Post Construction Noise Monitoring Report

Lisarow to Ourimbah Pacific Highway Upgrade

Transport for NSW

12 November 2024

→ **The Power of Commitment**

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Executive summary

A measurement-based post construction noise assessment (PCNA) was conducted to quantify the level of noise impacts associated with the Lisarow to Ourimbah Pacific Highway Upgrade project and to verify that noise impacts have been suitably considered in the design mitigation recommendations.

Noise monitoring: Road traffic noise monitoring was undertaken at four locations within the study area. Noise monitoring locations were selected with consideration to the pre-construction stage operational noise monitoring locations and the nearest/most-affected receivers based on design stage predictions. Noise monitoring was conducted across two periods. The second period (period 2) was required to supplement incomplete monitoring data at two of the locations from the initial monitoring period (period 1).

Traffic volumes: A traffic noise survey was conducted at ten (10) locations on by Matrix Traffic and Transport Data (Matrix) to provide concurrent traffic volumes with period 1 noise monitoring. This enables comparison of the measured noise levels and traffic volumes with the future-projected noise levels and traffic volumes.

SCATS traffic information was provided by Transport for NSW at three intersections (Railway Crescent, Tuggerah Street and The Ridgeway) across both noise monitoring period 1 and 2 to supplement the tube counts and provide traffic volume information for noise monitoring period 2. As SCATS data does not include detail on speed or traffic makeup (such as HV%), this data was only used to confirm that overall volumes were reasonably consistent across monitoring periods 1 and 2.

Traffic volume discussion

Traffic volumes during the survey are generally lower on the Pacific Highway than those projected at design stage by an average of 25% during the daytime and 22% during the night time.

Measured heavy vehicle percentages are on average 6% higher during the daytime and 5% higher during the night time than projected for opening year with maximum 2-way differences of up to 9% (at ATC1 - Pacific Highway, north of Railway Crescent).

Measured 85th percentile speeds on the Pacific Highway within the study area are typically 5 km/h faster than posted during the daytime and 10 km/h faster than posted during the night time period.

Assessment of traffic noise levels:

Measured traffic noise levels indicate that no additional mitigation would be required as results are all within (lower than) +2dB of predicted noise levels at the same dwellings for project opening year. However, it is relevant to consider the traffic volumes, speeds and heavy vehicle percentages encountered during the surveys and their comparison to predictions from the design stage assessment.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.5 and the assumptions and qualifications contained throughout the Report.

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Glossary

Acute noise level	A level of road traffic noise of 65 dB(A) or more for the day period of 7 am to 10 pm or 60 dB(A) or more for the night period of 10 pm to 7 am and measured as an equivalent continuous noise level (L_{Aeq}) 1 metre from the building facade.
Controlling criterion	Whichever of the day or night L_{Aeq} criteria (Noise Criteria Guideline) provides the most stringent noise targets.
Cumulative limit	A total noise level that is 5 dBA or more above the Noise Criteria Guideline criteria in the build year.
Decibel	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
Existing road corridor	A corridor of land that is zoned for road purposes in relevant environmental planning instruments such as LEPs and contains an existing formed and dedicated public or classified road.
Feasibility (Roads and Maritime Services interpretation)	Relates to engineering considerations (what can be practically built). These engineering considerations may include: – The inherent limitations of different techniques to reduce noise emissions from road traffic noise sources. – Safety issues such as restrictions on road vision. – Road corridor site constraints such as space limitations. – Floodway and stormwater flow obstruction. – Access requirements. – Maintenance requirements. – The suitability of building conditions for at property treatments.
Ground-borne vibration	Ground-borne vibration is transmitted from source to receiver through the ground.
L_{AN}	Statistical sound measurement recorded on the 'A' weighted scale.
$L_{A1\ (period)}$	The sound pressure level that is exceeded for 1% of the measurement period.
$L_{A10\ (period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A10\ (18\ hour)}$	The arithmetic average of the L_{A10} levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
$L_{A90\ (period)}$	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90\ (15\ min)}$
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Aeq\ (1\ hr)}$	The L_{Aeq} noise level for a one-hour period. It represents the highest tenth percentile hourly A-weighted Leq during the period 7 am to 10 pm, or 10 pm to 7 am (whichever is relevant).
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
L_{Amax}	The maximum sound level recorded during the measurement period.
L_{Amin}	The minimum sound level recorded during the measurement period.
Mitigation	Reduction in severity
Noise sensitive receiver	An area or place potentially affected by noise which includes: – A residential dwelling – An educational institution, library, childcare centre or kindergarten – A hospital, surgery or other medical institution – An active (e.g. golf course) or passive (e.g. national park) recreational area – Commercial or industrial premises – A place of worship

Overbridge/overpass	A road or pedestrian footway over the railway line.
Peak Particle Velocity	Current practices for assessments of the risk of structural damage to buildings use measurements of Peak Particle Velocity (PPV) in millimetres per second.
Rating background level	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes.
Reasonable (Roads and Maritime Services interpretation)	Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits provide significant social, economic or environmental benefits. The factors to be considered are: – The noise reduction provided and the overall number of people that benefit from the mitigation. – Existing and future noise levels, including changes in noise levels in the build and design year and the extent of any exceedance of the noise criteria. – Potential for a mitigation measure to reduce noise during construction as well as from road traffic after the project is complete. – The cost of mitigation, including the cost of noise mitigation measures as a percentage of the total project cost and the ongoing maintenance and operational costs. – Community views and wishes (typically gathered at a number of stages including route selection, following concept design, community consultation process following the noise assessment and post opening in the operational noise report). – Visual impacts for the community surrounding the road project and for road users. These are typically identified in the environmental impact assessment. – The wider community benefits arising from noise mitigation of the proposed road or road redevelopment. – Relative weighting of treatments with respect to protection of outdoor areas or only internal living spaces.
Receiver	A noise modelling term used to describe a map reference point where noise is predicted.
Short-term vibration	Vibration that occurs so infrequently that it does not cause structural fatigue nor does it produce resonance in the structure.
Sound Pressure Level (SPL)	20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level of 20 micropascals.
Tonality	Noise containing a prominent frequency or frequencies characterised by a definite pitch.
Vibration dose value	As defined in BS6472 – 1992, the vibration dose value is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).

List of abbreviations

AVTG	Assessing Vibration: A Technical Guideline
CNS	Construction Noise Strategy (TfNSW 2012)
CoRTN	Calculation of Road Traffic Noise
dB	Decibel
dB(A)	Unit used to measure ‘A-weighted’ sound pressure levels
EPA	Environment Protection Authority
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
NCA	Noise catchment area
NCG	Noise Criteria Guideline
NMG	Noise Mitigation Guideline
REF	Review of Environmental Factors
RBL	Rating background level
RING	Rail Infrastructure Noise Guideline
rms	Root Mean Square
RNP	Road Noise Policy
VDV	Vibration dose value
V_{rms}	The vibration velocity presented as a root mean square value.
PPV	Peak particle velocity

1. Introduction

GHD Pty. Ltd. has been engaged by Transport for New South Wales to conduct a post construction traffic noise assessment in relation to the recently completed Lisarow to Ourimbah Pacific Highway Upgrade (the project).

The Pacific Highway north of Gosford is the urban arterial road providing access to Gosford's northern suburbs and the Pacific Motorway (M1) and Ourimbah. This section of the Pacific Highway carries around 30,000 vehicles per day from regional and local areas. The project consisted of upgrade to about 1.6 kilometres of the Pacific Highway, between Ourimbah Street and Parsons Road, Lisarow.

Key features of the project included:

– Two lanes in each direction on the Pacific Highway (formerly single lane each way).
– A new bridge over the rail line, replacing the existing narrow bridge near Railway Crescent.
– New traffic lights at the Railway Crescent and Tuggerah Street (formerly Macdonalds Road) intersections with the Pacific Highway.
– Upgrading the existing traffic lights at The Ridgeway.
– Improved pedestrian and cycle paths along and across the highway.
– Improved access to the parking area at Lisarow Railway Station.

1.1 Purpose of report

The purpose of this assessment is to inform Transport for New South Wales the results of assessment of traffic noise levels from the Project post opening with consideration to noise predictions conducted as part of the Project's design stage modelling and the applicable traffic noise criteria.

1.2 Scope of this assessment

The following tasks have been undertaken as part of the post construction noise assessment (PCNA):

– Review monitoring locations in consultation with TfNSW to finalise the list of unattended and attended locations. The post construction noise monitoring and assessment will be undertaken in accordance with the TfNSW Road noise model validation guideline (August 2022) first approach.
– Long-term unattended road traffic noise monitoring was undertaken at four locations. Unattended noise loggers were deployed for a minimum of seven (7) days to record noise data (period 1). Additional noise monitoring (period 2) was conducted at three of these locations due to insufficient data being collected during the initial logging period.
– Operator attended short-term road traffic noise monitoring was conducted at each of the 4 noise monitoring locations during the survey. The purpose of these surveys is twofold; to qualify the unattended noise logging results and to observe existing noise sources and their relative contribution to the total ambient noise environment.
– Noise logger data was assessed and filtered to remove invalid data due to extraneous noise or adverse weather conditions informed by the nearby Bureau of Meteorology weather station at Gosford.
– Traffic volume count surveys including classifications and speeds were undertaken at ten (10) locations concurrently with the noise monitoring period 1. SCATS traffic information was provided by Transport for NSW at three intersections (Railway Crescent, Tuggerah Street and The Ridgeway) across both noise monitoring period 1 and 2 to supplement the tube counts and provide traffic volume information for noise monitoring period 2. As SCATS data does not include detail on speed or traffic makeup (such as HV%), this data was only used to confirm that overall volumes were consistent across monitoring period 1 and 2.
– The previous (open year only) noise prediction results vs the actual PCNA unattended noise monitoring results were compared at the four monitoring locations.
– The previous traffic volume assumptions (open year only) were compared to the actual traffic counts undertaken during the post construction unattended noise logging.

1.3 Assumptions

The methodology and assumptions for the noise assessment are outlined in the specific sections within this report.

1.4 Report structure

The report is comprised of the following sections:

- **Section 2 – Methodology:** Summarises the methods and guidance used for the noise assessment.
- **Section 3 – Study area:** presents the monitoring locations, traffic counter locations and noise sensitive receivers.
- **Section 4 – Environmental objectives:** Summarises the relevant legislation, guidelines and assessment criteria relevant to the operational noise assessment.
- **Section 5 – Review of mitigation measures:** Presents detail of the proposed noise mitigation measures identified at project design stage.
- **Section 6 – Noise assessment:** Presents the measurement methodology, noise measurement details, provides a summary of noise measurement results and presents a summary of traffic volumes. Includes assessment of noise levels with respect to the objectives and provides discussion of the results.
- **Section 7 – Conclusions:** Presents a summary of the study findings and sets out the principal conclusions for the study.
- **Section 8 – References:** Presents a list of documents and literature referenced within this report.

1.5 Limitations

This report has been prepared by GHD for Transport for NSW and may only be used and relied on by Transport for NSW for the purpose agreed between GHD and Transport for NSW as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Transport for NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer to Section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Transport for NSW 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.

The findings of this report represent the findings apparent at the date and time of the assessment. It is the nature of environmental assessments that all variations in environmental conditions cannot be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

Site conditions (including the presence of insect noise or other noise sources) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

2. Methodology

This post construction operational noise compliance has been undertaken using a measurement based approach outlined in the TfNSW *Road noise model validation guideline* (August 2022), which states:

> *There are two approaches to confirming post construction operational compliance. The first is by measurement only and the second is by measurement and validated post construction operational noise model.*
>
> *The first approach is best suited for projects with small number of affected receivers where noise logging can be completed at most receivers and the worst affected receiver before and after the project.*

As noise monitoring and predictions were conducted during the project design stage, the PCNA assessment involves comparison of measured noise levels at opening year (2024) with the predicted opening year noise levels at the same locations from the design stage assessment. Where measured noise levels are found to be within less than +2dB of predicted noise levels, treatments provided as part of the project are considered adequate with no additional treatments required.

Comparison of projected versus actual traffic volumes and heavy vehicle percentages has also been undertaken, including recommendations where significant difference have been identified.

This assessment has been prepared with consideration to the following guidelines and standards:

– Calculation of Road Traffic Noise (CoRTN), Department of Transport Welsh Office (1988).
– Noise Policy for Industry, New South Wales Environmental Protection Authority (2017).
– Road noise model validation guideline, Transport for NSW (August 2022).

3. Study area

This study area for the project at design stage was between Ourimbah St and Parsons Rd and includes residences within about 500 metres of the proposed works. Noise impacts at sensitive receivers within the study area were assessed as part of the project Review of Environmental Factors (Upgrade of the Pacific Highway, Ourimbah Street to Parsons Road, Lisarow- Noise and Vibration Assessment, Jacobs, 2014) and design stage assessment - Lisarow to Ourimbah Pacific Highway Upgrade Noise Assessment (GHD September 2017).

Noise sensitive receivers along the proposal route were grouped into noise catchment areas (NCAs) in order to undertake the noise assessment. NCAs were grouped into locations with similar noise exposures, which may require specific noise mitigations. As part of the REF, four residential NCAs were identified along the project route. Other sensitive land uses in the study area include:

– Pluim Park
– Lisarow Public School
– Lisarow High School
– Lisarow Church of Christ

The Study area, noise sensitive receivers, project (design) roads, noise logging locations and traffic counter locations are all shown in Figure 3.1.

Paper Size ISO A4

0 0.1 0.2 0.3 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Transport for NSW
Lisarow to Ourimbah PCNA

Study area, monitoring locations, traffic count locations

Project No. 12517172
Revision No. A
Date. 01/10/2024

FIGURE 1

Print Date: 01/10/2024

Data Source: GHD | Imagery: Nearmap 2024.

Created By: SR

4. Environmental objectives

4.1 Summary of assessment guidelines

The assessment environmental objective for the Project were defined during the environmental approvals and design stages. The relevant guideline is summarised in Table 4.1. Additional details for each set of criteria are provided in the relevant sections.

Table 4.1 Guideline summary used to determine assessment criteria

Impact	Document
Operational traffic noise	*Road Noise Policy*, (DECCW 2011).

4.2 Operational noise criteria

The *Road Noise Policy*, published by the Office of Environment and Heritage, provides non-mandatory traffic noise assessment criteria for residential receivers near new roads and redevelopments of existing roads. The target levels should aim to be achieved at the year of project opening and 10 years after project opening. The design stage assessment years were 2021 (projected opening) and 2031 (projected design year).

The corridor follows along the existing Pacific Highway between Parsons Rd and Ourimbah St. The *Road Noise Policy* redeveloped arterial road criteria was applied.

The *Road Noise Policy* road traffic noise assessment criteria are presented in Table 4.2 for residential receivers and Table 4.3 for other sensitive land uses.

The *Road Noise Policy* relative increase criteria assesses any increase in the total traffic noise level at a receiver due to the proposed project. The relative increase criteria is exceeded if the 'build option' noise levels increase by more than 12 dB(A) above the 'no-build option' noise levels. The 12 dB(A) relative increase criteria are not applicable to local roads. The *Road Noise Policy* requires residential receivers to be considered 600 m from the road centre line for the assessment of the relative increase criteria.

Residences experiencing exceedances of the road traffic noise assessment criteria or the relative increase criteria were considered for mitigation measures. It is important to note that the *Road Noise Policy* also recognises,

> *"In assessing feasible and reasonable mitigation measures an increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible to the average person."*

Table 4.2 Road Noise Policy: road traffic noise assessment criteria at residential receivers, dB(A)

Road category	Type of project	Assessment criteria (external)	
		Day-time (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	$L_{Aeq(15hr)}$ 60 (external)	$L_{Aeq(9hr)}$ 55 (external)

Table 4.3 Road Noise Policy: road traffic noise assessment criteria at other sensitive land uses, dB(A)

Existing sensitive land use	Assessment criteria, dB(A)		Additional considerations
	Day (7:00 am-10:00 pm)	Night (10:00 pm-7:00 am)	
1. School classrooms	$L_{Aeq,1hour}$ 40 (internal) when in use	–	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in *Australian/New Zealand Standard 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors.*
2. Hospital wards	$L_{Aeq,1hour}$ 35 (internal) when in use	$L_{Aeq,1hour}$ 35 (internal) when in use	
3. Places of worship	$L_{Aeq,1hour}$ 40 (internal) when in use	$L_{Aeq,1hour}$ 40 (internal) when in use	The criteria are internal, i.e. the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what in these areas may be affected by road traffic noise.
4. Open space (active use)	$L_{Aeq,15\ hour}$ 60 (external) when in use	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants making them less sensitive to external noise intrusion.
5. Open space (passive use)	$L_{Aeq,15hour}$ 55 (external) when in use	-	Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion e.g. playing chess, reading.
6. Isolated residences in commercial or industrial zones	-	-	For isolated residences in industrial or commercial zones, the external ambient noise levels can be higher than those in residential areas. Internal noise levels in such residences are likely to be more appropriate in assessing any road traffic noise impacts, and the proponent should determine suitable internal noise level targets, taking guidance from Australian Standard 2107:2000 (Standards Australia 2000).
7. Mixed use development	-	-	Each component of use in a mixed use development should be considered separately. For example, in a mixed use development containing residences and a childcare facility, the residential component should be assessed against the appropriate criteria for residences in Table 3 (RNP), and the childcare component should be assessed against point 8 below.
8. Childcare facilities	Sleeping rooms $L_{Aeq,1hour}$ 35 (internal) Indoor play areas $L_{Aeq,1hour}$ 40 (internal) Outdoor play areas $L_{Aeq,1hour}$ 55 (external)	-	Multi-purpose spaces, e.g. shared indoor play/sleeping rooms should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.
9. Aged care facilities	-	-	Assessed as residential receivers.

4.2.1 'Acute' traffic noise criteria

Receivers that experience noise levels equal than or higher than $L_{Aeq(15\ hr)}$ 65 dB(A) or $L_{Aeq(9\ hr)}$ 60 dB(A) are classified as 'acute' according to the ENMM. Receivers that are predicted to experience acute levels of noise would be subject to noise mitigation in accordance with ENMM practice note (iv).

4.2.2 Assessment timeframe

As a post-construction assessment, road traffic noise levels are evaluated at the following points in time provided in Table 4.4 as per guidance in the TfNSW *Road noise model validation guideline* (August 2022) for the 'measurement based' approach.

Table 4.4 Assessment timeframe

Timeframe	Description	Adopted year for assessment
Opening year	The year of the project road opening (actual completion)	2024

5. Review of mitigation measures

Table 5.1 provides a summary of mitigation options for qualifying receivers in accordance with the *Environmental Noise Management Manual*, the relevant guidance document at the time of the design-stage assessment.

Table 5.1 Summary of mitigation measures

Receiver addresses	Reason for treatment	Discussion
970 Pacific Highway Street (R324) 968 Pacific Highway Street (R327)	Acute noise exposure	Fewer than four receivers for mitigation in this area, therefore façade treatments were expected to be the most viable treatment option.
3 Dora St (R412) 8 Railway Crescent (R413) 20 Railway Crescent (R417) 1 Dora Street (R411) 20 A Railway Crescent (R416) 34 Railway Crescent (R423) 25 Barkala St (R439)	Exceed RNP criteria and noise levels increase by more than 2 dB(A)	Receivers in this area are scattered and not located close enough to each other for a noise wall to be reasonable and feasible. Therefore, façade treatments were expected to be the most viable treatment option.
889 Pacific Highway (R4811) 889 Pacific Highway (R4812) 889 Pacific Highway (R4801) 889 Pacific Highway (R4802) 889 Pacific Highway (R4791) 889 Pacific Highway (R4792)	Acute noise exposure	These properties have an existing brick wall that partially shields the receivers from operational road noise. The Project's Review of Environmental Factors (REF) identified that an increase in the height of this wall may provide sufficient mitigation for these receivers. Assessment of this noise wall as part of the detailed design found that the wall was not reasonable to construct. Therefore, façade treatments are expected to be the most viable treatment option.

6. Noise assessment

6.1 Noise monitoring

6.1.1 Overview

Road traffic noise monitoring was undertaken at four locations within the study area. Noise monitoring locations were selected with consideration to the pre-construction stage operational noise monitoring locations and the nearest/most-affected receivers based on design stage predictions. Pre-construction monitoring locations were unable to be used exclusively due to changes resulting from the Project alignment, availability of access to property, or suitability of location for the purposes of post construction traffic noise monitoring. Final selection was subject to access arrangements being made with landowners.

Noise monitoring was conducted across two periods. The second period (period 2) was required to supplement incomplete monitoring data at two of the locations from the initial monitoring period (period 1).

A traffic noise survey was conducted at ten (10) locations on by Matrix Traffic and Transport Data (Matrix) to provide concurrent traffic volumes with period 1 noise monitoring. This enables comparison of the measured noise levels and traffic volumes with the future-projected noise levels and traffic volumes.

SCATS traffic information was provided by Transport for NSW at three intersections (Railway Crescent, Tuggerah Street and The Ridgeway) across both noise monitoring period 1 and 2 to supplement the tube counts and provide traffic volume information for noise monitoring period 2. As SCATS data does not include detail on speed or traffic makeup (such as HV%), this data was only used to confirm that overall volumes were reasonably consistent across monitoring periods 1 and 2.

6.1.2 Measurement methodology

The methodology for the post construction noise monitoring program included the following:

- A preferred monitoring position at the dwelling was selected with consideration to the pre-construction monitoring locations, detailed design assessment positions, façade orientation, floor level, landowner agreement and site constraints such as extraneous noise sources and obstacles.
- A field calibration check was performed on the noise monitoring equipment using a sound level calibrator (Bruel and Kjaer s/n:3027708). At completion of the measurements, the meter's field calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 1 dBA.
- Noise monitoring was undertaken at four (4) locations adjacent to the road corridor to measuring post-construction operational road traffic noise levels. Operator attended observations were conducted adjacent to the loggers to identify the presence of any ambient noise sources in the vicinity of the monitoring locations.
- Period 1 noise logging occurred between Monday 5 August and Monday 19 August 2024.
- Period 2 noise logging occurred between Thursday 29 August and Tuesday 10 September 2024.
- Noise logging was undertaken using Svan 977 environmental noise loggers within current calibration. All noise loggers were programmed to accumulate L_{A90}, L_{A10} and L_{Aeq} noise descriptors at 15 minute intervals continuously over the entire monitoring period.
- The data collected by the loggers was downloaded and analysed, partial measurement days and any invalid data were removed.
- Invalid data refers to periods of time where average hourly wind speeds were greater than 5 m/s, or when rainfall occurred (>0.2 mm/hr).
- Meteorological data was based on data obtained at the nearby Bureau of Meteorology GOSFORD AWS weather station (Station ID: 061425) situated around 5.5 km to the south of the study area.
- Additional unattended noise logger data filtering was required at location P2 (25 Barkala Street) due to the proximity and influence of rail noise impacts at this location. The $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ unattended noise logging results presented in this report for location P2 (25 Barkala Street) excludes the impacts of rail noise.

6.1.3 Noise monitoring details

Noise monitoring locations, survey dates and logger equipment details are presented in Table 6.1 below.

Table 6.1 Noise monitoring locations

ID	Address	Data collected (time and date)	Line of sight	Microphone height, m	Monitoring location	Logger Model, Serial Number and Laboratory Calibration Date[1]
Survey period 1 - Monday 5 August and Monday 19 August 2024						
P01	970 Pacific Highway	05/8/2024 16:00 19/8/2024 16:45	Yes	1.5 m (ground floor)	Façade	SVAN 977C (97530) 25/09/2023
P02	25 Barkala Street	05/8/2024 14:00 07/8/2024 04:30	Yes	1.5 m (first floor)	Façade	SVAN 977C (97578) 06/09/2023
P03	20B Railway Crescent	05/8/2024 15:15 19/8/2024 15:30	Yes	1.5 m (ground floor)	Façade	SVAN 977B (45746) 07/07/2023
P04	6/889 Pacific Highway	05/8/2024 18:15 08/8/2024 23:29	Yes	1.5 m above first floor level (~4.5 m)	Façade	SVAN 977C (97579) 06/09/2023
Survey period 2 - Thursday 29-August and Tuesday 10 September 2024						
P01	970 Pacific Highway	29/8/2024 15:15 10/9/2024 10:00	Yes	1.5 m (ground floor)	Façade	SVAN 977C (97530) 25/09/2023
P02	25 Barkala Street	29/8/2024 17:00 10/9/2024 10:00	Yes	1.5 m (first floor)	Façade	SVAN 977 (36821) 30/08/2023
P04	6/889 Pacific Highway	29/8/2024 18:00 10/9/2024 10:00	Yes	1.5 m above first floor level (~4.5 m)	Façade	SVAN 977B (45751) 10/07/2023

1) Calibration intervals for Sound Level Meters are specified as 2-years within the NATA General Equipment Table (March 2023).

6.1.4 Summary of unattended noise monitoring results

6.1.4.1 Traffic noise levels

A summary of the measured traffic noise levels across all monitoring locations and relevant to the project, are provided in Table 6.2. Presented results are for combined period 1 and 2 monitoring and have been filtered as discussed in Section 6.1.2. Daily measurement data are tabulated in Appendix B.

Table 6.2 Summary of measured traffic noise levels

Logger ID	Receiver ID	Address	Measured road traffic noise level	
			$L_{Aeq\ (15\ hour)}$	$L_{Aeq\ (9\ hour)}$
P01	327	970 Pacific Highway	64.1	60.5
P02	439	25 Barkala Street	60.0	55.2
P03	416	20B Railway Crescent	54.7	50.6
P04	4792	6/889 Pacific Highway	66.0	61.0

6.2 Traffic volumes

6.2.1 Overview

Road traffic volumes were logged by Matrix using tube counters at ten (10) locations with data provided between Thursday 8 August and Monday 19 August inclusive. Locations of the tube counters were:

– ATC 1. Pacific Hwy, North Of Railway Cres
– ATC 2. Railway Cres, South Of Pacific Hwy
– ATC 3. Pacific Hwy, Between Railway Cres & Tuggerah St
– ATC 4. Tuggerah St, East Of Pacific Hwy
– ATC 5. Pacific Hwy, Between The Ridgeway & Tuggerah St
– ATC 6. The Ridgeway, East Of Pacific Hwy
– ATC 7. Pacific Hwy, Between The Ridgeway & Parsons Rd
– ATC 8. Parsons Rd, South Of Pacific Hwy
– ATC 9. Pacific Hwy, South Of Parsons Rd
– ATC 10. Dora St, West Of Railway Cres

These locations are shown on Figure 3.1 (Section 3).

6.2.1.1 PCNA measured traffic volume summary

Tube count data was used to indicate directional traffic volumes, speeds and heavy vehicle percentages. Volumes for relevant noise assessment periods of 7:00 am to 10:00 pm (15-hour) and 10:00 pm to 7:00 am (9-hour) were extracted from the data to use in this assessment.

A summary of traffic volumes measured during the 2024 survey are presented in Table 6.3.

Table 6.3 PCNA traffic volume summary (8 August – 19 August)

Count location	Description	Direction	Volumes		Speeds (km/h) (85%'ile)		Heavy vehicle percentage (%)	
			15 hr (Day)	9 hr (Night)	15 hr (Day)	9 hr (Night)	15 hr (Day)	9 hr (Night)
ATC 1	Pacific Hwy, North Of Railway Cres	NB	12431	1581	66	70	11.3%	10.6%
		SB	12467	1605	68	72	12.8%	13.7%
		Combined	24898	3185	67	71	12.1%	12.1%
ATC 2	Railway Cres, South Of Pacific Hwy	NB	3579	324	64	70	7.4%	10.8%
		SB	3158	483	63	70	11.2%	13.9%
		Combined	6736	807	64	71	9.2%	12.5%
ATC 3	Pacific Hwy, Between Railway Cres & Tuggerah St	NB	10983	1398	64	69	9.8%	9.7%
		SB	11318	1269	63	69	8.7%	8.7%
		Combined	22302	2667	64	69	9.3%	9.2%
ATC 4	Tuggerah St, East Of Pacific Hwy	EB	3692	243	41	43	12.4%	8.5%
		WB	2811	333	42	44	6.3%	5.2%
		Combined	6503	576	42	44	9.7%	6.8%
ATC 5	Pacific Hwy, Between The Ridgeway & Tuggerah St	NB	11411	1348	68	72	11.9%	11.1%
		SB	10799	1260	67	72	13.9%	14.0%
		Combined	22210	2608	67	72	12.8%	12.5%
ATC 6	The Ridgeway, East Of Pacific Hwy	EB	4061	264	50	55	6.7%	6.8%
		WB	4319	421	53	57	5.1%	5.7%
		Combined	8381	685	52	57	5.9%	6.1%
ATC 7	Pacific Hwy, Between The Ridgeway & Parsons Rd	NB	12107	1253	67	71	9.3%	10.3%
		SB	11249	1333	66	72	13.4%	13.3%
		Combined	22351	2431	66	71	11.1%	11.8%
ATC 8	Parsons Rd, South Of Pacific Hwy	NB	4843	271	40	46	7.5%	13.0%
		SB	5922	265	39	46	4.3%	8.7%
		Combined	10765	536	40	46	5.7%	10.8%
ATC 9	Pacific Hwy, South Of Parsons Rd	NB	11384	1240	60	66	10.1%	12.2%
		SB	11099	1320	60	66	5.2%	6.7%
		Combined	22483	2560	60	66	7.7%	9.4%
ATC 10	Dora St, West Of Railway Cres	EB	464	57	49	50	8.3%	7.9%
		WB	542	28	45	43	3.4%	5.3%
		Combined	1005	85	47	49	5.6%	6.9%

6.2.2 Comparison to design traffic volumes

Comparison of traffic volumes projected during the Project's design stage to those measured during this assessment can assist in evaluation of measured noise level comparison to projected noise levels. Important parameters that contribute to a given traffic noise level are:

– Volumes during the assessment time period (15hr and 9hr); speeds (typically evaluated as 85th percentile for traffic noise modelling), and; heavy vehicle percentages.

Data is presented in following tables as follows:

– Table 6.4 compares the measured traffic volumes and projected traffic volumes for the 15 hour (day) and 9 hour (night) periods.
– Table 6.5 compares the measured traffic heavy vehicle percentages and projected traffic heavy vehicle percentages for the 15 hour (day) and 9 hour (night) periods.
– Table 6.6 compares the measured traffic speeds and posted speeds (modelled speeds) for the 15 hour (day) and 9 hour (night) periods.

Table 6.4 Traffic volume comparison

Traffic counter ID	Location	Direction	Measured Volumes (PCNA Survey)		Projected Volumes (Opening year 2021)		Projected Volumes (Design year 2031)		Percentage difference (2021)		Percentage difference (Design year)	
			15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr
ATC 1	Pacific Hwy, North Of Railway Cres	NB	12431	1581	17594	2187	18957	2539	-29%	-28%	-34%	-38%
		SB	12467	1605	17550	2145	17618	2238	-29%	-25%	-29%	-28%
		Combined	24898	3185	35144	4332	36575	4777	-29%	-26%	-32%	-33%
ATC 2	Railway Cres, South Of Pacific Hwy	NB	3579	324	4906	517	4804	590	-27%	-37%	-26%	-45%
		SB	3158	483	4762	715	4545	785	-34%	-32%	-31%	-38%
		Combined	6736	807	9668	1232	9349	1375	-30%	-34%	-28%	-41%
ATC 3	Pacific Hwy, Between Railway Cres & Tuggerah St	NB	10983	1398	15011	1607	15652	1790	-27%	-13%	-30%	-22%
		SB	11318	1269	14899	1773	14655	1744	-24%	-28%	-23%	-27%
		Combined	22302	2667	29910	3380	30307	3534	-25%	-21%	-26%	-25%
ATC 4	Tuggerah St, East Of Pacific Hwy	EB	3692	243	1421	163	1621	185	160%	49%	128%	31%
		WB	2811	333	2540	302	2695	321	11%	10%	4%	4%
		Combined	6503	576	3961	465	4316	506	64%	24%	51%	14%
ATC 5	Pacific Hwy, Between The Ridgeway & Tuggerah St	NB	11411	1348	15011	1607	15652	1790	-24%	-16%	-27%	-25%
		SB	10799	1260	14899	1773	14655	1744	-28%	-29%	-26%	-28%
		Combined	22210	2608	29910	3380	30307	3534	-26%	-23%	-27%	-26%
ATC 6	The Ridgeway, East Of Pacific Hwy	EB	4061	264	4622	487	4770	546	-12%	-46%	-15%	-52%
		WB	4319	421	3227	384	2904	346	34%	10%	49%	22%
		Combined	8381	685	7849	871	7674	892	7%	-21%	9%	-23%
ATC 7	Pacific Hwy, Between The Ridgeway & Parsons Rd	NB	12107	1253	14183	1495	15395	1623	-15%	-16%	-21%	-23%
		SB	11249	1333	14426	1659	14233	1637	-22%	-20%	-21%	-19%
		Combined	22351	2431	28609	3154	29628	3260	-22%	-23%	-25%	-25%
ATC 8	Parsons Rd, South Of Pacific Hwy	NB	4843	271	4972	524	5577	588	-3%	-48%	-13%	-54%
		SB	5922	265	3990	459	3791	436	48%	-42%	56%	-39%
		Combined	10765	536	8962	983	9368	1024	20%	-45%	15%	-48%

Traffic counter ID	Location	Direction	Measured Volumes (PCNA Survey)		Projected Volumes (Opening year 2021)		Projected Volumes (Design year 2031)		Percentage difference (2021)		Percentage difference (Design year)	
			15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr
ATC 9	Pacific Hwy, South Of Parsons Rd	NB	11384	1240	13703	1444	14793	1559	-17%	-14%	-23%	-20%
		SB	11099	1320	14816	1704	15339	1764	-25%	-23%	-28%	-25%
		Combined	22483	2560	28519	3148	30132	3323	-21%	-19%	-25%	-23%
ATC 10	Dora St, West Of Railway Cres	EB	464	57	-	-	-	-	-	-	-	-
		WB	542	28	-	-	-	-	-	-	-	-
		Combined	1005	85	-	-	-	-	-	-	-	-
ATC 2 + ATC 10	Railway Cres, South Of Pacific Hwy + Dora St, West Of Railway Cres	EB	4042	381	4906	517	4804	590	-18%	-26%	-16%	-35%
		WB	3699	511	4762	715	4545	785	-22%	-29%	-19%	-35%
		Combined	7742	892	9668	1232	9349	1375	-20%	-28%	-17%	-35%

Table 6.5 Traffic volume - Heavy vehicle percentage comparison

Traffic counter ID	Location	Direction	Measured Volumes HV% (PCNA Survey)		Projected Volumes HV% (Opening year 2021)		Projected Volumes HV% (Design year 2031)		Difference in HV% (Meas' 2024 vs projected 2021)		Difference in HV% (Meas' 2024 vs Design year 2031)	
			15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr
ATC 1	Pacific Hwy, North Of Railway Cres	NB	11%	11%	4%	4%	10%	14%	8%	6%	1%	-3%
		SB	13%	14%	3%	4%	7%	9%	10%	9%	6%	5%
		Combined	12%	12%	3%	4%	9%	12%	9%	8%	4%	0%
ATC 2	Railway Cres, South Of Pacific Hwy	NB	7%	11%	1%	8%	6%	6%	6%	3%	1%	5%
		SB	11%	14%	6%	8%	8%	9%	5%	6%	3%	5%
		Combined	9%	13%	4%	8%	7%	8%	5%	5%	2%	5%
ATC 3	Pacific Hwy, Between Railway Cres & Tuggerah St	NB	10%	10%	7%	10%	7%	10%	3%	0%	3%	0%
		SB	9%	9%	6%	8%	6%	8%	3%	1%	3%	1%
		Combined	9%	9%	7%	9%	7%	9%	3%	0%	3%	0%
ATC 4	Tuggerah St, East Of Pacific Hwy	EB	12%	9%	2%	3%	2%	3%	10%	5%	10%	6%
		WB	6%	5%	1%	2%	1%	1%	5%	3%	6%	4%
		Combined	10%	7%	1%	2%	1%	2%	8%	4%	9%	5%
ATC 5	Pacific Hwy, Between The Ridgeway & Tuggerah St	NB	12%	11%	7%	10%	7%	10%	5%	1%	5%	1%
		SB	14%	14%	6%	8%	6%	8%	8%	6%	8%	6%
		Combined	13%	13%	7%	9%	7%	9%	6%	4%	6%	3%
ATC 6	The Ridgeway, East Of Pacific Hwy	EB	7%	7%	0%	0%	0%	0%	7%	7%	7%	7%
		WB	5%	6%	0%	0%	0%	0%	5%	6%	5%	6%
		Combined	6%	6%	0%	0%	0%	0%	6%	6%	6%	6%
ATC 7	Pacific Hwy, Between The Ridgeway & Parsons Rd	NB	9%	10%	4%	6%	4%	6%	5%	4%	5%	4%
		SB	13%	13%	5%	8%	5%	8%	8%	5%	8%	5%
		Combined	11%	12%	5%	7%	4%	7%	7%	5%	7%	5%
ATC 8	Parsons Rd, South Of Pacific Hwy	NB	7%	13%	1%	2%	2%	2%	6%	11%	6%	11%
		SB	4%	9%	4%	5%	3%	4%	0%	4%	1%	5%
		Combined	6%	11%	2%	3%	2%	3%	3%	8%	3%	8%
ATC 9		NB	10%	12%	2%	3%	3%	4%	8%	9%	7%	9%

Traffic counter ID	Location	Direction	Measured Volumes HV% (PCNA Survey)		Projected Volumes HV% (Opening year 2021)		Projected Volumes HV% (Design year 2031)		Difference in HV% (Meas' 2024 vs projected 2021)		Difference in HV% (Meas' 2024 vs Design year 2031)	
			15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr	15hr	9hr
	Pacific Hwy, South Of Parsons Rd	SB	5%	7%	1%	1%	1%	1%	4%	5%	5%	6%
		Combined	8%	9%	2%	2%	2%	2%	6%	7%	6%	7%
ATC 10	Dora St, West Of Railway Cres	EB	8%	8%	-	-	-	-	-	-	-	-
		WB	3%	5%	-	-	-	-	-	-	-	-
		Combined	6%	7%	-	-	-	-	-	-	-	-
ATC 2 + ATC 10	Railway Cres, South Of Pacific Hwy + Dora St, West Of Railway Cres	EB	7%	10%	1%	8%	6%	6%	6%	3%	1%	4%
		WB	10%	13%	6%	8%	8%	9%	4%	6%	2%	4%
		Combined	9%	12%	4%	8%	7%	8%	5%	4%	2%	4%

Table 6.6 Traffic volume - Speed comparison

Traffic counter ID	Location	Direction	Measured Speeds 85%'ile (PCNA Survey)		Posted Speeds (Modelled speeds for opening and design years)	Difference in Speeds (Meas' 2024 vs posted speeds)	
			15hr	9hr		15hr	9hr
ATC 1	Pacific Hwy, North Of Railway Cres	NB	65.7	70.0	60	10%	17%
		SB	67.7	72.4	60	13%	21%
		Combined	66.6	71.1	60	11%	18%
ATC 2	Railway Cres, South Of Pacific Hwy	NB	64.0	69.9	60	7%	16%
		SB	63.5	70.2	60	6%	17%
		Combined	63.7	71.1	60	6%	18%
ATC 3	Pacific Hwy, Between Railway Cres & Tuggerah St	NB	64.2	69.0	60	7%	15%
		SB	63.4	68.8	60	6%	15%
		Combined	63.8	68.7	60	6%	15%
ATC 4	Tuggerah St, East Of Pacific Hwy	EB	41.3	43.2	60	-31%	-28%
		WB	42.5	43.6	60	-29%	-27%
		Combined	41.6	43.7	60	-31%	-27%
ATC 5	Pacific Hwy, Between The Ridgeway & Tuggerah St	NB	67.8	71.8	60	13%	20%
		SB	66.6	72.2	60	11%	20%
		Combined	67.2	71.7	60	12%	20%
ATC 6	The Ridgeway, East Of Pacific Hwy	EB	49.8	54.9	60	-17%	-9%
		WB	52.8	57.3	60	-12%	-5%
		Combined	51.5	57.2	60	-14%	-5%
ATC 7	Pacific Hwy, Between The Ridgeway & Parsons Rd	NB	66.5	71.4	60	11%	19%
		SB	66.5	72.2	60	11%	20%
		Combined	66.4	71.4	60	11%	19%
ATC 8	Parsons Rd, South Of Pacific Hwy	NB	40.4	46.1	60	-33%	-23%
		SB	39.4	45.6	60	-34%	-24%
		Combined	39.8	45.9	60	-34%	-24%

Traffic counter ID	Location	Direction	Measured Speeds 85%'ile (PCNA Survey)		Posted Speeds (Modelled speeds for opening and design years)	Difference in Speeds (Meas' 2024 vs posted speeds)	
			15hr	9hr		15hr	9hr
ATC 9	Pacific Hwy, South Of Parsons Rd	NB	59.6	66.4	60	-1%	11%
		SB	60.4	65.7	60	1%	10%
		Combined	59.9	66.2	60	0%	10%
ATC 10	Dora St, West Of Railway Cres	EB	48.6	49.6	60	-19%	-17%
		WB	45.0	43.1	60	-25%	-28%
		Combined	46.9	48.8	60	-22%	-19%
ATC 2 + ATC 10	Railway Cres, South Of Pacific Hwy + Dora St, West Of Railway Cres	EB	56.3	59.8	60	-6%	0%
		WB	54.2	56.6	60	-10%	-6%
		Combined	55.3	59.9	60	-8%	0%

6.3 Traffic noise levels assessment

Comparison of the measured traffic noise levels across all monitoring locations and the modelled opening year (2021) projected traffic noise levels at the same receivers, are provided in Table 6.7.

