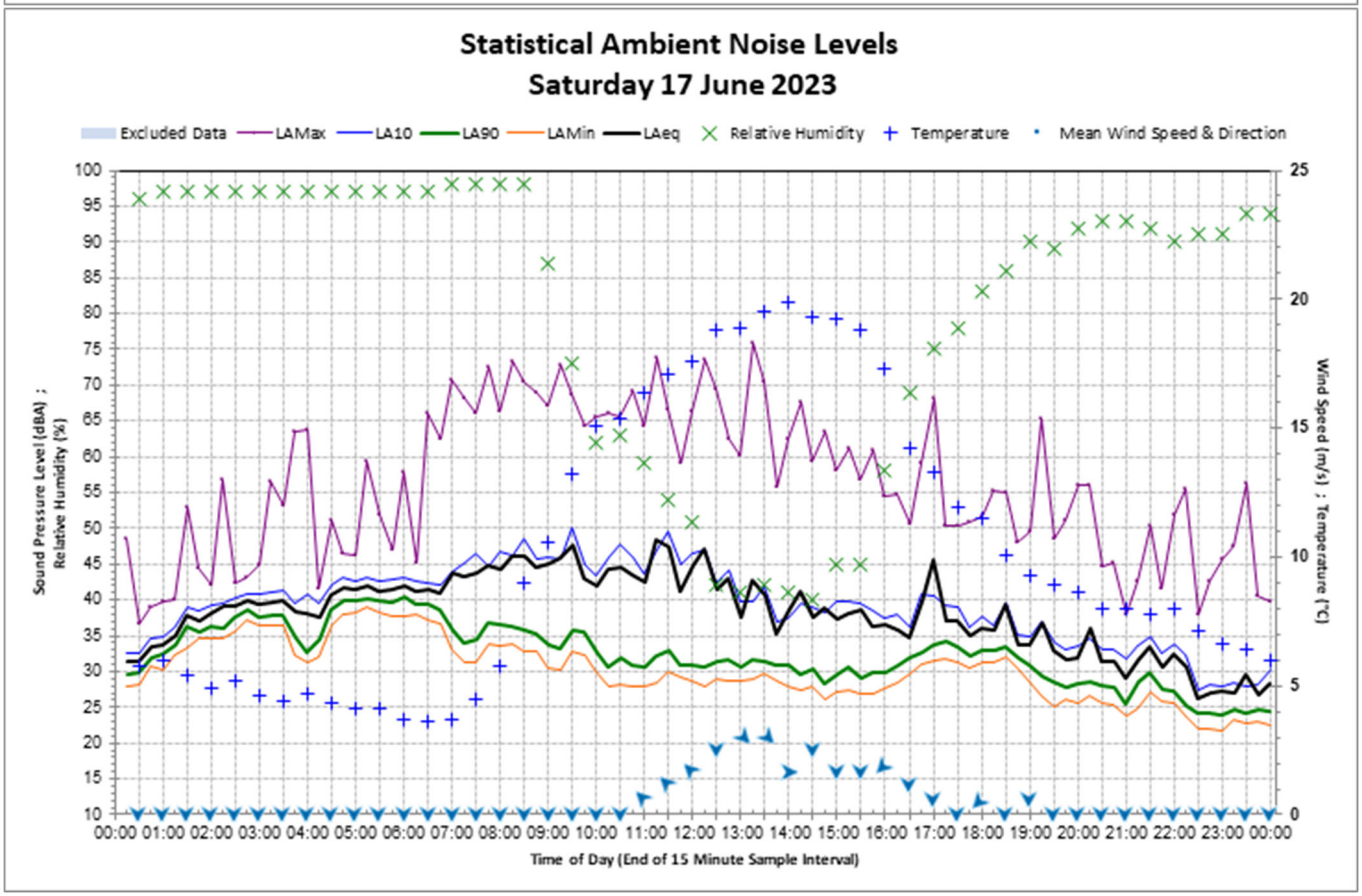
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Saturday 17 June 2023
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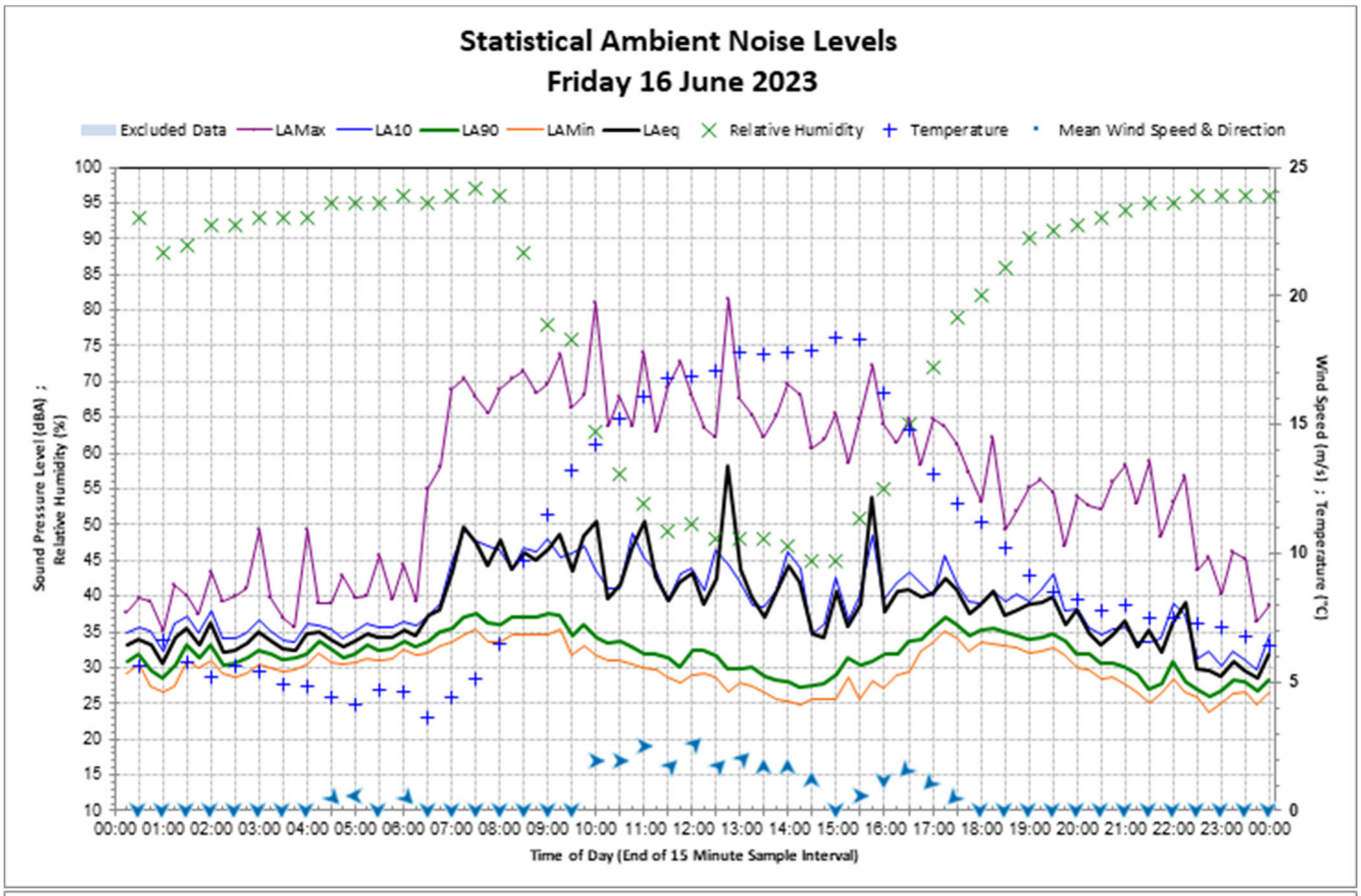
