

Noise Assessment

Proposed Primary School Development
125 The Southern Parkway
Forster, NSW

Document Information

Noise Assessment

Proposed Primary School Development

125 The Southern Parkway, Forster, NSW

Prepared for: Site R&D Pty Ltd

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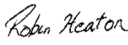
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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Site R&D Pty Ltd (SRD) to prepare a Noise Assessment (NA) to quantify emissions from the proposed primary school development to be established at 125 The Southern Parkway, Forster, NSW, 2428.

The NA has quantified potential operational and construction noise emissions from the project and recommends reasonable and feasible noise controls where required.

This assessment has been undertaken in accordance with the following documents:

- NSW Department of Environment and Climate Change (DECCW), NSW Interim Construction Noise Guideline (ICNG), 2009;
- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017;
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures;
- International Organisation for Standardisation (ISO) 9613-1:1993 (ISO9613:1) - Acoustics - Attenuation of Sound During Propagation Outdoors - Part 1: Calculation of the Absorption of Sound by the Atmosphere;
- International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation; and
- ISO/TR 17534-3 - Acoustics — Software for the calculation of sound outdoors — Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

2.1 Background

The project proposes a 350-place primary school which is to be located on a greenfield site. The site is in a suburban area approximately 2km south of Forster town centre. The project will comprise of three double storey educational buildings comprising of classrooms, administration offices, staff rooms staff and student amenities. The project will also provide outdoor learn areas as well as a school canteen, parent/teacher parking facilities and greenfield play areas.

The project site is bound to the north by a residential aged care facility and to the west by undeveloped land currently utilised as parkland. To the immediate south of the site is an undeveloped lot with a residential receiver located on the far side of the green field site at a set back distance of 60m from the southern boundary of the project site. Additional residential receivers are located to the east of the project site across The Southern Parkway.

2.1.1 Proposed Activities & Operating Hours

There are several key activities associated with the project that have the potential to generate acoustic impacts on nearby receivers. **Table 1** provides a summary of project noise sources and the assessment period in which they propose to occur.

Table 1 Noise Generating Activities		
Activity/Source	Period	Operational
School Activities/Children at play	Day	✓
	Evening	X
	Night	X
Mechanical Plant	Day	✓
	Evening	X
	Night	X
Onsite Vehicles	Day	✓
	Evening	X
	Night	X

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

2.1.2 Receiver Review

A review of residential receivers in close proximity to the project has been completed and are summarised in **Table 2**. **Figure 1** provides a locality plan showing the position of these receivers in relation to the project.

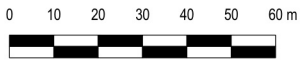
Table 2 Receiver Locations				
Receiver	Receiver Type	Receiver Height	Coordinates (MGA56)	
			Easting	Northing
R01	Residential	1.5m	455749	6436087
R02	Residential	1.5m	455792	6436086
R03	Residential	1.5m	455808	6436080
R04	Residential	1.5m	455861	6436073
R05	Residential	1.5m	455877	6436075
R06	Residential	1.5m	455926	6436075
R07	Residential	1.5m	455947	6436058
R08	Residential	1.5m	455967	6436063
R09	Residential	1.5m	455985	6436048
R10	Residential	1.5m	456009	6436055
R11	Residential	1.5m	456050	6436018
R12	Residential	1.5m	456053	6436034
R13	Residential	1.5m	456056	6436053
R14	Residential	1.5m	456061	6436100
R15	Residential	1.5m	456062	6436116
R16	Residential	1.5m	456061	6436135
R17	Residential	1.5m	456059	6436150
R18	Residential	1.5m	456100	6436162
R19	Residential	1.5m	455952	6436176
R20	Residential	1.5m	455932	6436170
R21	Residential	1.5m	455893	6436158
R22	Residential	1.5m	455865	6436150



FIGURE 1
Locality Plan
MAC221510-01
Forster Primary School

KEY

- Receivers
- Site Boundary
- Logger Location



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3 Noise Policy and Guidelines

3.1 External Activity Noise Emissions

Noise Emissions from external activities within school grounds are not addressed in any NSW state noise policies. Typically, guidance is sought from the Local Government Area (LGA) Development Control Plan (DCP) or Local Environmental Plan (LEP). A review of both documents on the Mid-Coast Council website did not provide guidance on school external activities noise assessments or criteria.

In lieu of state and LGA noise policies, guidance was sought from the Association of Australasian Acoustic Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment, 2013 (GCCCAA). The GCCCAA recommends criterion based on the measured background noise levels and duration of outdoor play. The GCCCAA guidance is reproduced below.

Base Criteria – With the development of child care centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed Leq,15min 45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).

Background Greater Than 40 dB(A) – The contributed Leq,15min noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (ie background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).

Up to 4 hours (total) per day – If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15 minute noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.

More than 4 hours (total) per day – If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15 minute noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

This is considered a conservative approach in assessing external noise emissions

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

3.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level (PINL)** and **Project Amenity Noise Level (PANL)** determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period. The measured RBLs relevant to the project are contained in **Section 4**.

3.2.3 Project Intrusiveness Noise Level (PINL)

The PINL ($L_{Aeq}(15min)$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

Background noise levels need to be determined before intrusive noise can be assessed. The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. It is noted that the exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and,
- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

Where a project intrusiveness noise level has been derived in this way, the derived level applies for a period of 10 years to avoid continuous incremental increases in intrusiveness noise levels. This approach is consistent with the purpose of the intrusiveness noise level to limit significant change in the acoustic environment. The purpose of the project amenity noise level is to moderate against background noise creep.

3.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: “to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows”:

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 3**.

Table 3 Amenity Noise Levels

Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship			
- internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