Table 6.7 Comparison of measured and projected traffic noise levels

Logger ID	Receiver ID	Address	Measured road traffic noise level		Predicted opening year traffic noise level (year 2021)		Difference Measured 2024 'minus' modelled at opening year 2021	
			$L_{Aeq\ (15\ hour)}$	$L_{Aeq\ (9\ hour)}$	$L_{Aeq\ (15\ hour)}$	$L_{Aeq\ (9\ hour)}$	$L_{Aeq\ (15\ hour)}$	$L_{Aeq\ (9\ hour)}$
P01	327	970 Pacific Highway	64.1	60.5	67.2	60.6	-3.1	-0.1
P02	439	25 Barkala Street	60.0	55.2	64.5	58.4	-4.5	-3.2
P03	416	20B Railway Crescent	54.7	50.6	60.6	54.6	-5.9	-4.0
P04	4792	6/889 Pacific Highway	66.0	61.0	70.2	63.6	-4.2	-2.6

6.3.1 Discussion of results

Noise level discussion

Measured traffic noise levels are within a less than +2 dB range of predicted operational noise levels for project opening year, which were undertaken during the project design stage. As shown in Table 6.7:

– Measured traffic noise levels are typically lower than was predicted for the daytime and night time periods.

– Noise levels at P03 are expected to be attenuated by a boundary fence present at this property between the residence and the roadway. This was not included in modelling during design stage as it is a residential fence, however is likely to provide some attenuation of traffic noise levels.

– Measured traffic noise levels indicate that no additional mitigation would be required as results are all within (lower than) +2dB of predicted noise levels at the same dwellings for project opening year. However it is relevant to consider the traffic volumes, speeds and heavy vehicle percentages encountered during the surveys and their comparison to predictions from the design stage assessment.

Traffic volume discussion

– Traffic volumes shown in Section 6.2.2 (Table 6.4) suggest that volumes during the survey are generally lower on the Pacific Highway than those projected at design stage by an average of 25% during the daytime and 22% during the night time:

  - Side roads of The Ridgeway, Parsons Road and Tuggerah Street show higher than projected volumes by 7%, 20% and 64% respectively during the daytime. During the night time measured volumes were only higher than expected on Tuggerah Street (24% higher than predicted for opening year 2021).
  - The higher than expected differences between the forecast traffic volumes and the observed traffic volumes on Tuggerah Street is likely due to several potential factors including:
    – The previous priority control on the Tuggerah Street exhibited few gaps for vehicles exiting Tuggerah Street (particularly the right-turn), with drivers potentially avoiding the intersection during peak hours.
    – The Tuggerah Street intersection with traffic signals now provides improved accessibility to the Pacific Highway corridor, encouraging vehicles to use the intersection during peak hours.
    – Due to previous congestion at Tuggerah Street, vehicles previously opted to use the upgraded The Ridgeway intersection. Since the Tuggerah Street intersection was upgraded, vehicles are likely now switching back to Tuggerah Street.
  - Railway Crescent and Dora Street combined measured to have about 20% lower volumes for daytime and 28% lower volumes for night time than predicted for opening year 2021.

– Traffic volume heavy vehicle percentages shown in Section 6.2.2 Table 6.5 indicate that measured heavy vehicle percentages are on average 6% higher during the daytime and 5% higher during the night time than projected for opening year with maximum 2-way differences of up to 9%, which occurred for the northern traffic count location (ATC1) on the Pacific Highway, north of Railway Crescent.
– Traffic volume speeds shown in Section 6.2.2 Table 6.6 indicate that measured 85th percentile speeds on the Pacific Highway within the study area are typically 5 km/h faster than posted during the daytime and 10 km/h faster than posted during the night time period

7. Conclusions

A measurement-based post construction noise assessment (PCNA) was conducted to quantify the level of noise impacts associated with the Lisarow to Ourimbah Pacific Highway Upgrade project and to verify that noise impacts have been suitably considered in the design mitigation recommendations.

Noise monitoring: Road traffic noise monitoring was undertaken at four locations within the study area. Noise monitoring locations were selected with consideration to the pre-construction stage operational noise monitoring locations and the nearest/most-affected receivers based on design stage predictions. Noise monitoring was conducted across two periods. The second period (period 2) was required to supplement incomplete monitoring data at two of the locations from the initial monitoring period (period 1).

Traffic volumes: A traffic noise survey was conducted at ten (10) locations on by Matrix Traffic and Transport Data (Matrix) to provide concurrent traffic volumes with period 1 noise monitoring. This enables comparison of the measured noise levels and traffic volumes with the future-projected noise levels and traffic volumes.

SCATS traffic information was provided by Transport for NSW at three intersections (Railway Crescent, Tuggerah Street and The Ridgeway) across both noise monitoring period 1 and 2 to supplement the tube counts and provide traffic volume information for noise monitoring period 2. As SCATS data does not include detail on speed or traffic makeup (such as HV%), this data was only used to confirm that overall volumes were reasonably consistent across monitoring periods 1 and 2.

Traffic volume discussion

Traffic volumes during the survey are generally lower on the Pacific Highway than those projected at design stage by an average of 25% during the daytime and 22% during the night time.

Measured heavy vehicle percentages are on average 6% higher during the daytime and 5% higher during the night time than projected for opening year with maximum 2-way differences of up to 9% (at ATC1 - Pacific Highway, north of Railway Crescent).

Measured 85th percentile speeds on the Pacific Highway within the study area are typically 5 km/h faster than posted during the daytime and 10 km/h faster than posted during the night time period.

Assessment of traffic noise levels:

Measured traffic noise levels indicate that no additional mitigation would be required as results are all within (lower than) +2 dB of predicted noise levels at the same dwellings for project opening year. However it is relevant to consider the traffic volumes, speeds and heavy vehicle percentages encountered during the surveys and their comparison to predictions from the design stage assessment.

8. References

Calculation of Road Traffic Noise (CoRTN), Department of Transport Welsh Office (1988)

Noise Policy for Industry, New South Wales Environmental Protection Authority (2017)

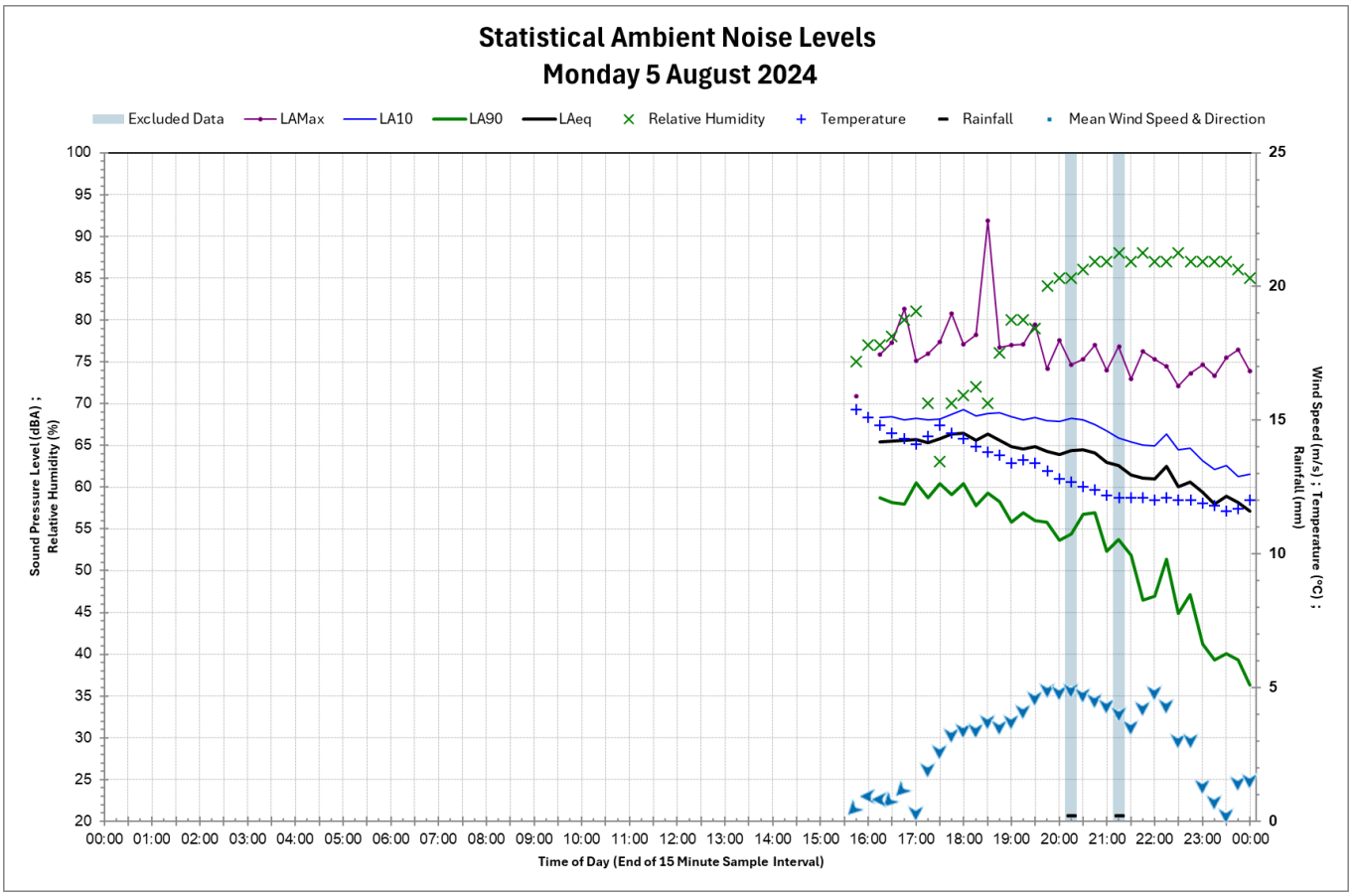
Road noise model validation guideline, Transport for NSW (August 2022)

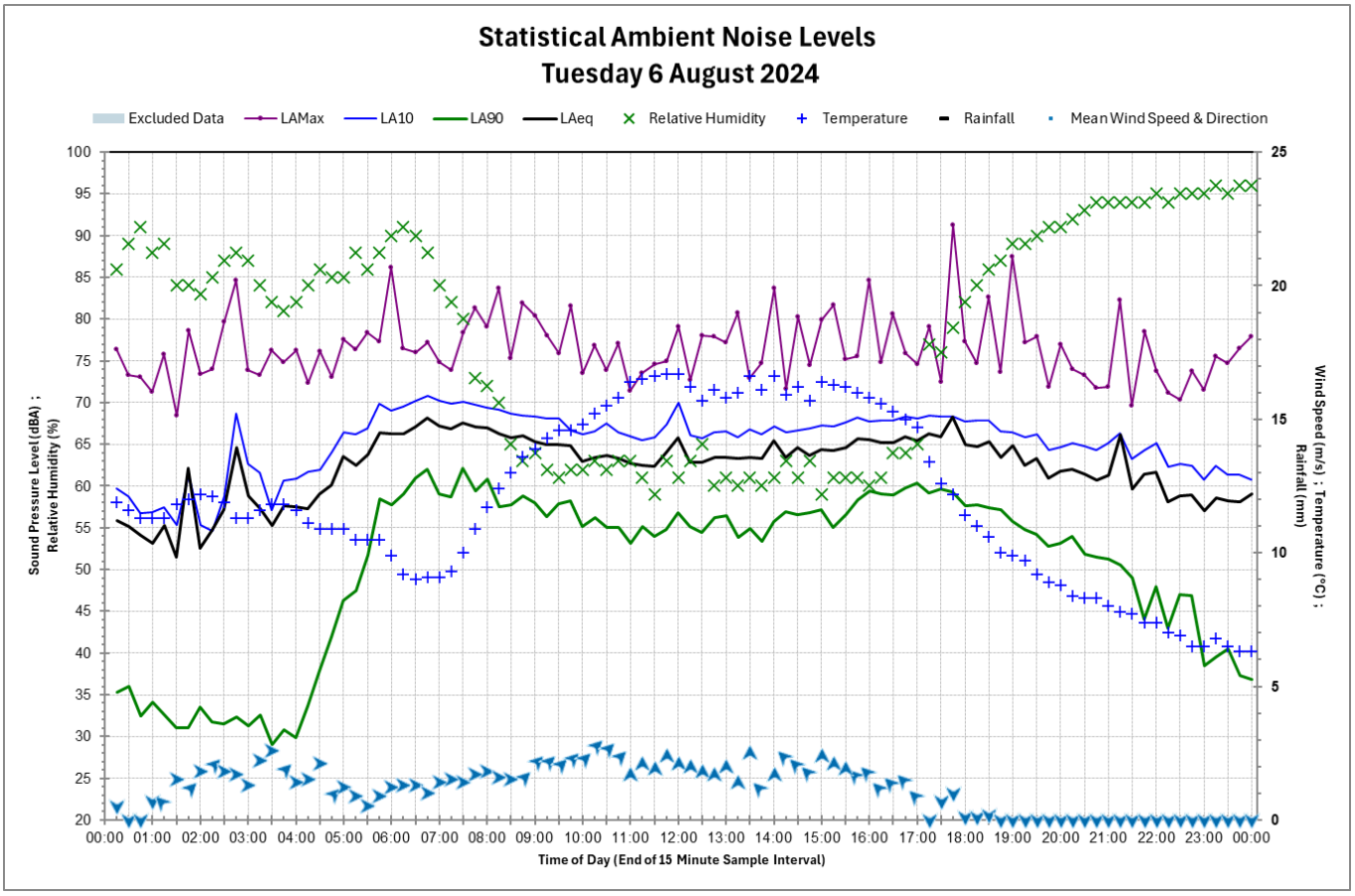
Appendices

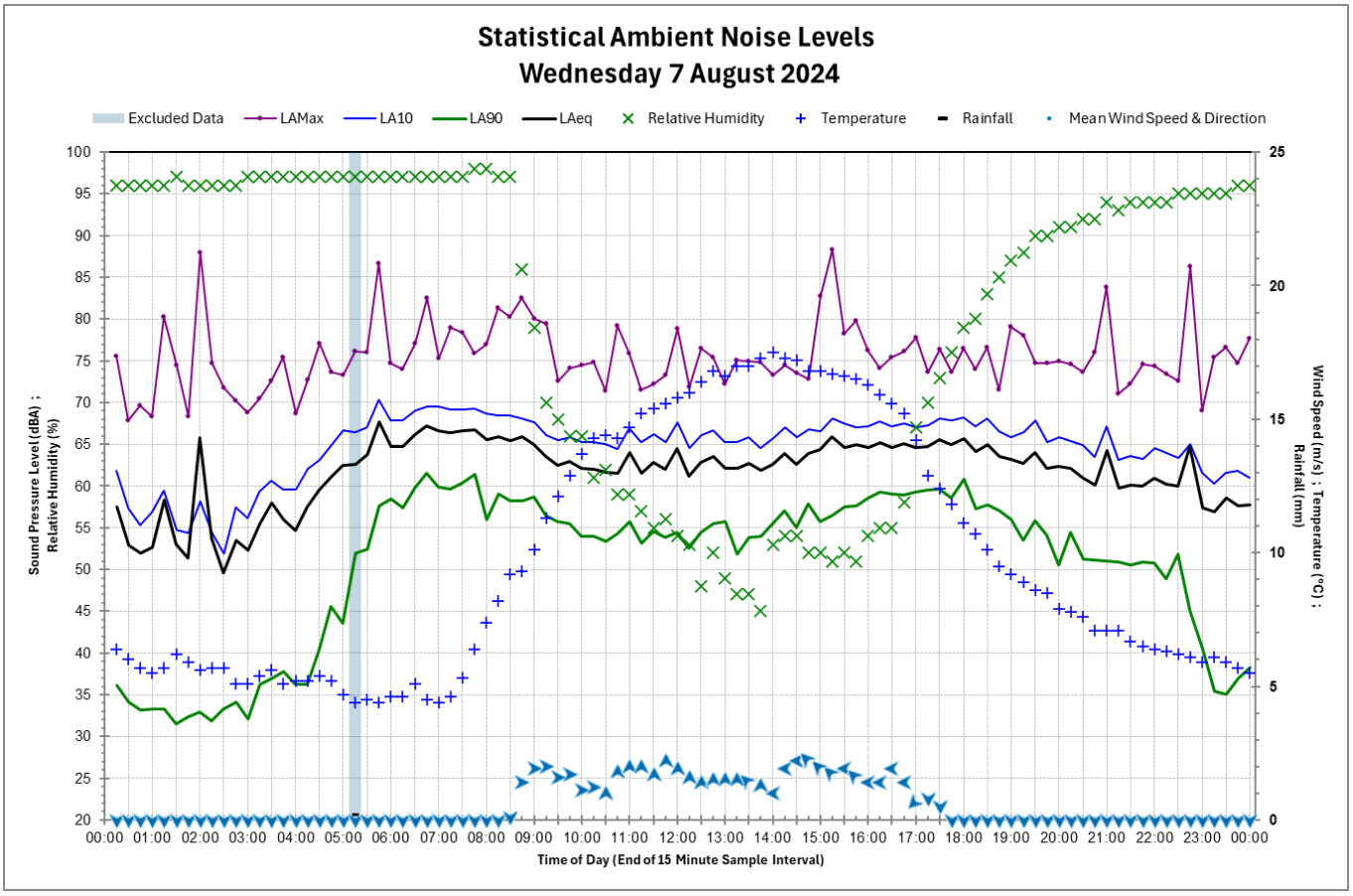
Appendix A

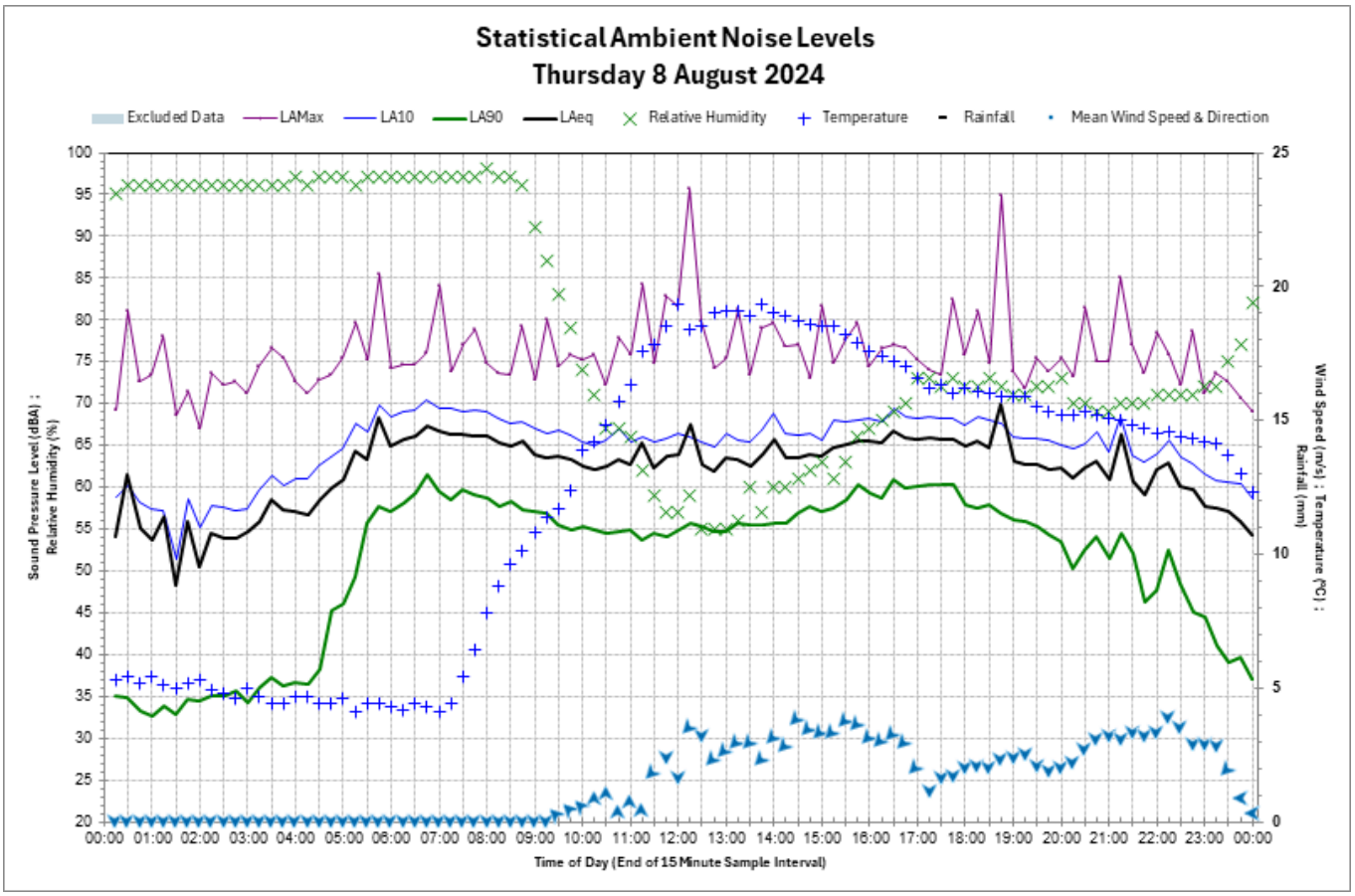
Noise monitoring charts

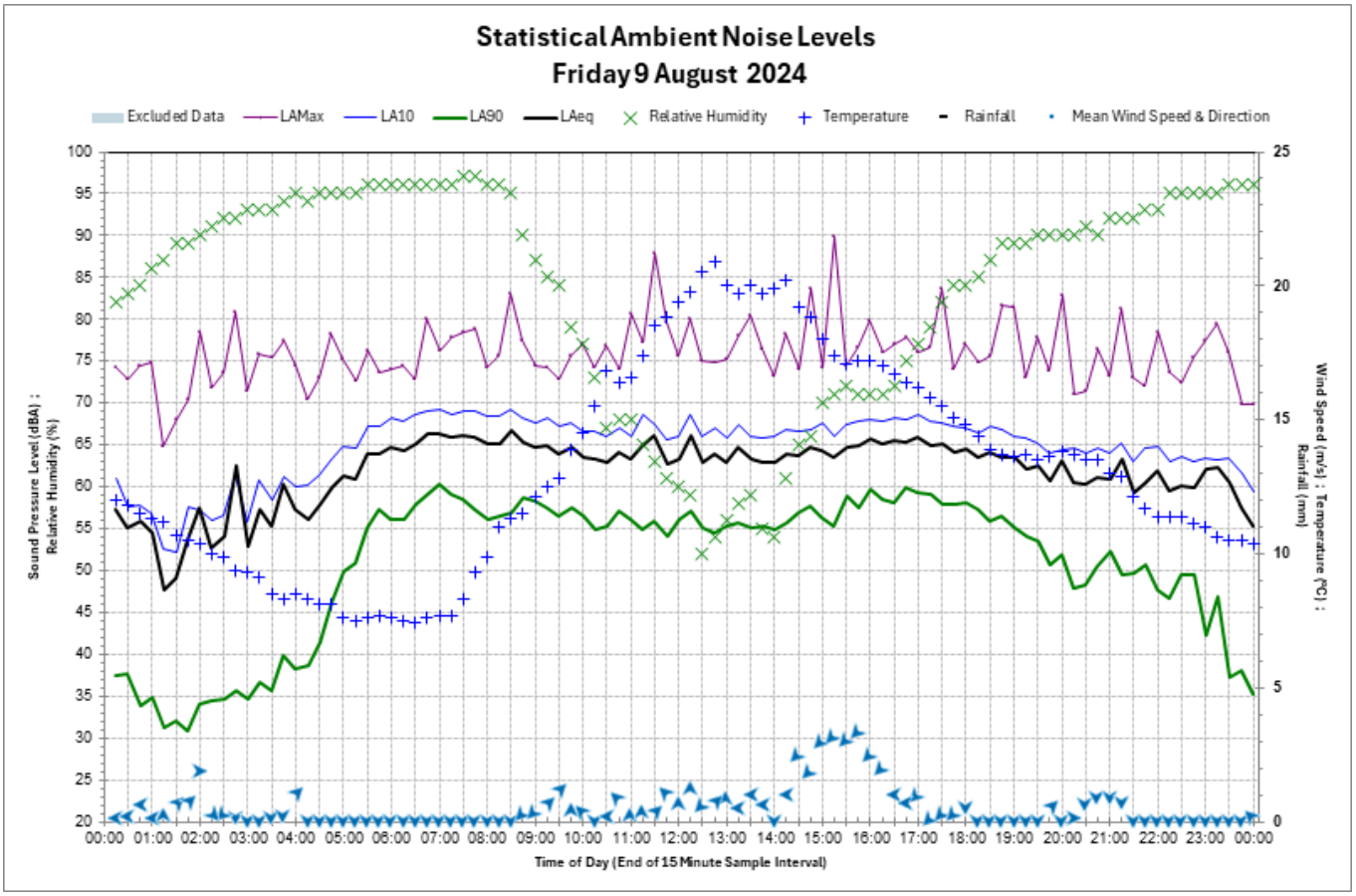
Location P01 – Period 1

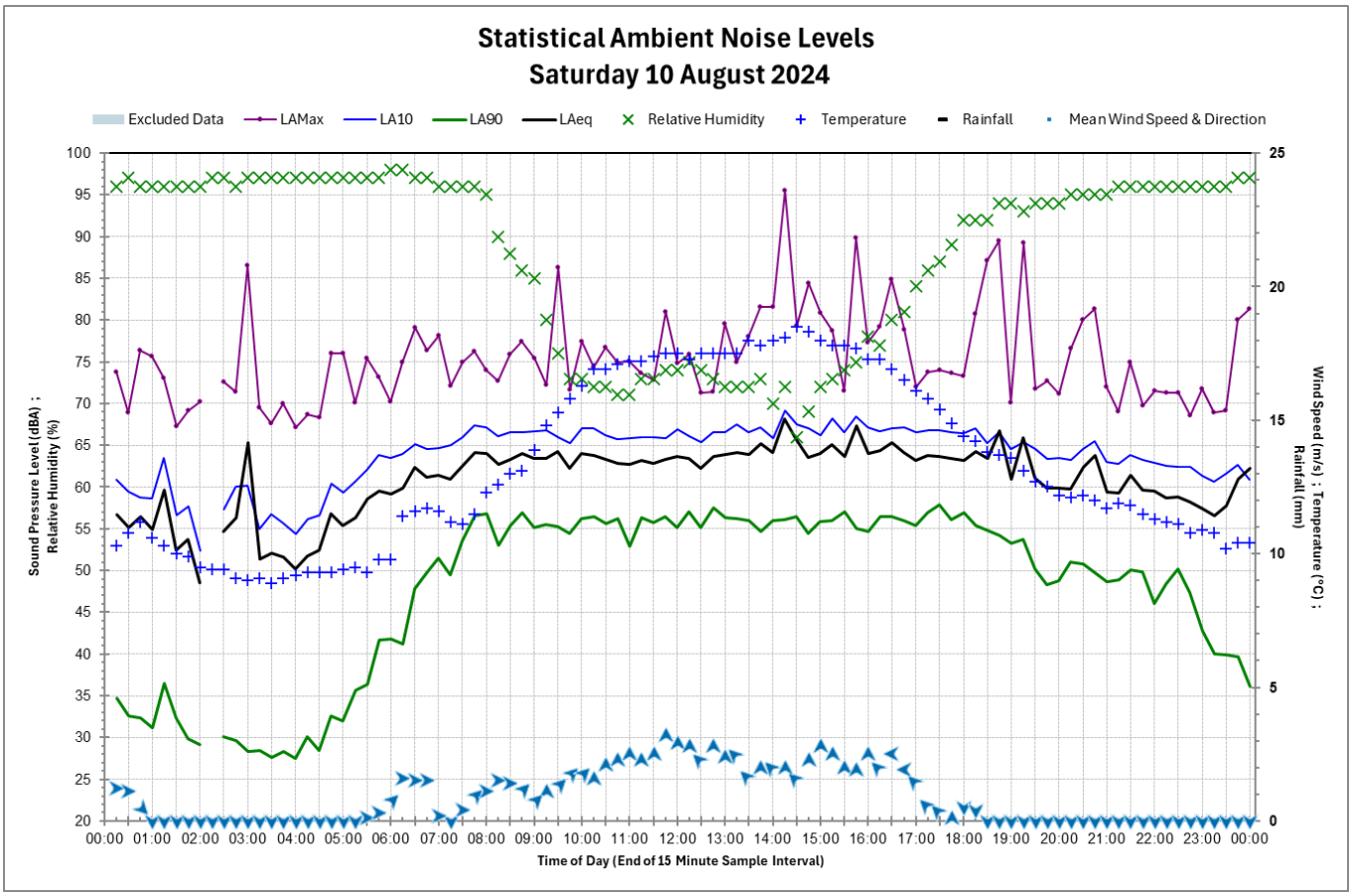


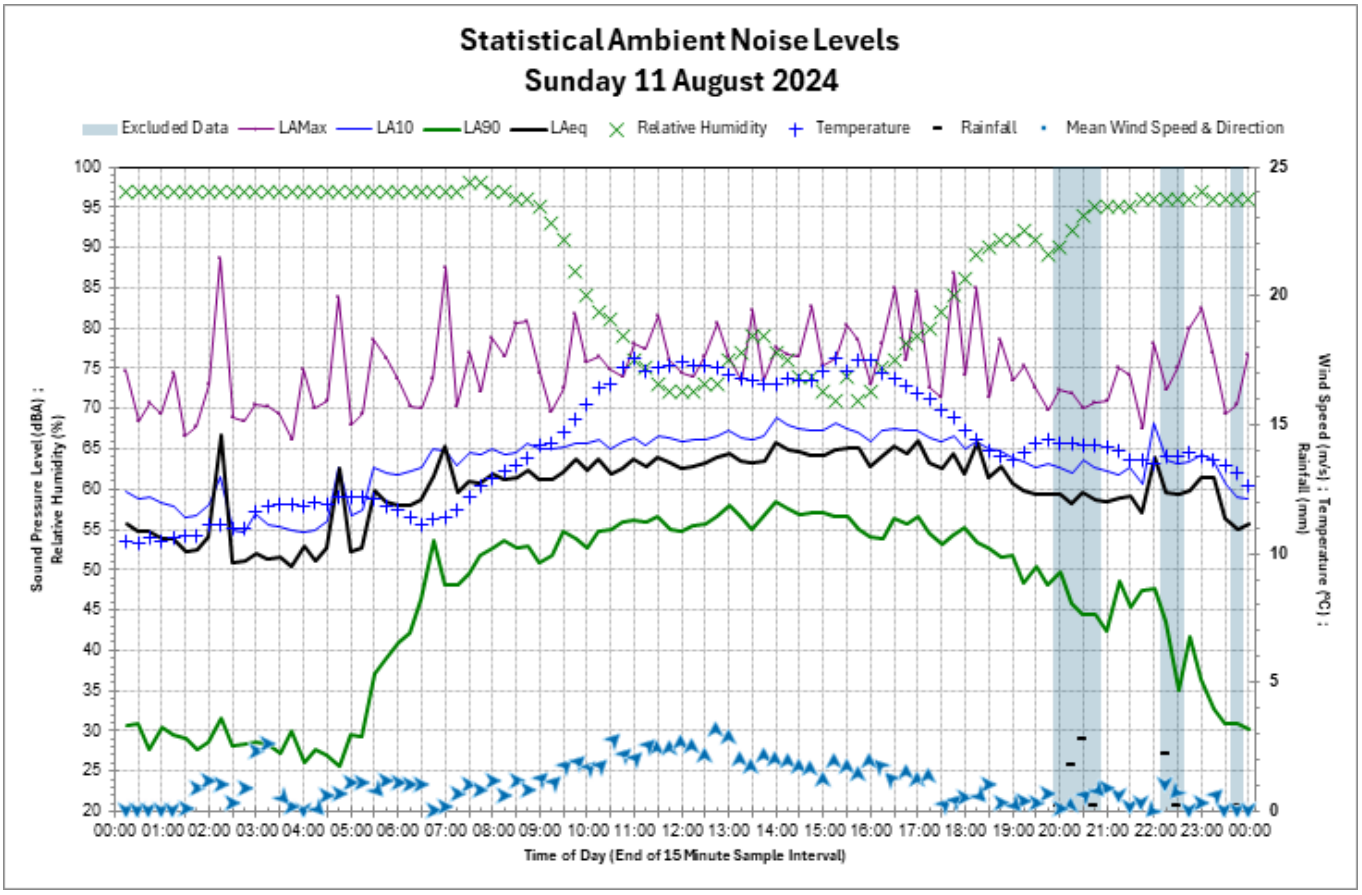


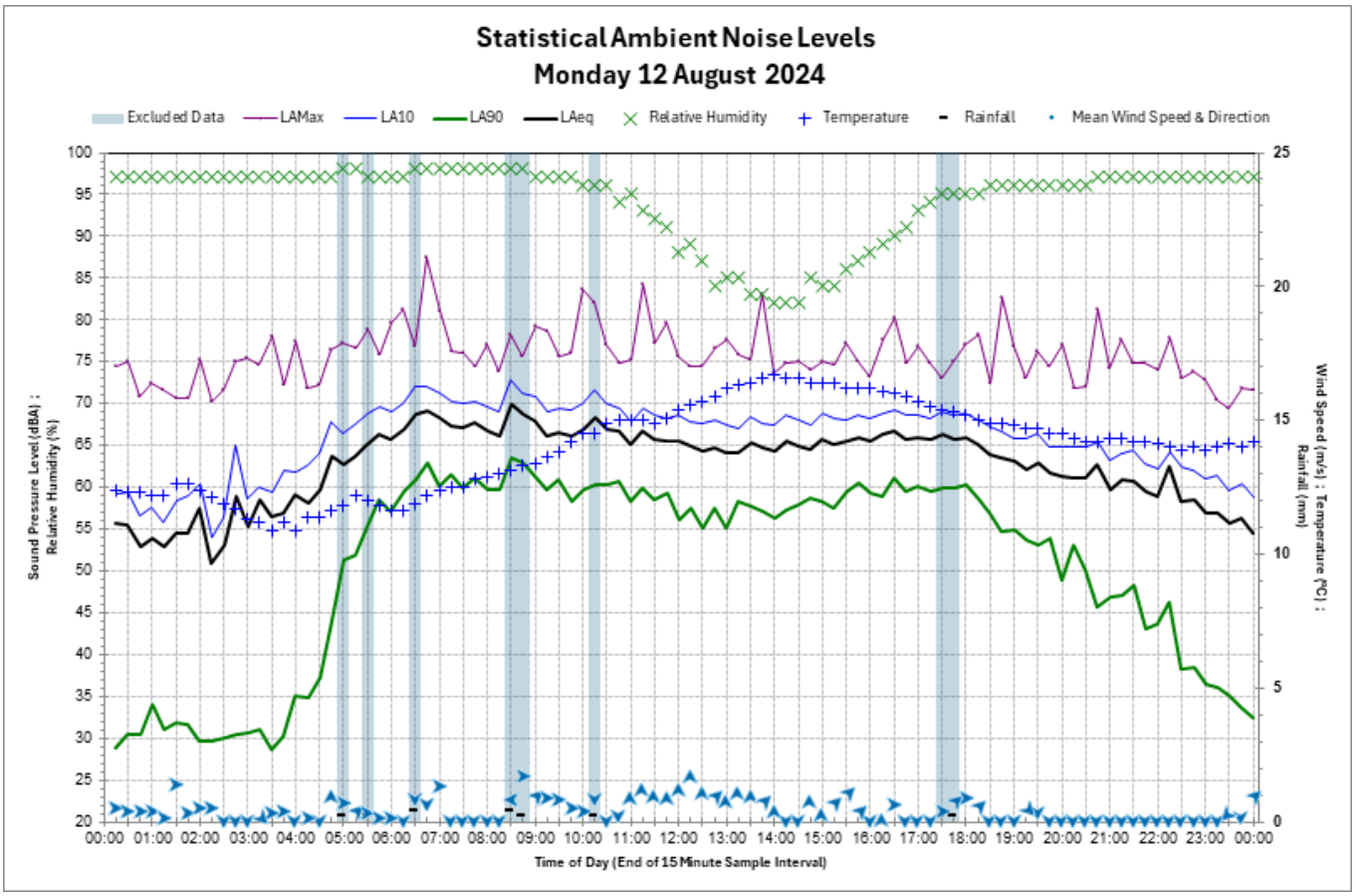

Statistical Ambient Noise Levels
Wednesday 7 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

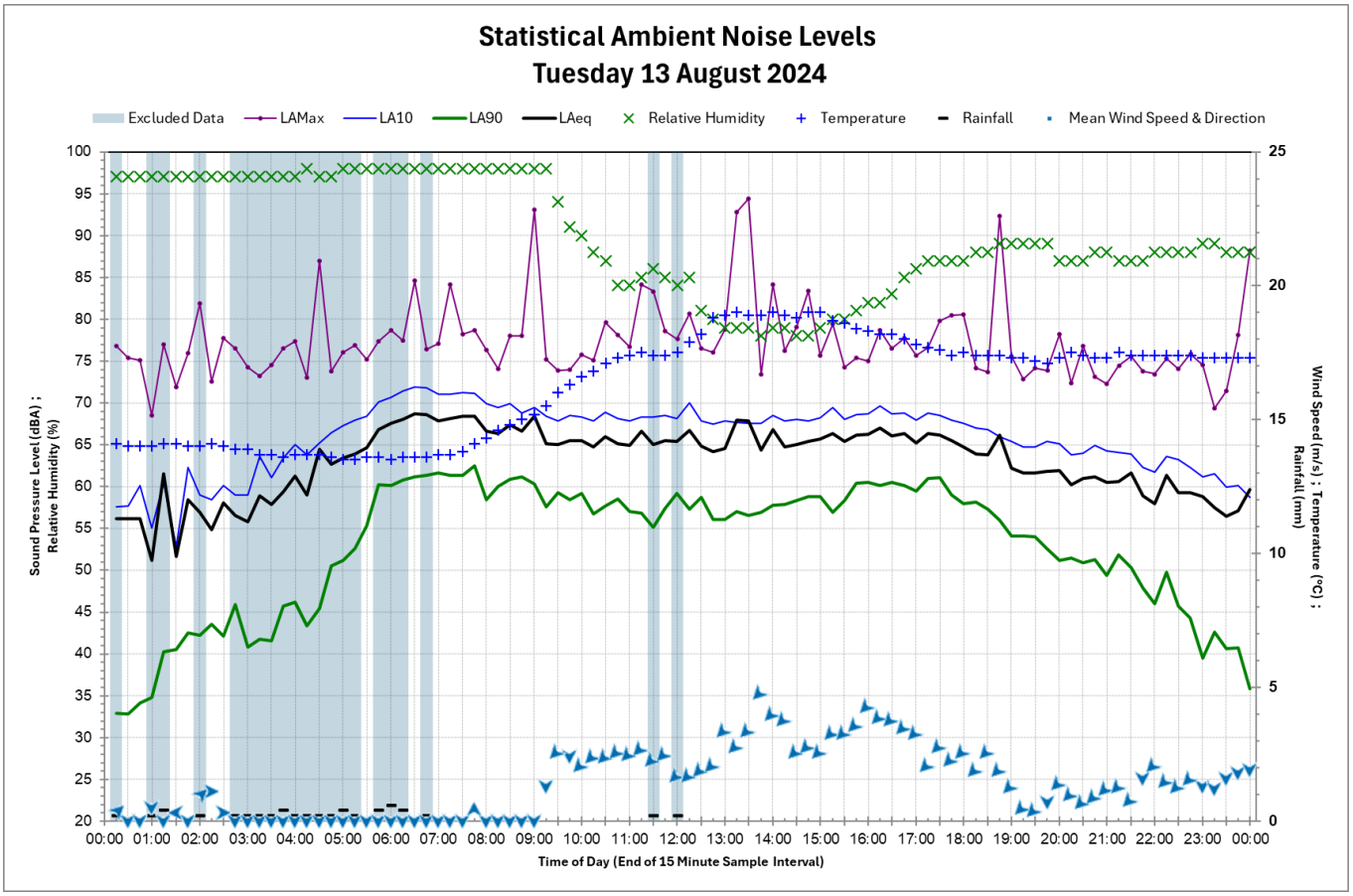

Statistical Ambient Noise Levels
Thursday 8 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