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 16 June 2023
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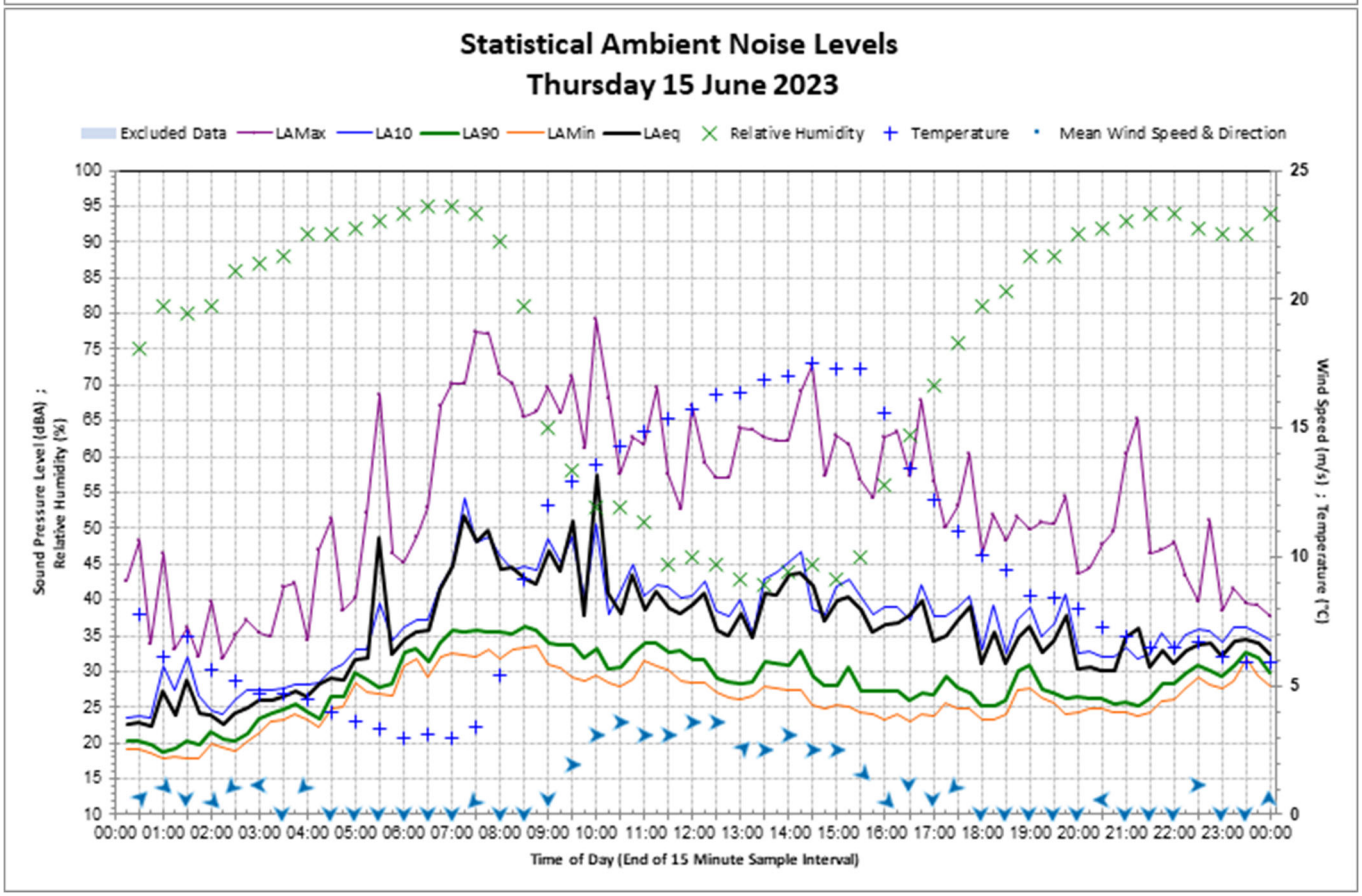
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