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

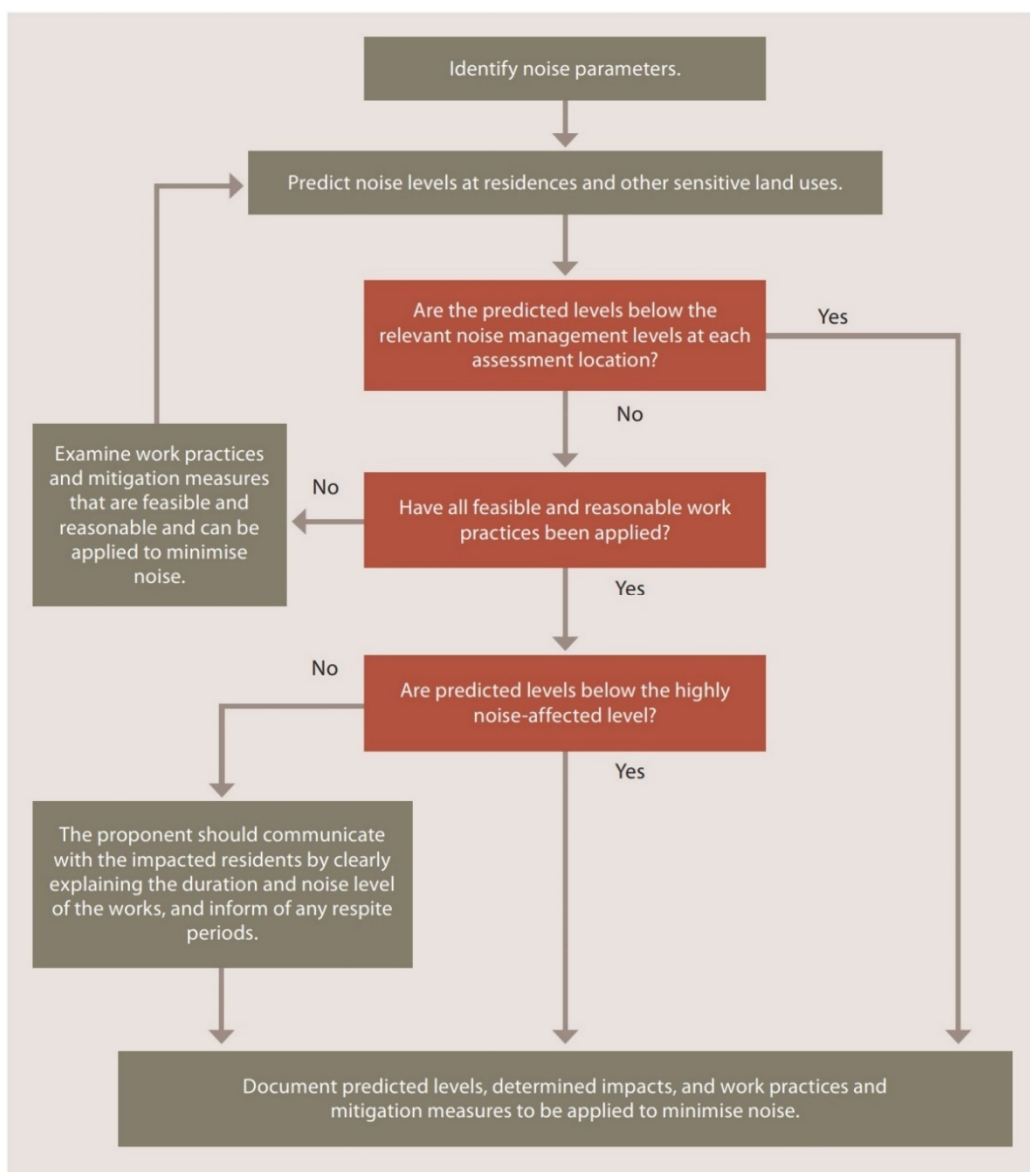
3.3 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- Qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This NA has adopted a quantitative assessment approach which is summarised in **Figure 2**. The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

Figure 2 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.3.1 Standard Hours for Construction

Table 4 presents the ICNG recommended standard hours for construction works.

Table 4 Recommended Standard Hours for Construction	
Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Construction activities are anticipated to be undertaken during standard construction hours.

3.3.2 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 5** reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB for Out of Hours (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 5 Noise Management Levels

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

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

4 Existing Environment

4.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at one location representative of the ambient environment surrounding the project site. The selected monitoring location is shown in **Figure 1** and is considered representative of surrounding residential receivers as per Fact Sheet B1.1 of the NPI.

The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

The measurements were carried out using one Svantek 977 noise analyser from Tuesday 15 February 2022 to Thursday 24 February 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Observations on-site identified the surrounding locality was typical of suburban environment, with local wind noise, local traffic, wildlife and noise from the adjacent aged care facility audible.

Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. Residential receivers situated in the surrounding area have been classified under the EPA's suburban amenity category. This criteria is used in conjunction with the intrusiveness criteria to determine the limiting criteria. The results of long-term unattended noise monitoring are provided in **Table 6**. The noise monitoring charts for the background monitoring assessment are provided in **Appendix B**.

Table 6 Background Noise Monitoring Summary						
Location	Measured Rating Background Noise Level (LA90), dBA			Measured LAeq(period) Noise Level dBA		
	Day	Evening	Night	Day	Evening	Night
	7am to 6pm	6pm to 10pm	10pm to 7am	7am to 6pm	6pm to 10pm	10pm to 7am
L1	37	38	41	52	52	53

Note 1: Assessment background level (RBL) – the single-figure background level representing each assessment period day, evening and night as per NPI Fact Sheet A.

Note 2: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology weather station Taree Airport AWS 31.89S 152.51°E 8m AMSL.

Note 3: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Attended Noise Monitoring

To supplement the unattended noise assessment and to quantify the changes in ambient noise in the community surrounding the operation, one 15 minute attended measurement was completed.

The attended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The attended noise monitoring was conducted using one Svantek 971 noise analyser at the site (see **Figure 1**) on Tuesday 15 February 2022 to quantify ambient background noise levels.

The attended measurement was completed during calm and clear meteorological conditions and confirmed that ambient traffic and commercial noise dominated the surrounding environment. The results of the short-term noise measurement and observations are summarised in **Table 7**.

Table 7 Operator-Attended Noise Survey Results

Date/Time (hrs)	Noise Descriptor (dBA re 20 μPa)			Meteorology	Description and SPL, dBA
	L _{Amax}	L _{Aeq}	L _{A90}		
Location L1					
15/02/2022	65	50	45	WD: E	Wind in trees 42-57
16:02				WS: 2.3m/s	Birds 40-65
				Temp: 26°C	Passing traffic 30-45

5 Assessment Criteria

5.1 Outdoor Activity Noise Criteria

Table 8 summarises the noise emission criteria from external activities based on the GCCCAA guidance. The base criteria of 45dBA has been adopted as the measured daytime RBL is below 40dB LAeq(15min).

Table 8 CCC Noise Emission Criteria			
Location	Period	Activity	Criteria
Residential Receivers	Day (7am-6pm)	Outdoor Play	45dB LAeq(15min)

5.2 Operational Noise Criteria

5.2.1 Intrusiveness Noise Levels

The PINL for the project are presented in **Table 9** and have been determined based on the RBL +5dBA and only apply to residential receivers.

Table 9 Project Intrusiveness Noise Levels					
Location	Receiver Type	Period ¹	Measured RBL dB LA90	Adopted RBL dB LA90 ²	PINL dB LAeq(15min)
L1	Residential	Day	37	37	42
		Evening	38	37	42
		Night	41	37	42

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: AS per NPI guidance the RBL for day cannot be above the RBL for evening or night period. Accordingly, the daytime RBL has been adopted for all three periods.

5.2.2 Amenity Noise Levels and Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 10**.

Table 10 Amenity Noise Levels and Project Amenity Noise Levels					
Receiver Type	Noise Amenity Area	Assessment Period ¹	NPI Recommended ANL dB LAeq(period)	ANL dB LAeq(period) ²	PANL dB LAeq(15min) ³
Residential	Suburban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Project Amenity Noise Level equals the Amenity Noise Level -5dB as there is other industry in the area.

Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

Note 4: External level based on 10dB loss through partially open window.