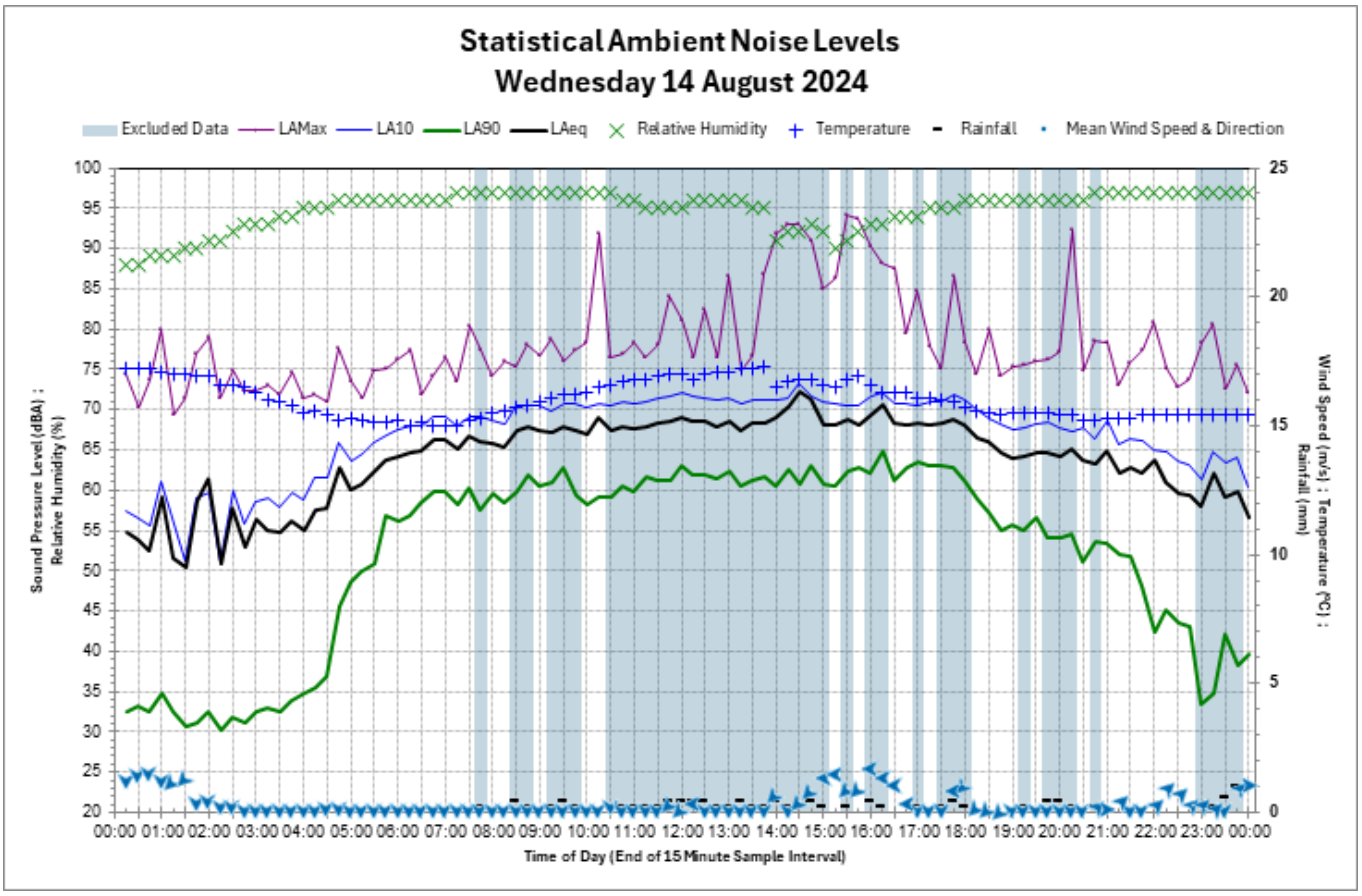

Statistical Ambient Noise Levels
Friday 9 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

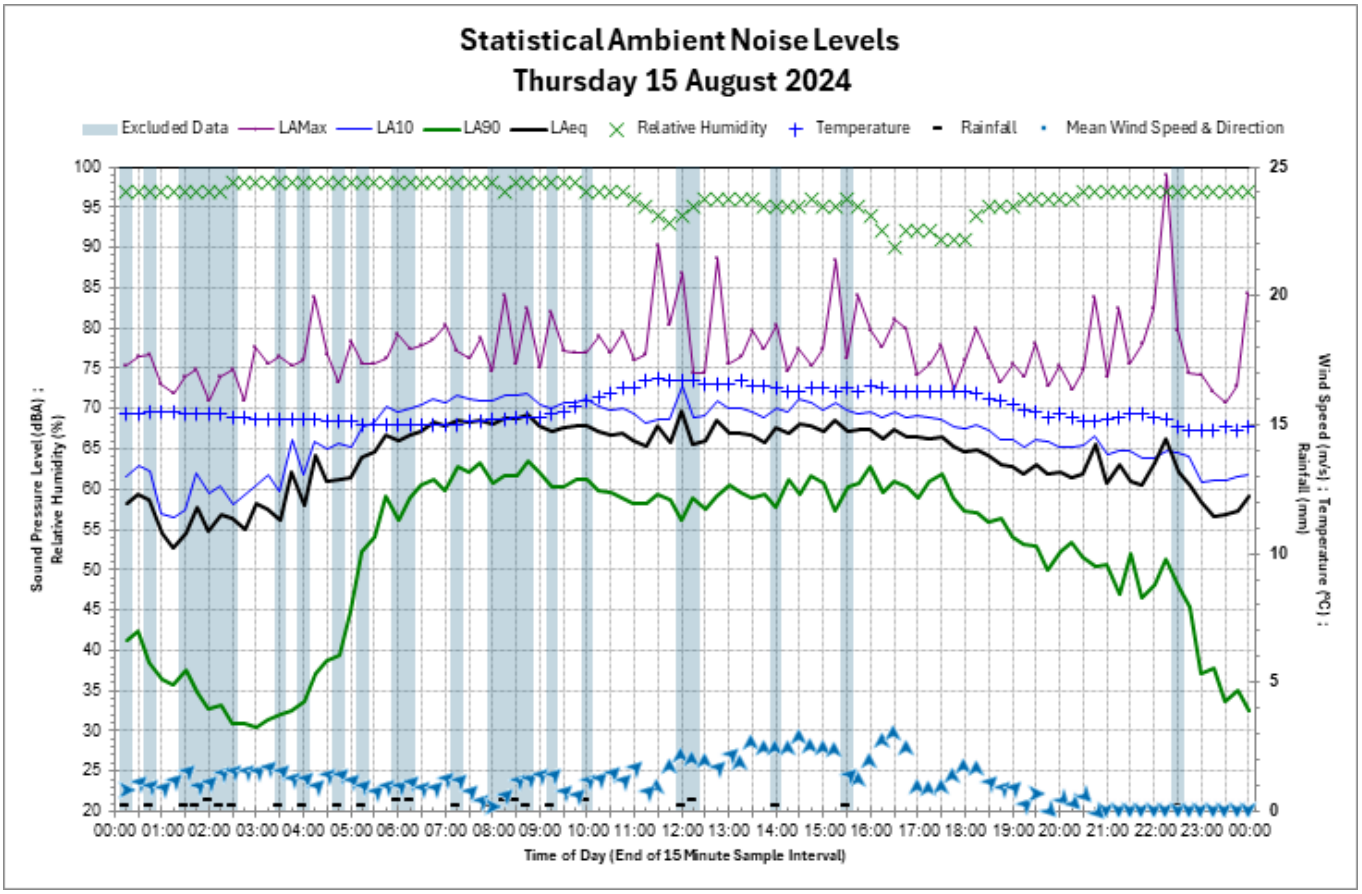

Statistical Ambient Noise Levels
Saturday 10 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

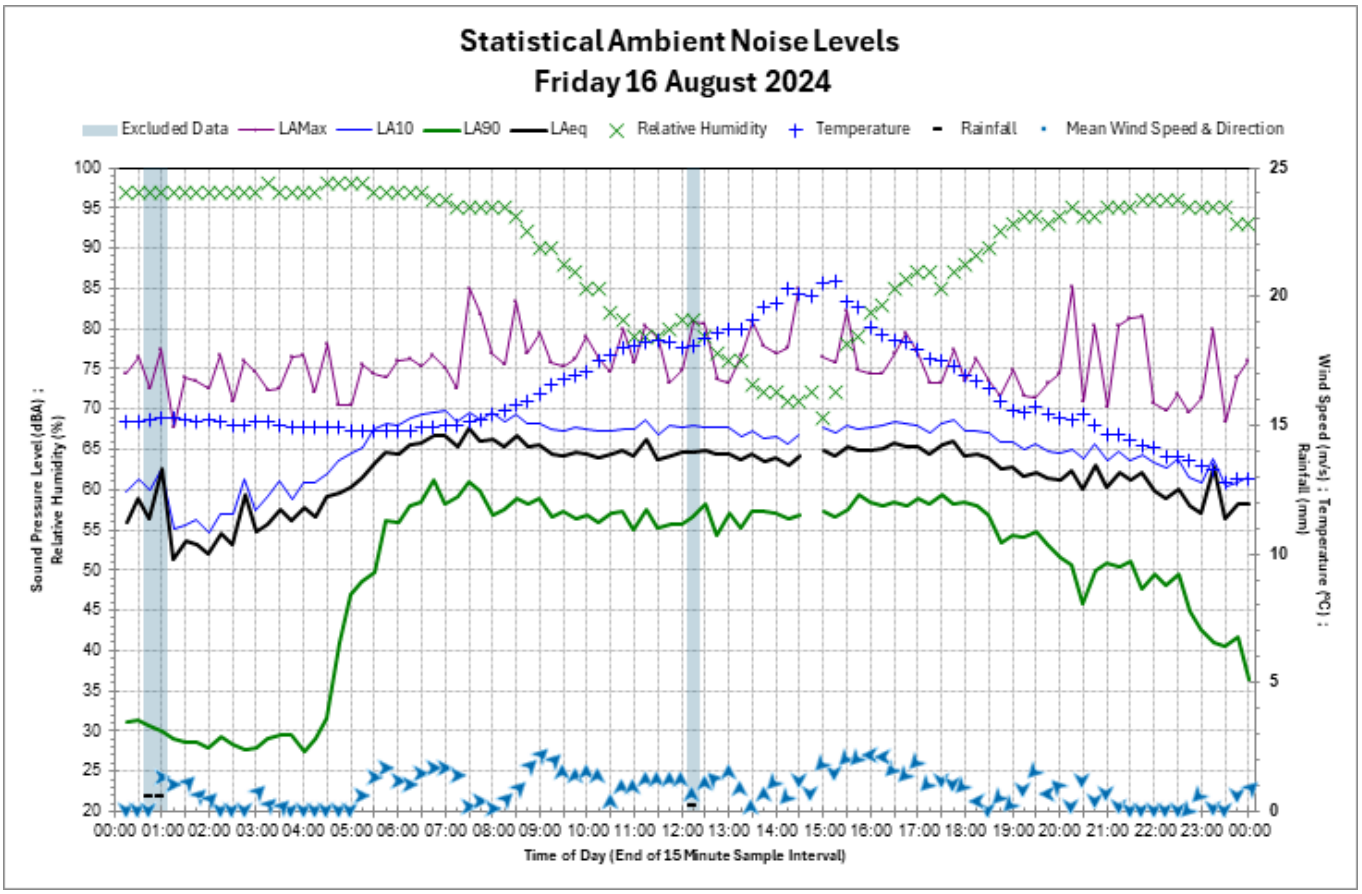

Statistical Ambient Noise Levels
Sunday 11 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

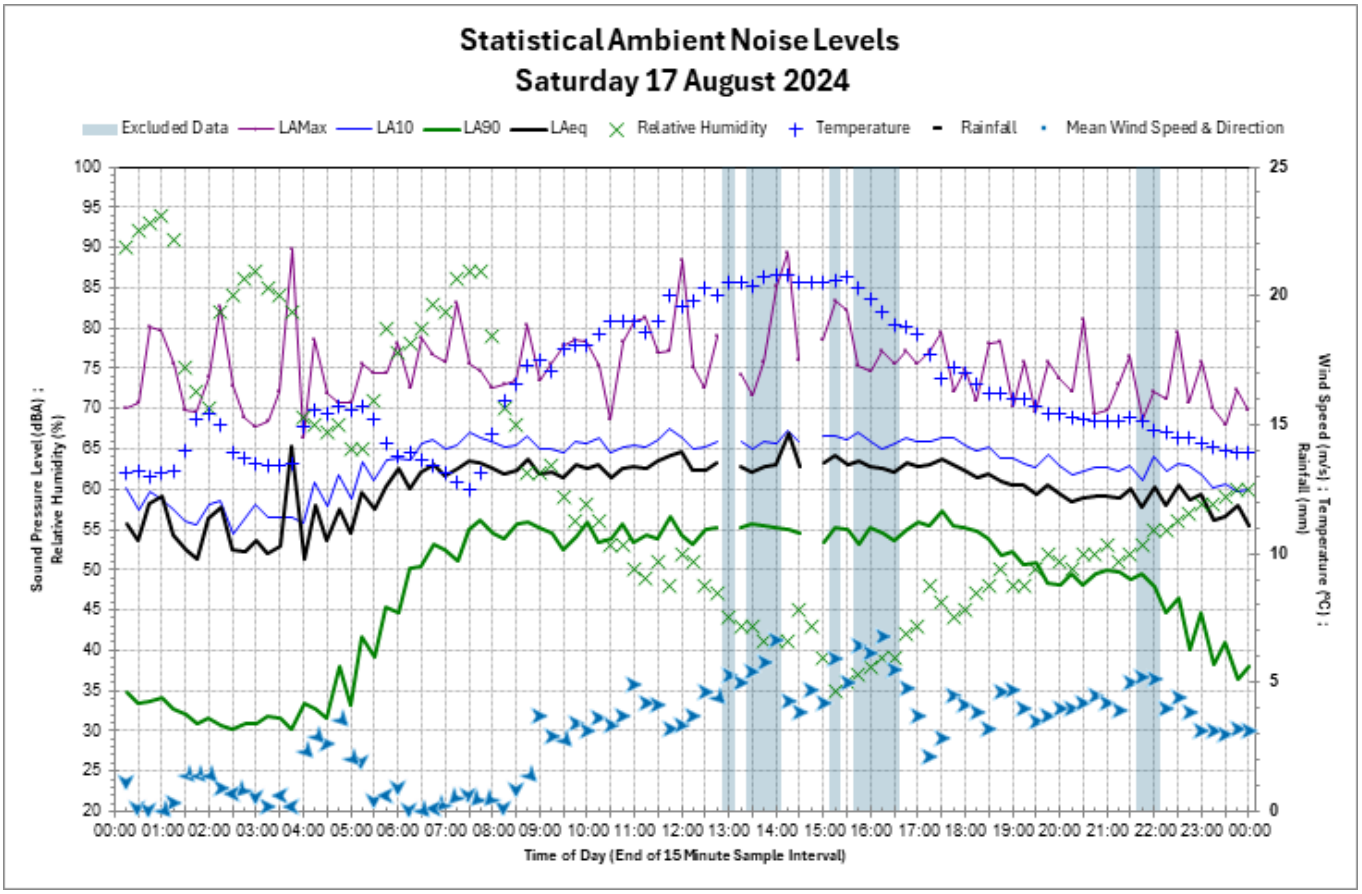

Statistical Ambient Noise Levels
Monday 12 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

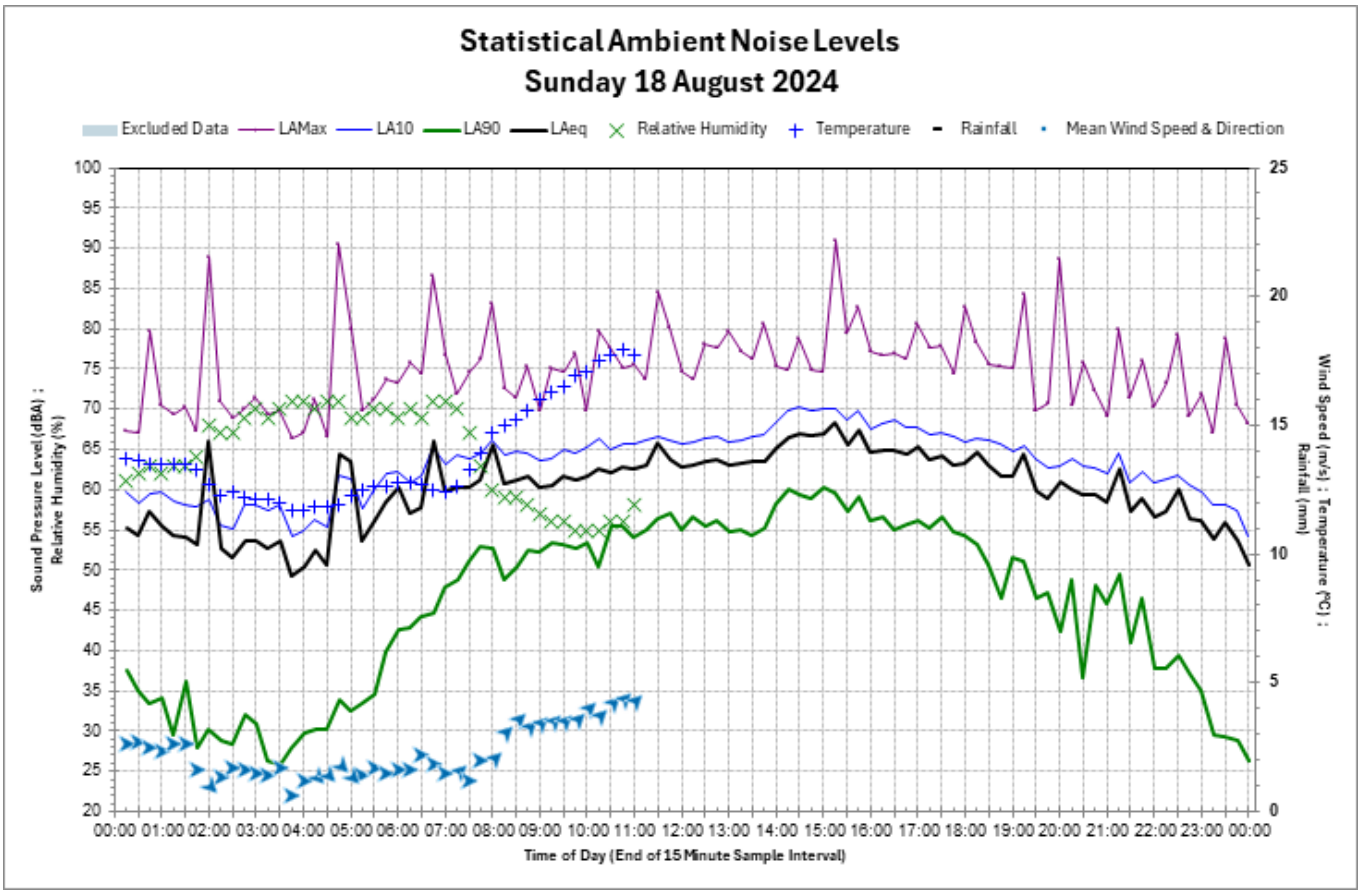

Statistical Ambient Noise Levels
Tuesday 13 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

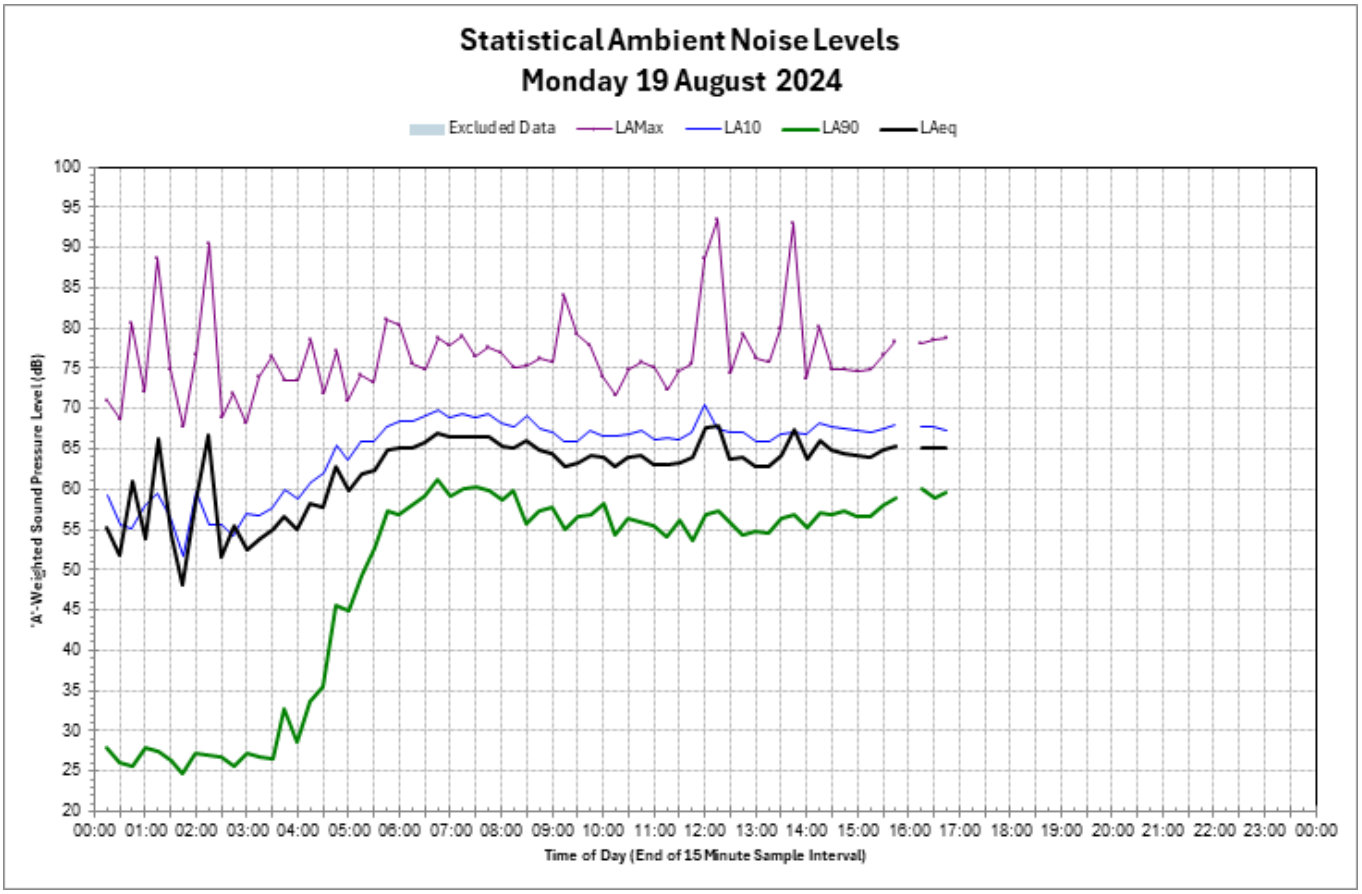

Statistical Ambient Noise Levels
Wednesday 14 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 15 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

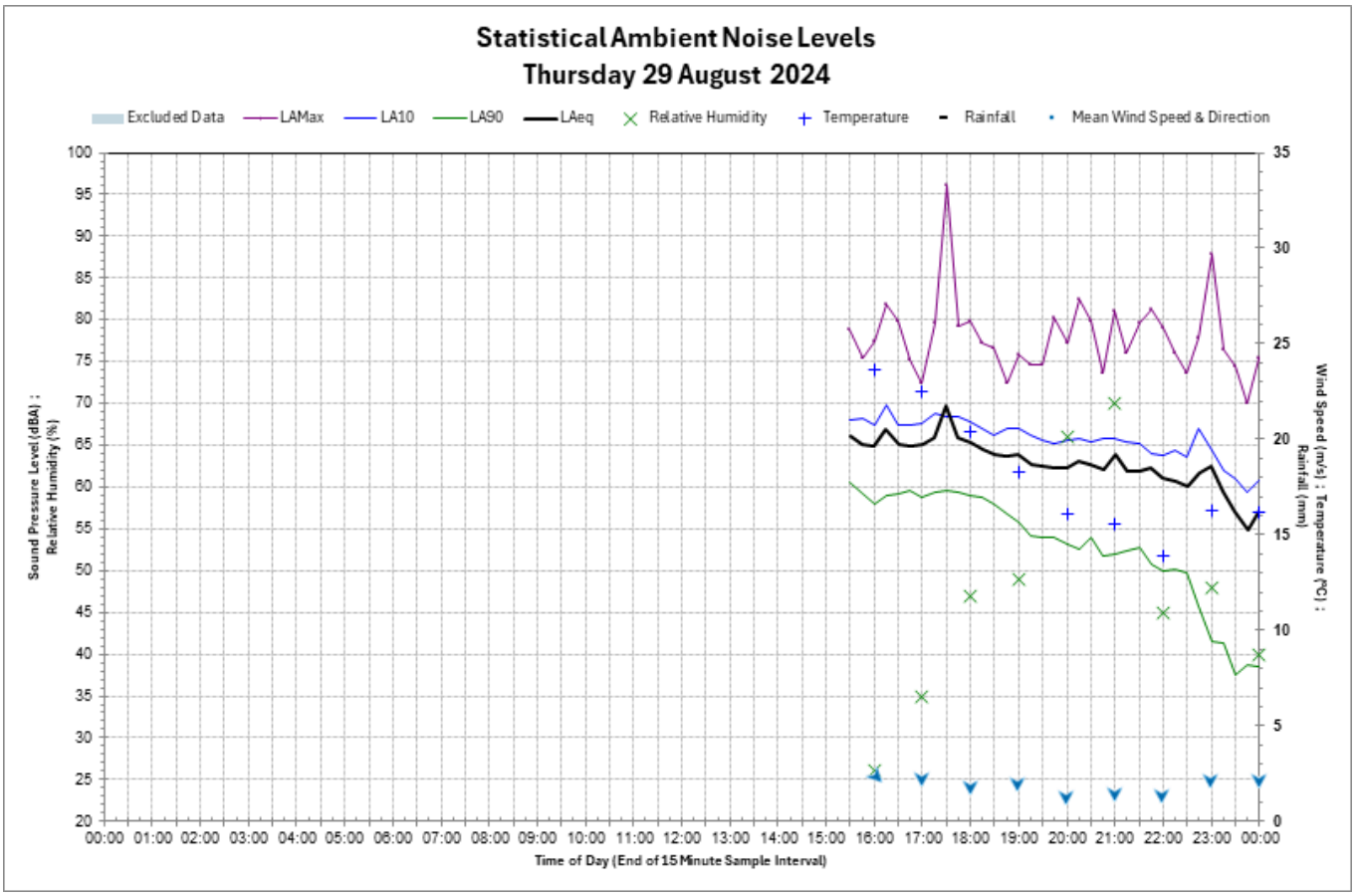

Statistical Ambient Noise Levels
Friday 16 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

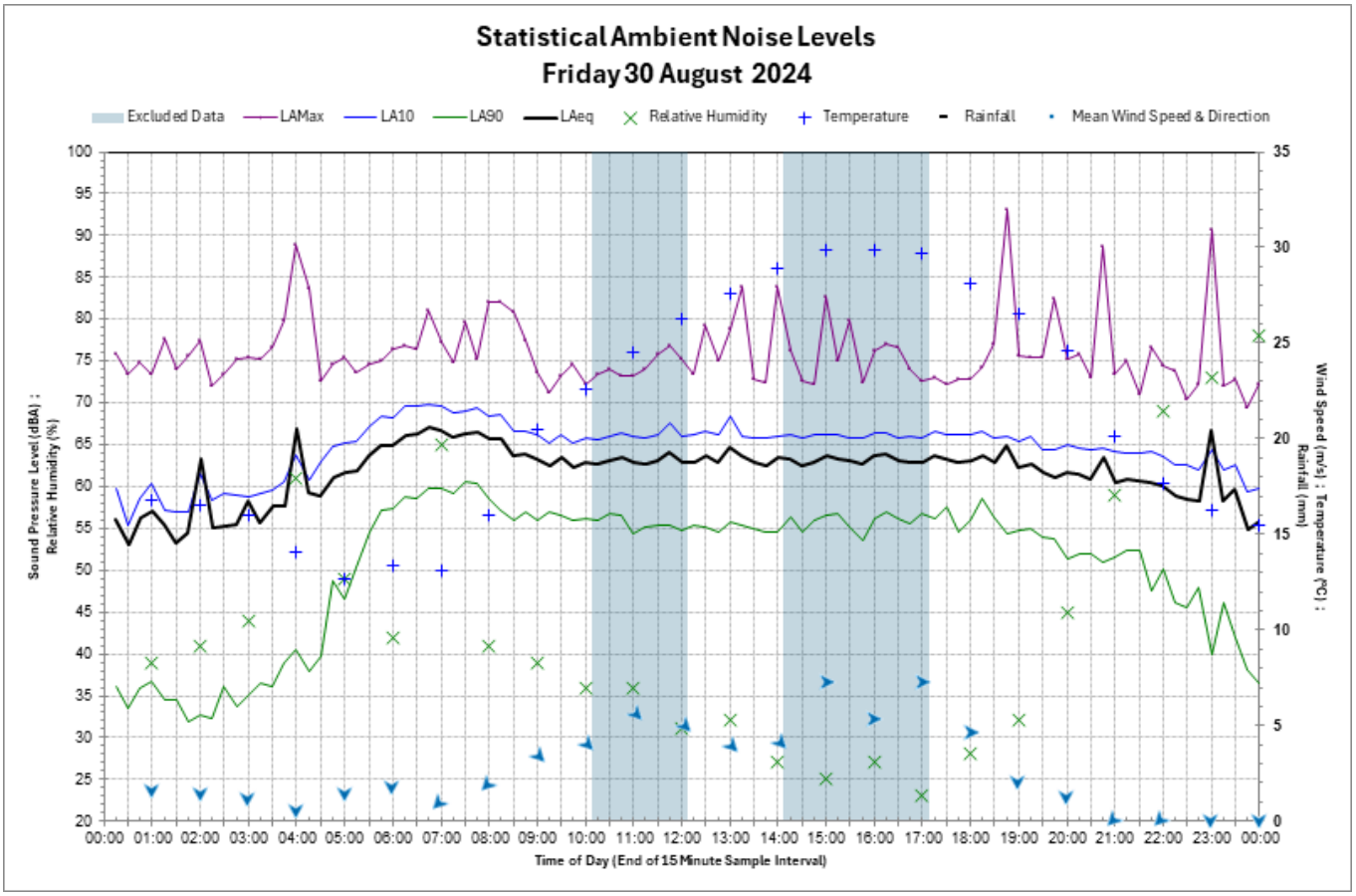

Statistical Ambient Noise Levels
Saturday 17 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

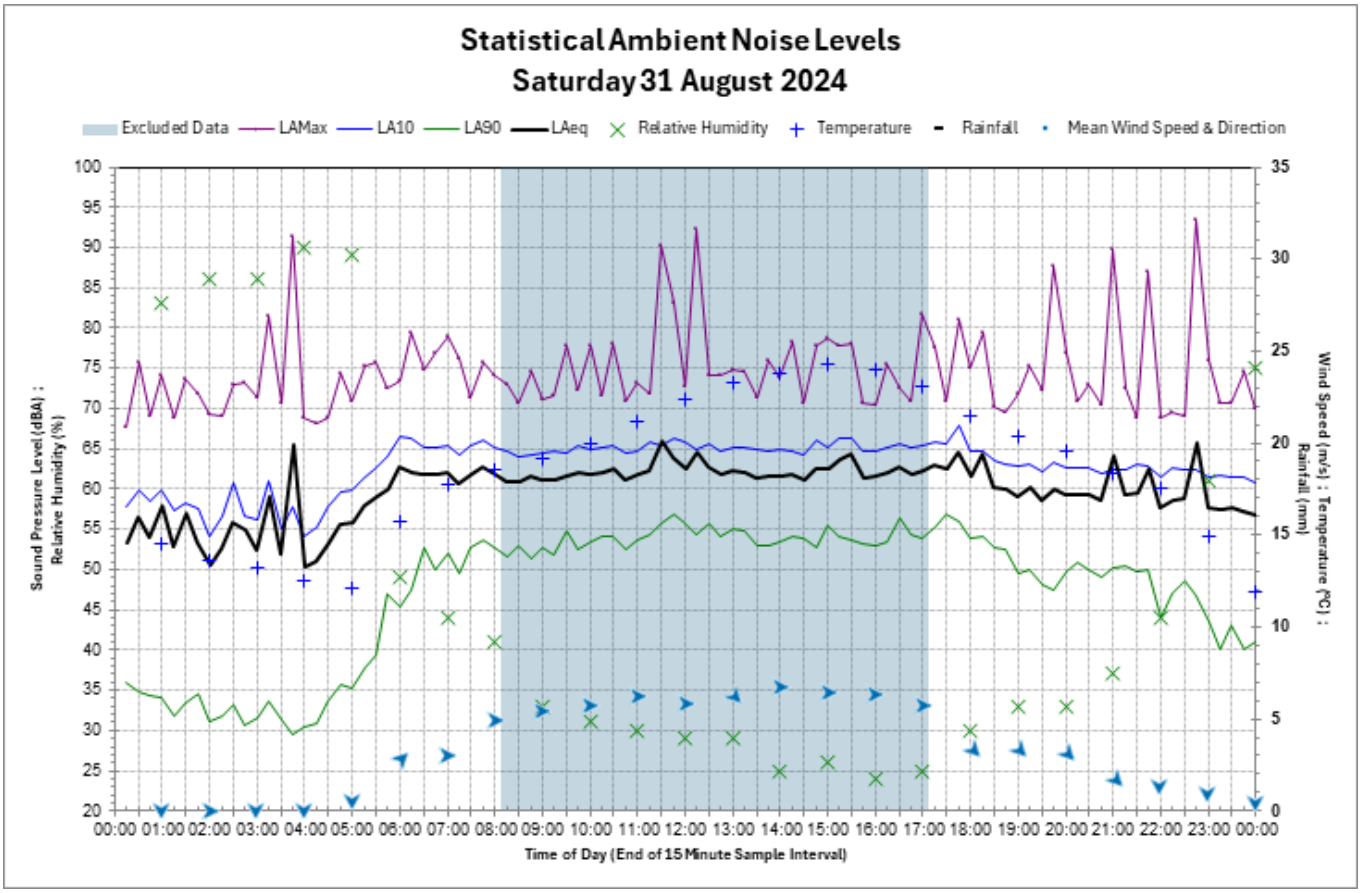

Statistical Ambient Noise Levels
Sunday 18 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

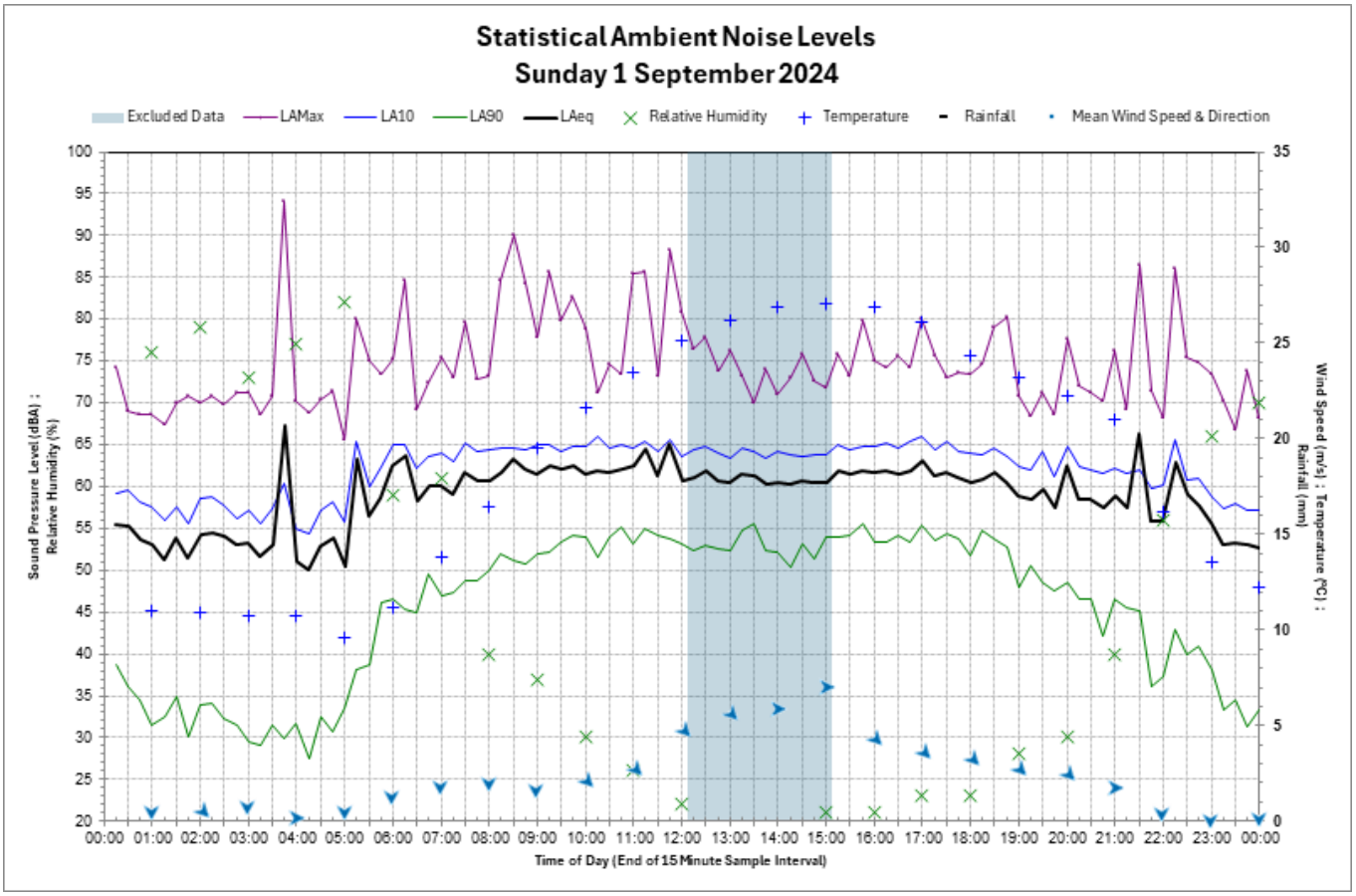

Statistical Ambient Noise Levels
Monday 19 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
'A'-Weighted Sound Pressure Level (dB)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Time of Day (End of 15 Minute Sample Interval)