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LAeq
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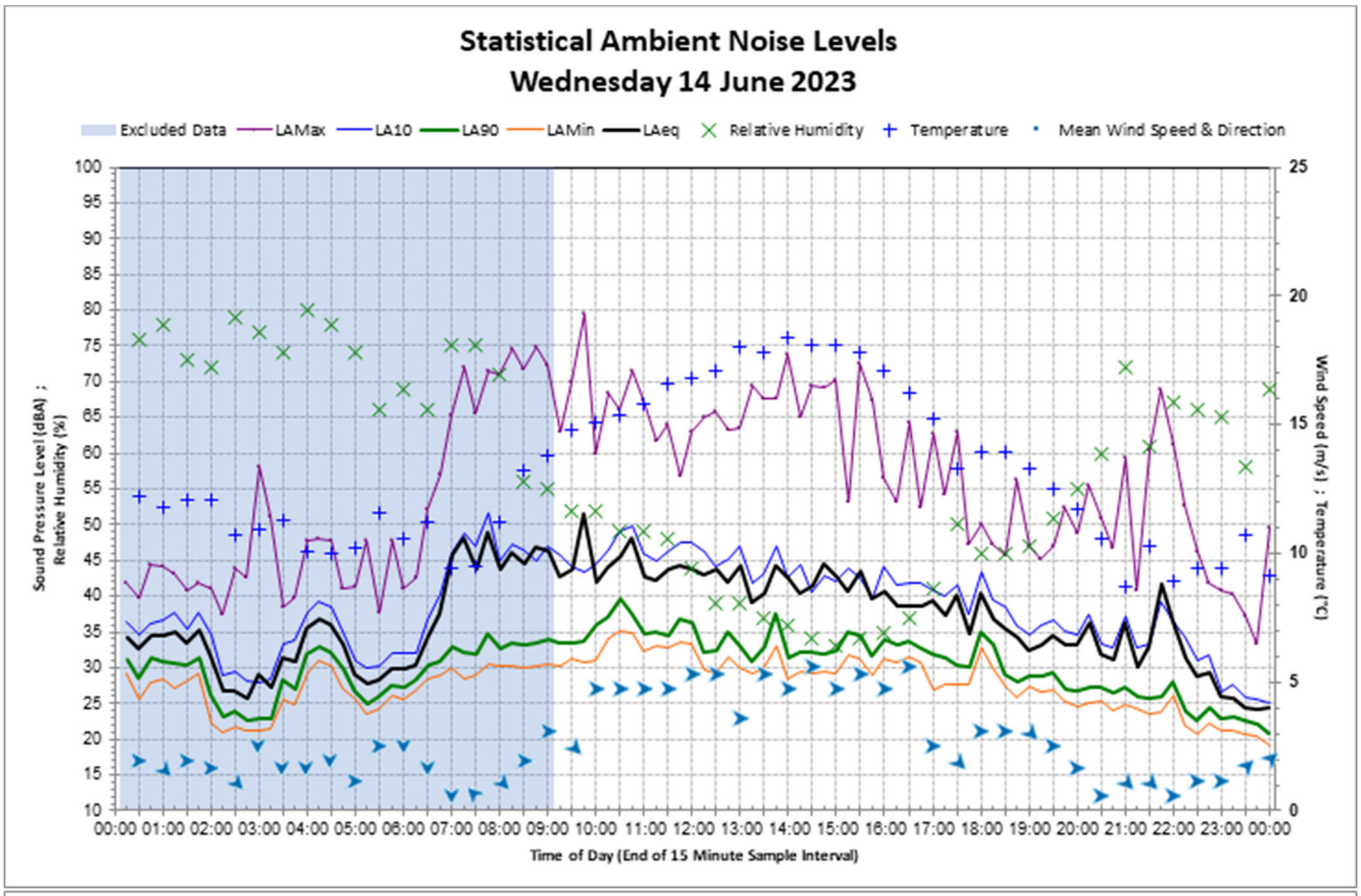
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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