5.2.3 Project Noise Trigger Levels

The PNTL are the lower of either the PINL or the PANL. **Table 11** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 11 Project Noise Trigger Levels					
Receiver Type	Noise Amenity Area	Assessment Period ¹	PINL dB LAeq(15min)	PANL dB LAeq(15min)	PNTL dB LAeq(15min)
Residential	Suburban	Day	42	58	42
		Evening	42	48	42
		Night	42	43	42

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5.3 Construction Noise Criteria

The relevant Noise Management Levels (NMLs) for standard construction hours are presented in **Table 12**.

Table 12 Construction Noise Management Levels			
Catchment (No) Receiver ID	Assessment Period ¹	Adopted RBL dB LA90	NML dB LAeq(15min)
Suburban Residential	Standard Hours	37	47 (RBL+10dBA)

Note 1: See **Table 4** for recommended standard hours for construction.

6 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2022.1) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613:1 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE¹. The ISO 9613 standards are the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

¹ Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

6.1 Sound Power Levels

Table 13 presents the sound power level for each noise source modelled in this assessment. It is noted that sound power levels were sourced from manufacturer's specifications or from in-field measurements at similar project sites.

Table 13 Acoustically Significant Sources - Sound Power Level (re 10^{-12} Watts)			
Item and number modelled per 15 minutes	Individual Lw dB LAeq	Modelled Source Lw dB LAeq(15min)	Source Height ¹
External Play Sources			
Groups of 5 People Talking with school outdoor areas (x34)	81	96	1.0m
School Operation			
AC Plant (x9)	78	88	1.8m
Car start up and drive off (x21) ²	81	86	0.5m
Parent/School vehicles travelling through Drop off Car Park (30 cars per 15min) ²	81	88	0.5m
Construction Fleet			
Combined Construction Fleet		108	1.5m

Note 1: Height above the relative ground or building below source.

Note 2: Includes a duration adjustment assuming vehicles operates for 90seconds within a period of 15-minutes for a vehicle to enter/leave the main vehicle flow through the project.

6.2 Noise Attenuation Assumptions, Controls and Recommendations

The noise model adopted the following assumptions, controls and recommendations:

- The mechanical plant for the school is yet to be finalised. Therefore, the modelling assumes three AC units per building, totalling nine AC units. The AC units are assumed to be located on the north east of the administration and Block A buildings. This locates the units away from student play areas and the nearest residential receiver located to the north of the project site;
- During external activities it is assumed that one in two children are speaking at any one time.

7 Noise Assessment Results

This assessment has quantified operational noise levels at the nearest receivers

7.1 External Activities Noise Emission

Noise predictions from all sources have been quantified at surrounding residential receivers to the project site and are presented in **Table 14**.

Table 14 Noise Predictions – All Receivers				
Location	Period ¹	Predicted Noise Level dB LAeq(15min)	Criteria dB LAeq(15min)	Compliant
R01	Day	<35	45	✓
R02	Day	36	45	✓
R03	Day	37	45	✓
R04	Day	43	45	✓
R05	Day	44	45	✓
R06	Day	43	45	✓
R07	Day	44	45	✓
R08	Day	44	45	✓
R09	Day	42	45	✓
R10	Day	42	45	✓
R11	Day	39	45	✓
R12	Day	39	45	✓
R13	Day	40	45	✓
R14	Day	<35	45	✓
R15	Day	<35	45	✓
R16	Day	<35	45	✓
R17	Day	<35	45	✓
R18	Day	<35	45	✓
R19	Day	<35	45	✓
R20	Day	<35	45	✓
R21	Day	<35	45	✓
R22	Day	<35	45	✓

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining

7.2 Operational Noise Assessment

Noise predictions from all onsite sources excluding external activities have been quantified at surrounding residential receivers to the project site and are presented in **Table 15**. Results demonstrate the PTNLs are satisfied for all assessed receivers.

Table 15 Noise Predictions – All Receivers

Location	Period ¹	Predicted Noise Level dB LAeq(15min)	PNTL dB LAeq(15min)	Compliant
R01	Day	<35	42	✓
R02	Day	<35	42	✓
R03	Day	<35	42	✓
R04	Day	<35	42	✓
R05	Day	<35	42	✓
R06	Day	<35	42	✓
R07	Day	35	42	✓
R08	Day	36	42	✓
R09	Day	37	42	✓
R10	Day	38	42	✓
R11	Day	<35	42	✓
R12	Day	<35	42	✓
R13	Day	38	42	✓
R14	Day	41	42	✓
R15	Day	42	42	✓
R16	Day	42	42	✓
R17	Day	42	42	✓
R18	Day	<35	42	✓
R19	Day	<35	42	✓
R20	Day	<35	42	✓
R21	Day	<35	42	✓
R22	Day	<35	42	✓

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

7.3 Construction Noise Assessment

Table 16 presents the results of modelled construction noise emissions. Predictions identify that emissions from construction are above the noise management levels at several assessed receivers. Accordingly, recommendations to reduce the impact of construction noise emissions on surrounding receivers are provided in **Section 7**.

Table 16 Construction Noise Levels – All Receivers

Rec	Period ¹	Predicted Noise Level				Management	Compliant
		dB LAeq(15min)				Level	
		Admin Building	Block A	Block B	Cola	dB LAeq(15min)	
R01	Day	47	47	48	49	47	X
R02	Day	49	50	51	51	47	X
R03	Day	50	50	51	52	47	X
R04	Day	53	53	56	56	47	X
R05	Day	54	55	57	57	47	X
R06	Day	58	58	59	61	47	X
R07	Day	59	57	57	59	47	X
R08	Day	58	56	57	59	47	X
R09	Day	57	55	56	57	47	X
R10	Day	57	56	56	56	47	X
R11	Day	53	51	52	53	47	X
R12	Day	54	52	53	53	47	X
R13	Day	57	55	55	56	47	X
R14	Day	57	55	55	55	47	X
R15	Day	58	56	56	54	47	X
R16	Day	59	57	56	55	47	X
R17	Day	59	57	55	55	47	X
R18	Day	39	53	48	39	47	X
R19	Day	63	70	73	65	47	X
R20	Day	61	65	74	66	47	X
R21	Day	57	58	62	61	47	X
R22	Day	54	55	58	58	47	X

Note 1: See **Table 4** for recommended standard hours for construction.

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8 Construction Recommendations

The results of the Noise Assessment demonstrate that levels during standard construction hours are above the ICNG noise management levels at the nearest receivers surrounding the project. Accordingly, it is recommended that noise management and mitigation measures be adopted during noise intensive construction activities to limit impacts on surrounding receivers.

Recommendations for consideration during construction activities for this project may include:

- implement boundary fences/retaining walls as early as possible to maximise their attenuation benefits to surrounding receivers;
- toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to the community;
- where possible use mobile screens or construction hording to act as barriers between construction works and receivers;
- all plant should be shut down when not in use. Plant to be parked/started at farthest point from relevant assessment locations;
- operating plant in a conservative manner (no over-revving);
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimisation of metallic impact noise;
- all plant are to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm; and
- undertake letter box drops to notify receivers of potential works.