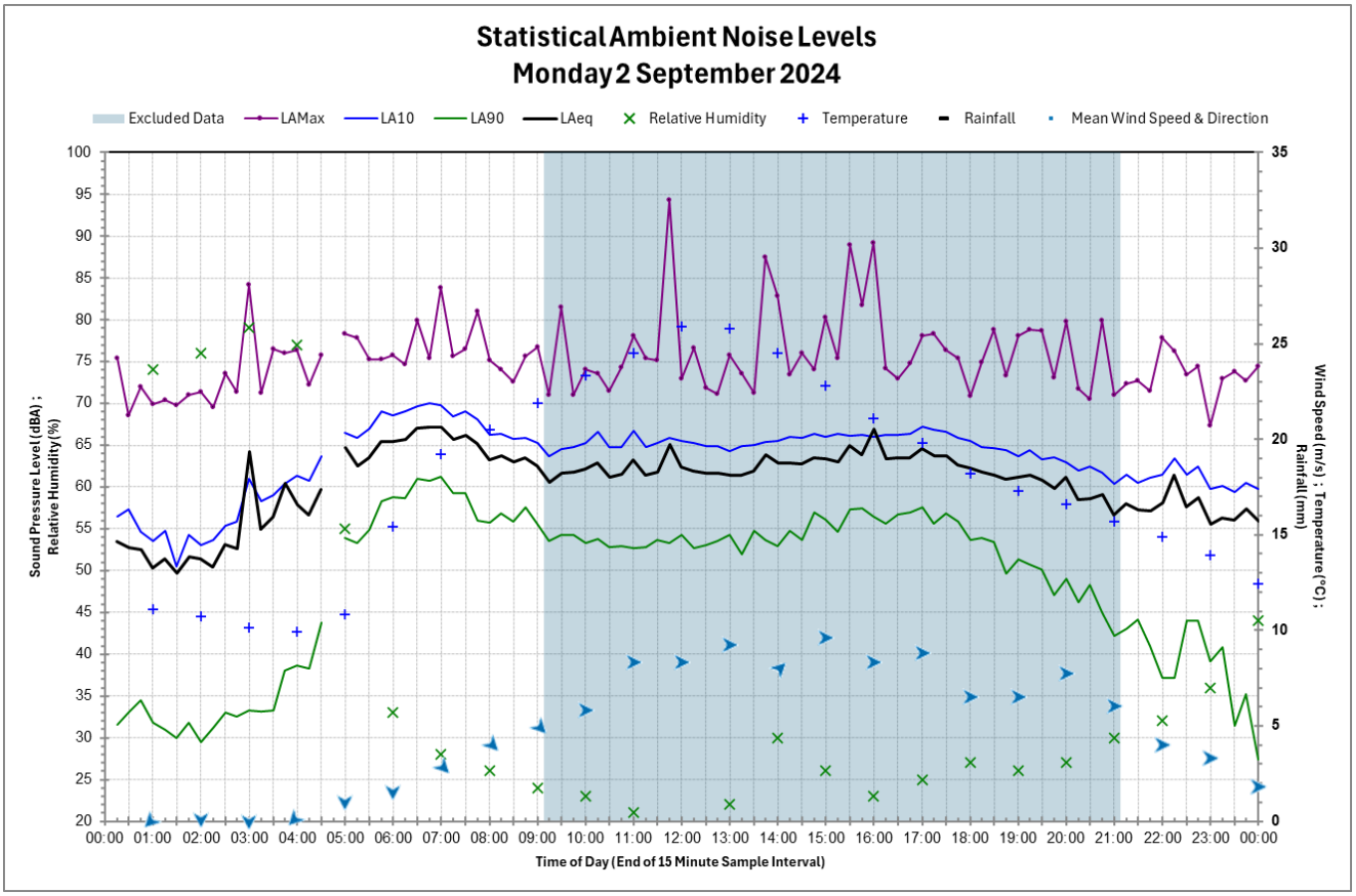
Location P01 – Period 2

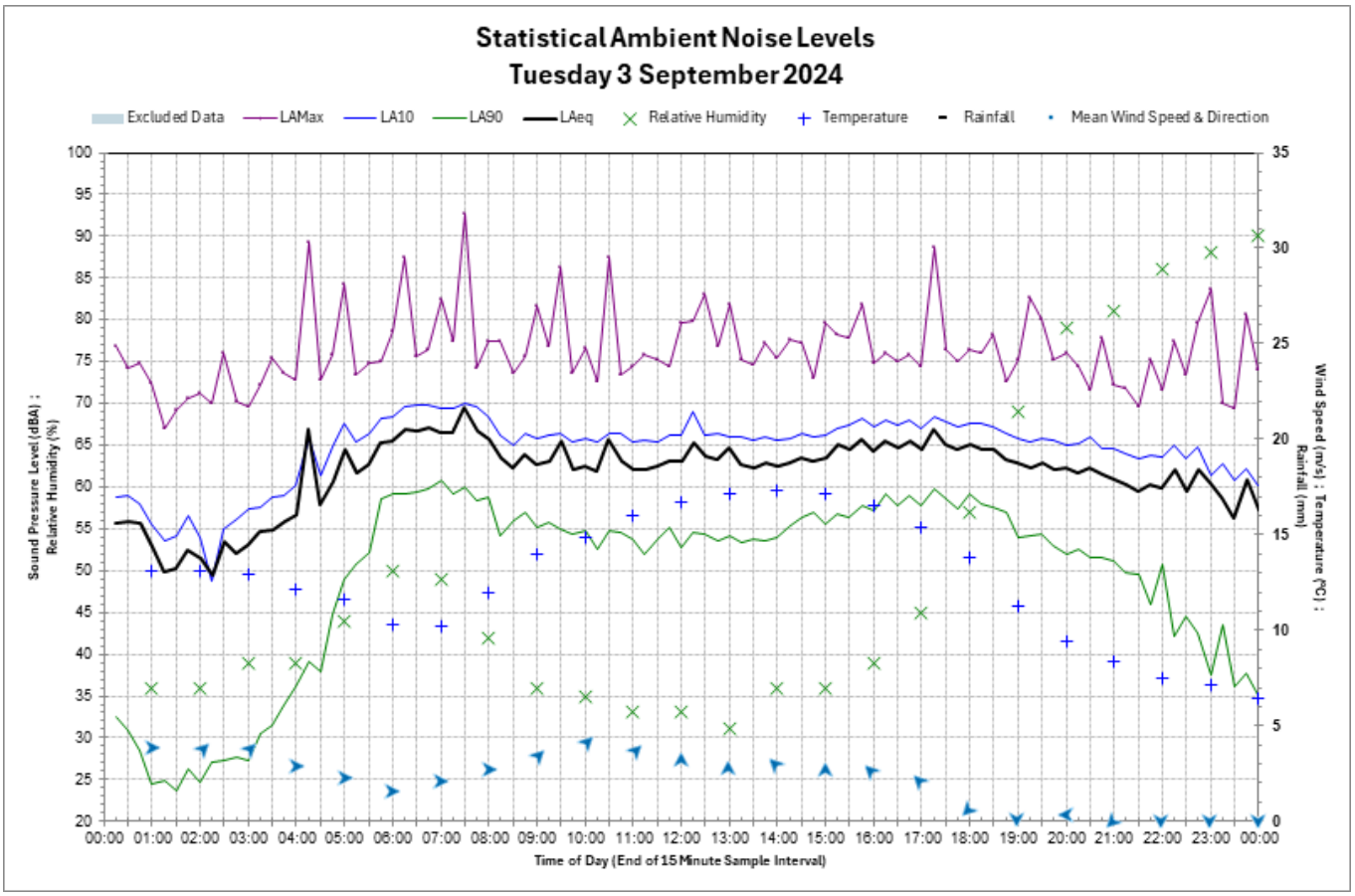


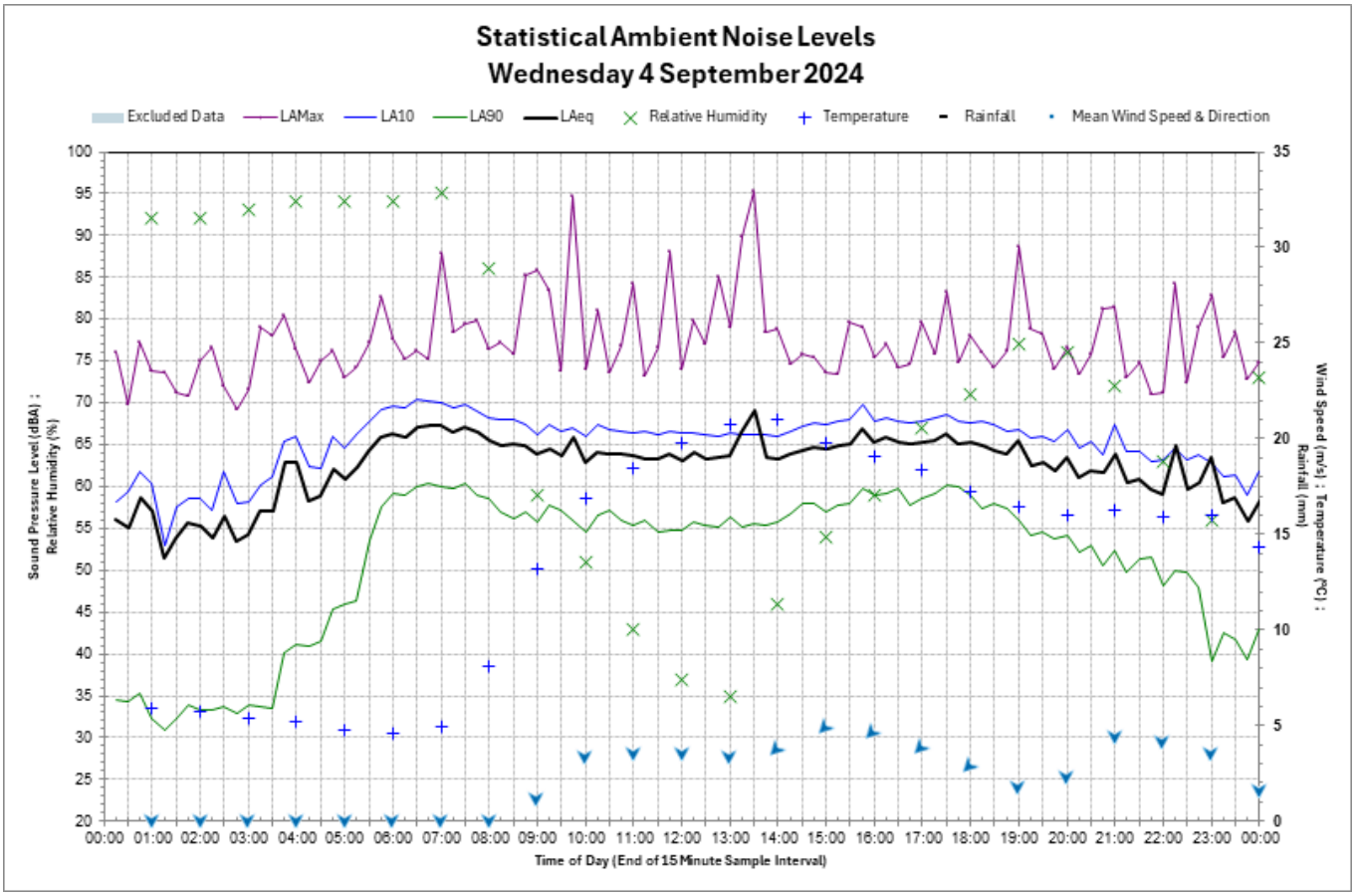


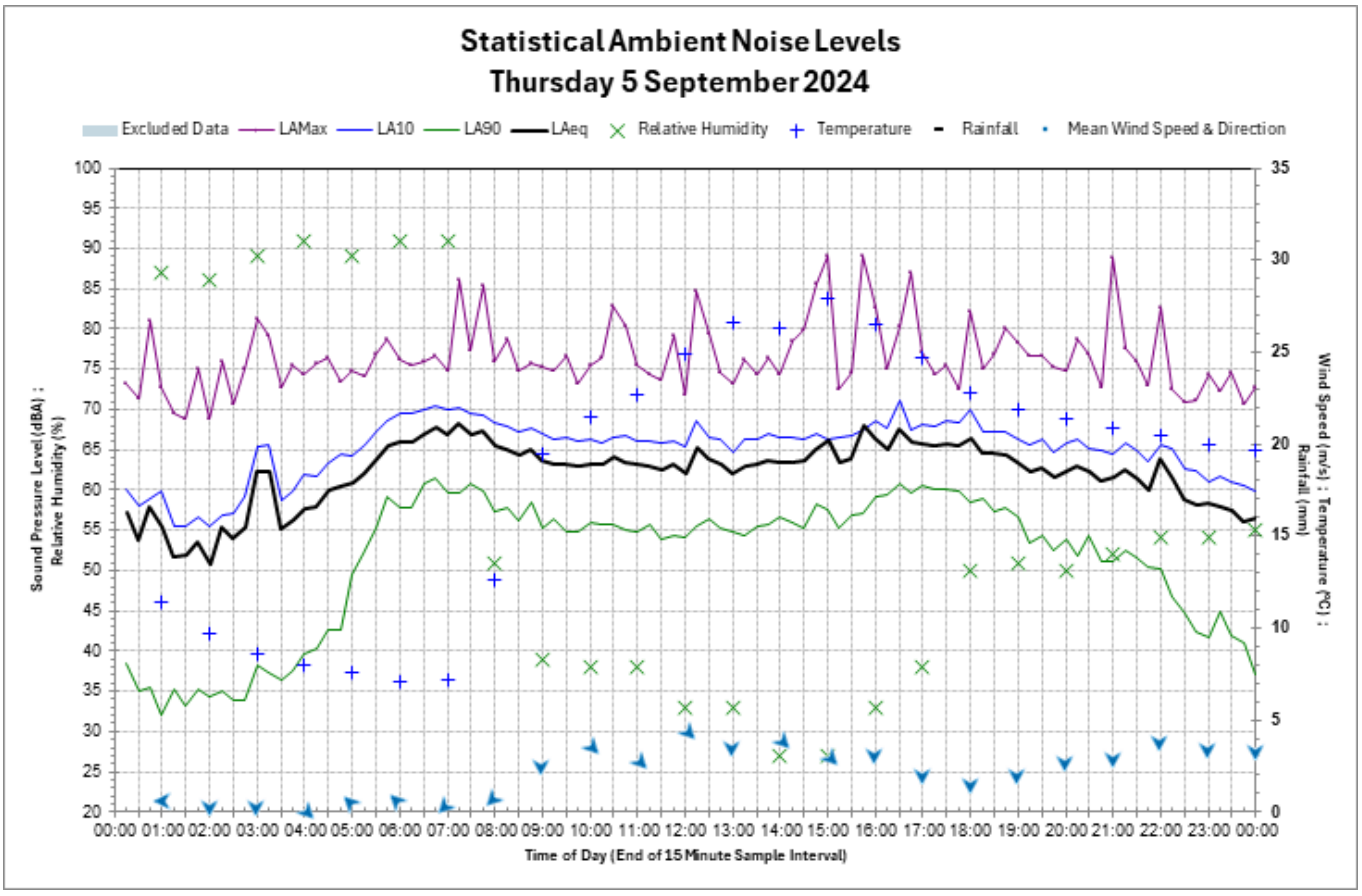

Statistical Ambient Noise Levels
Saturday 31 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

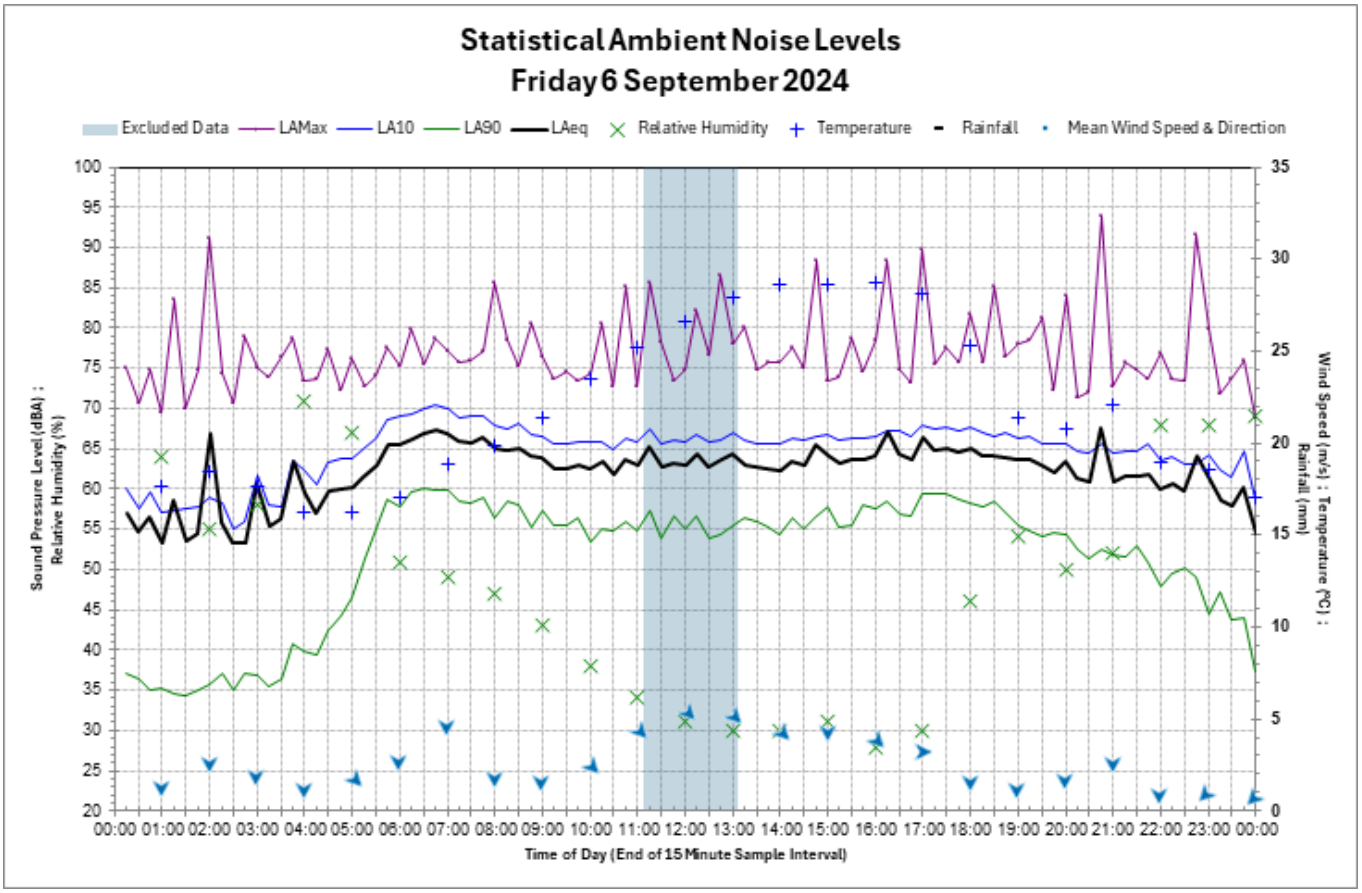

Statistical Ambient Noise Levels
Sunday 1 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

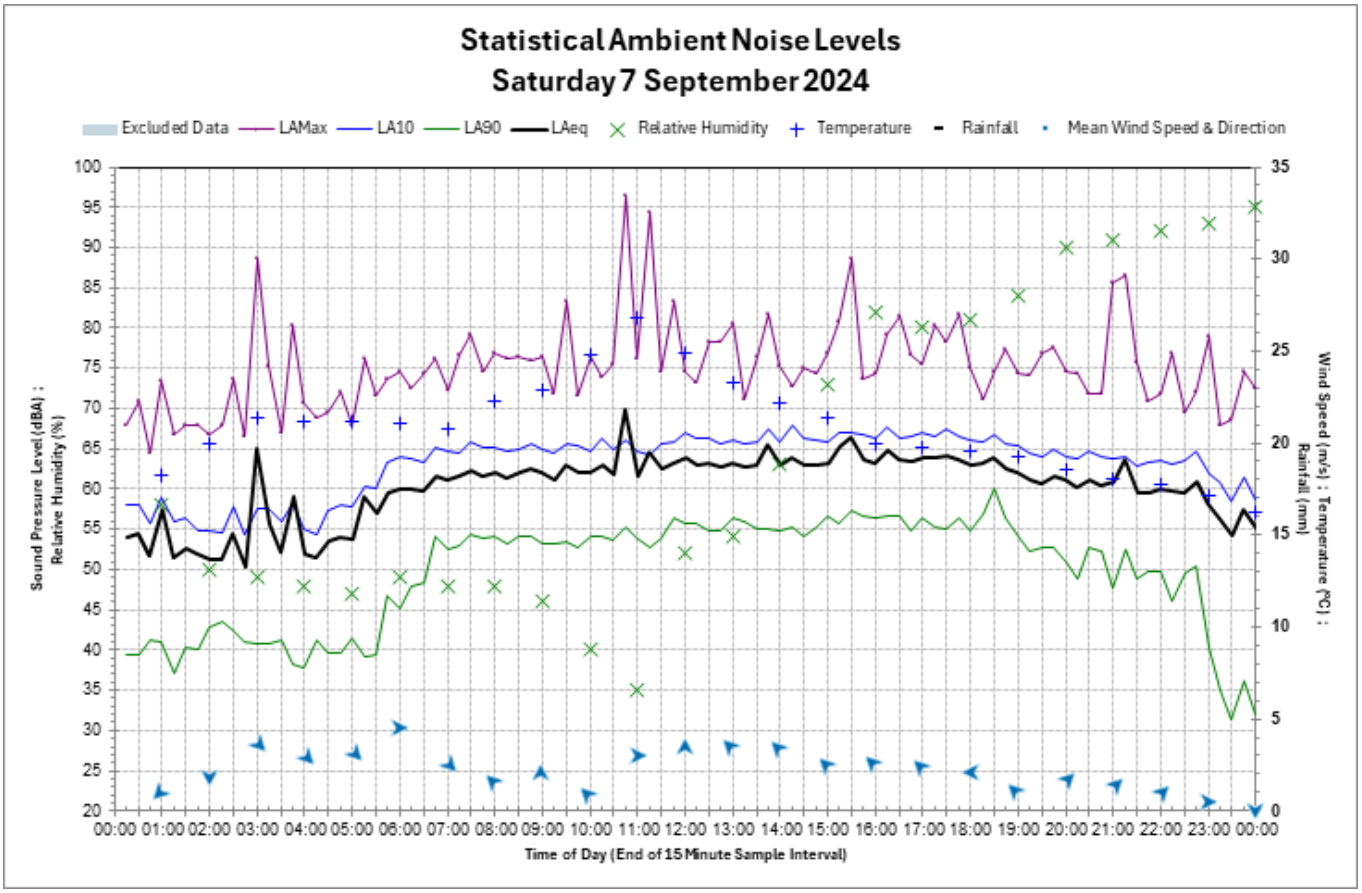

Statistical Ambient Noise Levels
Monday 2 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

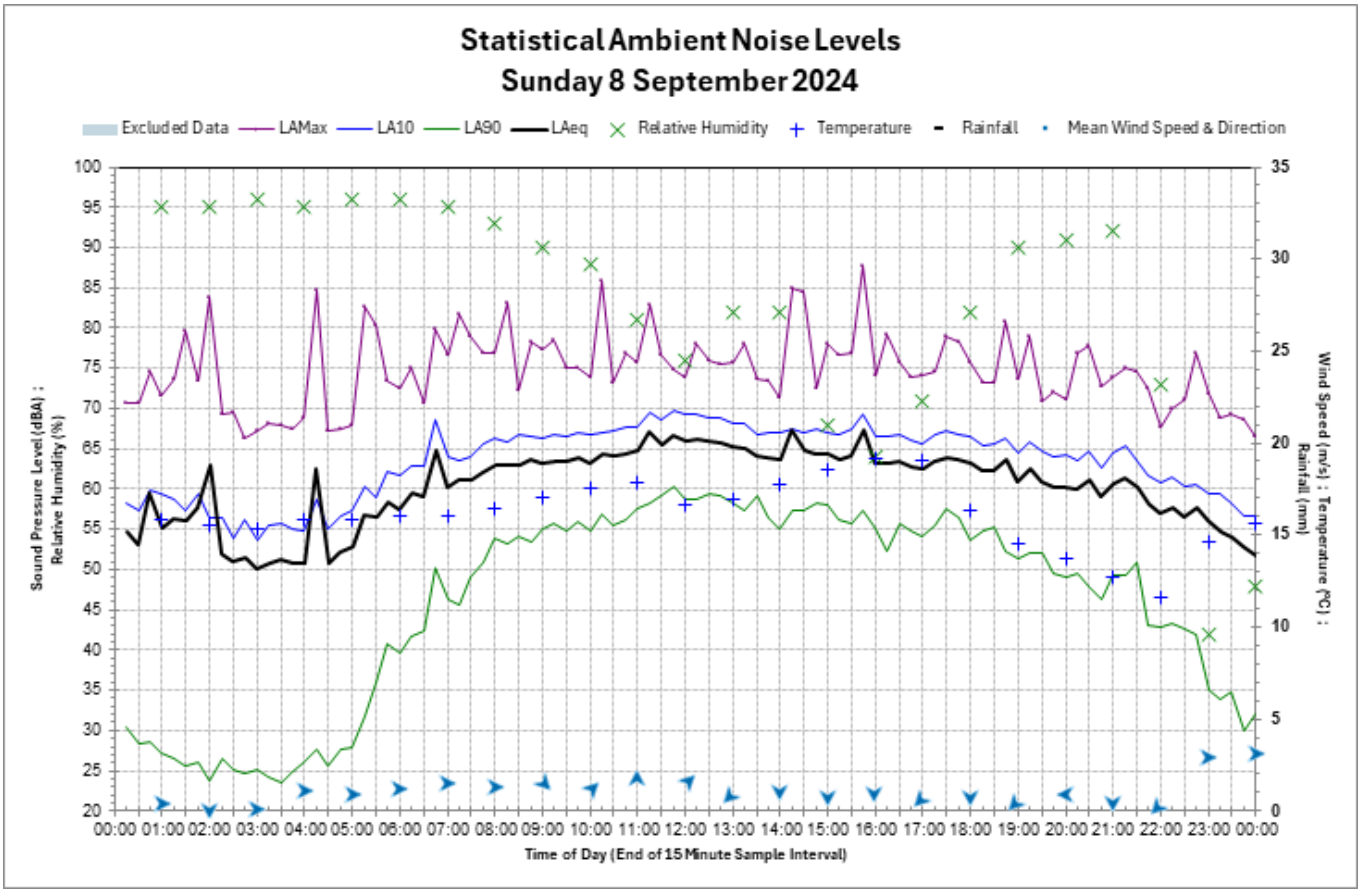

Statistical Ambient Noise Levels
Tuesday 3 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

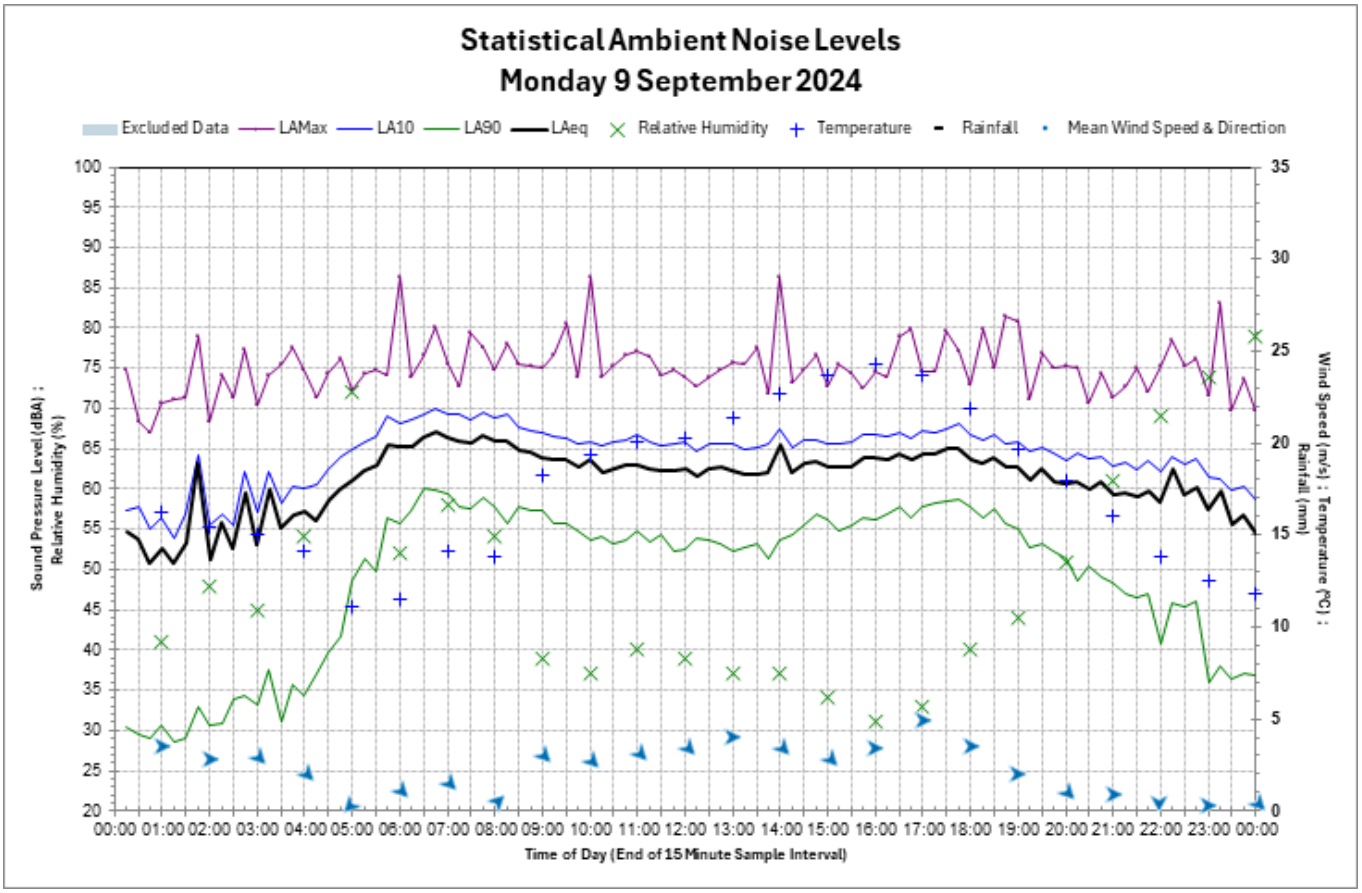

Statistical Ambient Noise Levels
Wednesday 4 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

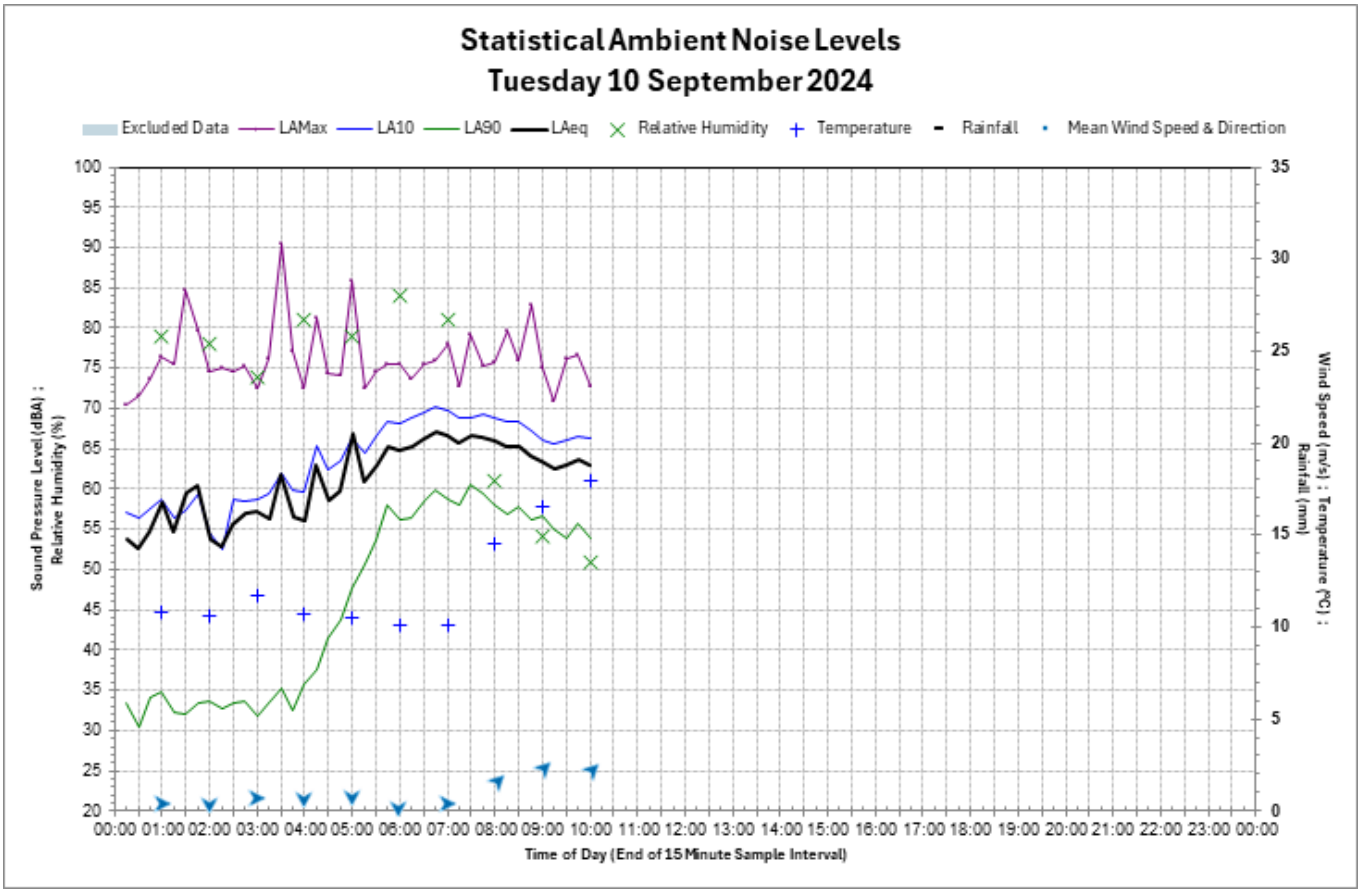

Statistical Ambient Noise Levels
Thursday 5 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 6 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

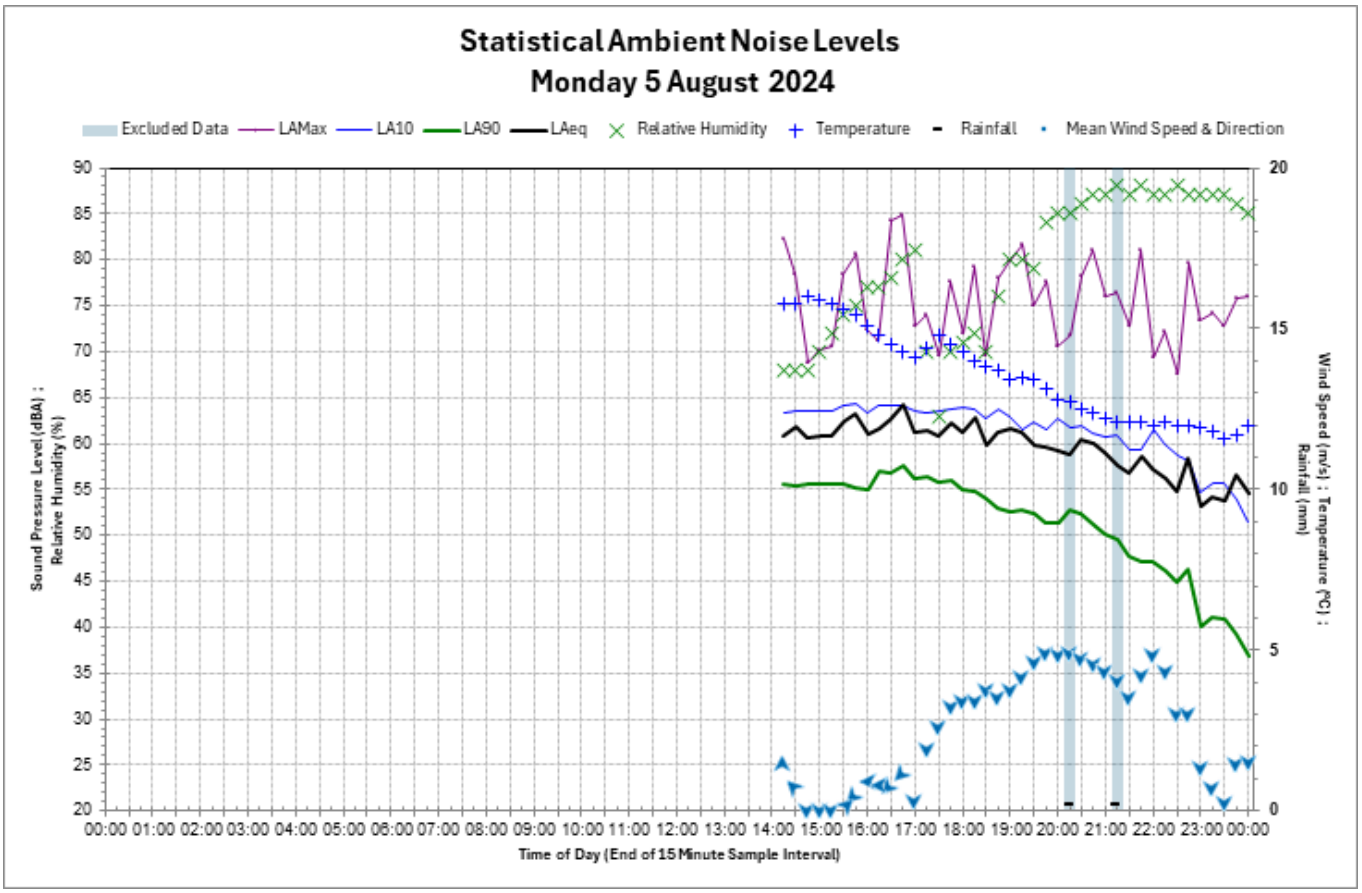

Statistical Ambient Noise Levels
Saturday 7 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

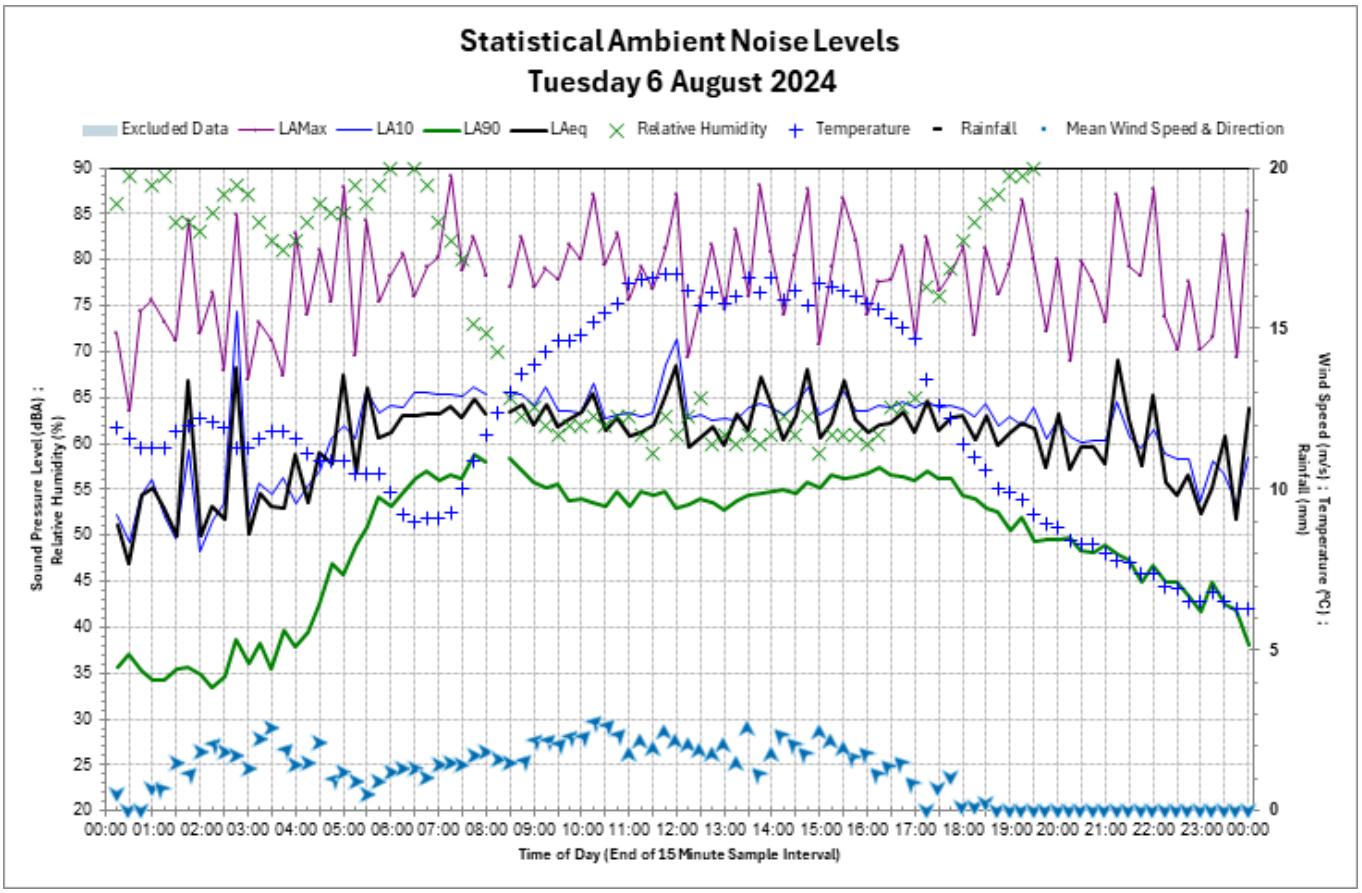

Statistical Ambient Noise Levels
Sunday 8 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