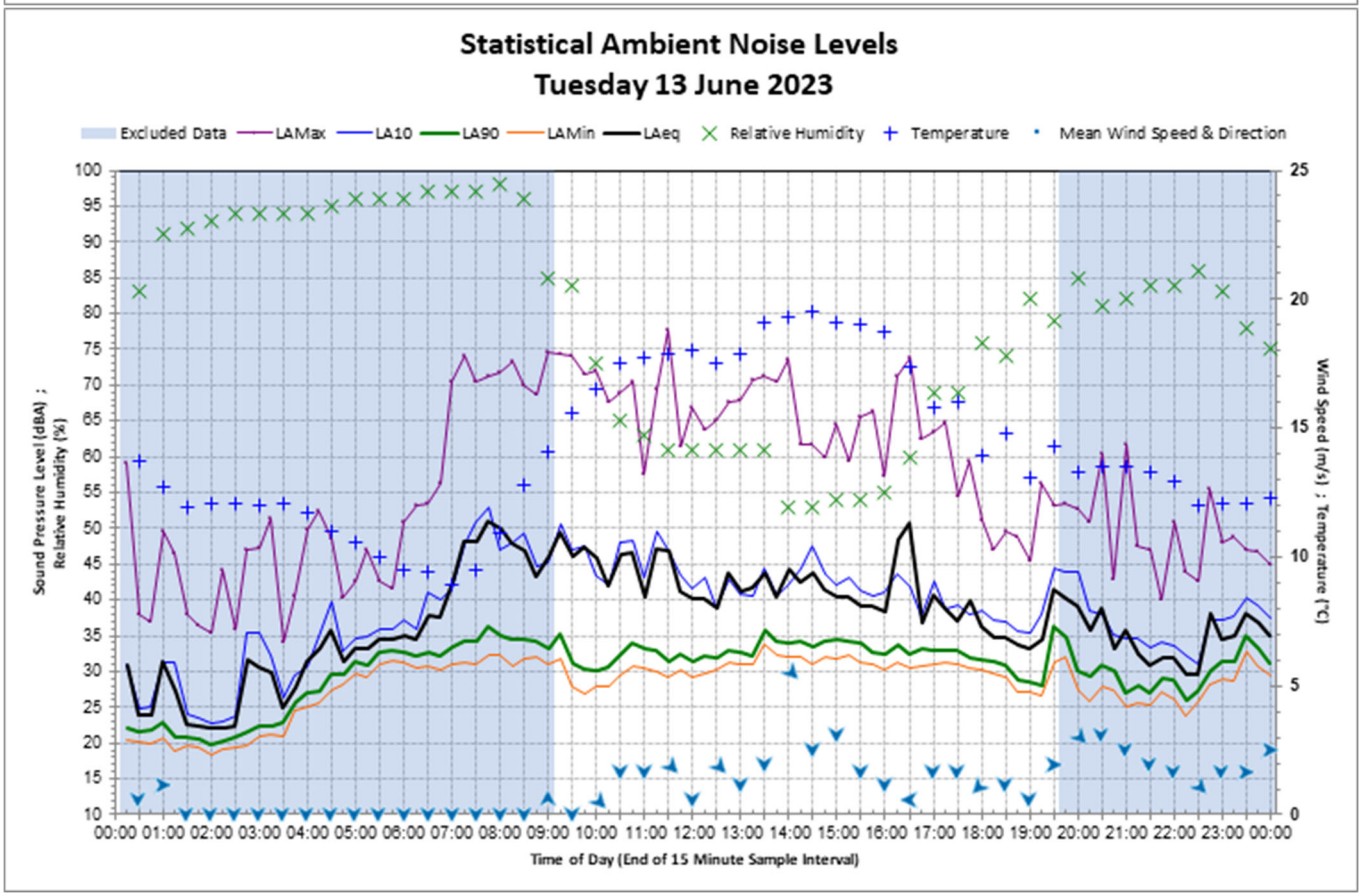
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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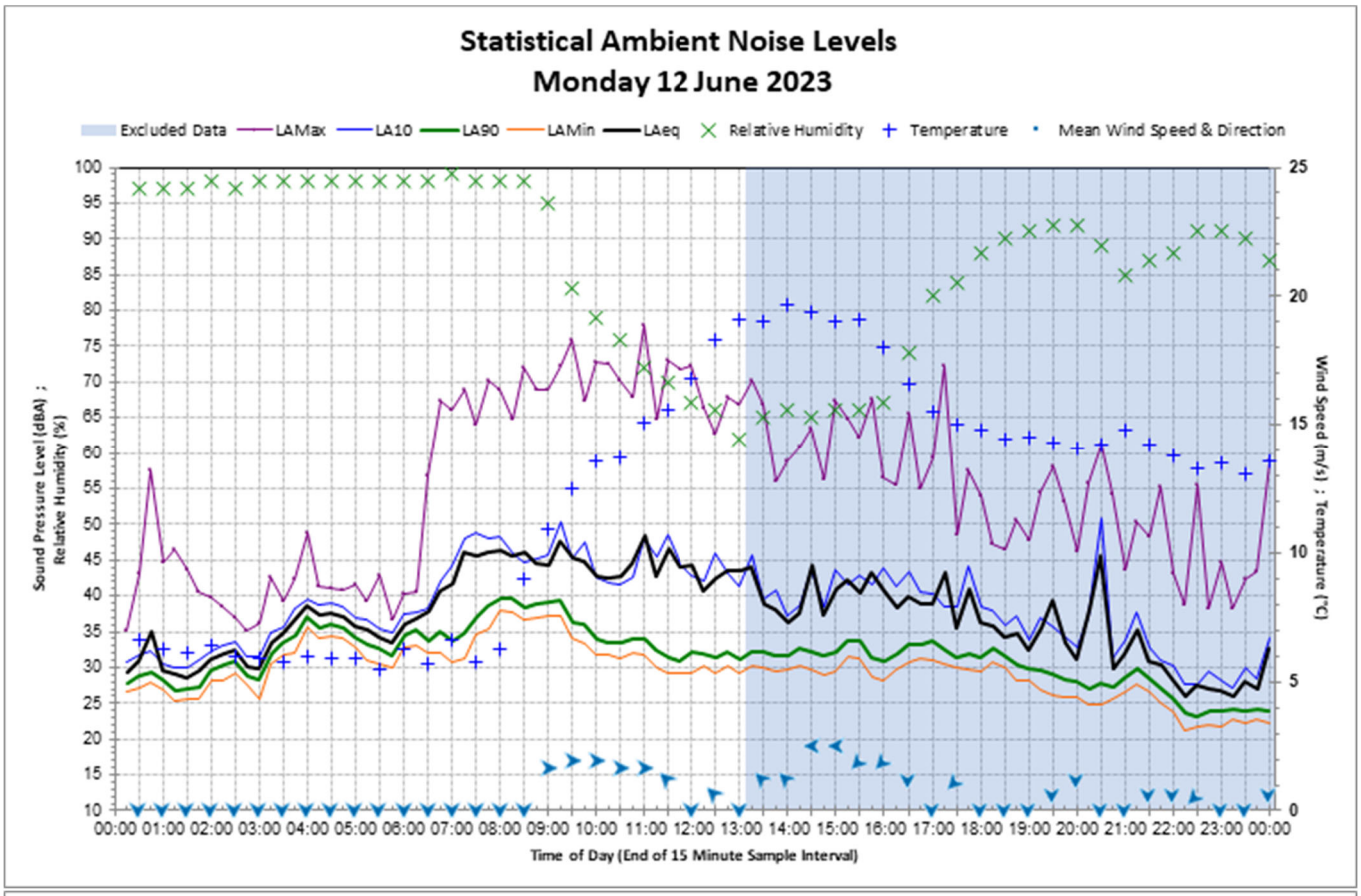