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9 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment to quantify emissions from the proposed primary school development to be established at 125 The Southern Parkway, Forster, NSW.

The results of the Noise Assessment demonstrate that emissions from external play activities within the project site will comply with the adopted noise criteria from the GCCCAA. This is considered a conservative approach in assessing external noise emissions.

Noise from other external sources including onsite vehicles and mechanical plant from the project would satisfy the relevant PNTLs at all assessed receivers during the daytime period.

Modelled noise emissions from operation construction activities identify that predicted noise emissions levels are above the applicable construction management levels at several receivers. Accordingly, noise management measures are provided in this report to reduce potential impacts on surrounding receivers.

Based on the Noise Assessment results, once noise controls are implemented to the project, there are no noise related issues which would prevent approval of the proposed project.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

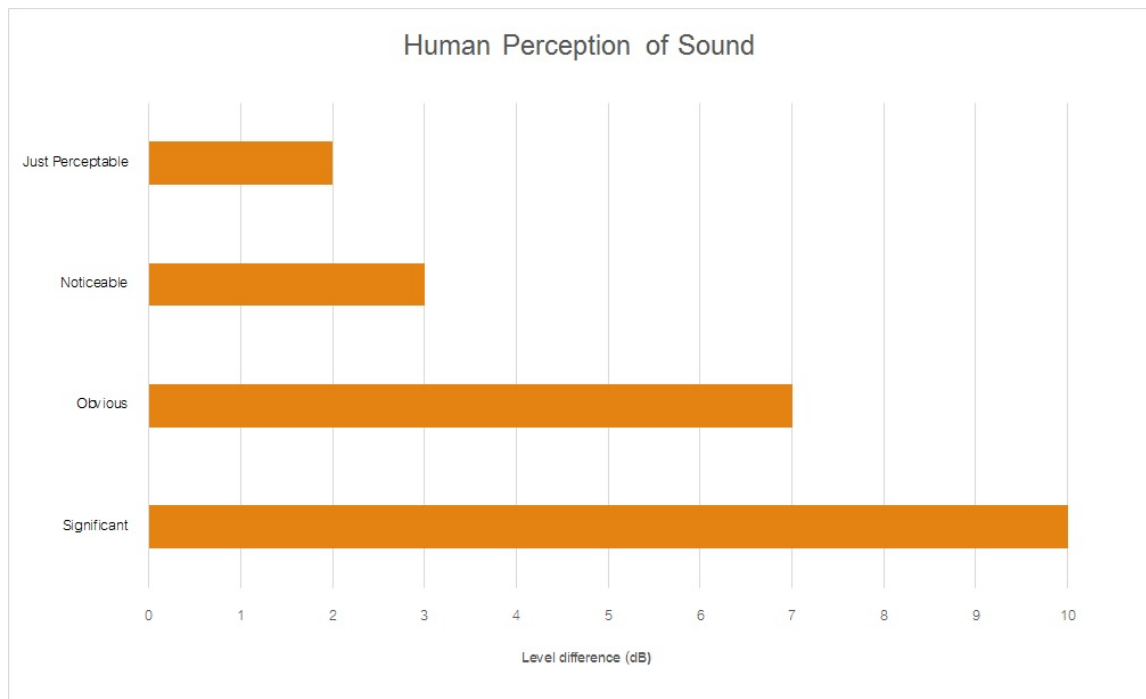
Table A1 Glossary of Acoustical Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmx	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by $10 \cdot \log_{10} (W/W_0)$. Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound

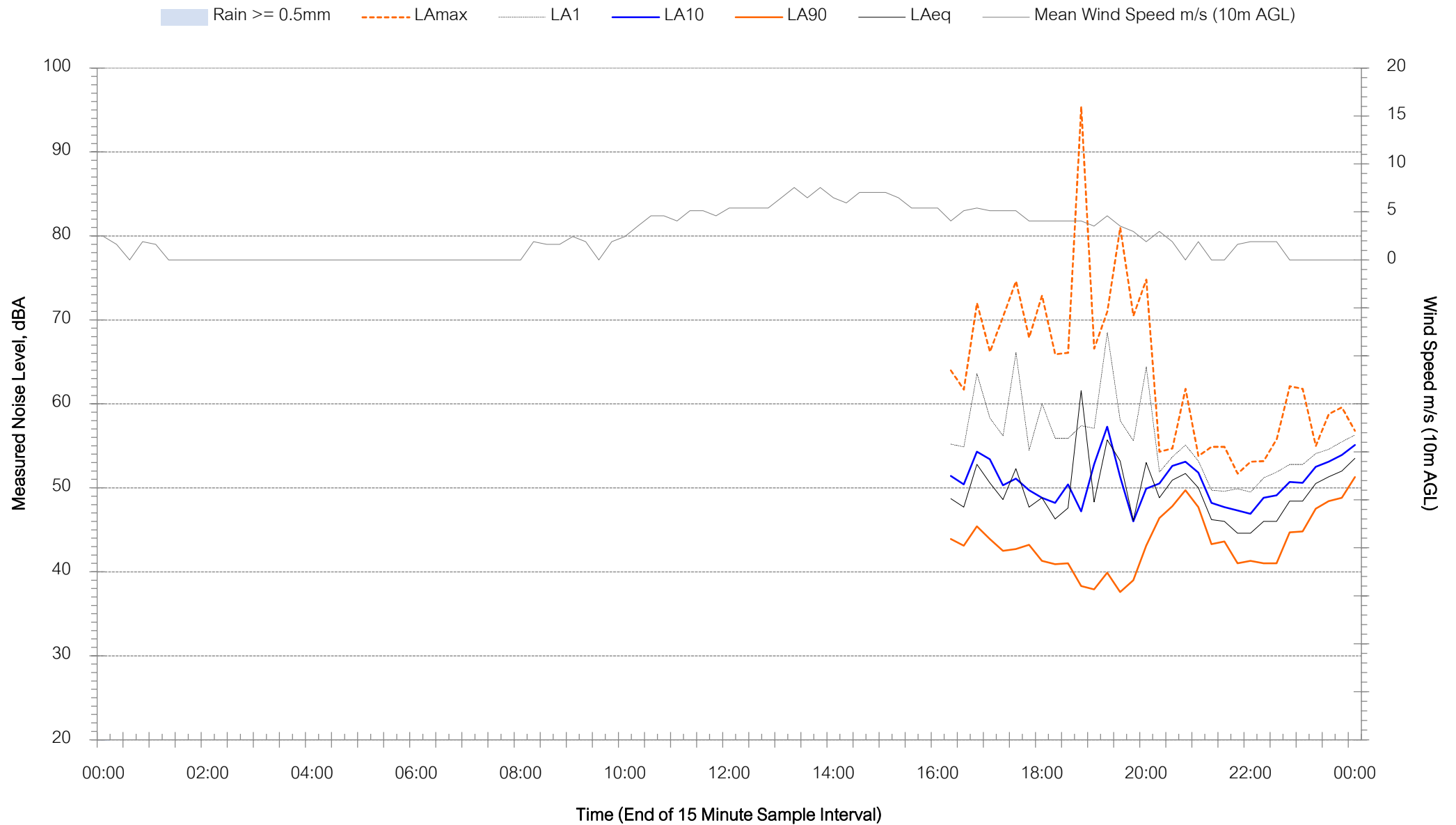


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Appendix B – Noise Monitoring Charts