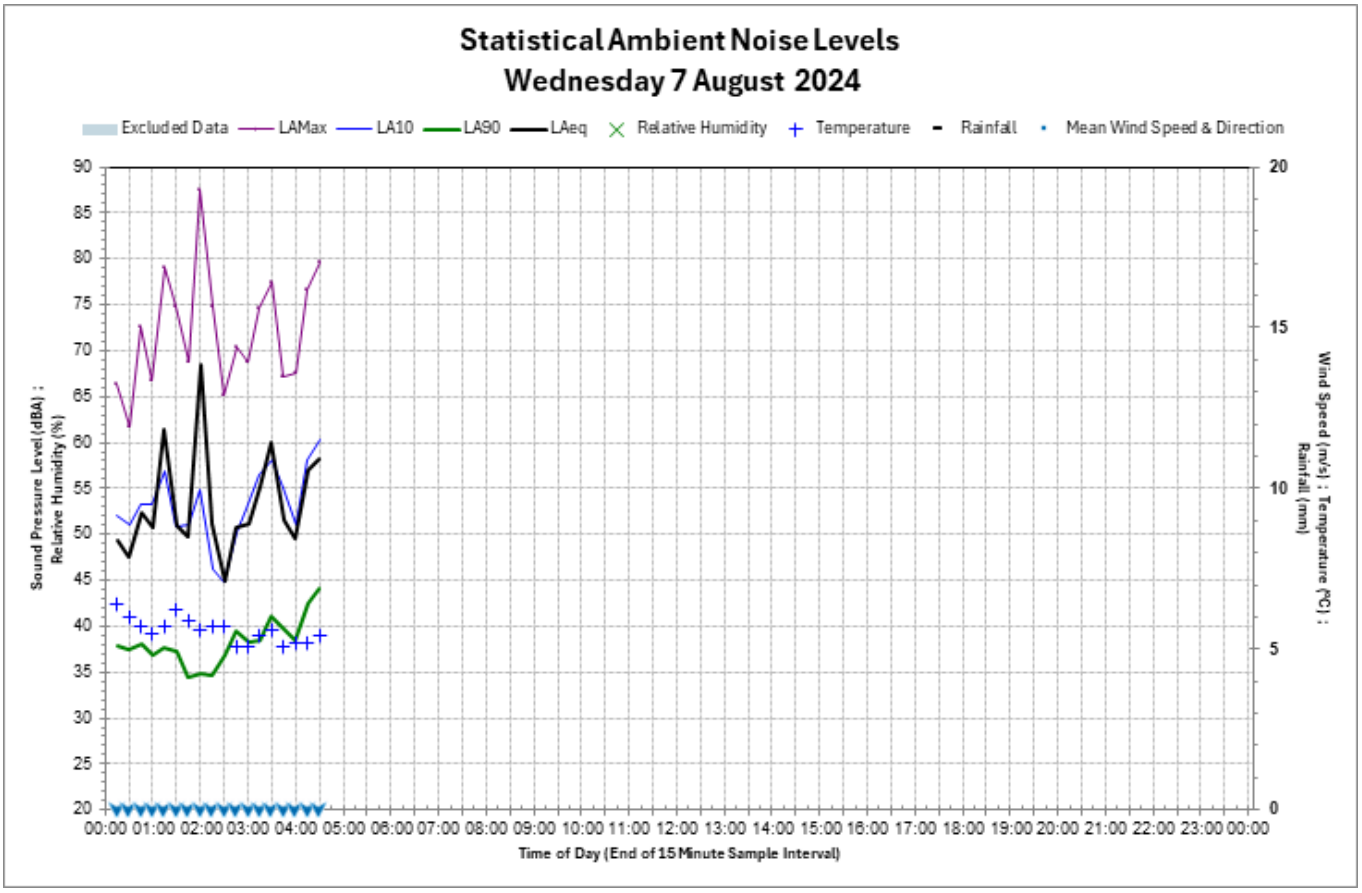

Statistical Ambient Noise Levels
Monday 9 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 10 September 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

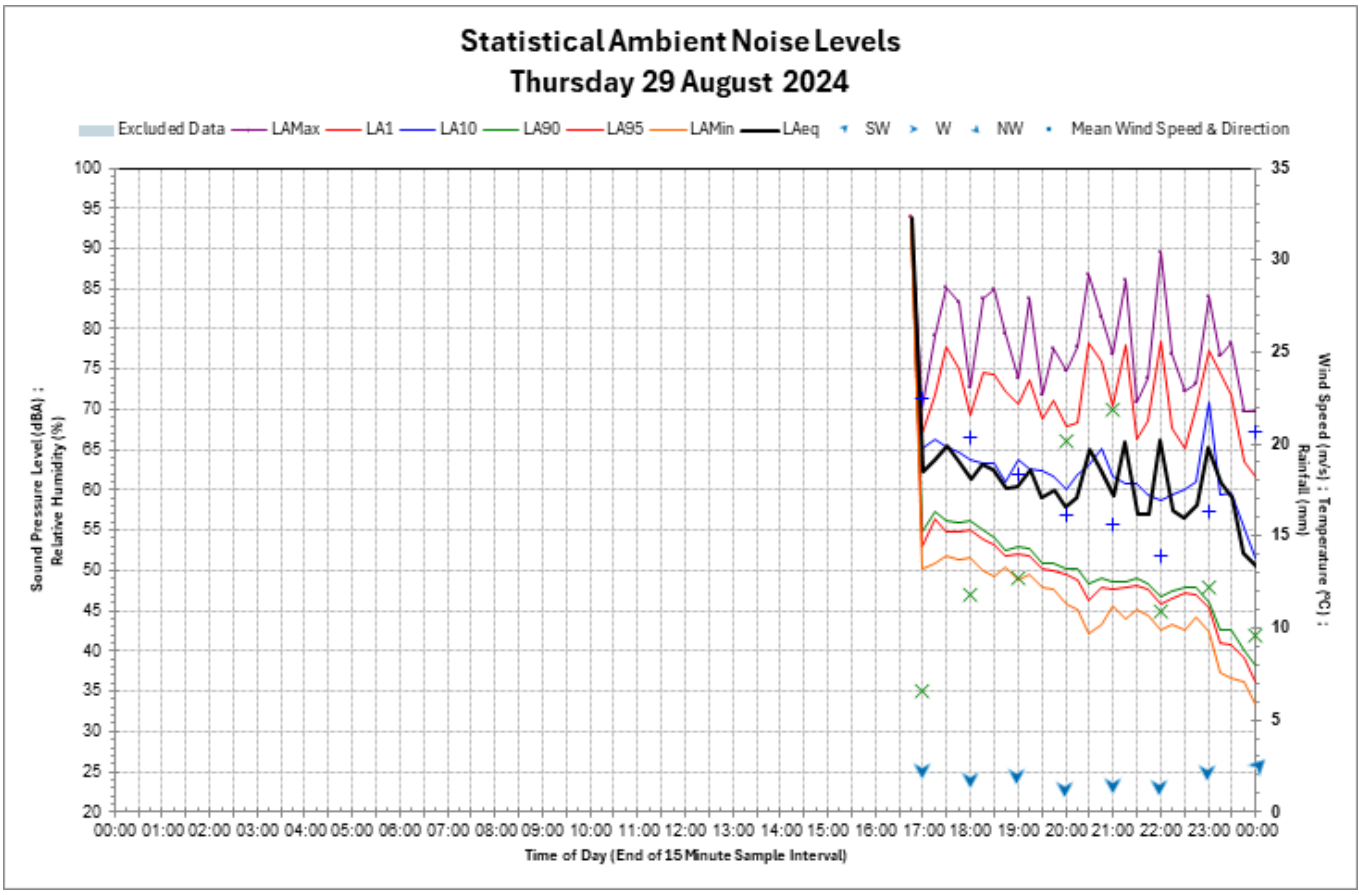
Location P02 – Period 1

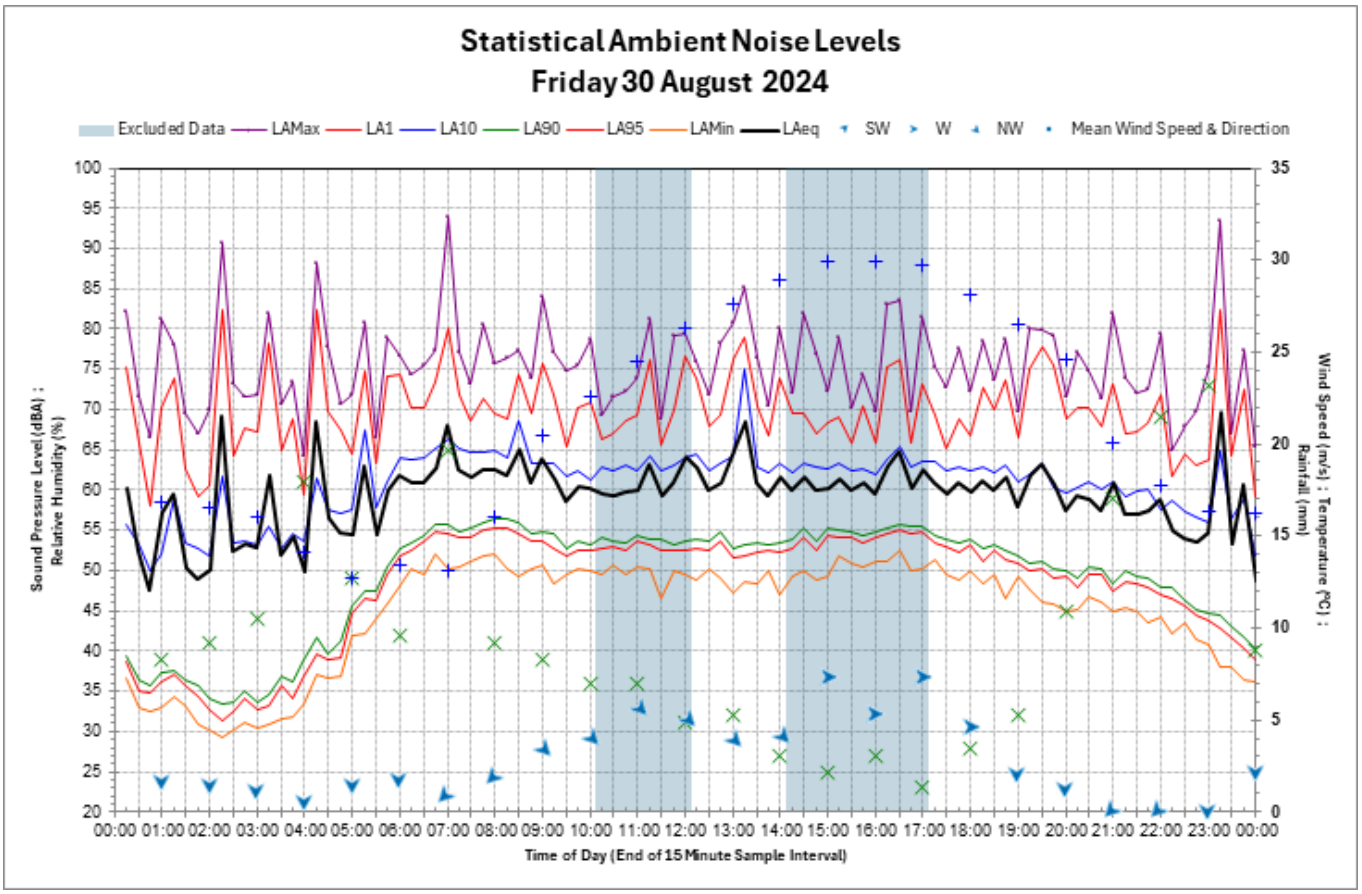


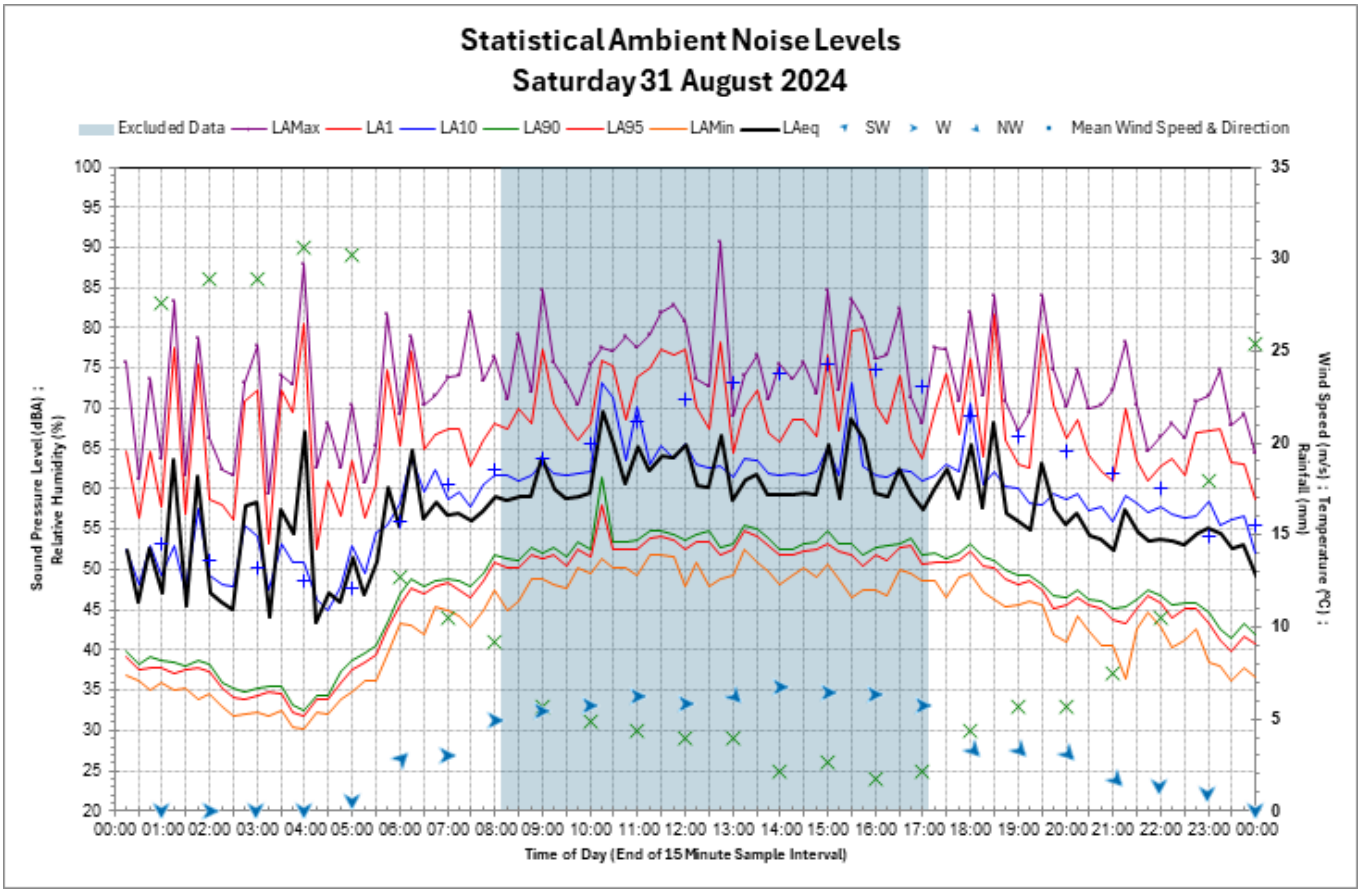


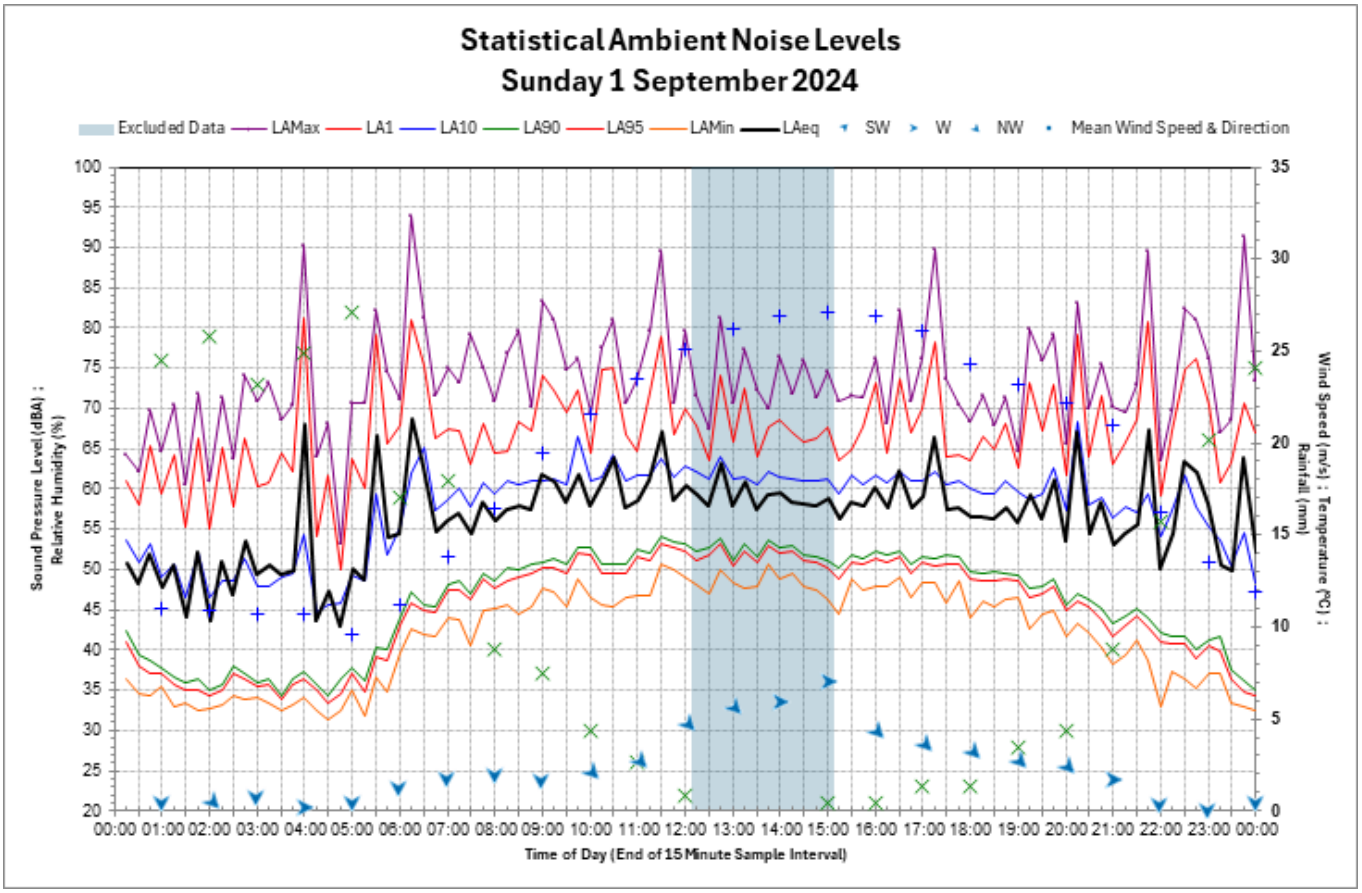

Statistical Ambient Noise Levels
Wednesday 7 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

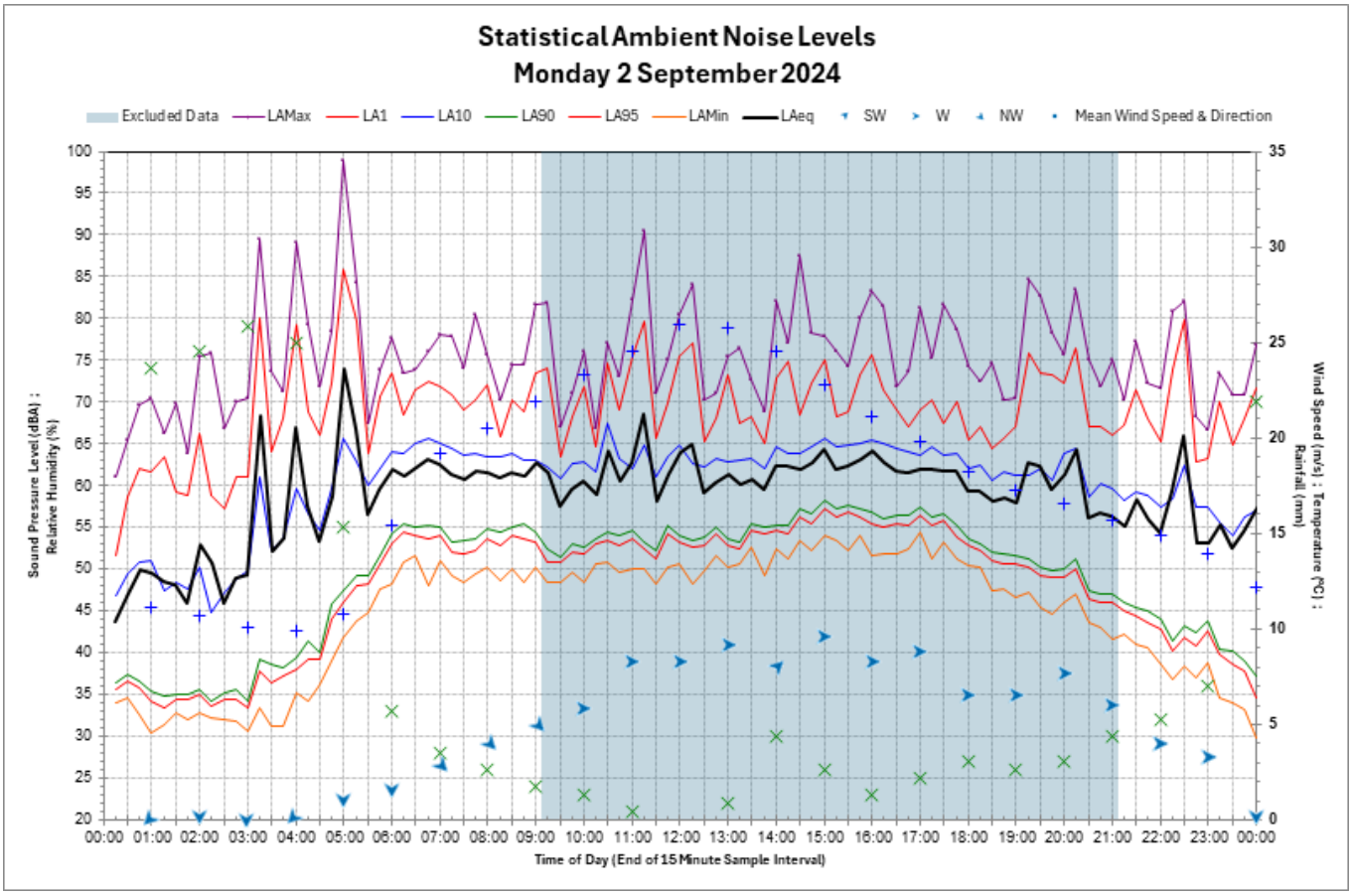
Location P02 – Period 2

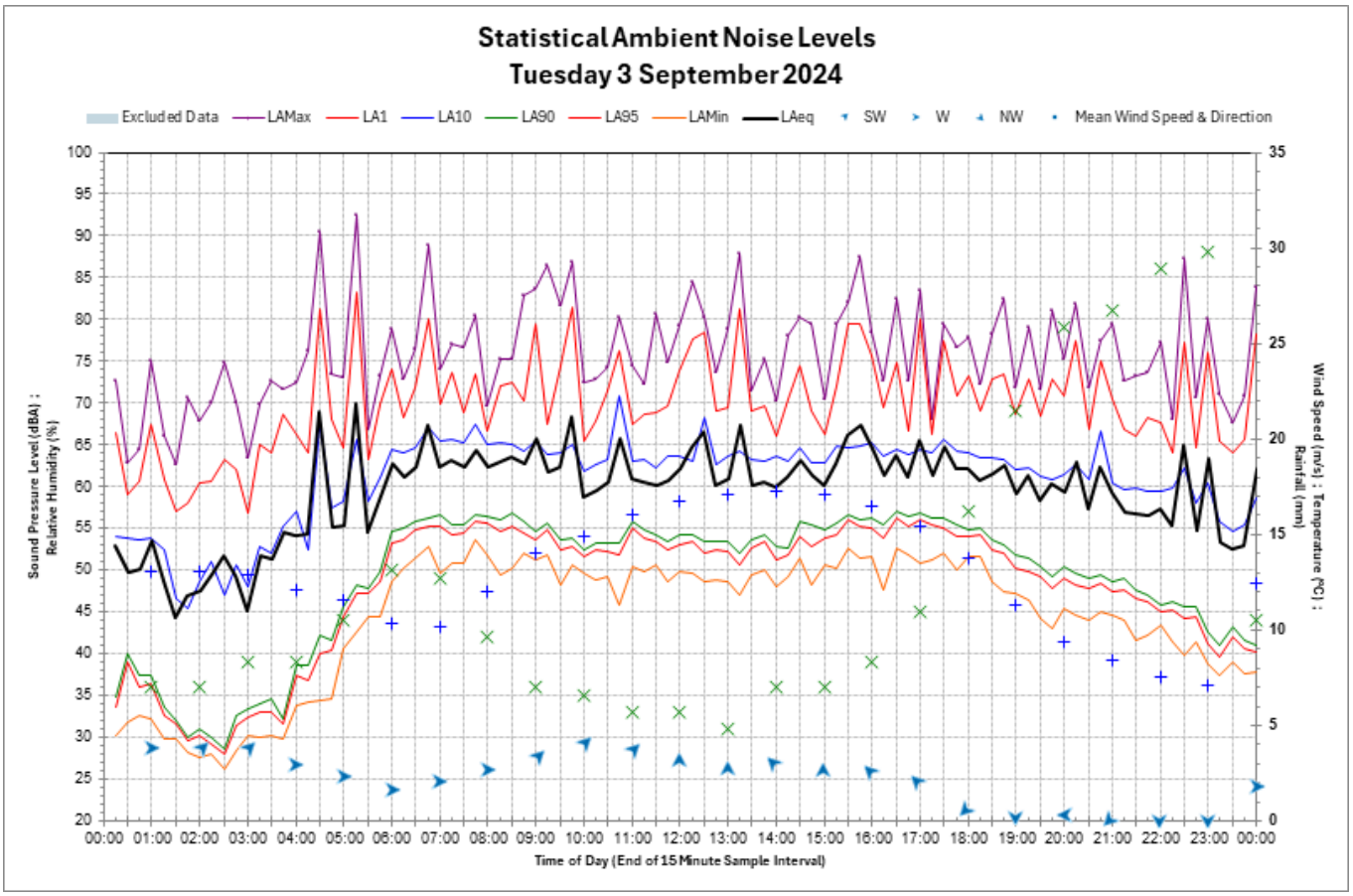


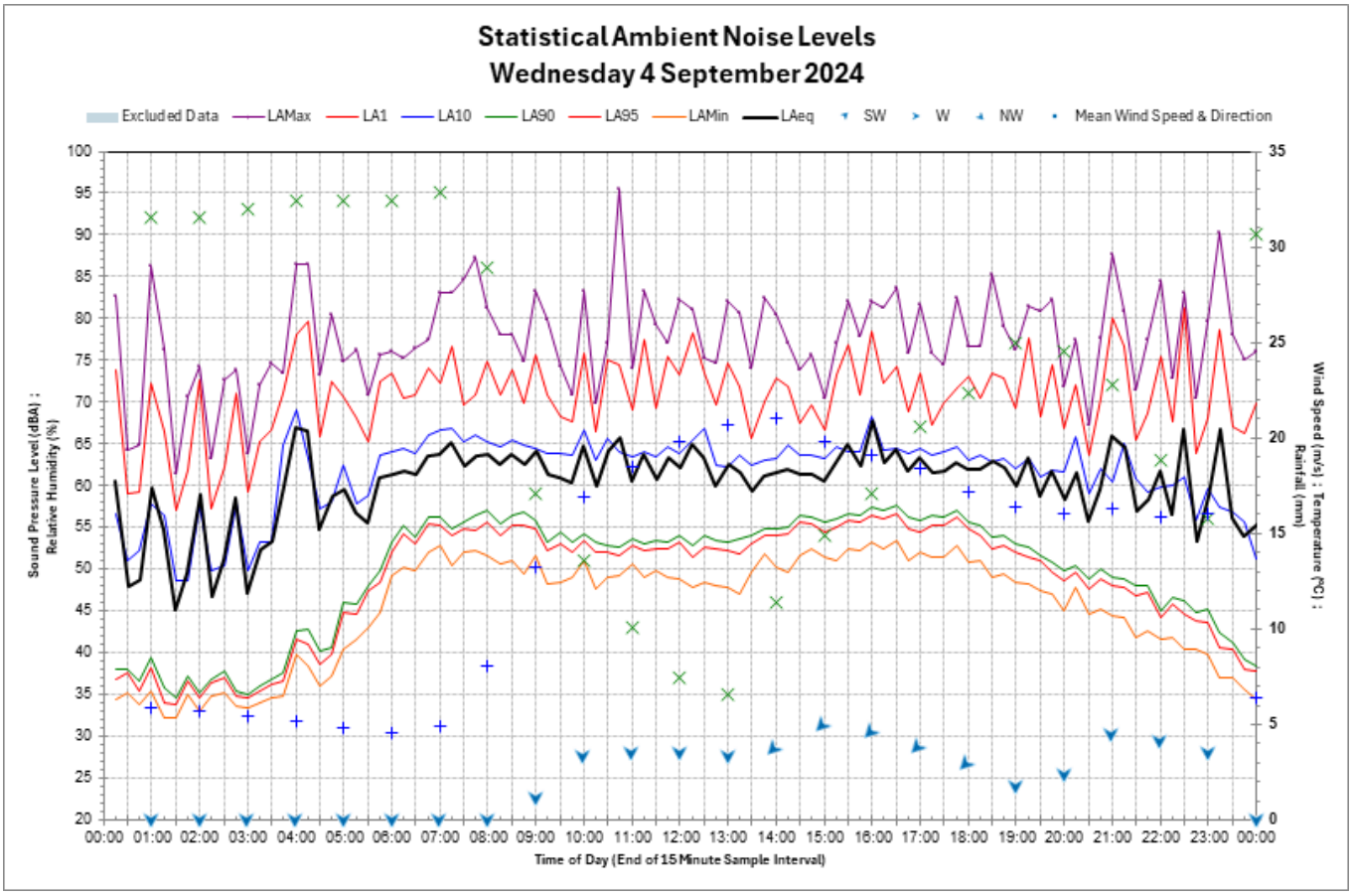


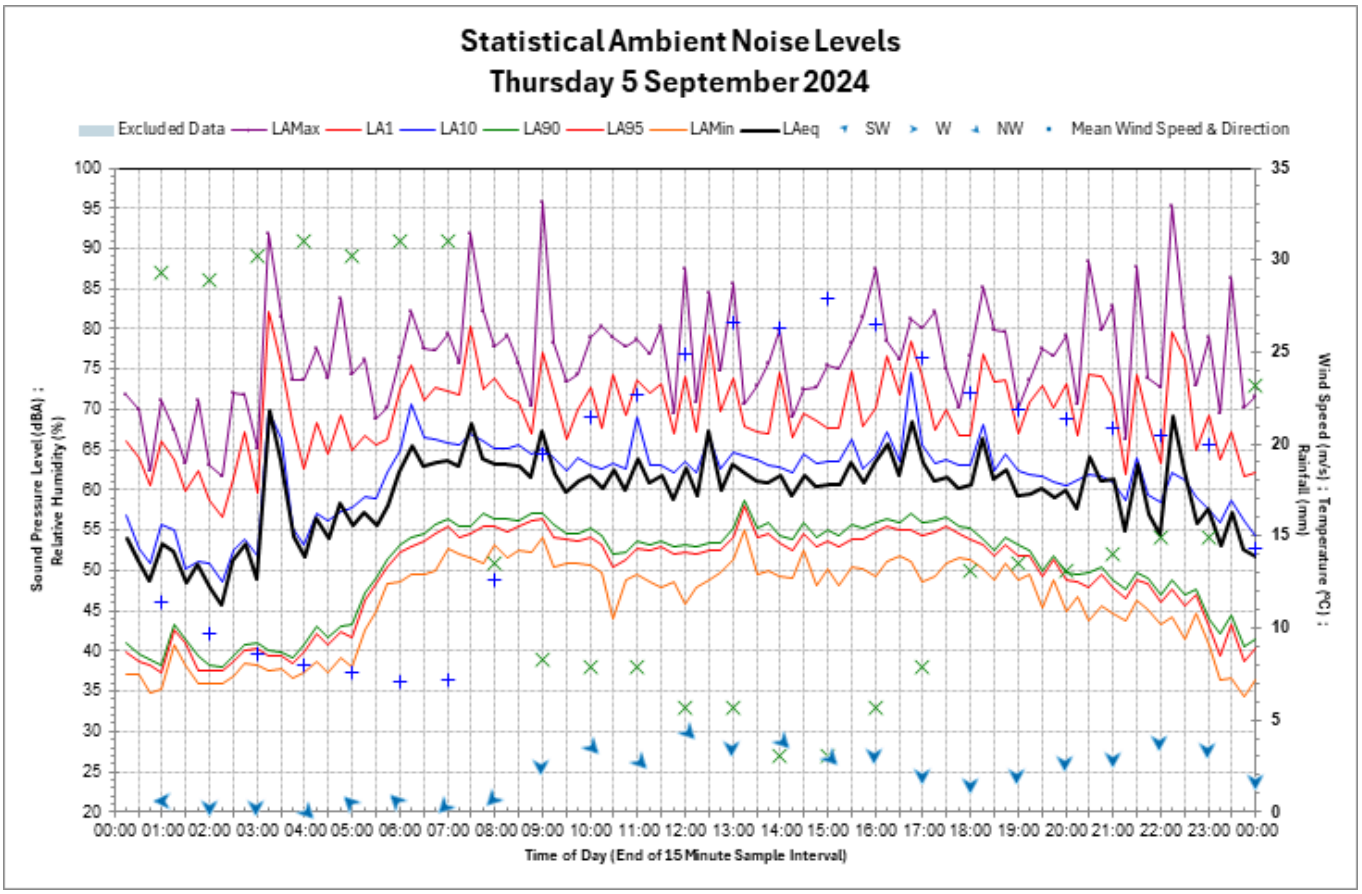

Statistical Ambient Noise Levels
Saturday 31 August 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

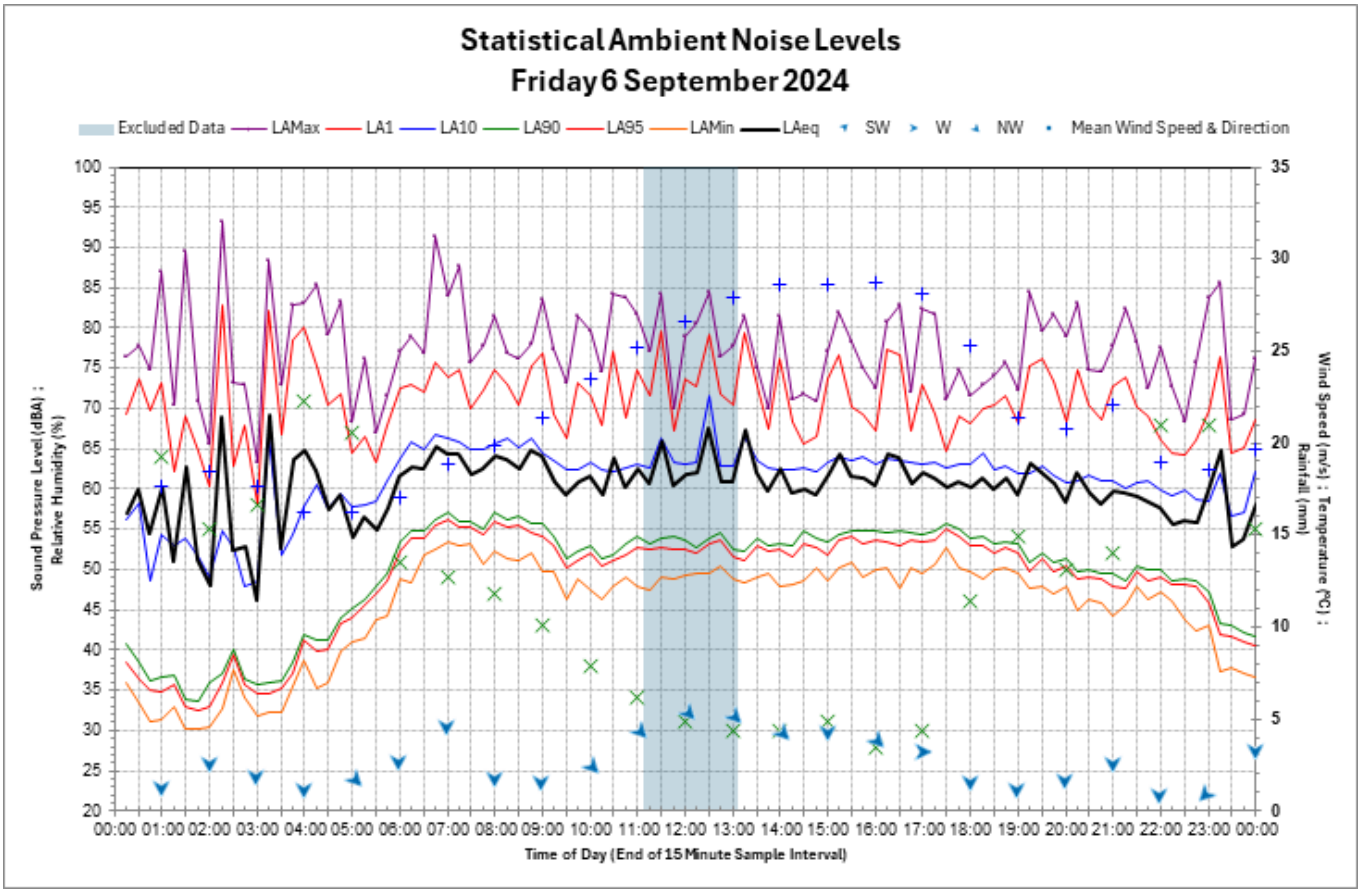

Statistical Ambient Noise Levels
Sunday 1 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

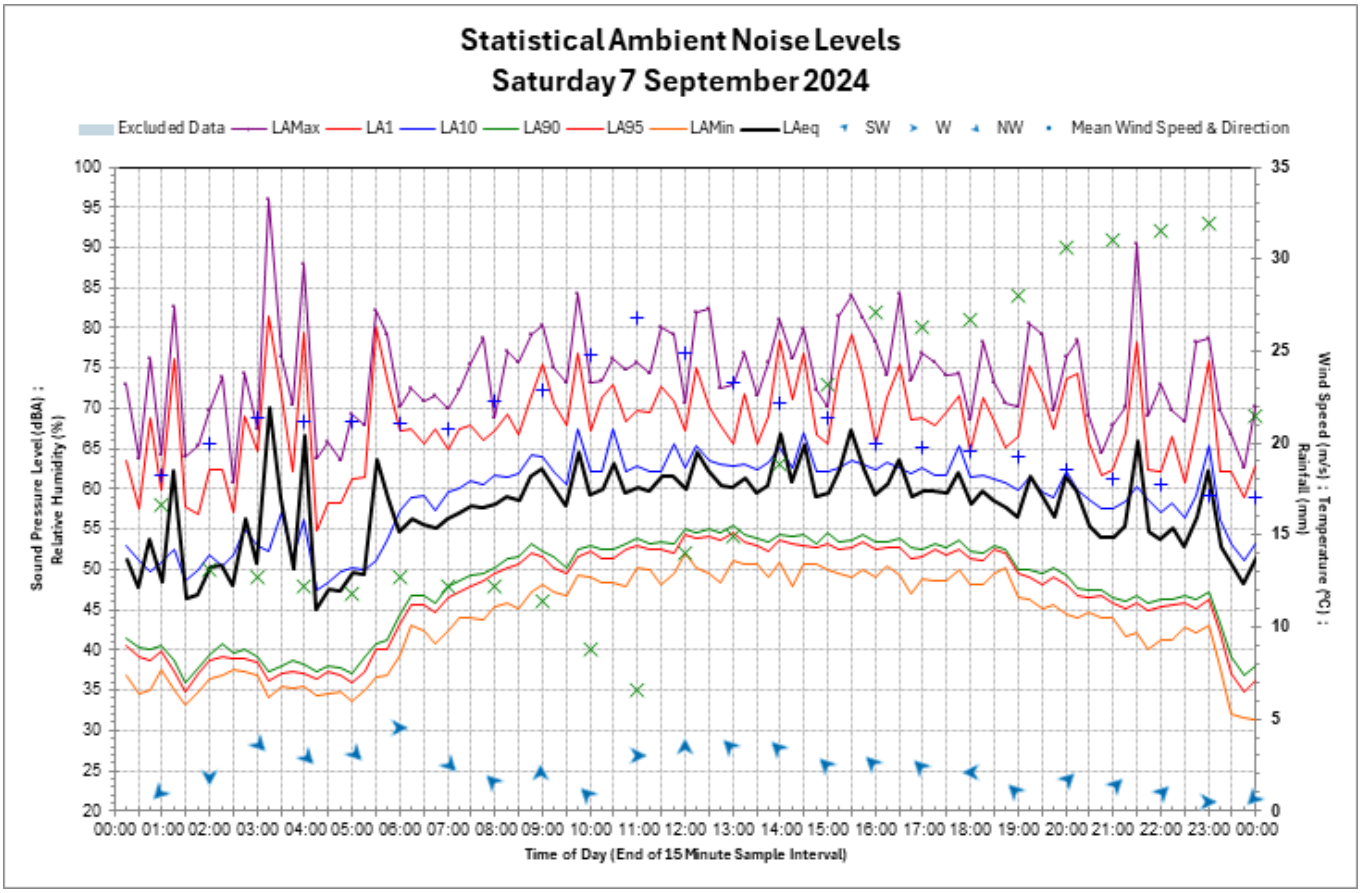

Statistical Ambient Noise Levels
Monday 2 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 3 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