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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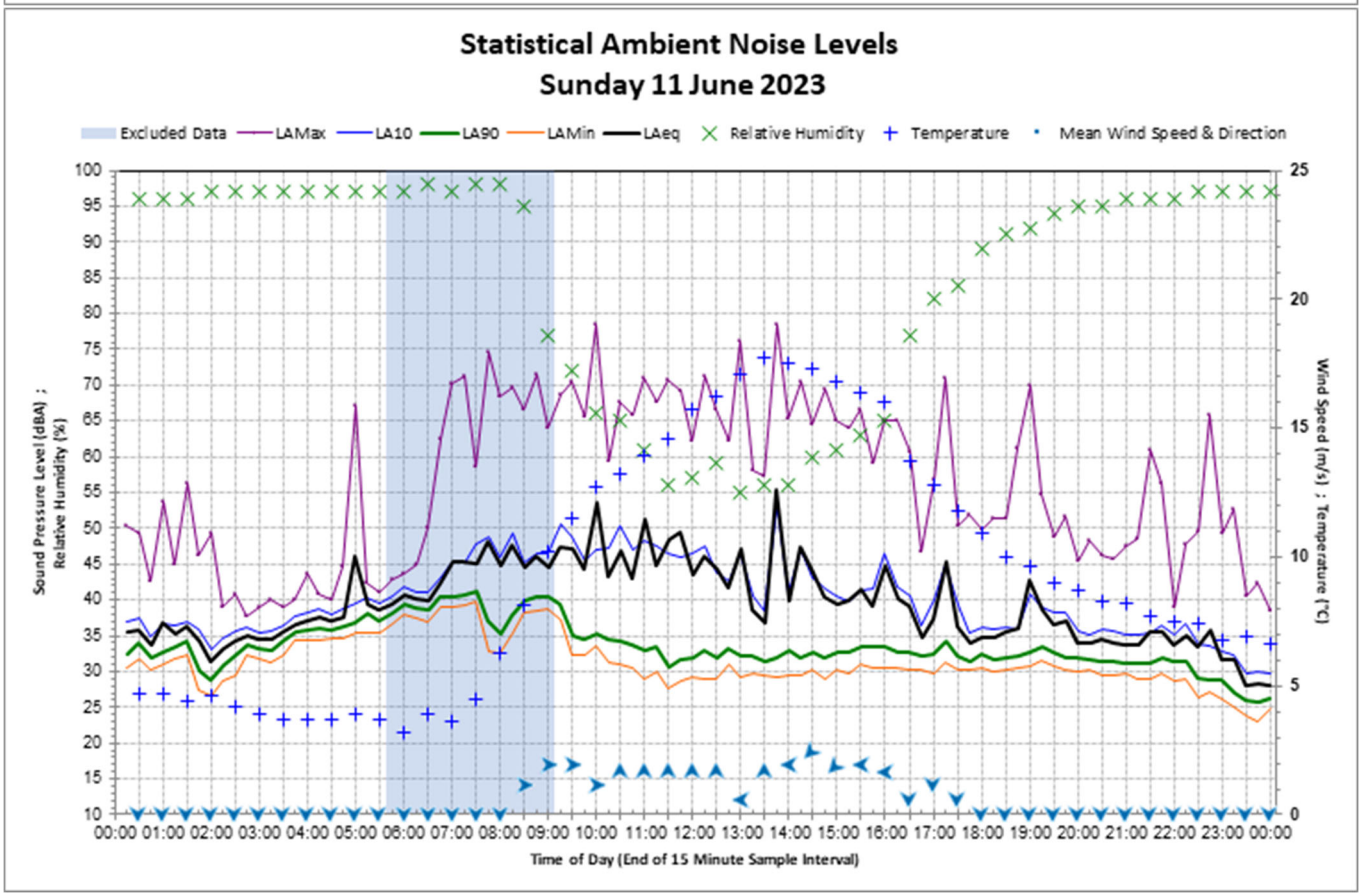
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