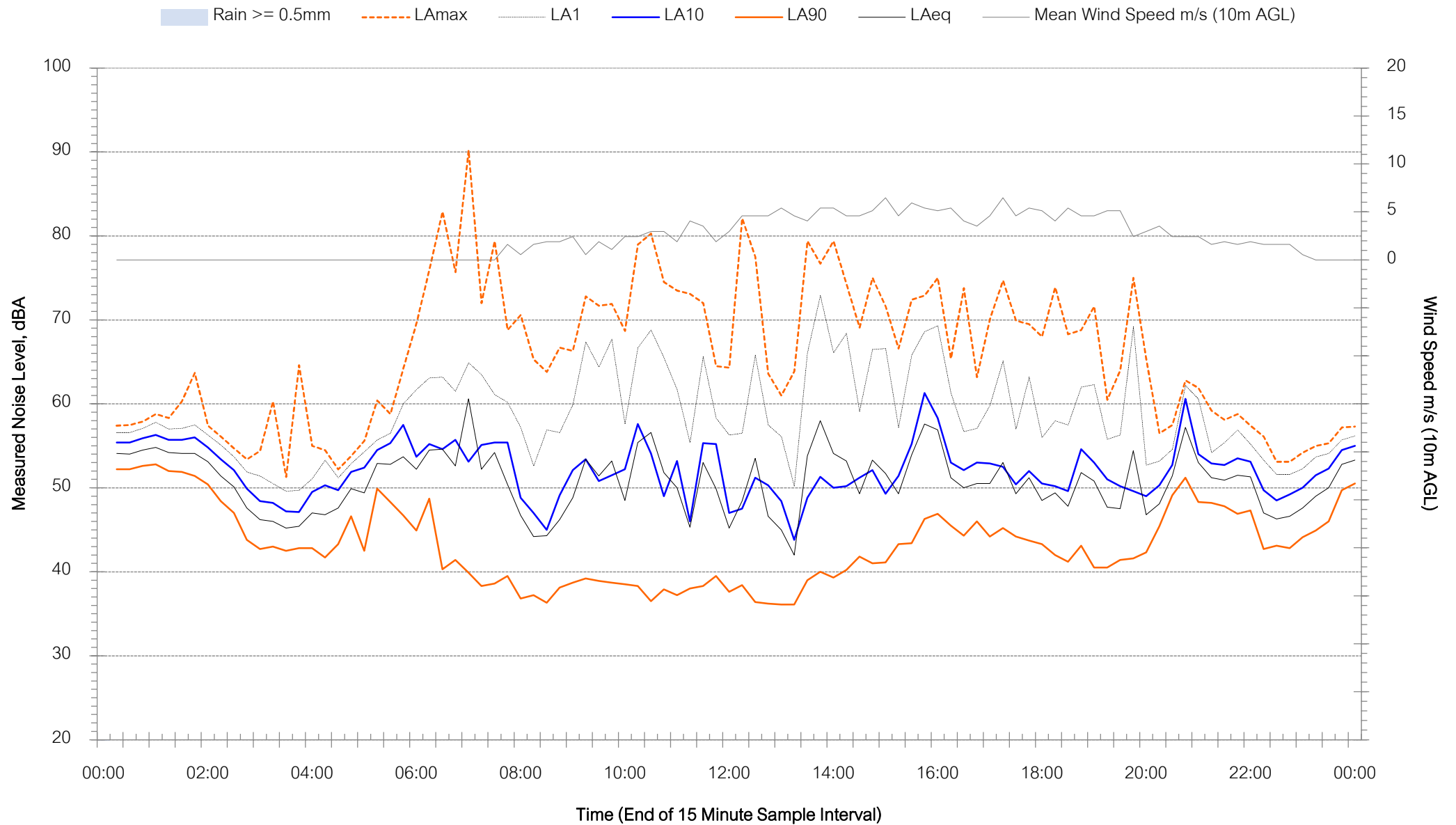
Background Noise Levels

The Southern Parkway, Forster - Tuesday 15 February 2022



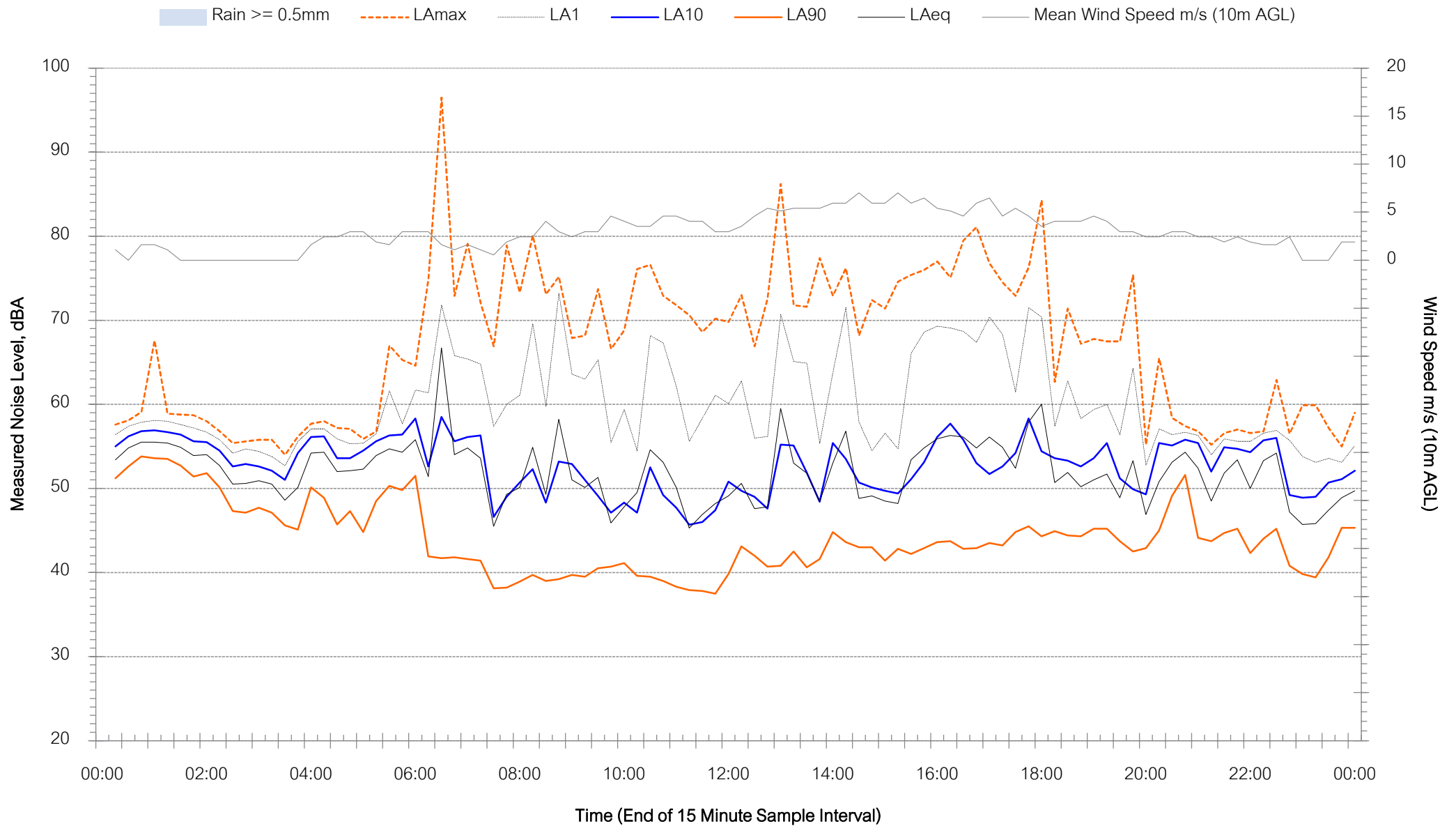
Background Noise Levels