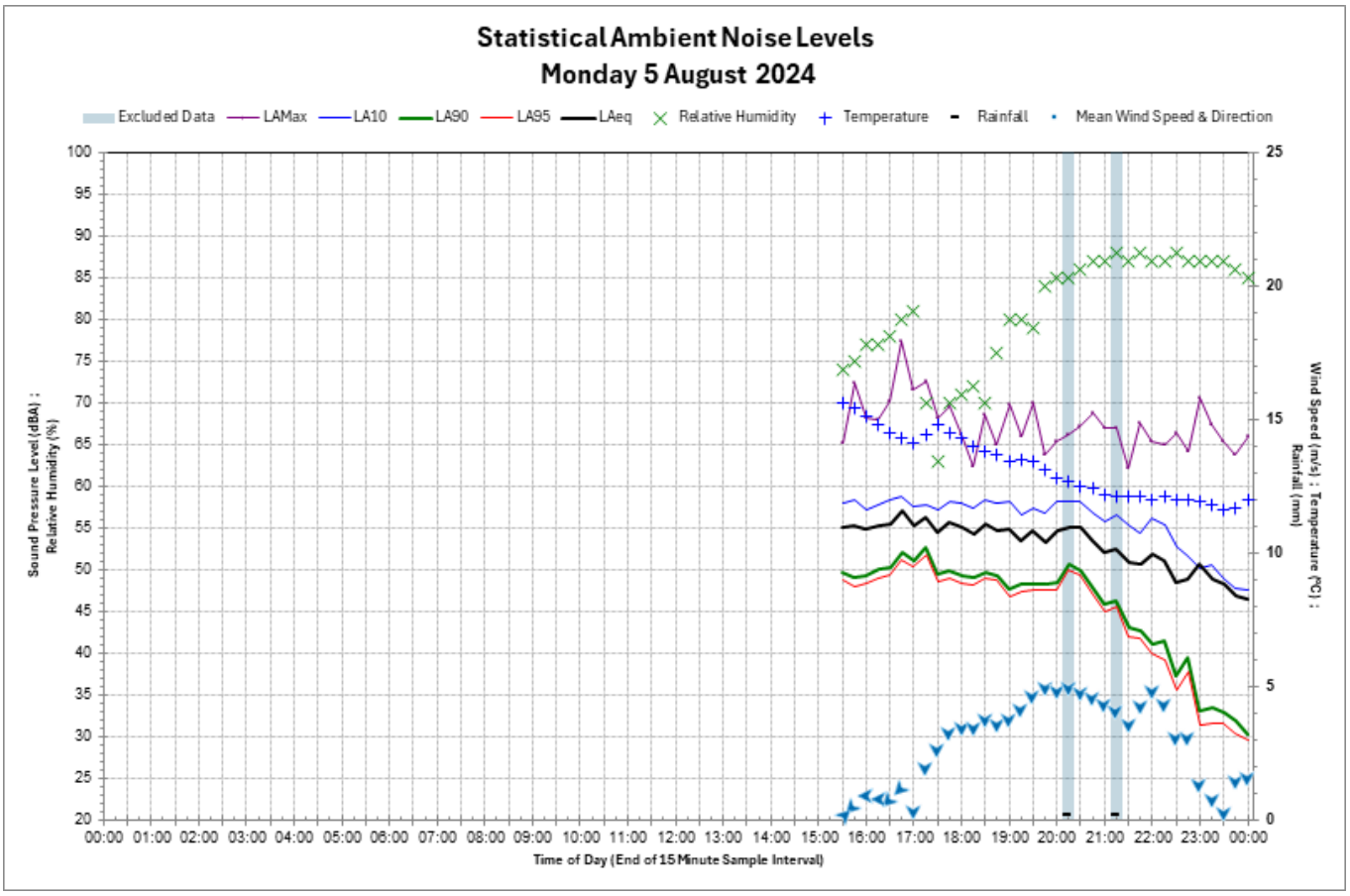

Statistical Ambient Noise Levels
Wednesday 4 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

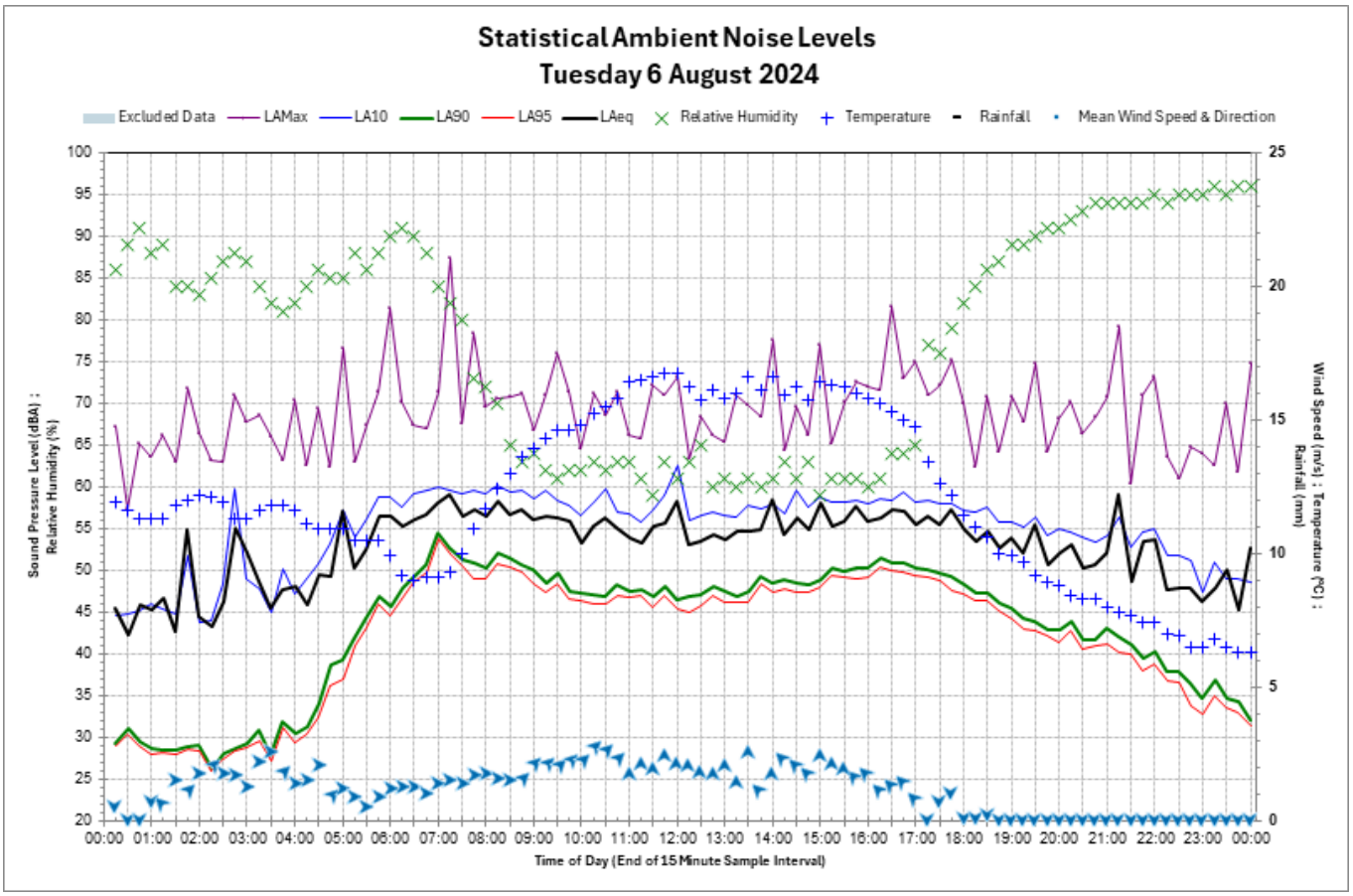

Statistical Ambient Noise Levels
Thursday 5 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

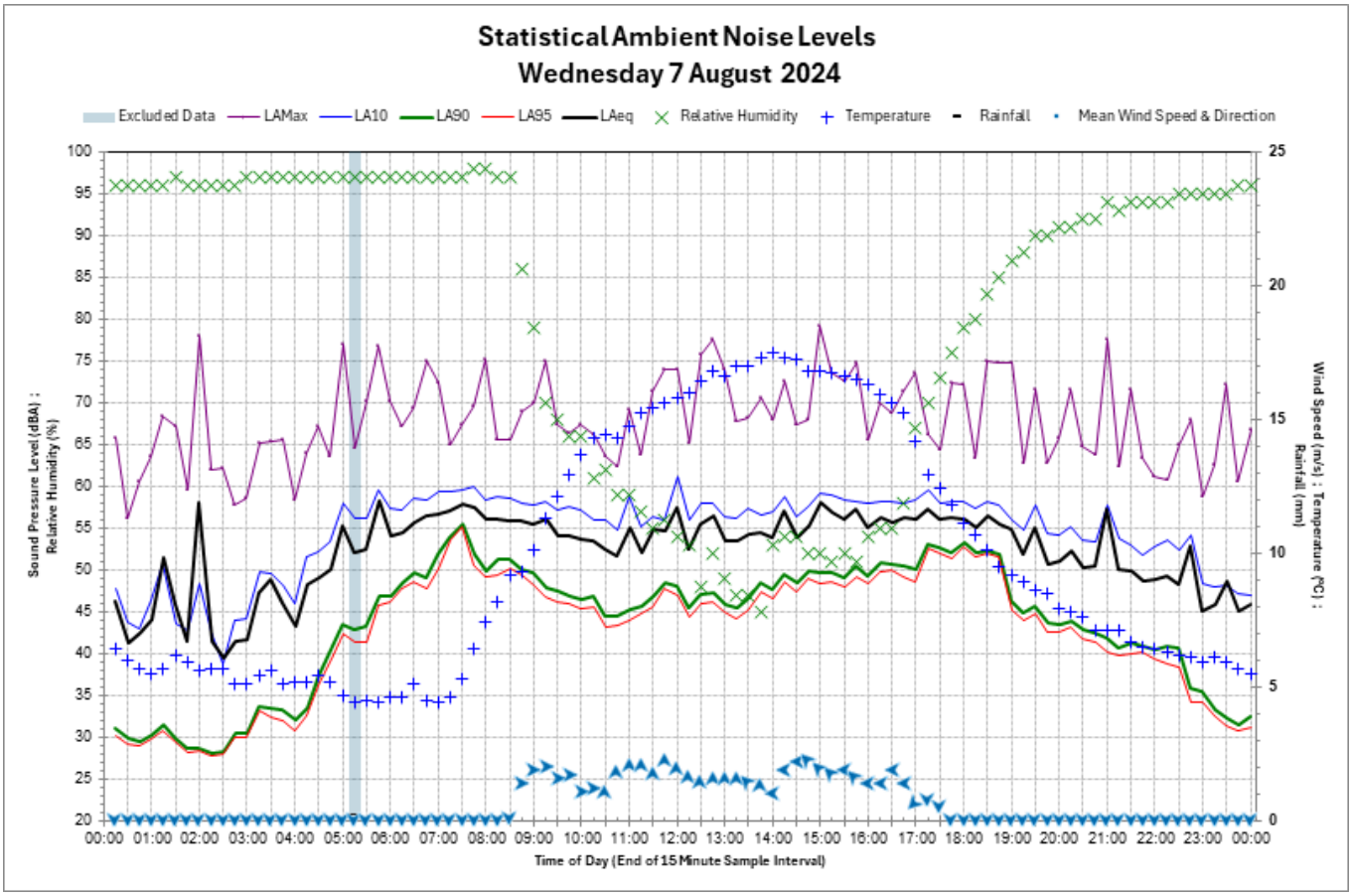

Statistical Ambient Noise Levels
Friday 6 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

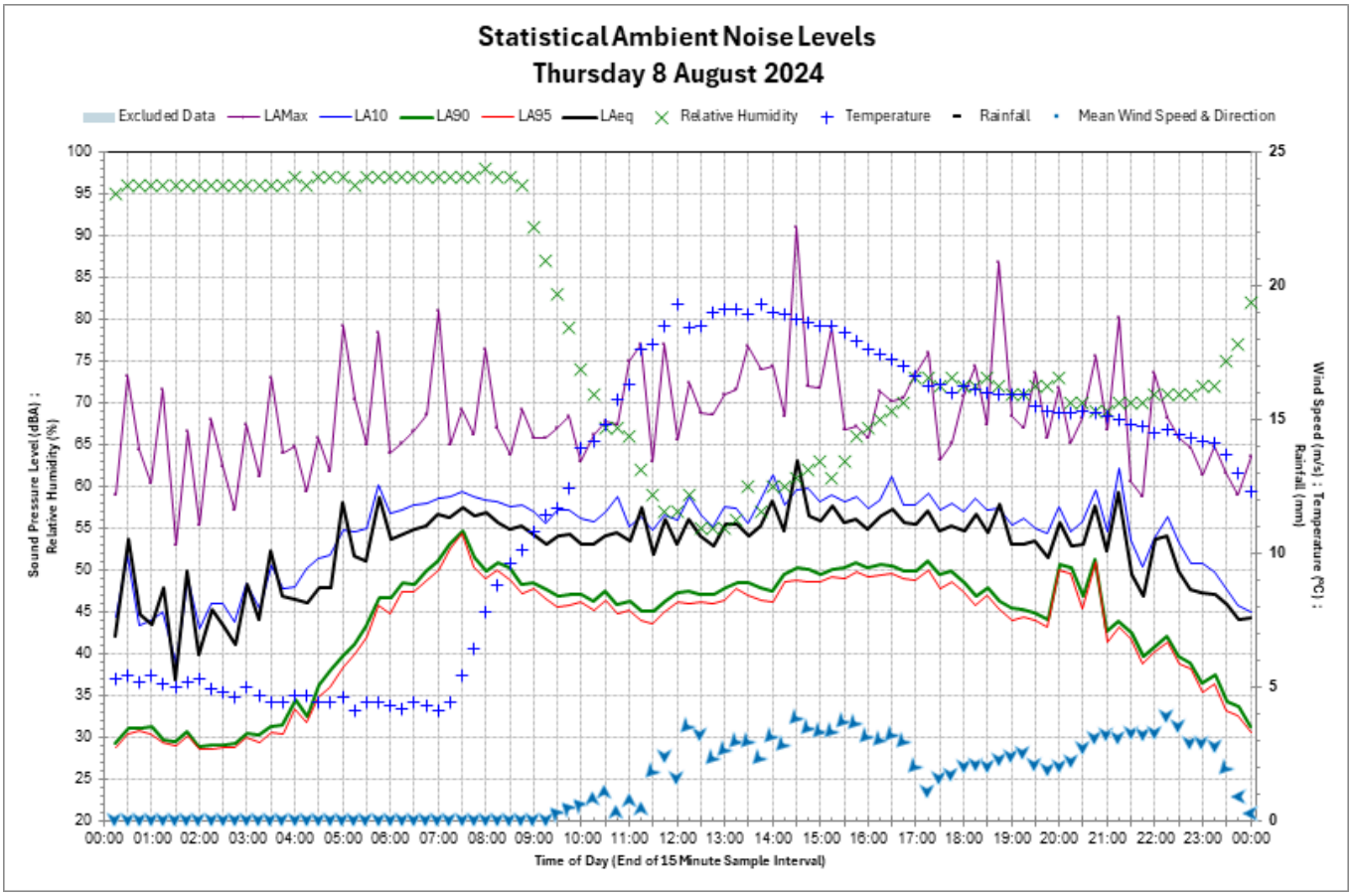

Statistical Ambient Noise Levels
Saturday 7 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

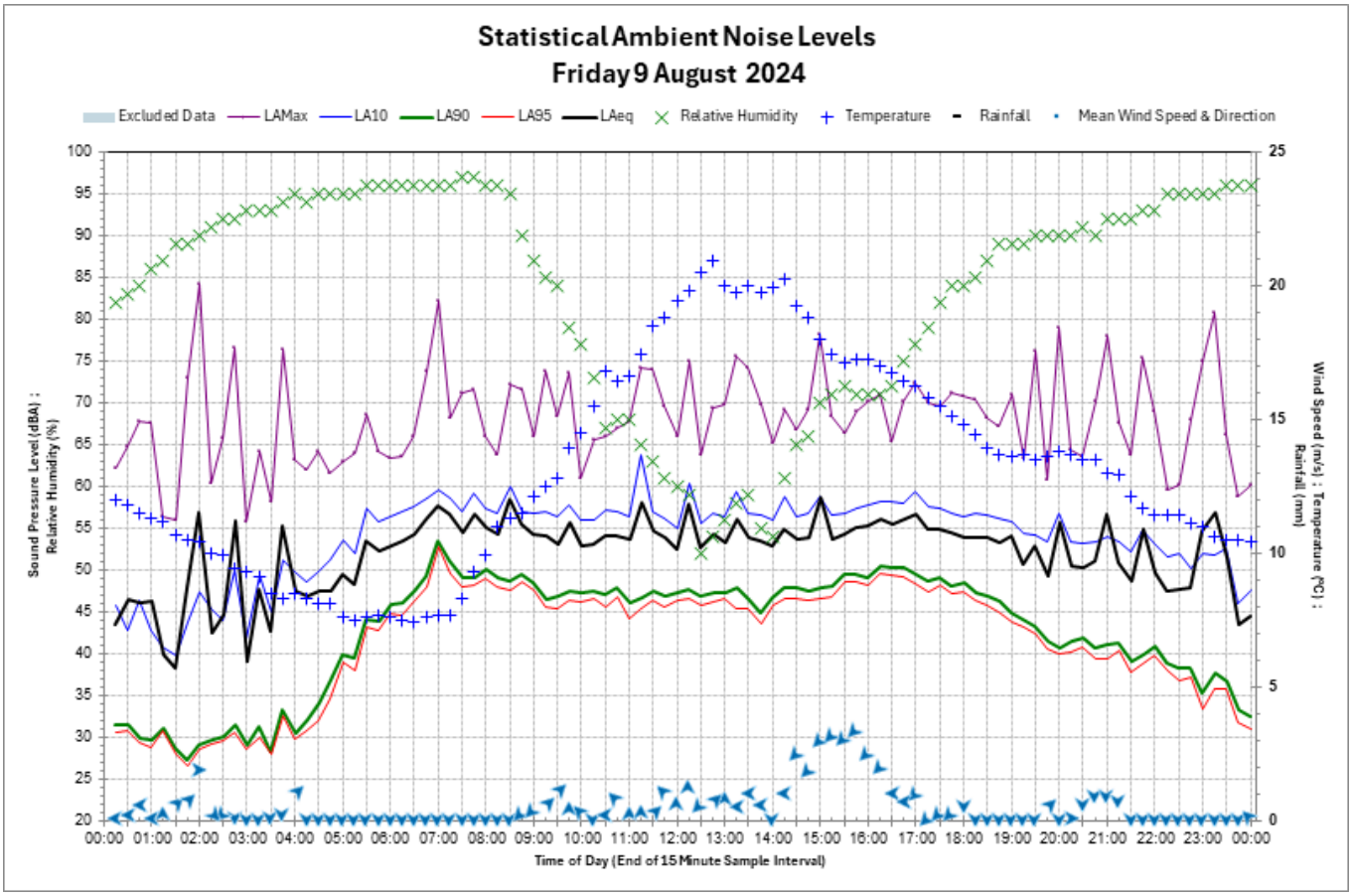
Location P03 – Period 1

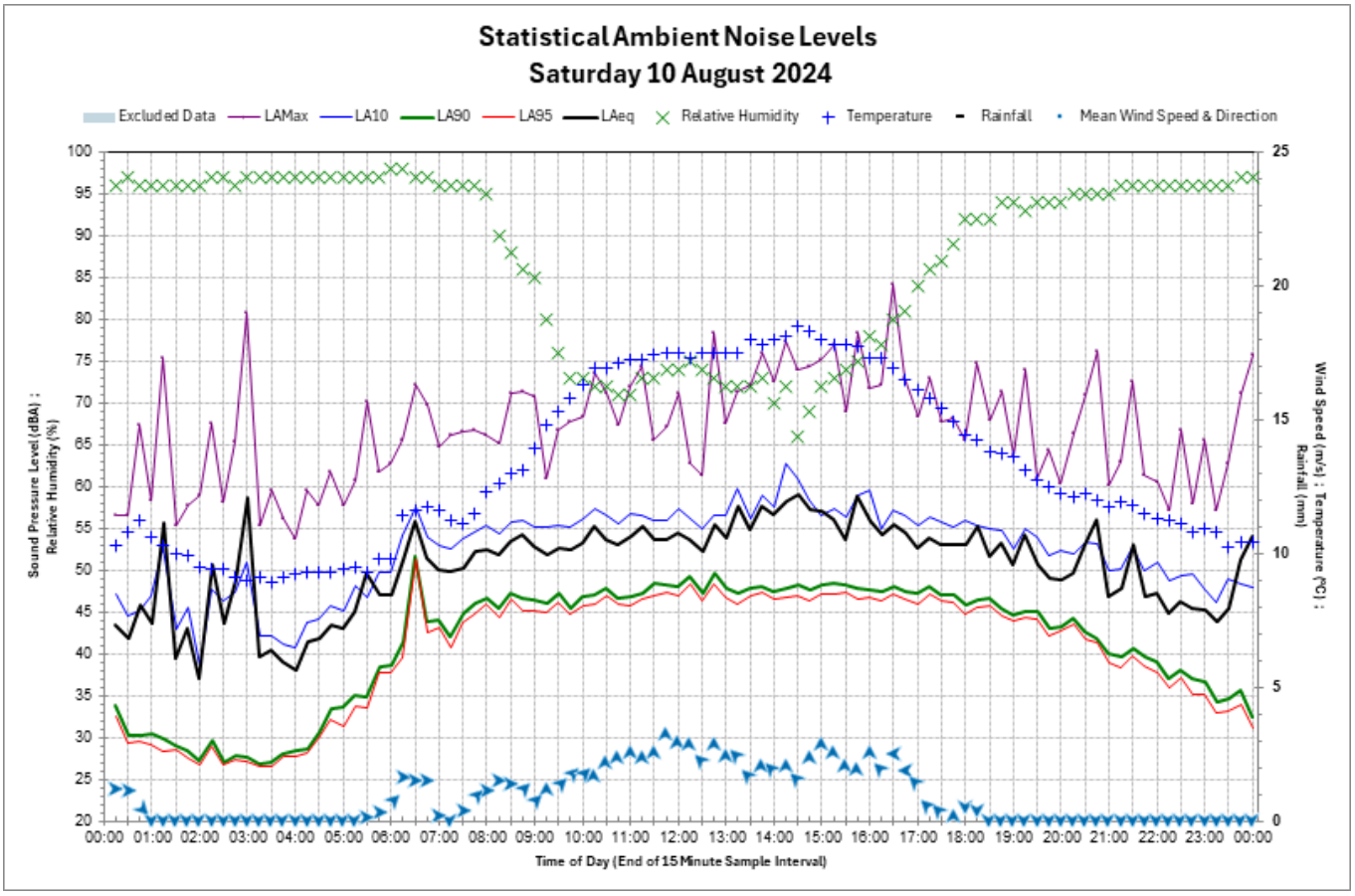


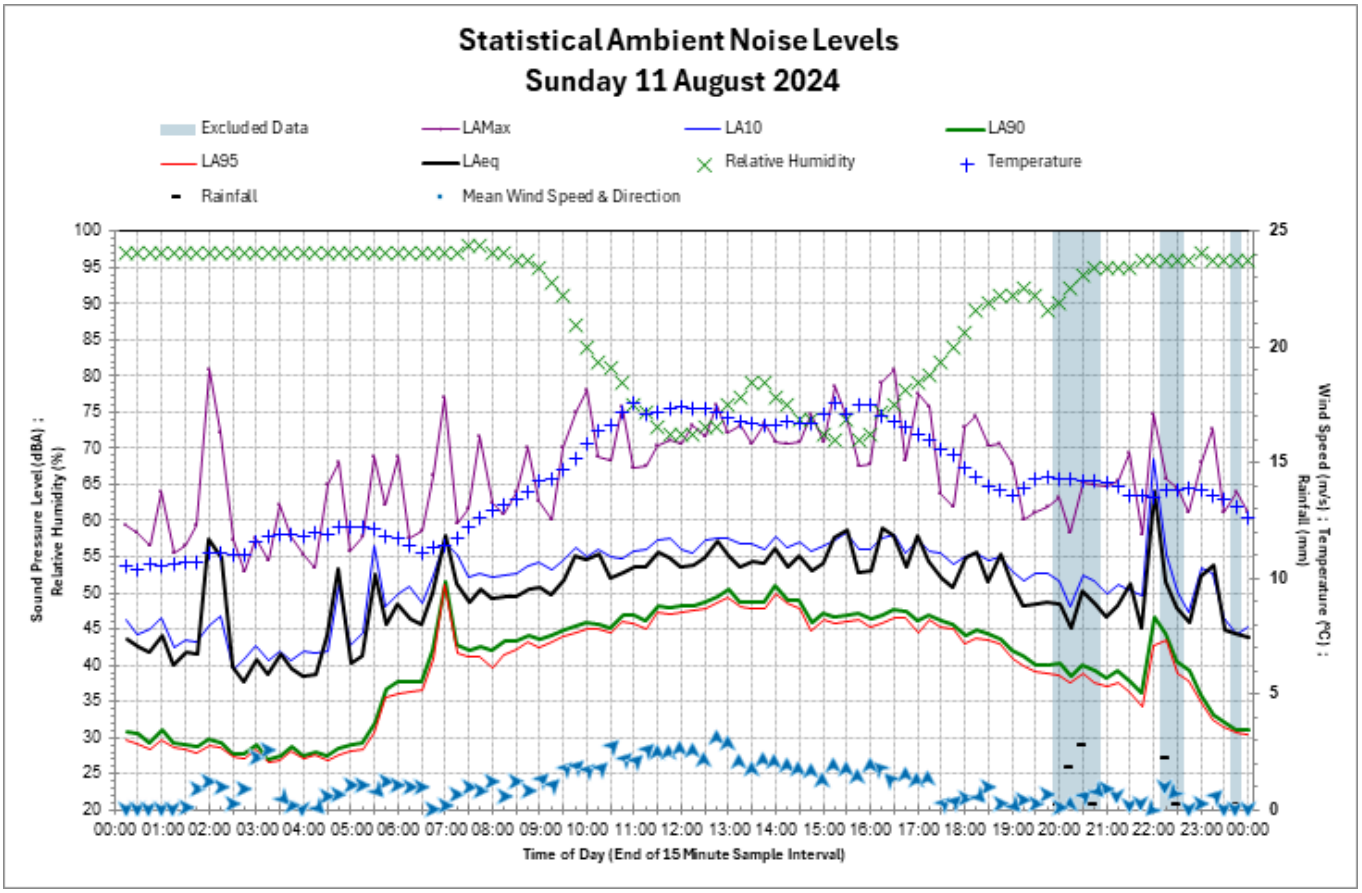


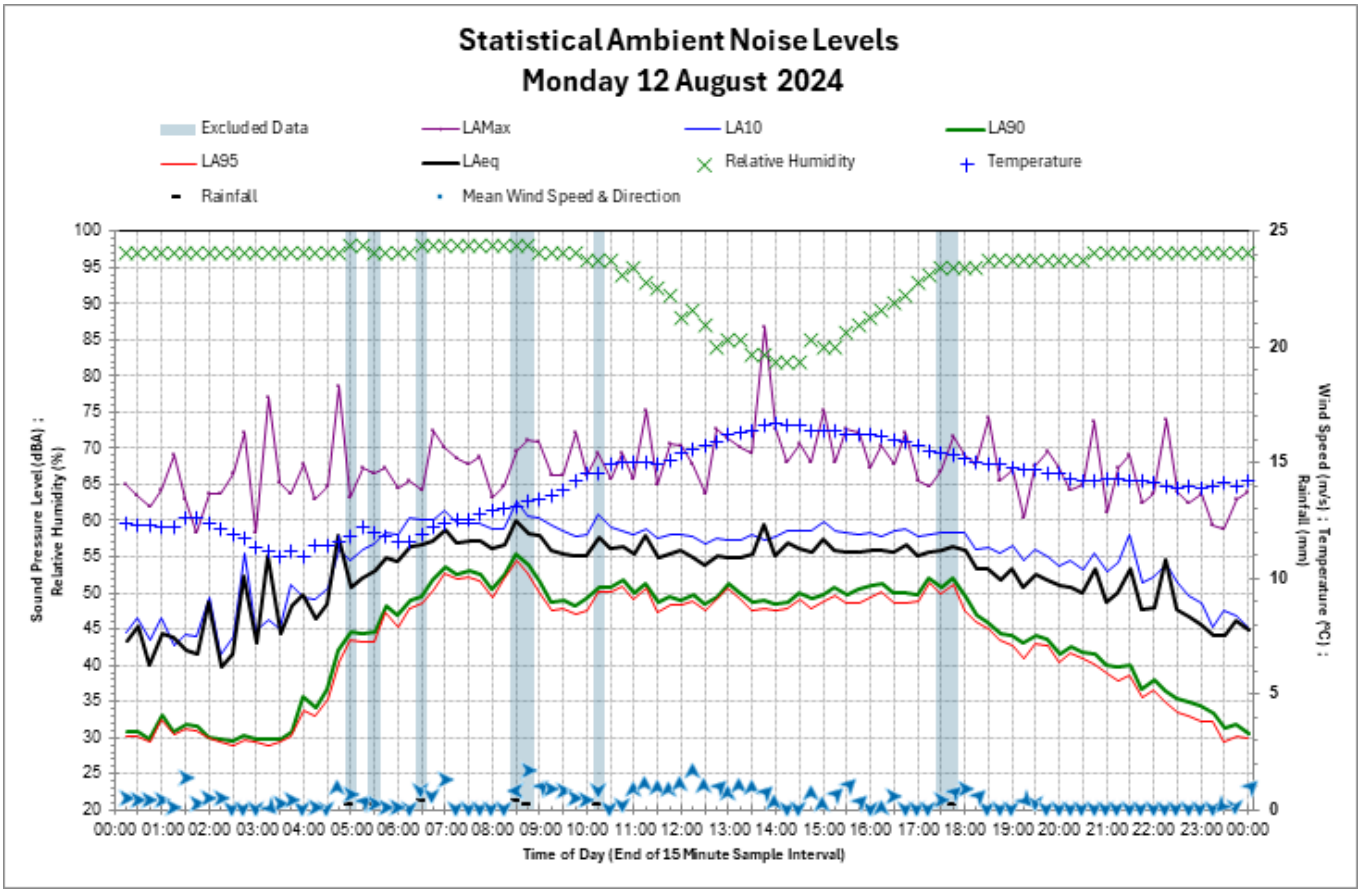

Statistical Ambient Noise Levels
Wednesday 7 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

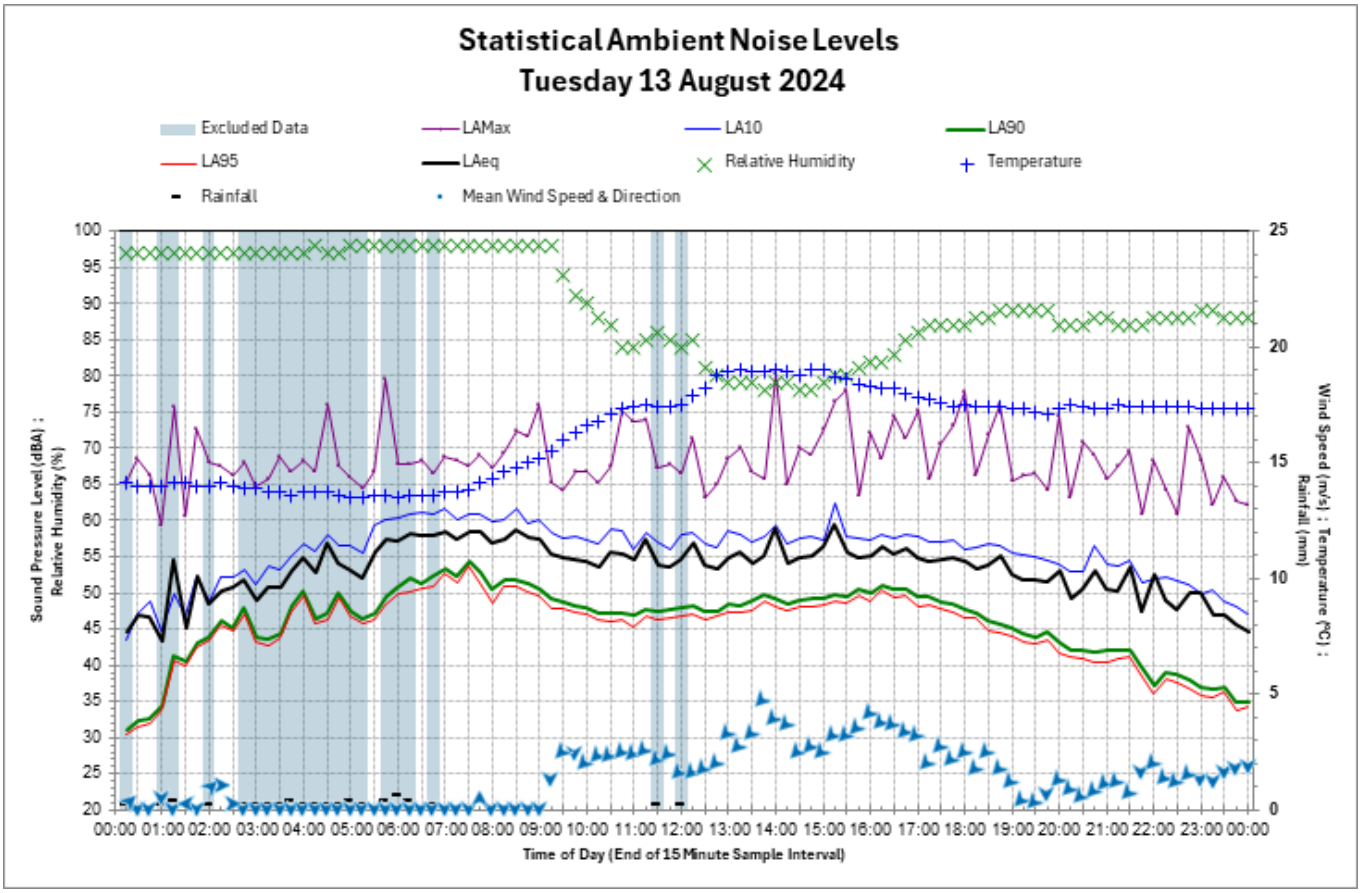

Statistical Ambient Noise Levels
Thursday 8 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

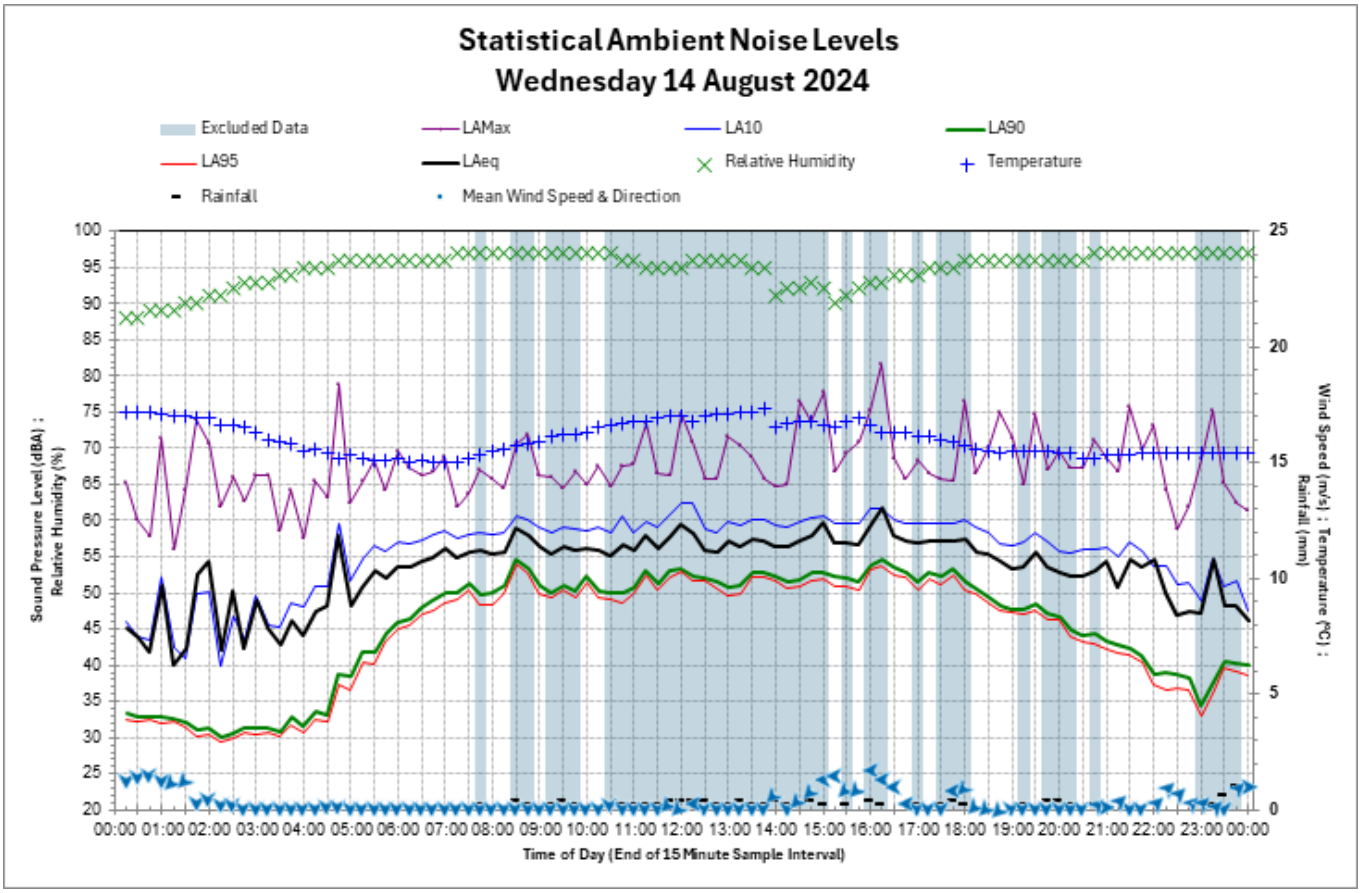

Statistical Ambient Noise Levels
Friday 9 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

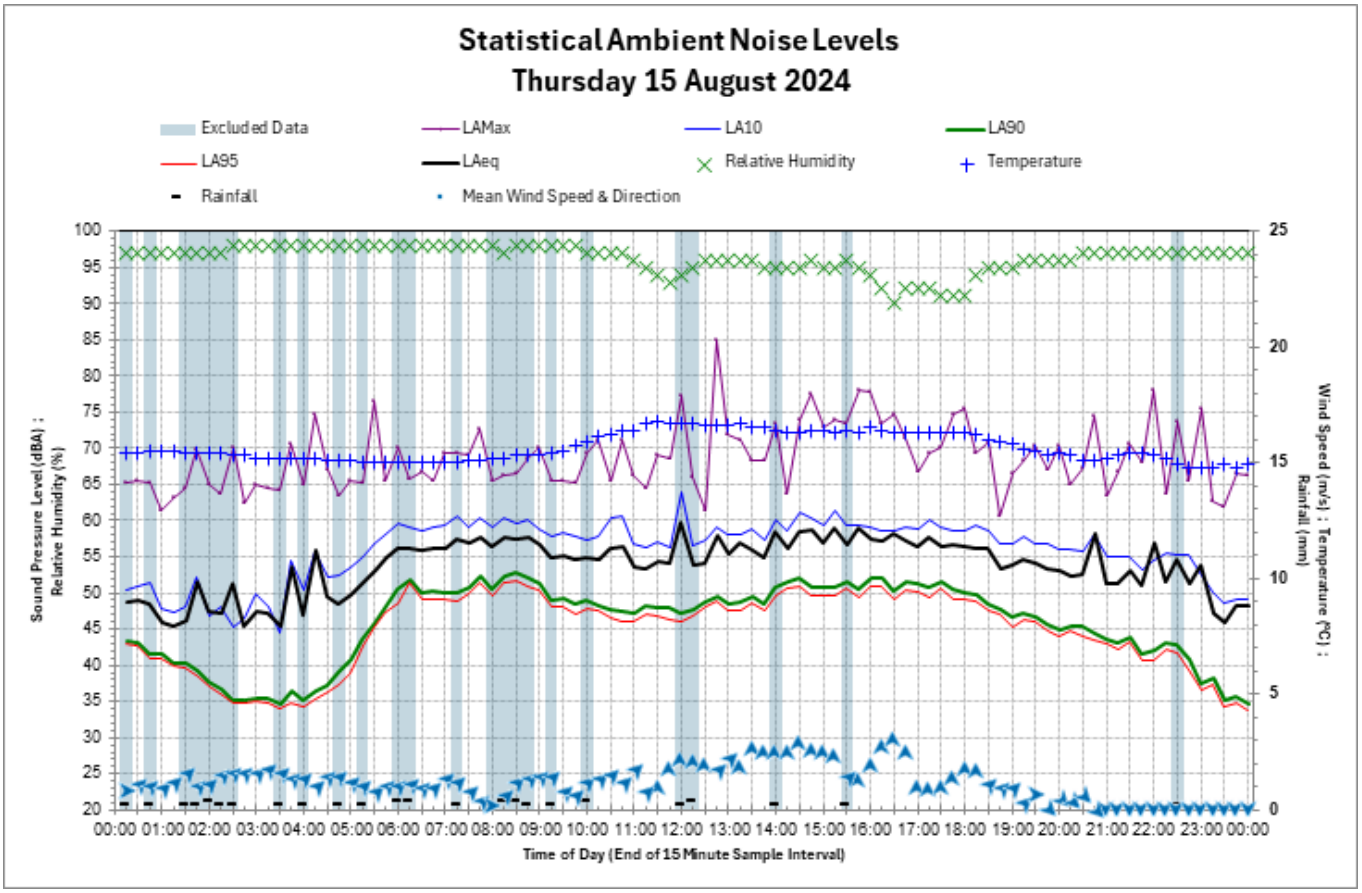

Statistical Ambient Noise Levels
Saturday 10 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