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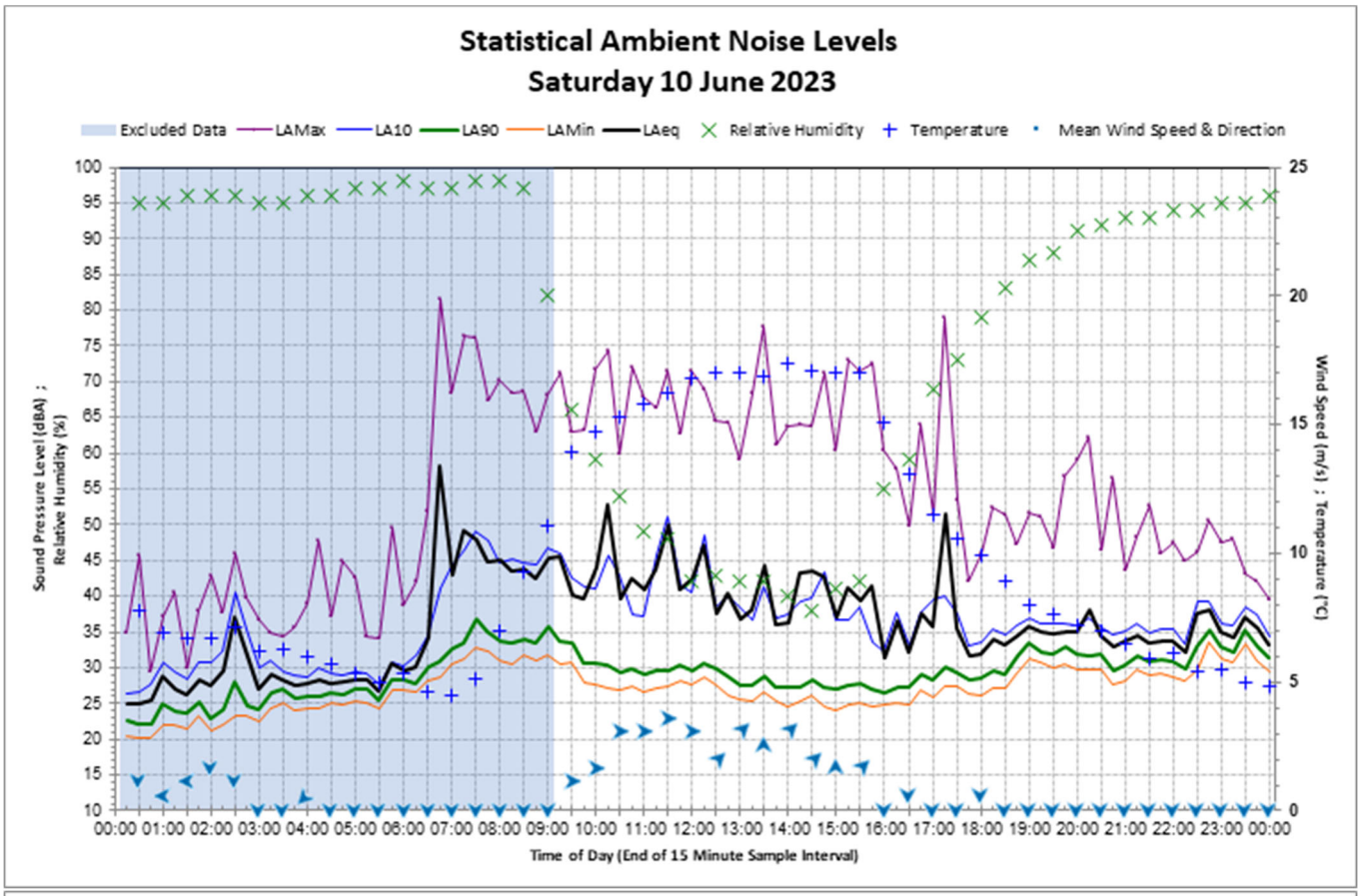
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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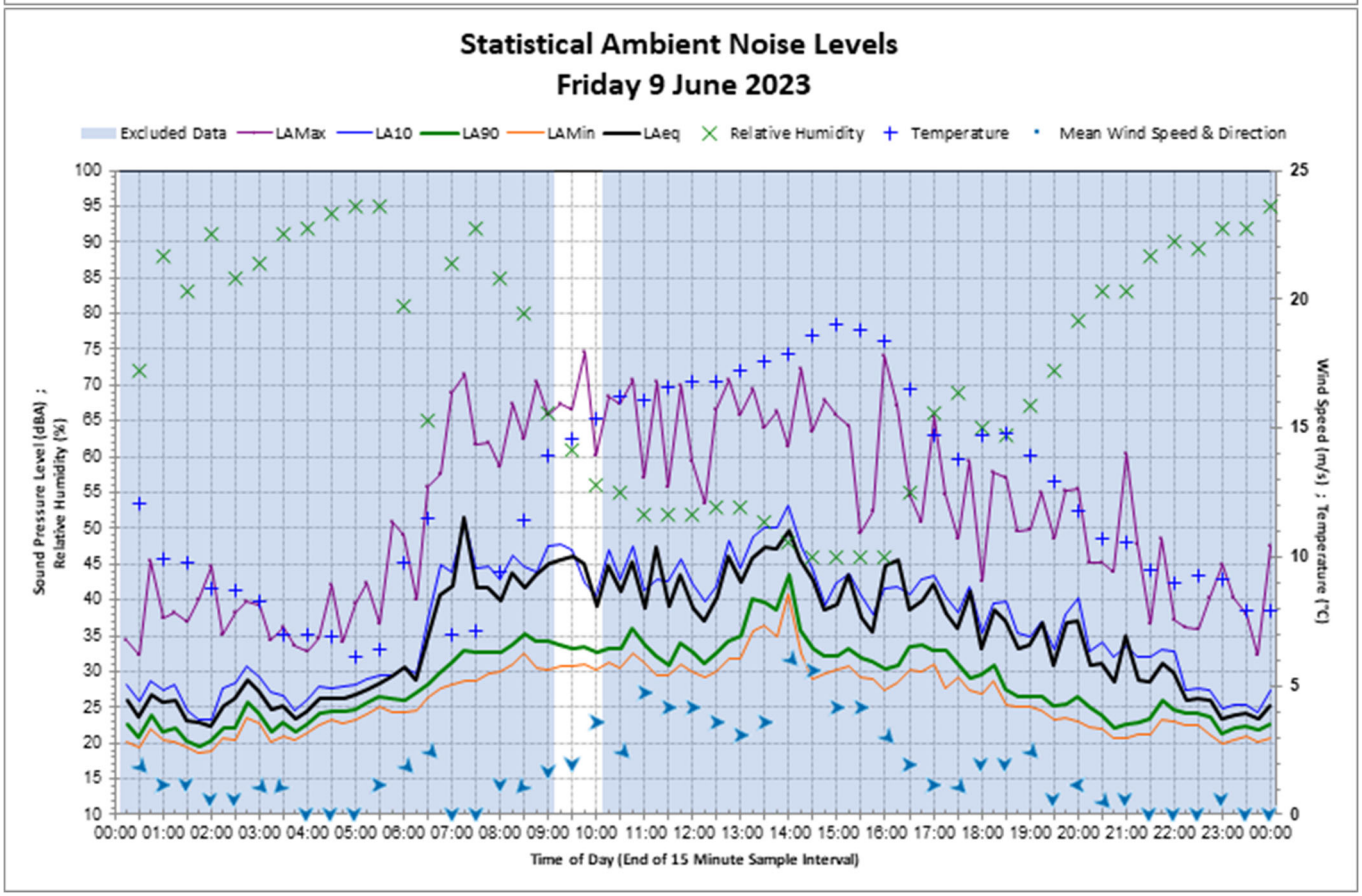