The Southern Parkway, Forster - Wednesday 16 February 2022



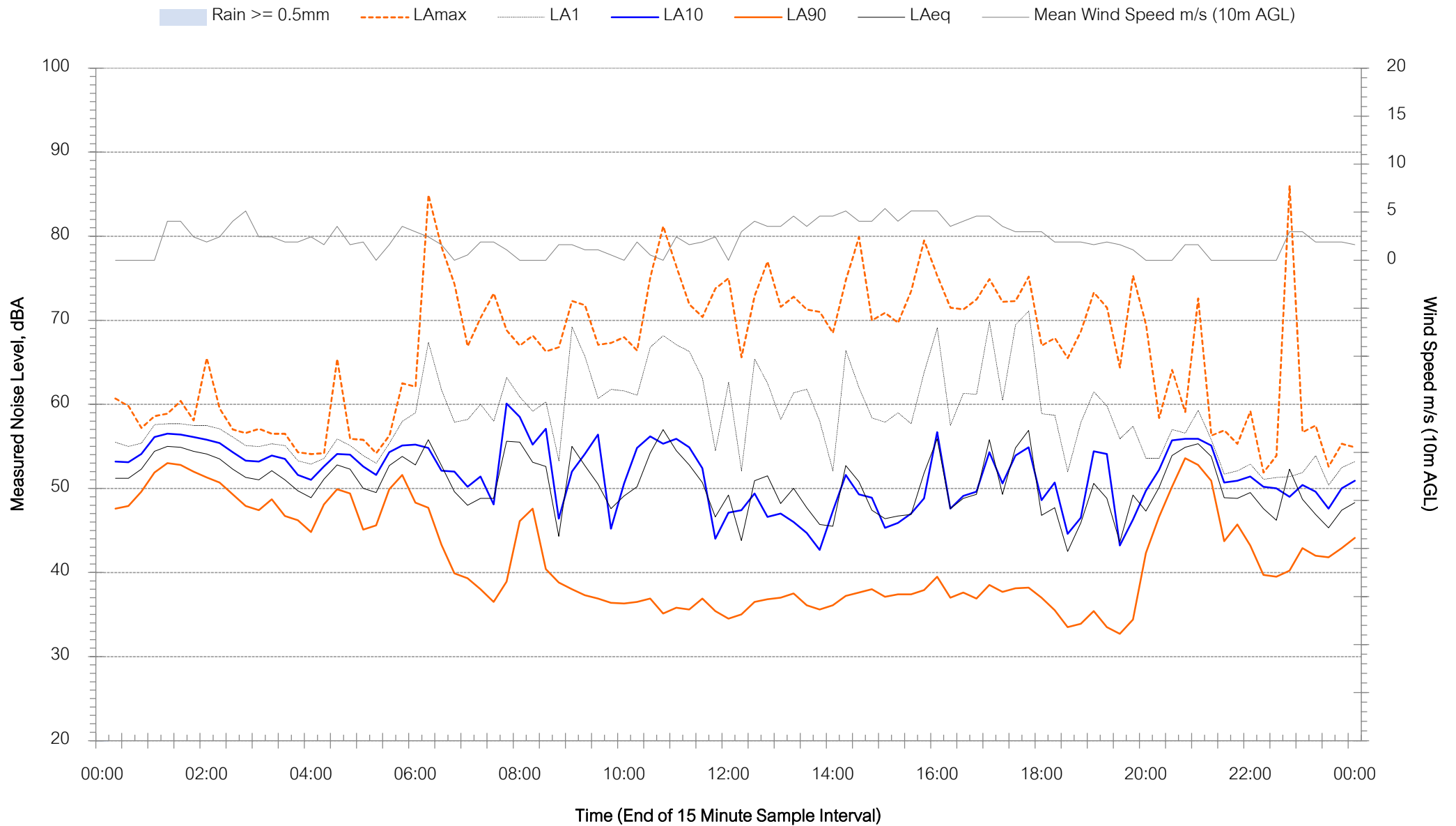
Background Noise Levels

The Southern Parkway, Forster - Thursday 17 February 2022



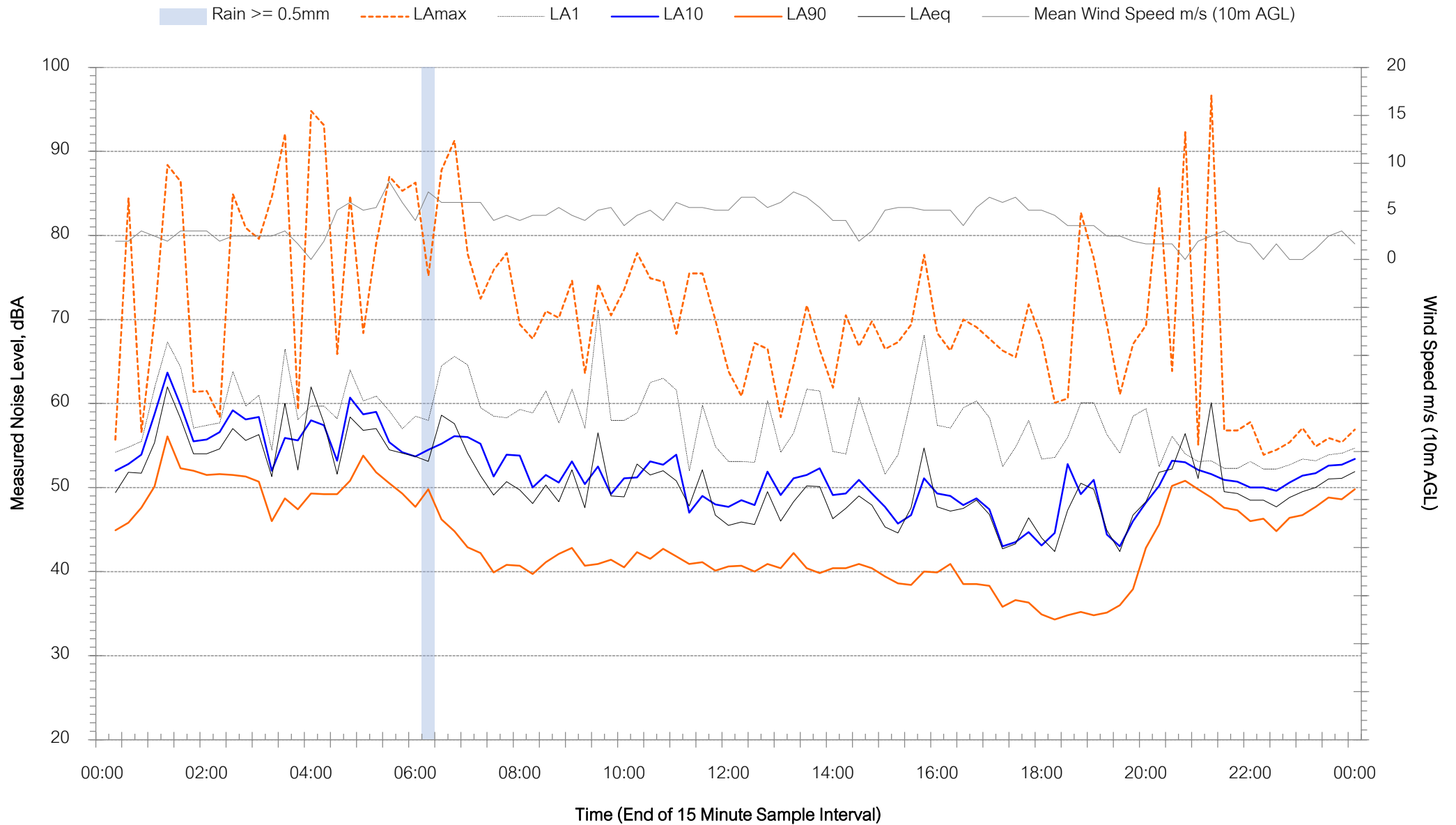
Background Noise Levels