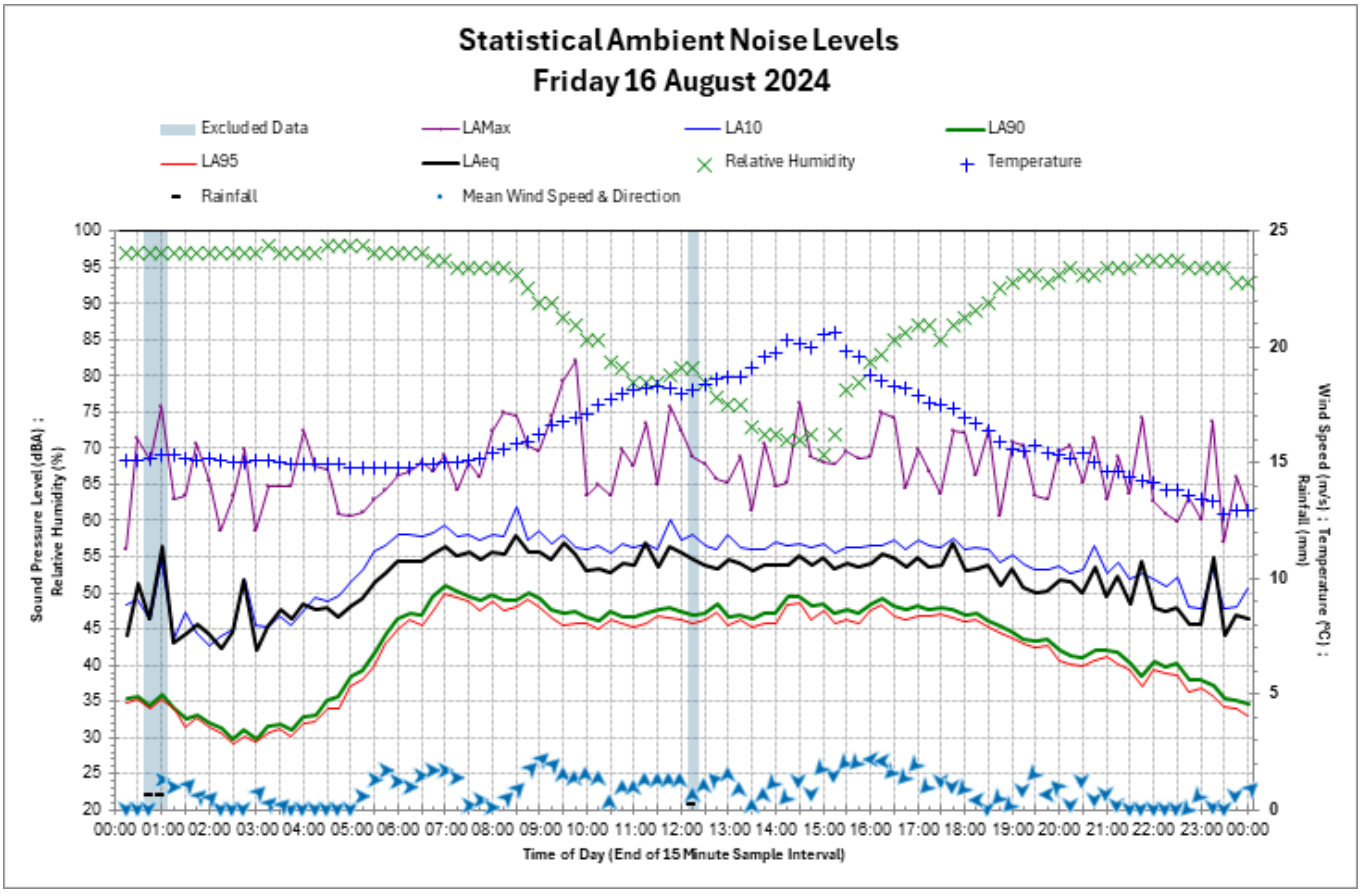

Statistical Ambient Noise Levels
Sunday 11 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

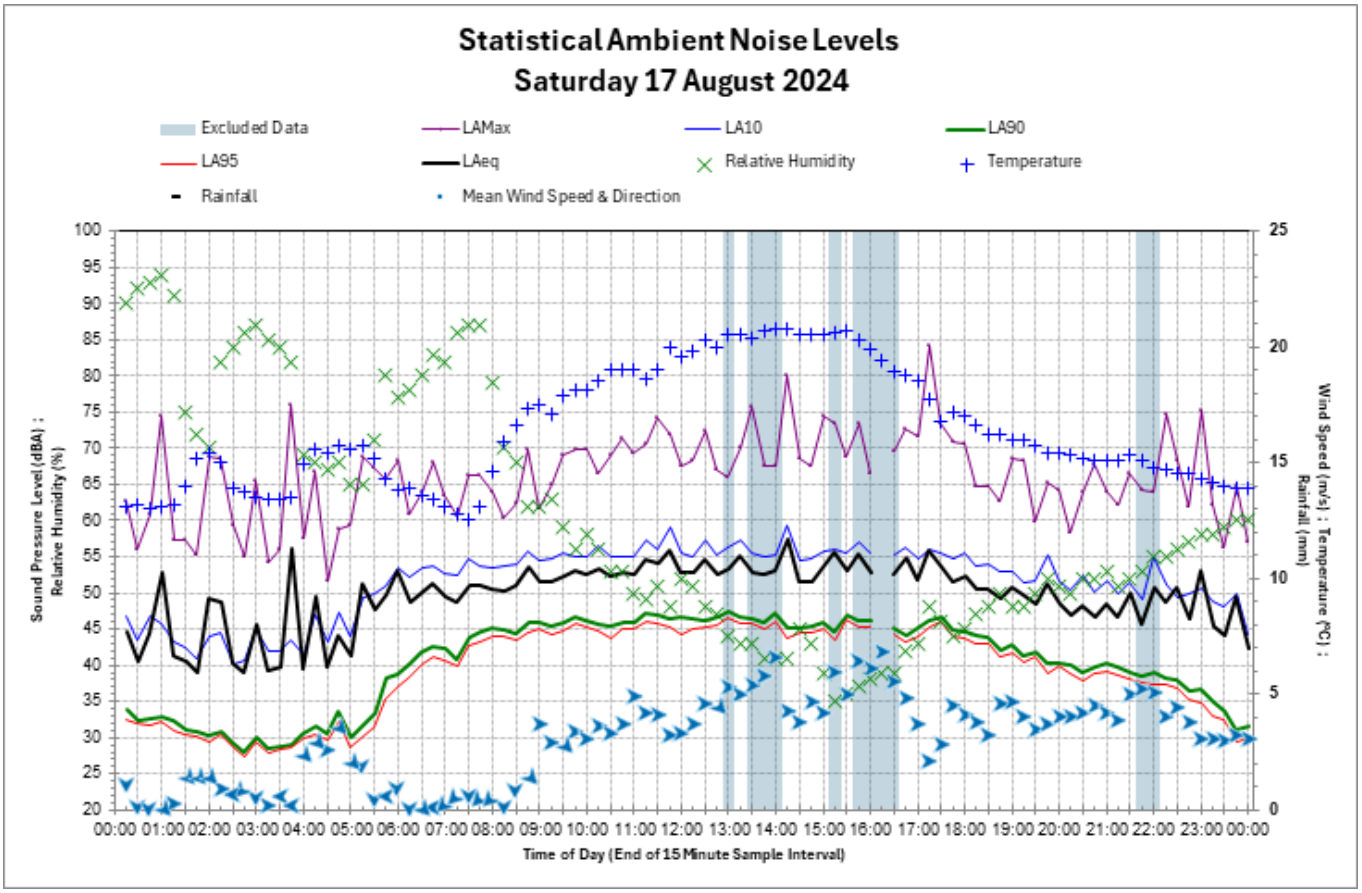

Statistical Ambient Noise Levels
Monday 12 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

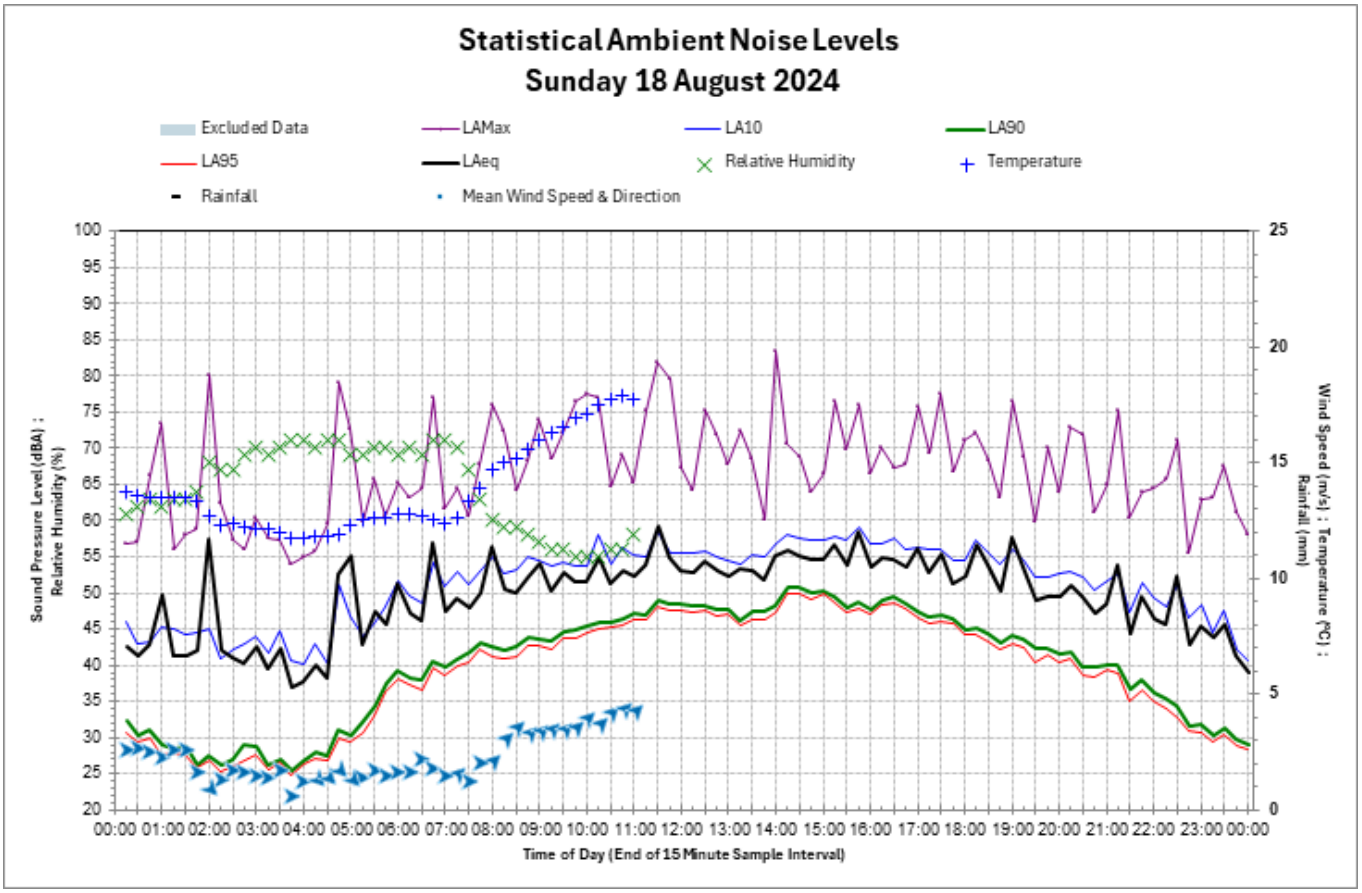

Statistical Ambient Noise Levels
Tuesday 13 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

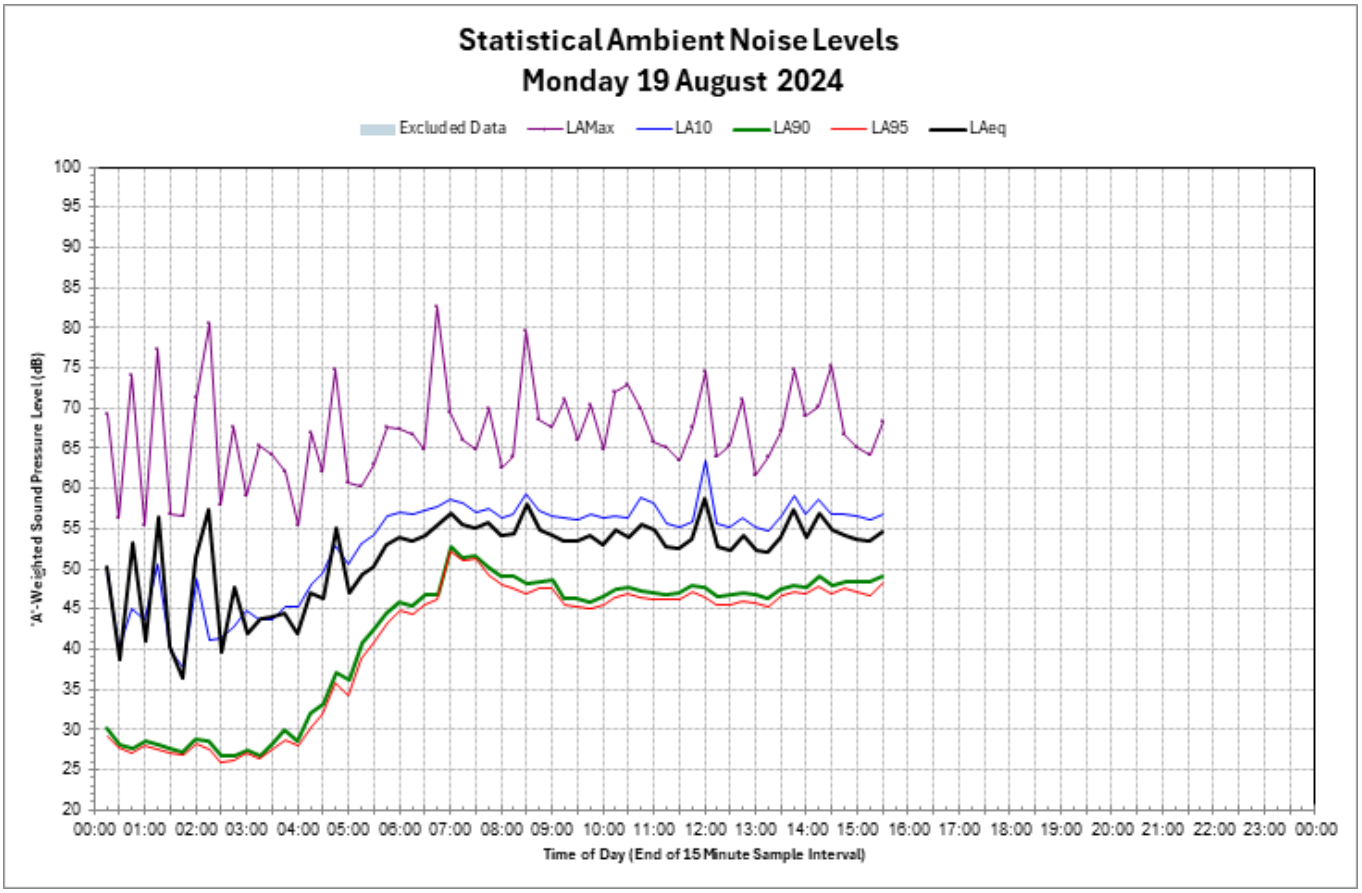

Statistical Ambient Noise Levels
Wednesday 14 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 15 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

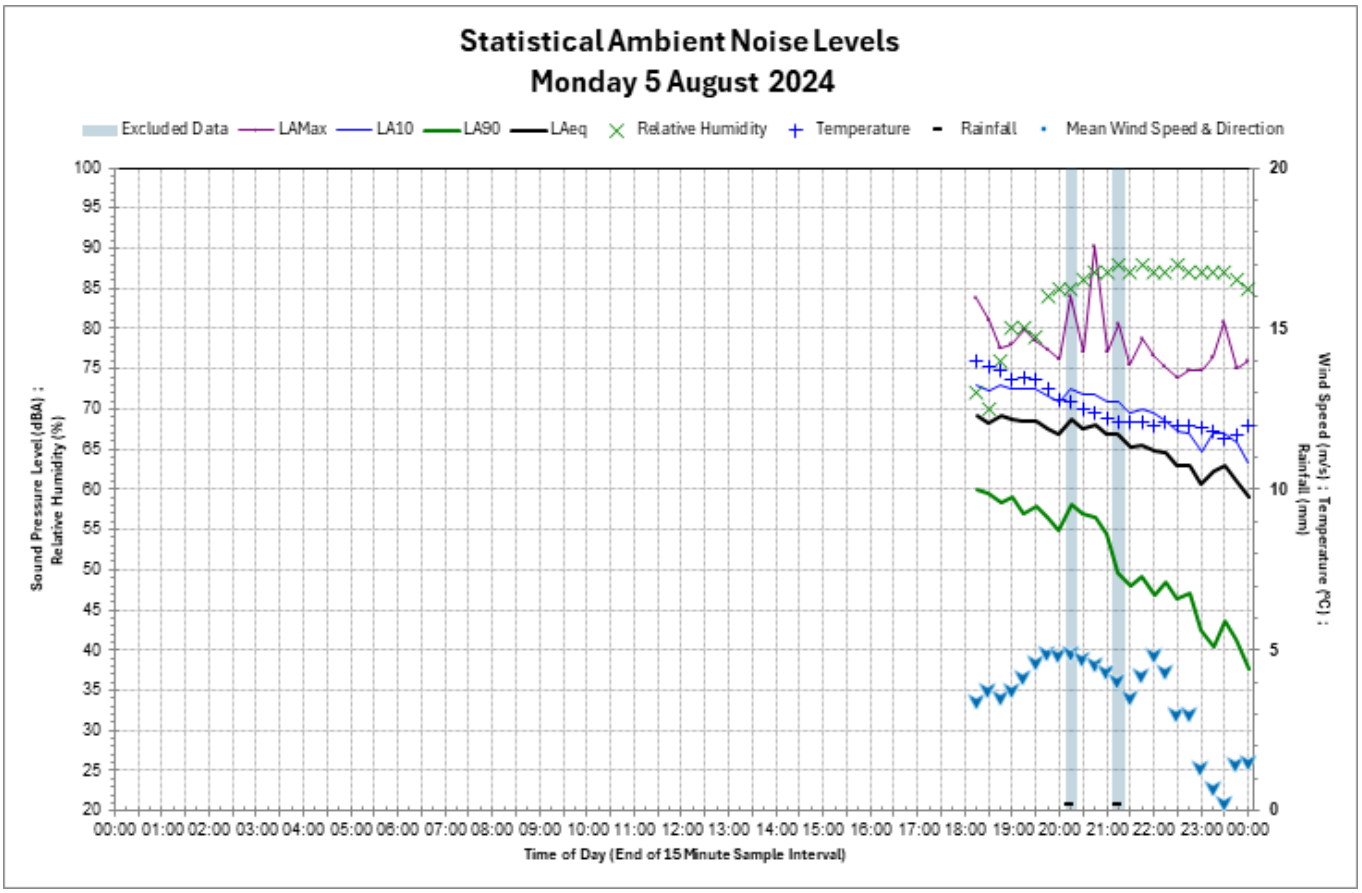

Statistical Ambient Noise Levels
Friday 16 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

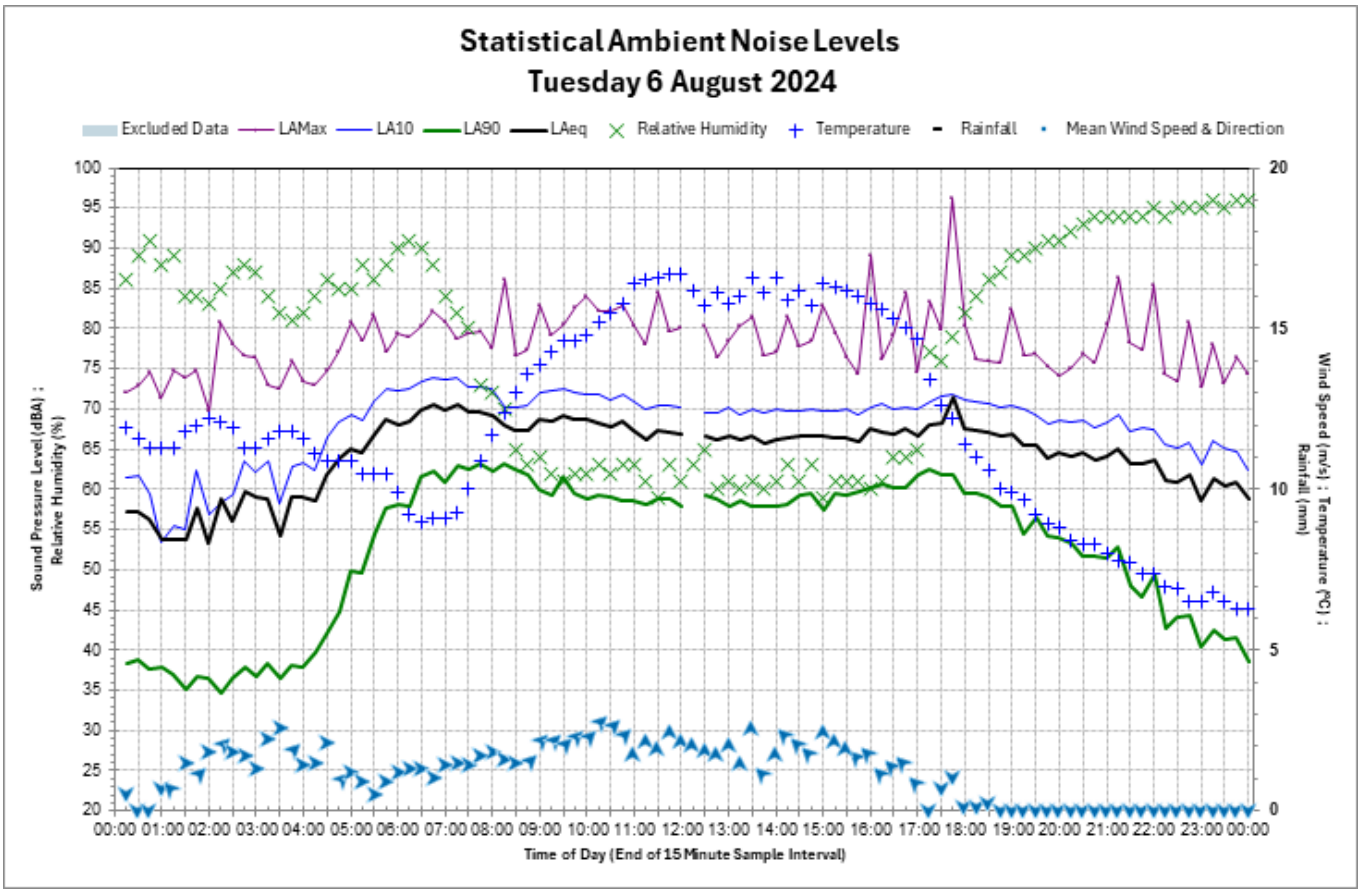

Statistical Ambient Noise Levels
Saturday 17 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

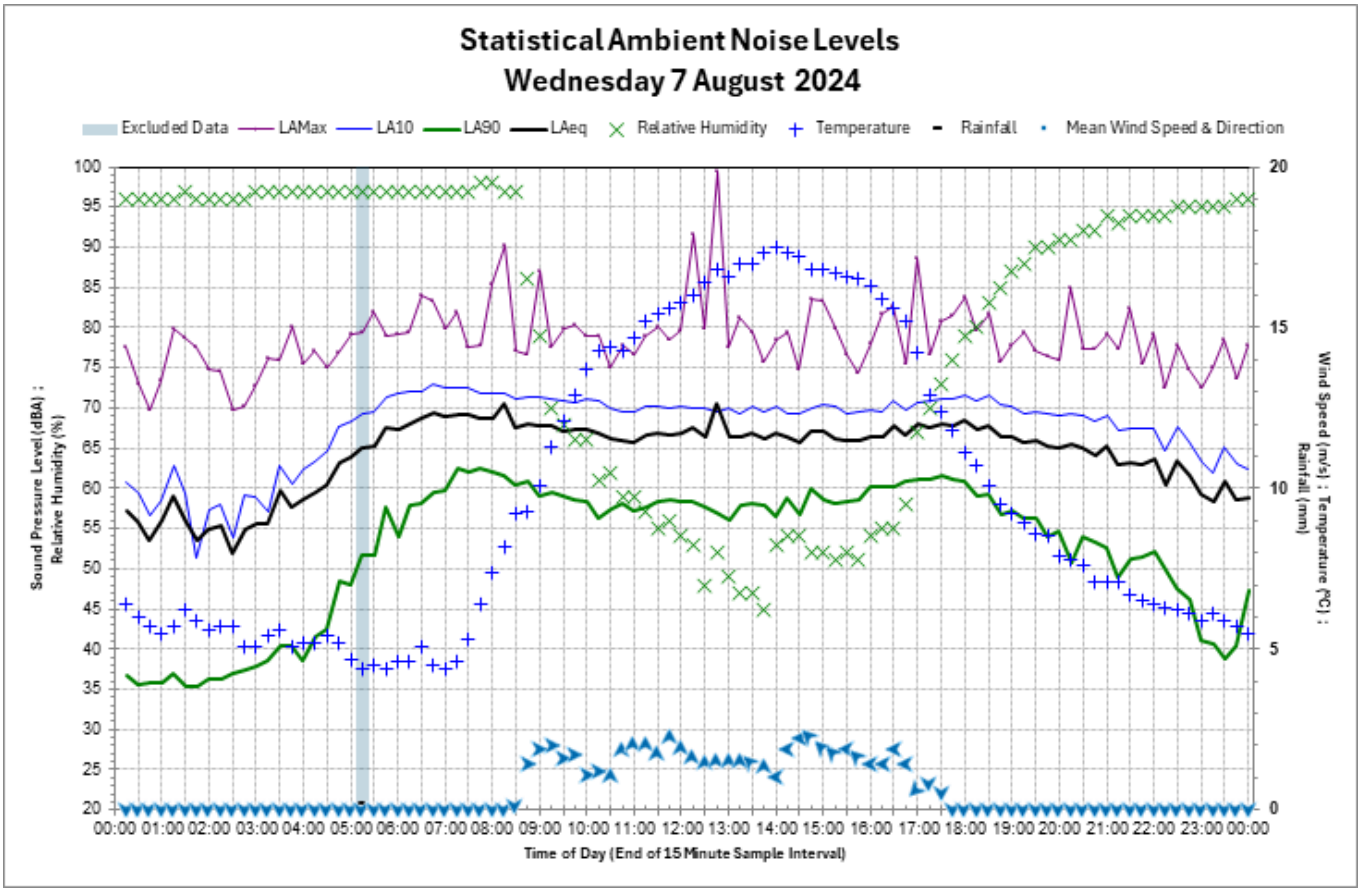

Statistical Ambient Noise Levels
Sunday 18 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

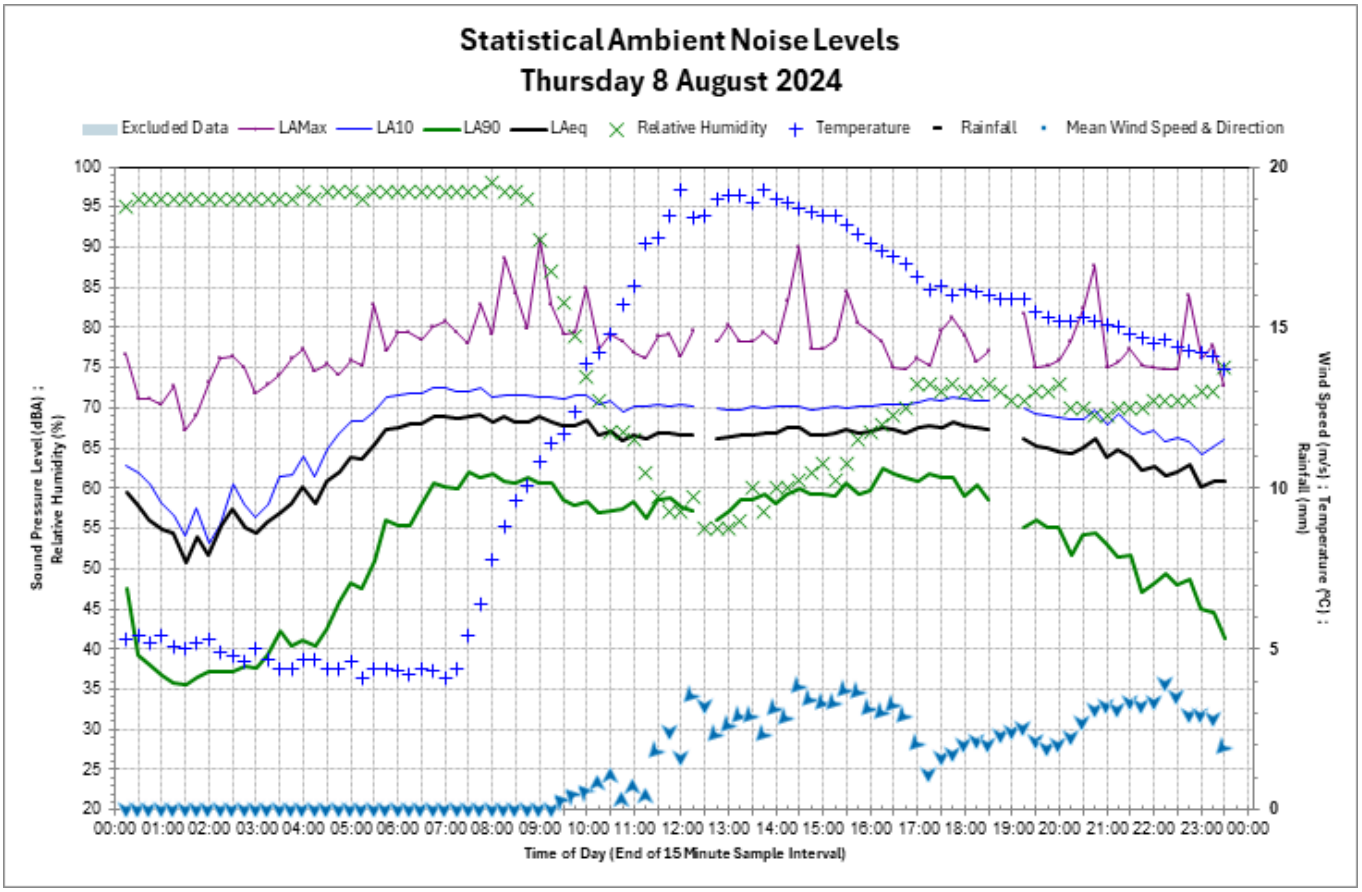

Statistical Ambient Noise Levels
Monday 19 August 2024
Excluded Data
LAMax
LA10
LA90
LA95
LAeq
'A'-Weighted Sound Pressure Level (dB)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Time of Day (End of 15 Minute Sample Interval)

Location P04 – Period 1

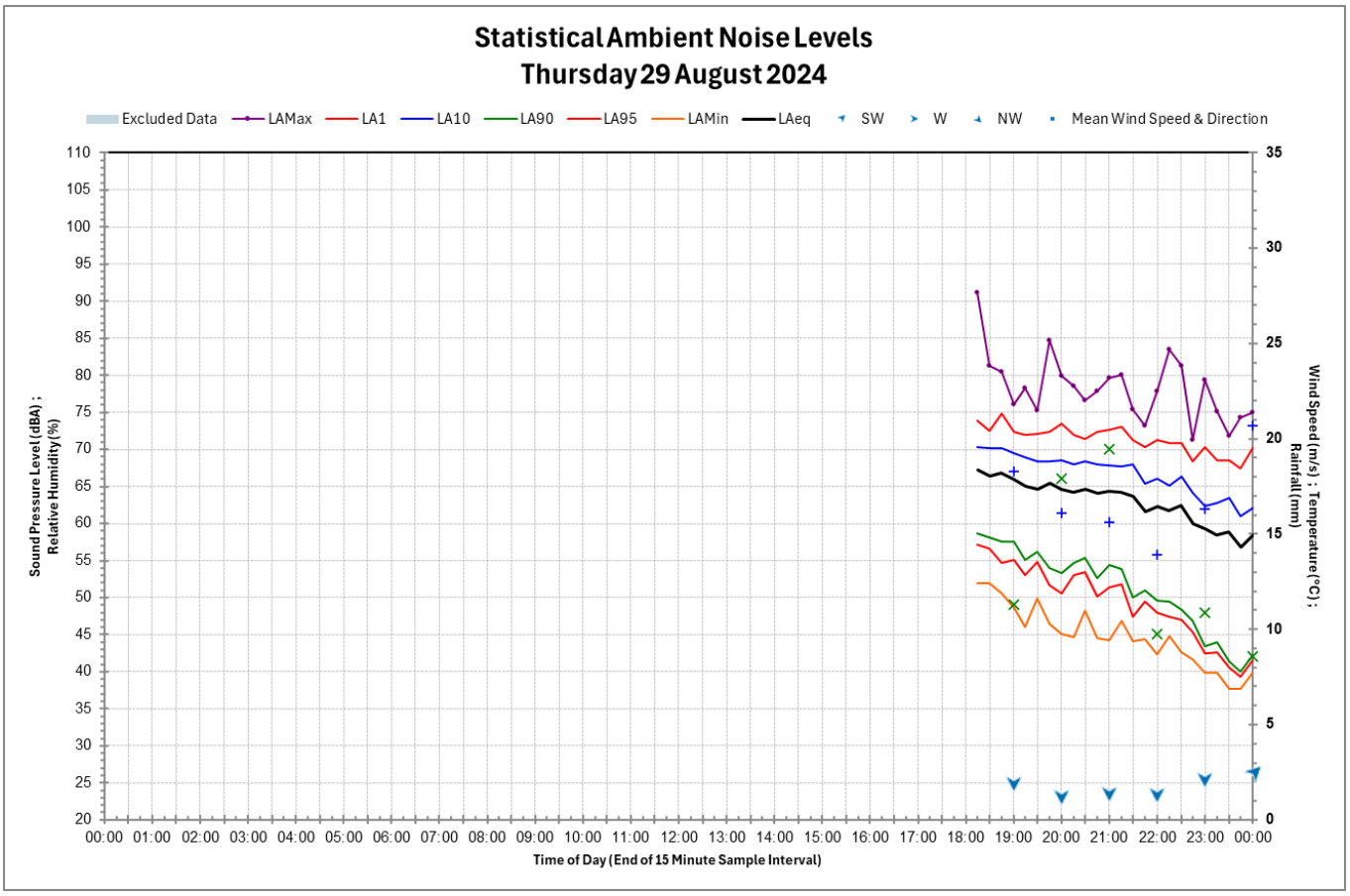


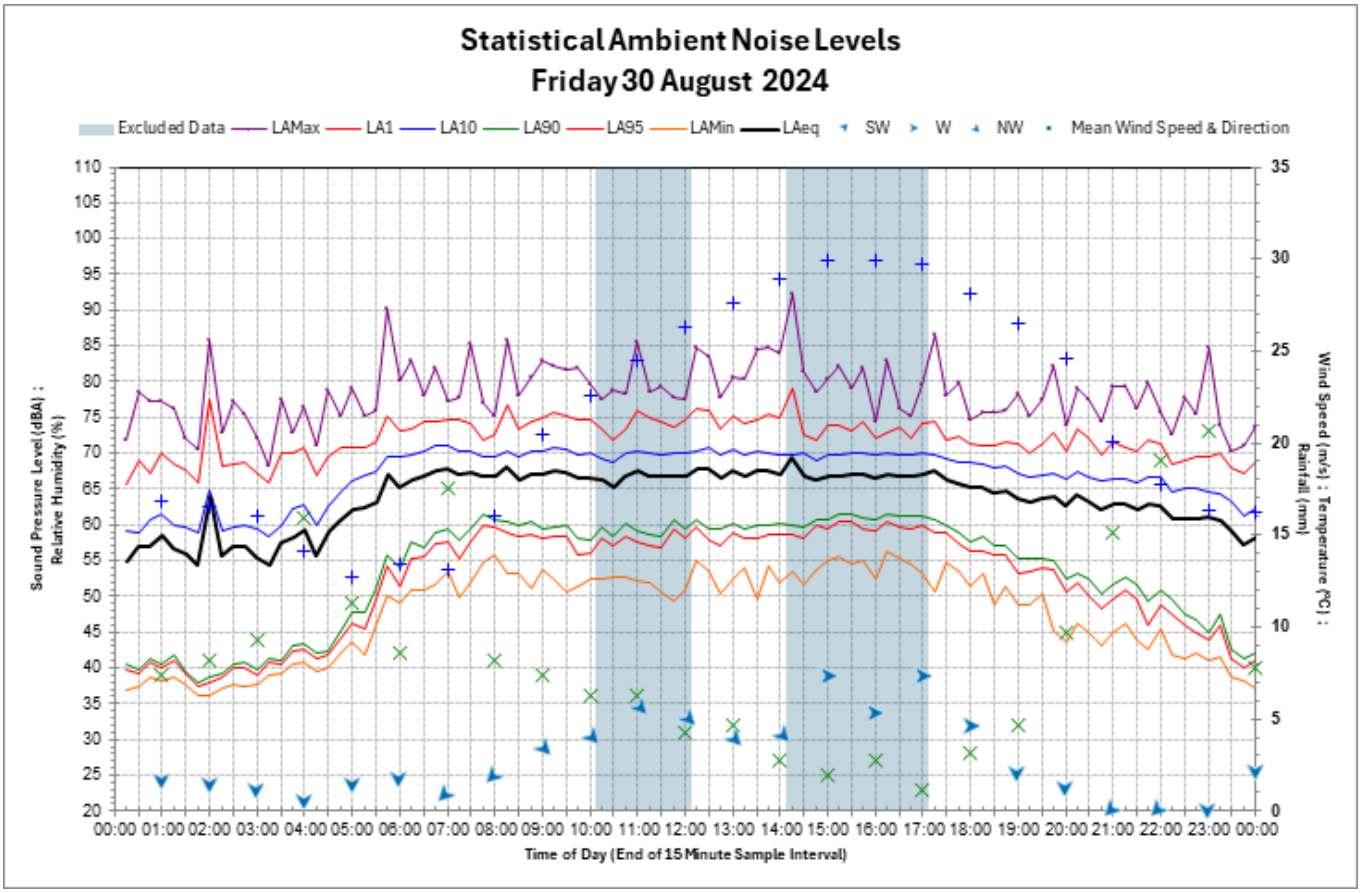


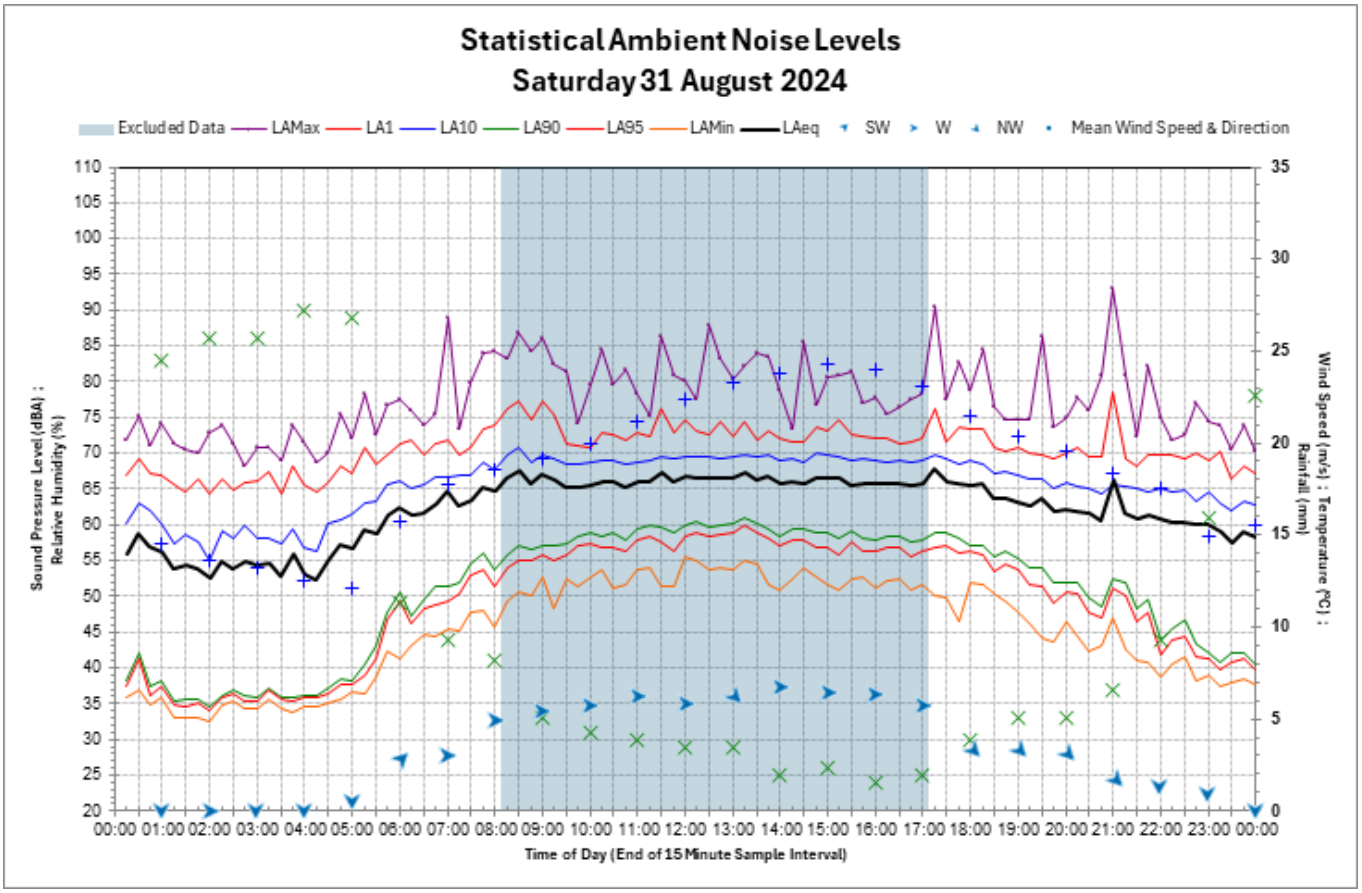

Statistical Ambient Noise Levels
Wednesday 7 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