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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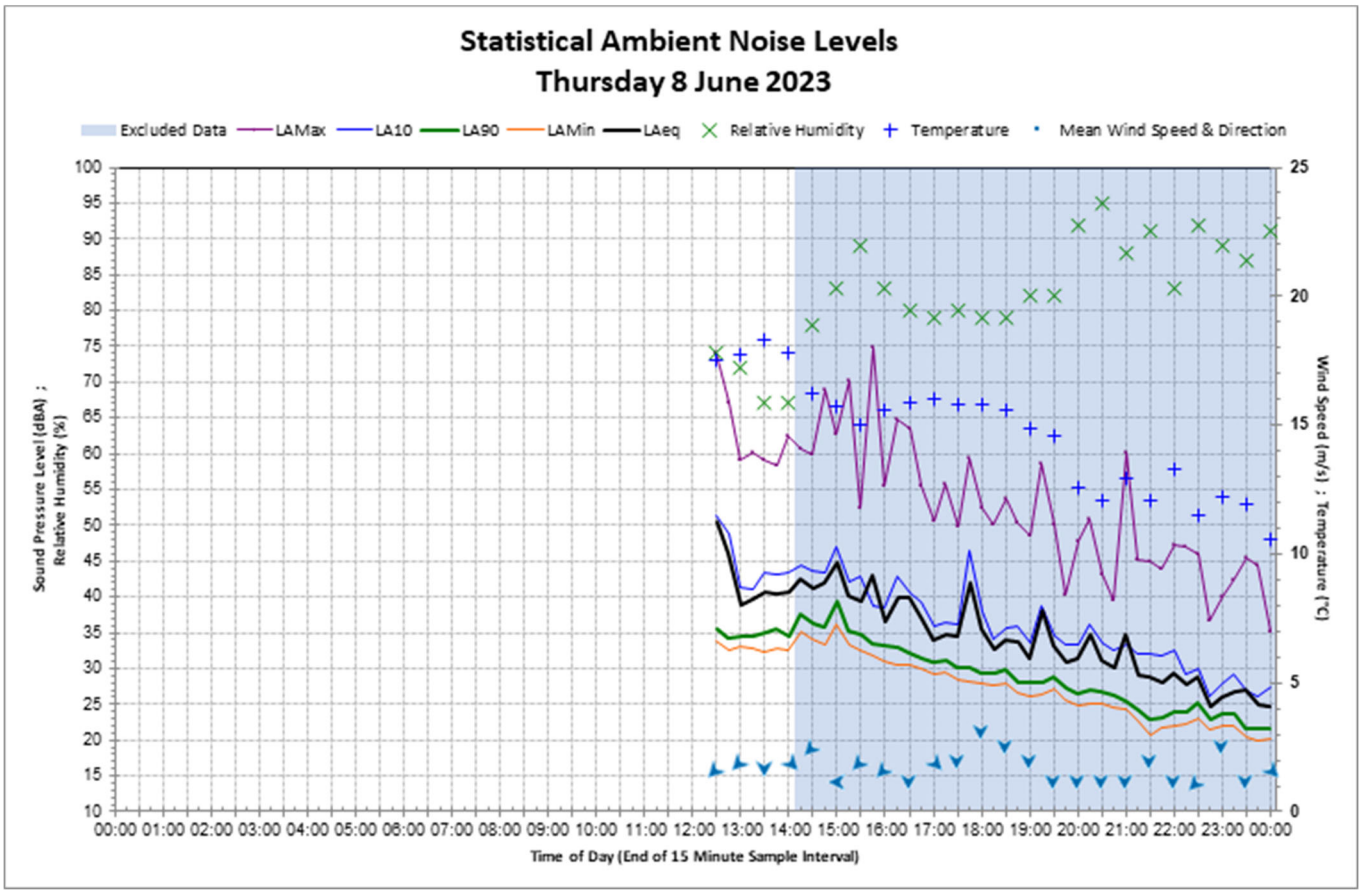
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
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Relative Humidity
Temperature
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C)
Time of Day (End of 15 Minute Sample Interval)

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