The Southern Parkway, Forster - Friday 18 February 2022



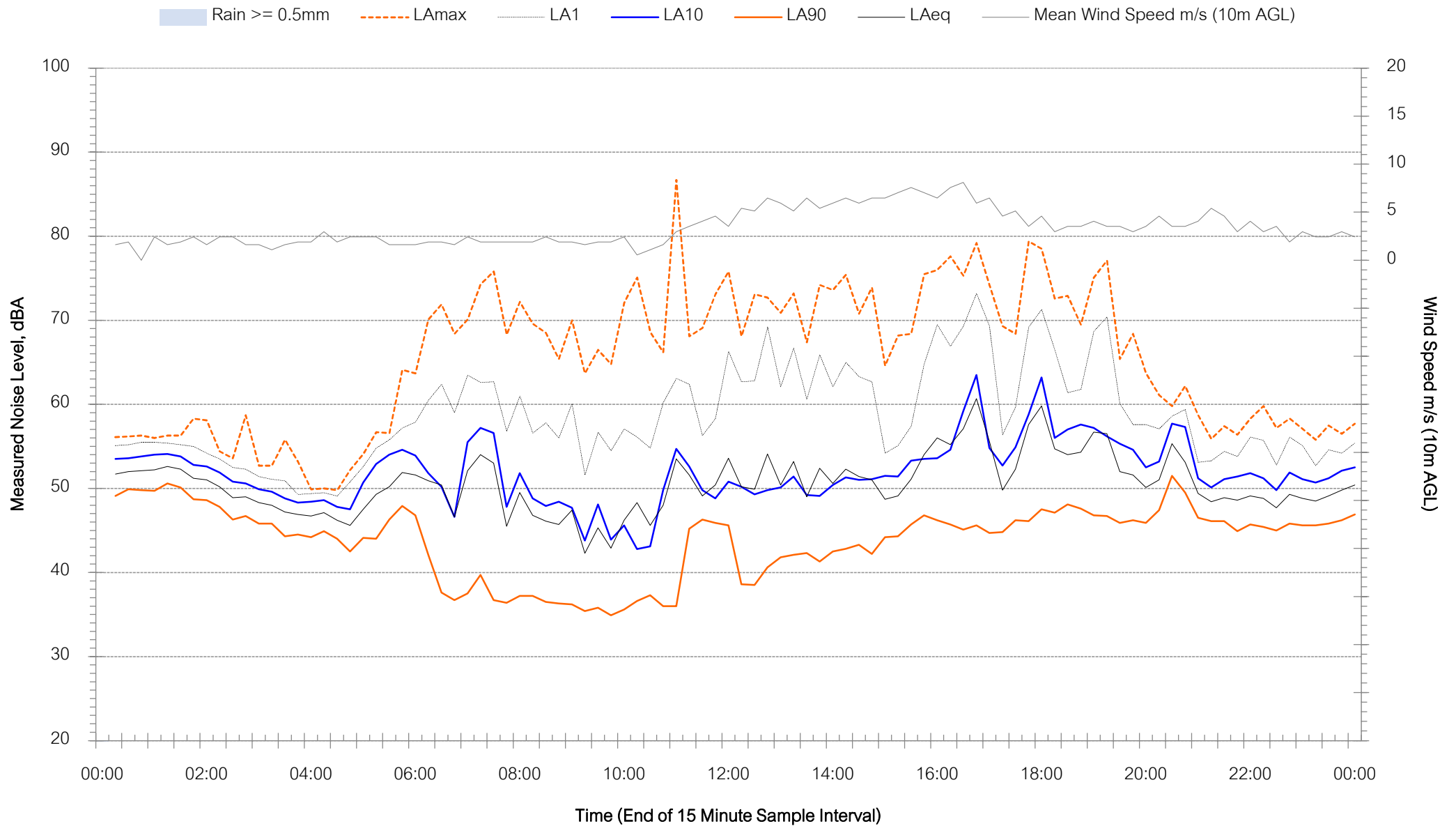
Background Noise Levels

The Southern Parkway, Forster - Saturday 19 February 2022



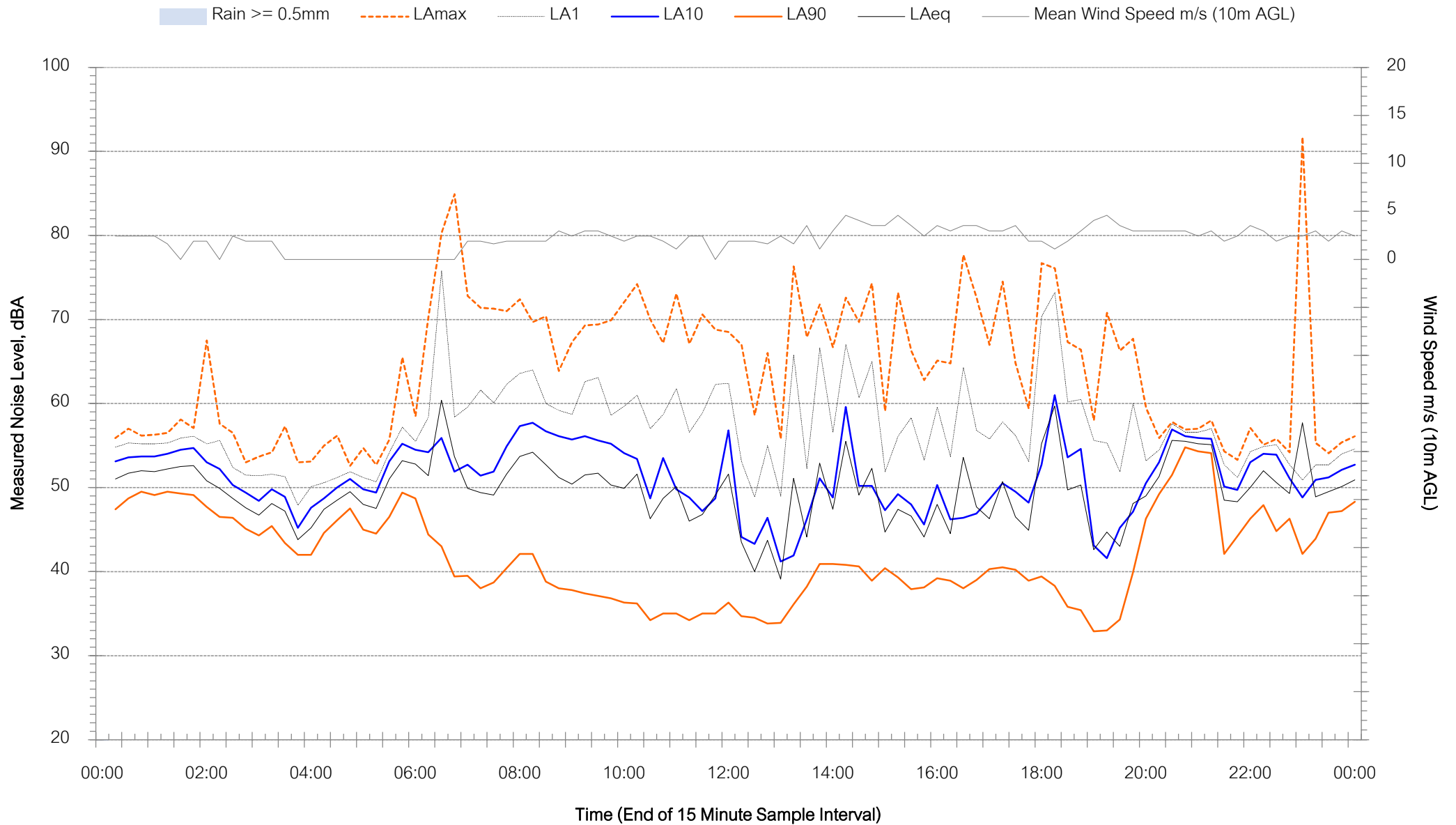