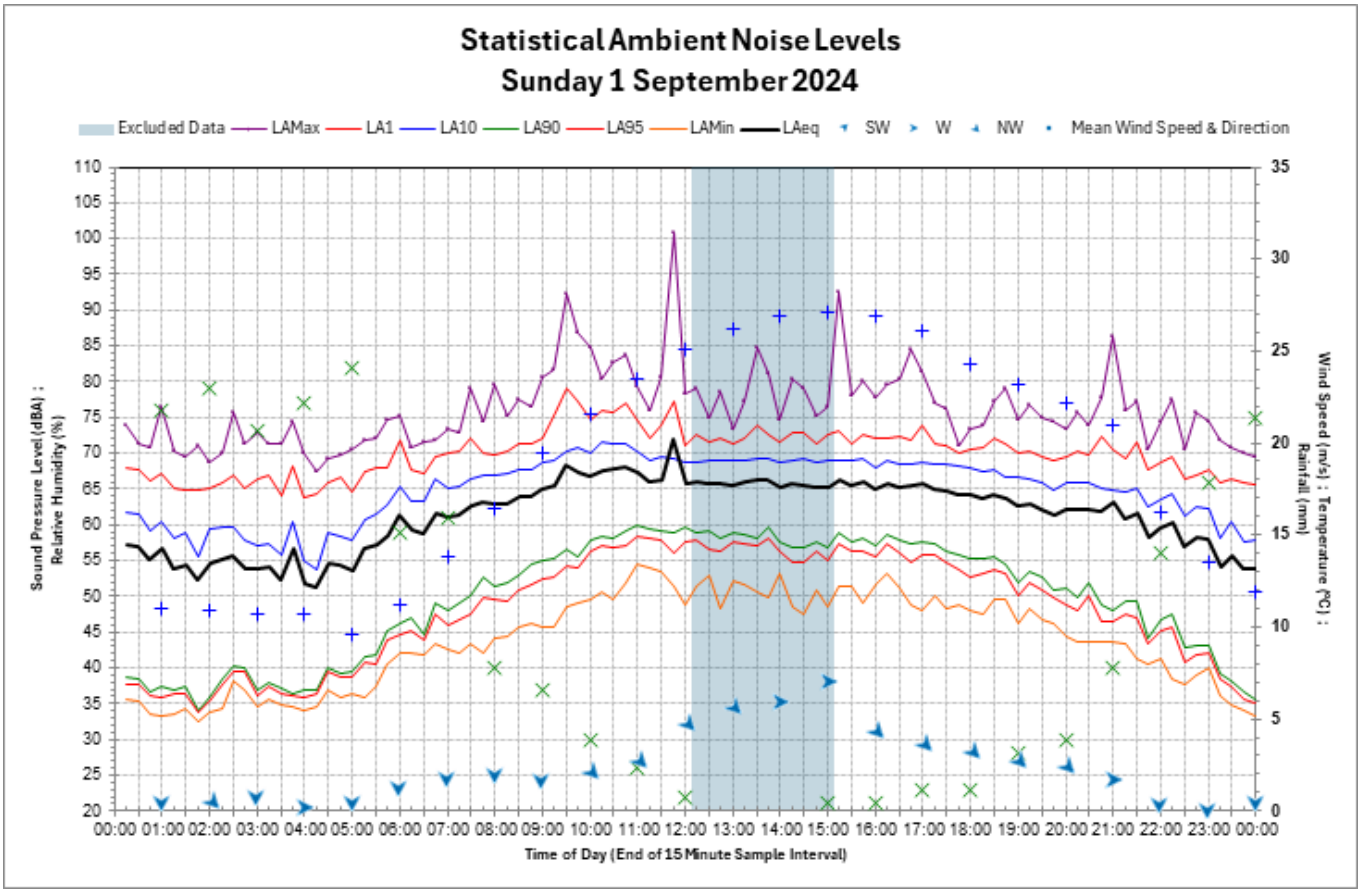

Statistical Ambient Noise Levels
Thursday 8 August 2024
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

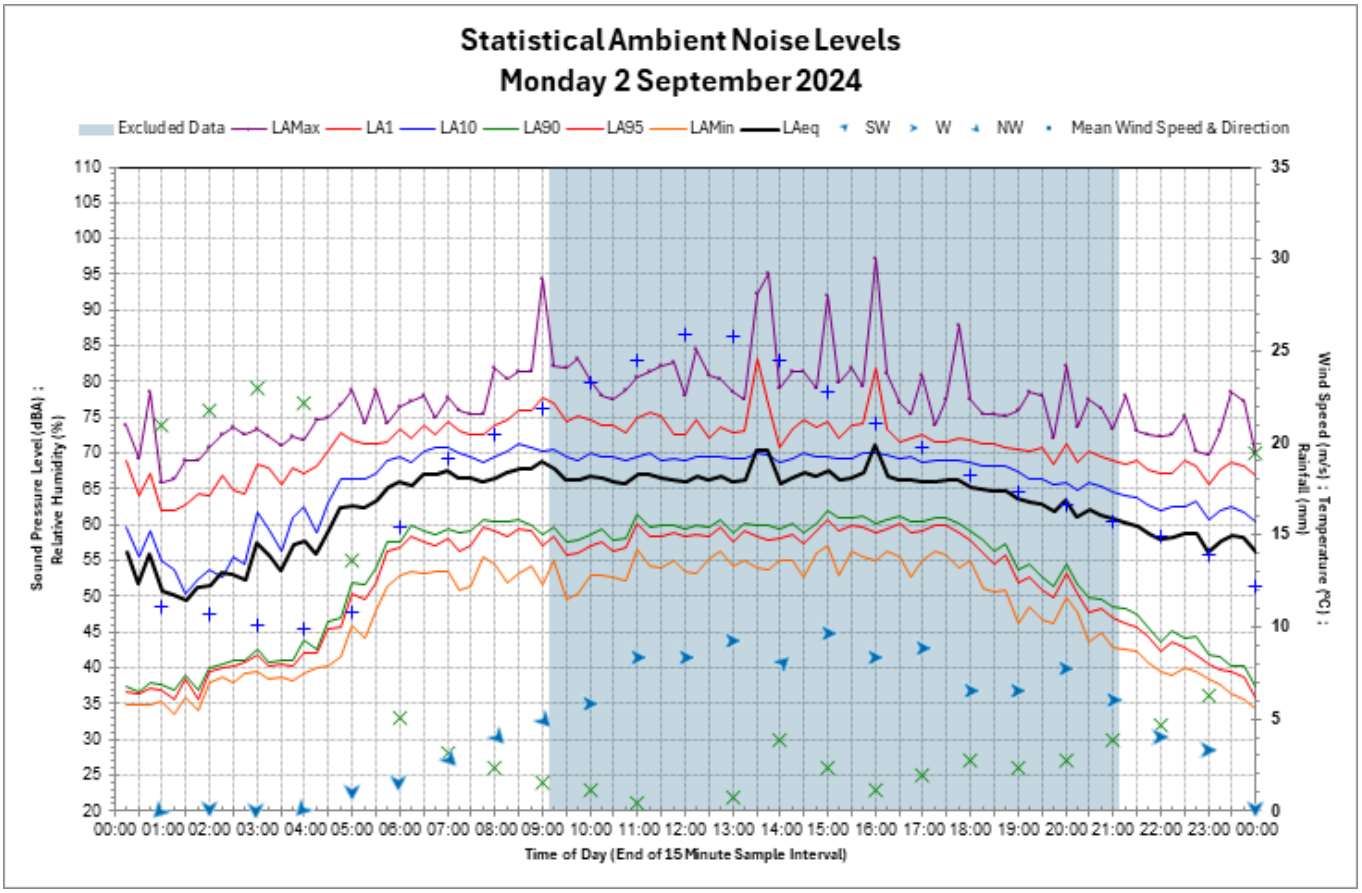
Location P04 – Period 2

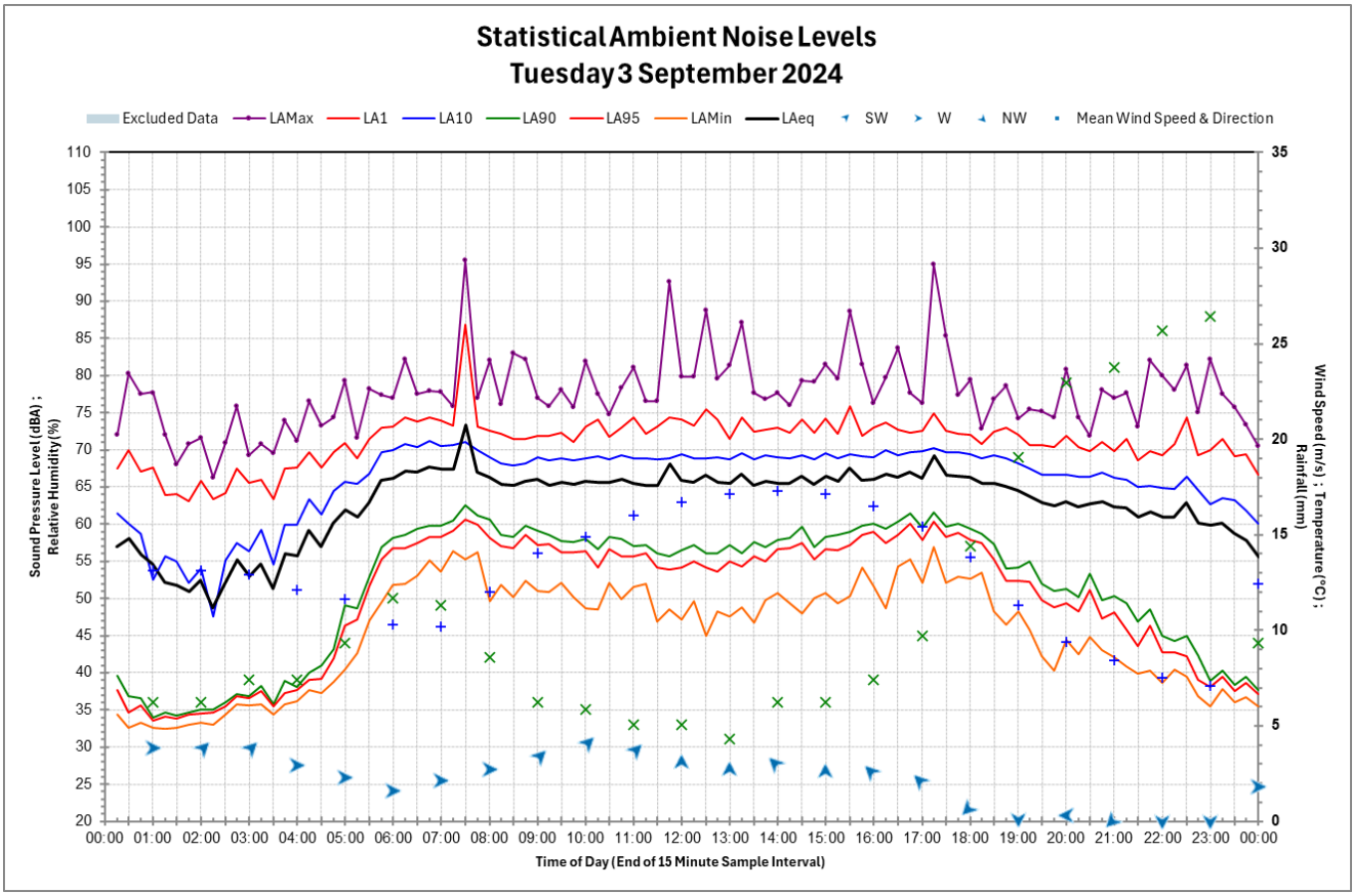


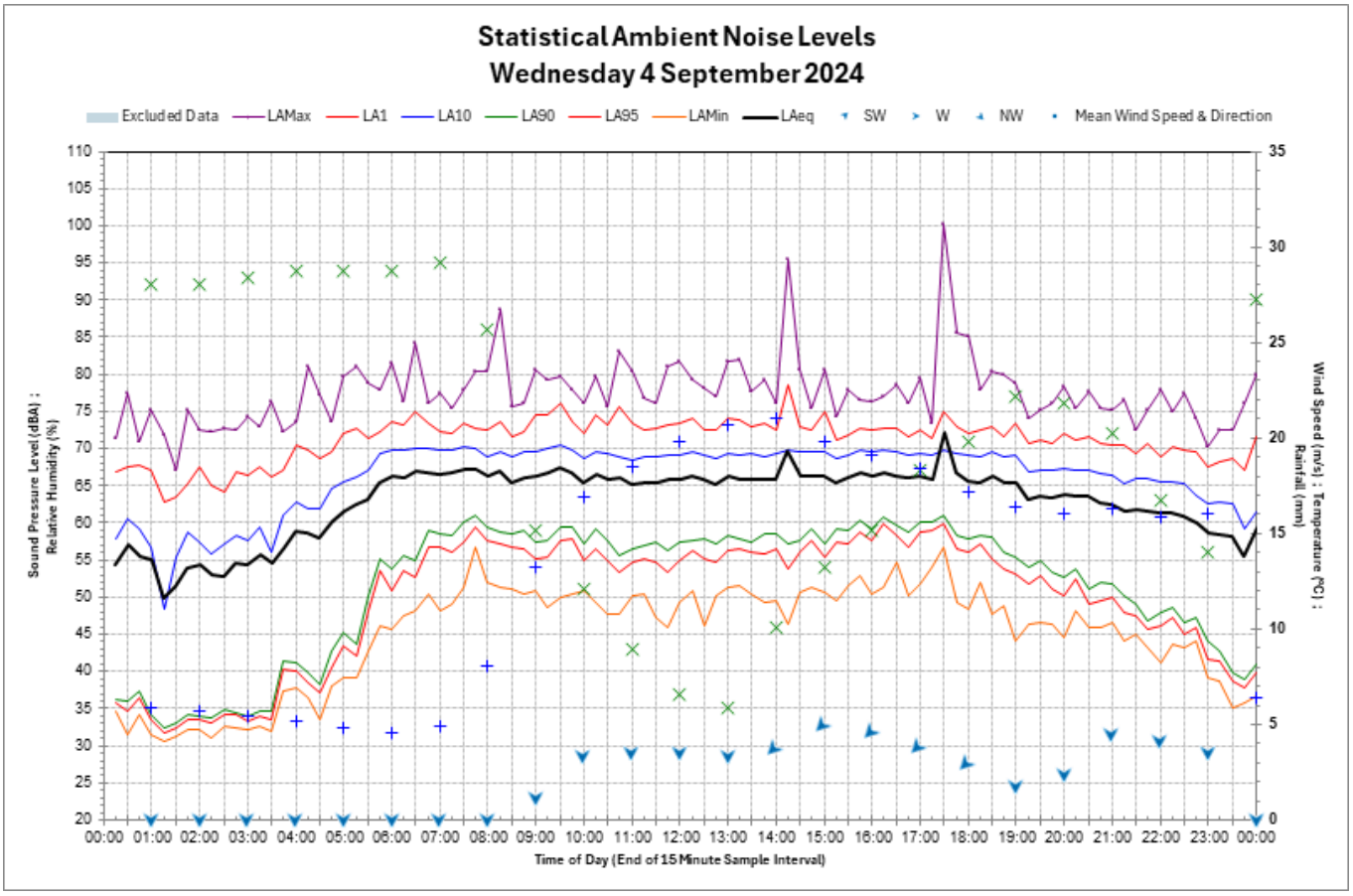


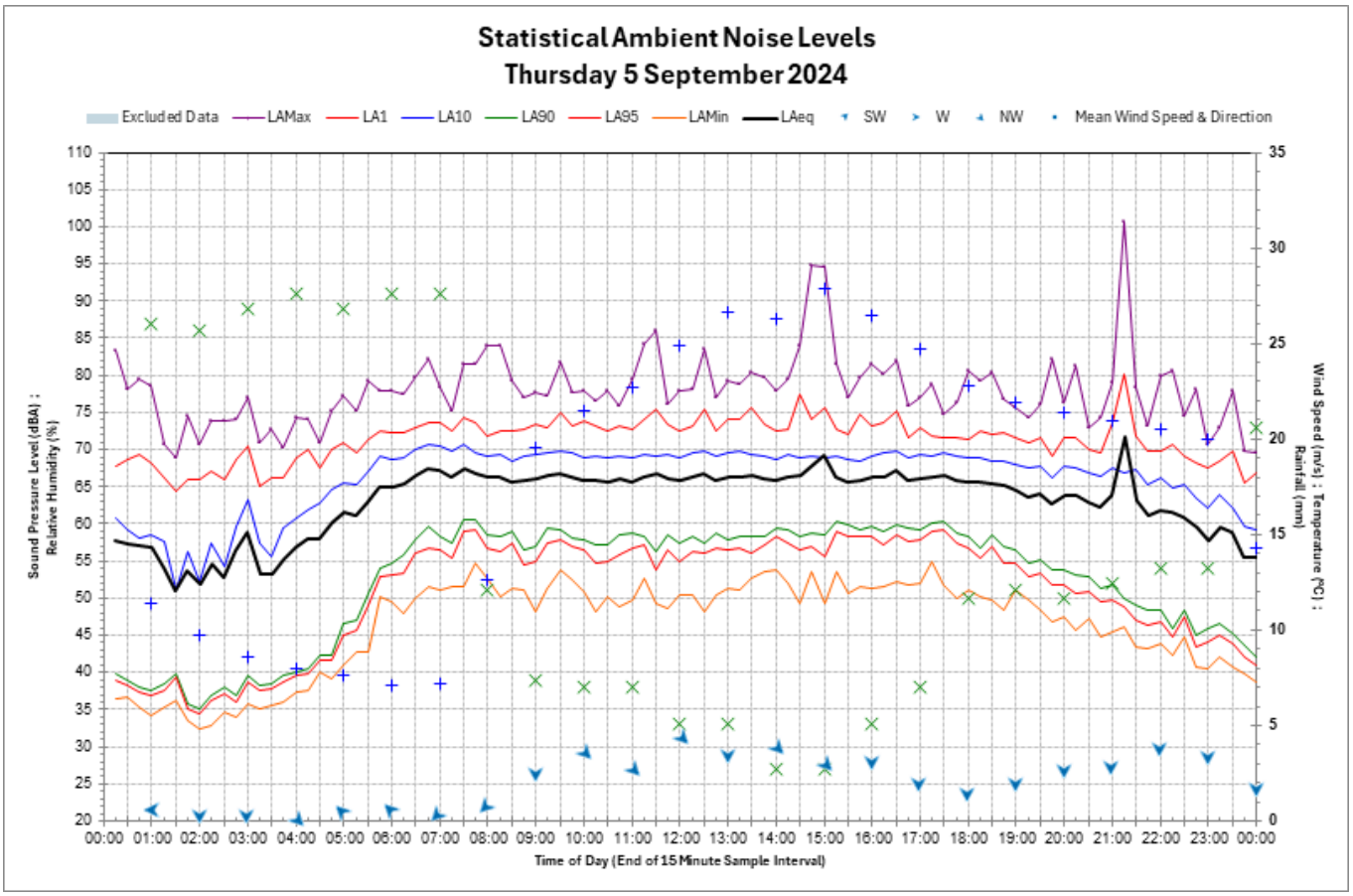

Statistical Ambient Noise Levels
Saturday 31 August 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

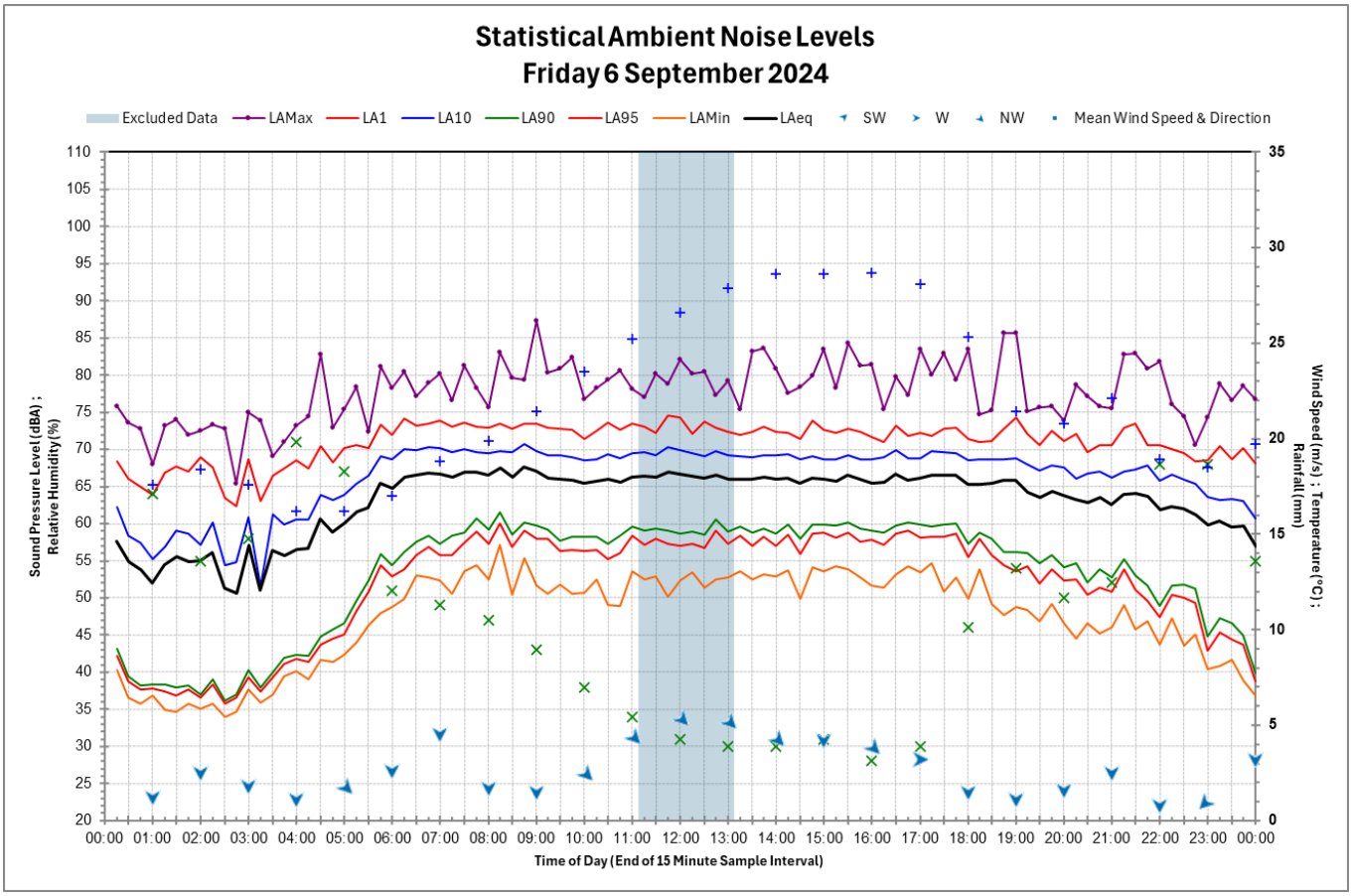

Statistical Ambient Noise Levels
Sunday 1 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

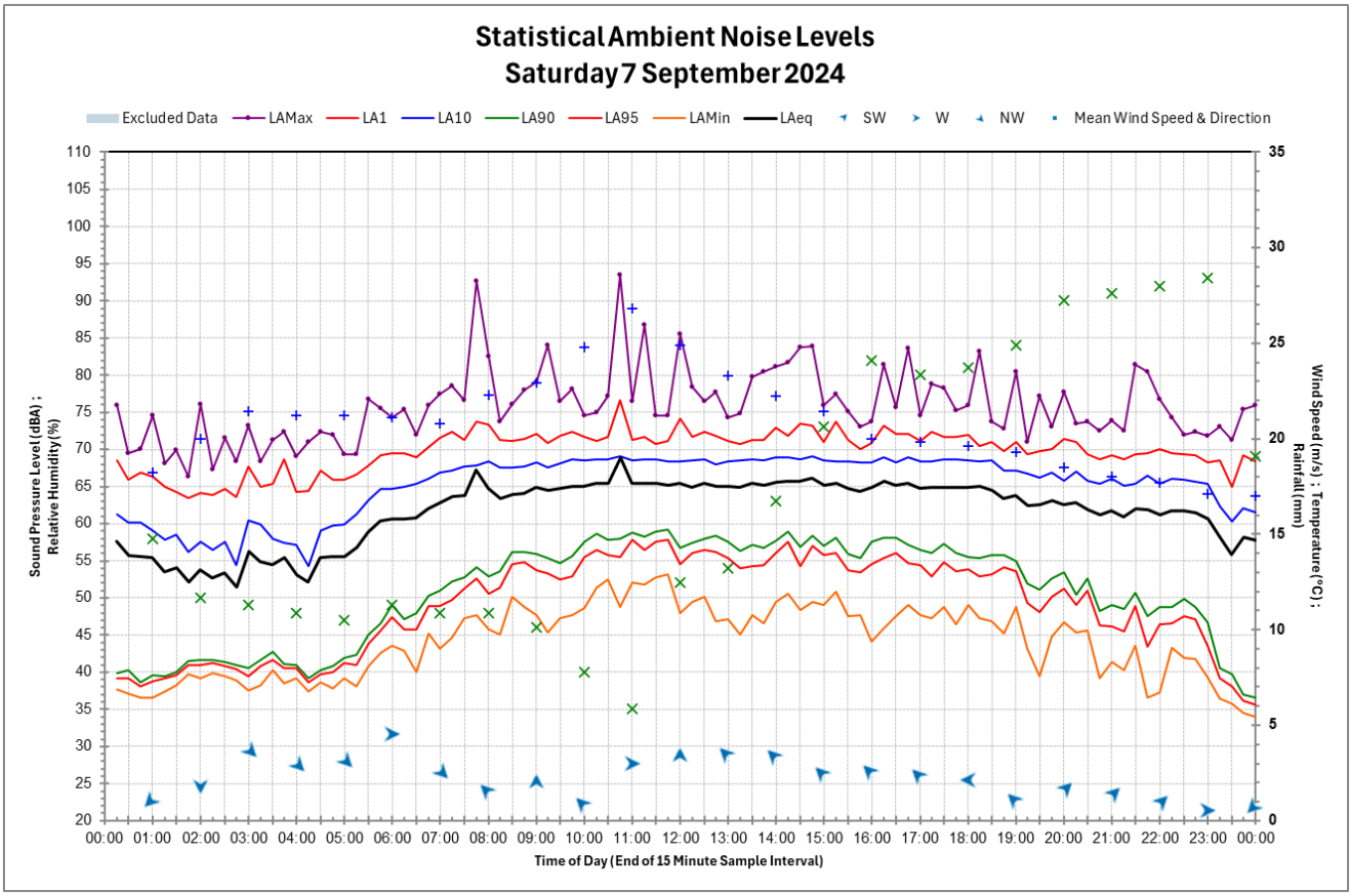

Statistical Ambient Noise Levels
Monday 2 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 3 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 4 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 5 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 6 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Saturday 7 September 2024
Excluded Data
LAMax
LA1
LA10
LA90
LA95
LAMin
LAeq
SW
W
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

Appendix B

Noise monitoring data summary

P01 – Period 1, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr	Leq 9hr	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Monday-5-Aug-24	59.2	64.0	64.8		61.9	60.3	65.8	65.4
Tuesday-6-Aug-24	66.6	63.7	64.8	64.5	61.2	59.8	66.2	65.8
Wednesday-7-Aug-24	66.2	63.1	64.0	63.8	61.5	60.1	65.5	65.9
Thursday-8-Aug-24	66.5	63.6	64.7	64.5	60.5	59.1	66.1	64.0
Friday-9-Aug-24	66.5	63.1	64.2	64.1	58.6	58.1	65.5	61.3
Saturday-10-Aug-24	65.5	62.3	63.5	63.6	58.5	57.8	64.9	61.3
Sunday-11-Aug-24	65.1	61.9	63.0	63.1	-	59.7	64.6	66.0
Monday-12-Aug-24	67.3	64.1	65.3	65.1	-	58.5	66.9	66.1
Tuesday-13-Aug-24	67.1	64.8	65.5	65.4	60.4	58.9	67.1	63.5
Wednesday-14-Aug-24	68.2	63.8	66.1	-	-	61.1	68.2	66.2
Thursday-15-Aug-24	68.1	65.3	66.2	-	61.2	59.6	67.9	64.1
Friday-16-Aug-24	66.6	63.4	64.5	64.3	58.7	58.1	65.6	60.6
Saturday-17-Aug-24	64.8	61.1	62.3	62.4	58.7	58.1	63.5	61.4
Sunday-18-Aug-24	64.9	62.1	63.4	63.4	61.2	59.8	66.0	64.2
Monday-19-Aug-24	67.6	63.9	65.0	64.9	-	-	65.2	-
Overall	**66.5**	**63.5**	**64.6**	**64.1**	**60.4**	**59.3**	**65.8**	**64.2**
Overall (Weekday)	**66.6**	**63.9**	**65.1**	**64.6**	**60.6**	**59.5**	**66.1**	**64.8**

Note: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.

P01 – Period 2, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr	Leq 9hr	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Thursday-29-Aug-24	65.9	63.8	64.5	-	61.7	60.4	66.2	64.5
Friday-30-Aug-24	65.7	62.7	63.7	-	59.1	58.5	64.4	62.0
Saturday-31-Aug-24	63.5	60.0	61.4	-	58.8	58.4	62.5	61.6
Sunday-1-Sep-24	63.4	60.4	61.4	-	61.2	59.3	62.2	64.9
Monday-2-Sep-24	64.4	61.7	64.3	-	61.2	59.5	64.8	64.6
Tuesday-3-Sep-24	66.2	63.2	64.2	63.9	61.8	60.3	65.3	65.4
Wednesday-4-Sep-24	66.6	63.7	64.7	64.5	61.7	60.2	66.0	65.1
Thursday-5-Sep-24	66.5	63.5	64.6	64.4	61.6	60.1	66.0	64.7
Friday-6-Sep-24	66.2	63.2	64.2	63.9	58.3	58.0	65.5	60.9
Saturday-7-Sep-24	65.1	61.8	63.0	63.1	57.8	57.0	64.5	60.1
Sunday-8-Sep-24	65.5	62.2	63.6	63.7	60.6	58.8	65.6	64.6
Monday-9-Sep-24	65.7	62.5	63.5	63.2	61.4	60.1	64.8	64.3
Tuesday-10-Sep-24	68.1	63.0	65.3	64.8	-	-	65.9	-
Overall	**65.7**	**62.6**	**63.9**	**64.0**	**60.6**	**59.3**	**65.3**	**64.6**
Overall (Weekday)	**66.2**	**63.1**	**64.4**	**64.2**	**61.0**	**59.7**	**65.5**	**64.6**

Note: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.

P02 – Period 1, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr[2]	Leq 9hr[2]	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Monday-5-Aug-24	61.5	60.4	61.1	-	55.7	60.0	62.2	62.7
Tuesday-6-Aug-24	63.2	62.5	63.2	60.1	54.9	58.3	64.9	61.4
Wednesday-7-Aug-24	-	58.3	-	-	-	-	-	-
Overall	**62.3**	**60.7**	**62.3**	**60.1**	**55.3**	**59.2**	**63.6**	**62.0**
Overall (Weekday)	**62.3**	**60.7**	**62.3**	**60.1**	**55.3**	**59.2**	**63.6**	**62.0**

Note 1: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.
Note 2: – Additional unattended noise logger data filtering was required at location P2 (25 Barkala Street) due to the proximity and influence of rail noise impacts at this location. The $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ unattended noise logging results presented in this report for location P2 (25 Barkala Street) excludes the impacts of rail noise.

P02 – Period 2, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr[2]	Leq 9hr[2]	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Thursday-29-Aug-24	62.3	61.9	62.5	-	56.1	60.3	63.7	63.6
Friday-30-Aug-24	62.7	61.4	61.8	-	53.6	59.0	63.3	62.3
Saturday-31-Aug-24	59.6	58.6	60.0	-	50.7	56.7	62.8	62.6
Sunday-1-Sep-24	60.4	60.0	60.8	-	55.8	62.4	62.0	65.6
Monday-2-Sep-24	61.0	61.9	60.9	-	57.3	59.7	61.6	64.2
Tuesday-3-Sep-24	63.3	62.0	62.8	60.1	55.7	59.5	64.1	62.2
Wednesday-4-Sep-24	63.3	61.9	62.6	60.5	55.4	59.8	63.6	64.2
Thursday-5-Sep-24	63.6	61.9	62.7	59.6	58.1	61.5	64.9	64.6
Friday-6-Sep-24	62.8	61.7	62.0	59.3	52.0	59.5	63.8	61.3
Saturday-7-Sep-24	61.6	60.3	60.8	58.5	52.0	58.7	62.8	62.4
Sunday-8-Sep-24	61.5	60.6	61.4	58.6	54.9	58.3	64.4	62.5
Monday-9-Sep-24	62.5	61.0	61.7	59.7	55.2	60.8	63.6	63.3
Tuesday-10-Sep-24	64.7	62.7	63.4	62.3	-	-	64.6	-
Overall	**62.5**	**61.3**	**61.9**	**60.0**	**55.2**	**59.9**	**63.6**	**62.9**
Overall (Weekday)	**62.8**	**61.9**	**62.3**	**60.4**	**55.8**	**60.1**	**63.7**	**63.5**

Note 1: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.
Note 2: – Additional unattended noise logger data filtering was required at location P2 (25 Barkala Street) due to the proximity and influence of rail noise impacts at this location. The $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ unattended noise logging results presented in this report for location P2 (25 Barkala Street) excludes the impacts of rail noise.

P03 – Period 1, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr	Leq 9hr	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Monday-5-Aug-24	55.9	53.8	54.6	54.6	52.0	50.8	55.6	55.1
Tuesday-6-Aug-24	56.7	54.5	55.6	55.5	51.5	50.5	56.8	55.7
Wednesday-7-Aug-24	56.5	54.1	55.1	55.1	51.3	50.4	56.4	55.0
Thursday-8-Aug-24	56.8	54.5	55.6	55.6	51.0	49.9	56.6	52.8
Friday-9-Aug-24	56.2	53.7	54.7	54.6	50.1	49.6	55.9	52.9
Saturday-10-Aug-24	54.8	52.9	54.1	54.2	49.2	48.4	56.7	52.0
Sunday-11-Aug-24	54.8	53.3	54.5	54.6		50.3	57.0	54.6
Monday-12-Aug-24	56.7	54.2	55.4	55.2		49.9	56.8	56.7
Tuesday-13-Aug-24	56.7	54.8	55.5	55.3	50.7	49.8	57.4	53.4
Wednesday-14-Aug-24	57.0	53.5	55.4			50.6	57.2	54.4
Thursday-15-Aug-24	57.5	55.1	56.0		50.5	49.1	57.5	53.0
Friday-16-Aug-24	55.7	53.1	54.2	54.2	48.5	48.3	55.6	50.4
Saturday-17-Aug-24	54.0	51.1	52.2	52.4	49.0	48.4	54.4	51.8
Sunday-18-Aug-24	53.8	52.3	53.5	53.6	50.9	49.9	55.8	52.7
Monday-19-Aug-24	57.3	53.6	54.8	54.7	-	-	55.3	-
Overall	**56.5**	**53.7**	**54.8**	**54.7**	**50.6**	**49.8**	**56.6**	**53.2**
Overall (Weekday)	**56.7**	**54.1**	**55.2**	**55.0**	**50.8**	**49.9**	**56.6**	**53.9**

Note: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.

P04 – Period 1, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr	Leq 9hr	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Monday-5-Aug-24	69.8	66.4	67.7	-	64.0	62.1	68.6	67.8
Tuesday-6-Aug-24	69.9	66.2	67.4	67.2	62.9	60.8	68.9	67.3
Wednesday-7-Aug-24	69.6	65.9	67.1	67.0	62.7	60.9	68.4	66.7
Thursday-8-Aug-24	69.9	65.9	67.1	67.0	61.5	61.5	68.4	61.7
Overall	**69.8**	**66.1**	**67.3**	**67.1**	**62.9**	**61.3**	**68.5**	**67.0**
Overall (Weekday)	**69.8**	**66.1**	**67.3**	**67.1**	**62.9**	**61.3**	**68.5**	**67.0**

Note: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.

P04 – Period 2, noise monitoring results summary

Date	L10 18hr	Leq 24hr	Leq 16hr	Leq 15hr	Leq 9hr	Leq 8hr	Leq 1hr Day	Leq 1hr Night
Thursday-29-Aug-24	66.8	63.8	64.9	-	61.8	60.2	66.1	65.3
Friday-30-Aug-24	68.2	64.5	66.1	-	58.8	57.8	67.2	61.3
Saturday-31-Aug-24	66.0	61.5	63.8	-	57.5	57.0	65.3	60.2
Sunday-1-Sep-24	66.6	63.2	64.9	-	60.9	58.8	67.6	64.9
Monday-2-Sep-24	66.3	62.8	66.1	-	61.1	58.8	67.7	65.0
Tuesday-3-Sep-24	68.1	64.7	66.0	65.9	61.1	59.5	67.0	65.0
Wednesday-4-Sep-24	68.2	64.7	66.0	66.0	60.9	59.1	67.2	64.3
Thursday-5-Sep-24	68.2	64.7	66.1	66.1	60.7	58.9	66.9	64.4
Friday-6-Sep-24	68.2	64.3	65.7	65.7	58.3	57.6	66.6	61.4
Saturday-7-Sep-24	67.3	63.2	64.5	64.7	57.7	57.0	65.5	61.4
Sunday-8-Sep-24	67.3	63.6	65.1	65.3	60.1	57.8	67.3	64.1
Monday-9-Sep-24	67.5	63.8	65.1	65.0	60.4	58.6	66.4	64.2
Tuesday-10-Sep-24	69.3	63.2	66.2	-	-	-	66.7	-
Overall	**67.5**	**63.8**	**65.5**	**65.5**	**60.1**	**58.5**	**66.9**	**64.3**
Overall (Weekday)	**68.2**	**64.1**	**65.8**	**65.7**	**60.5**	**58.9**	**66.9**	**64.3**

Note: Cells marked '-' indicate insufficient data for that day following exclusion of missing data, extraneous noise or weather affected data.

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