Background Noise Levels

The Southern Parkway, Forster - Sunday 20 February 2022



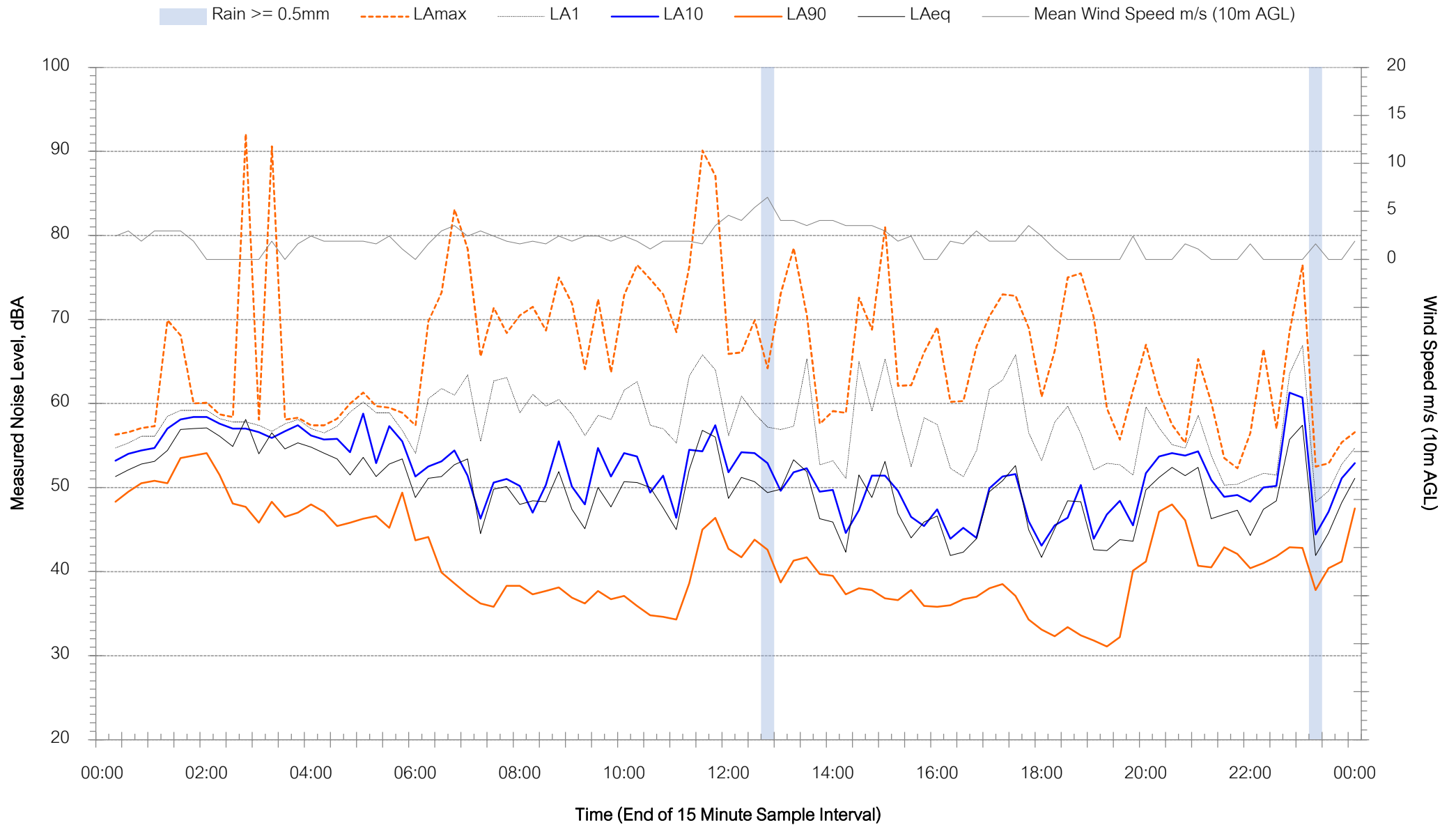
Background Noise Levels

The Southern Parkway, Forster - Monday 21 February 2022



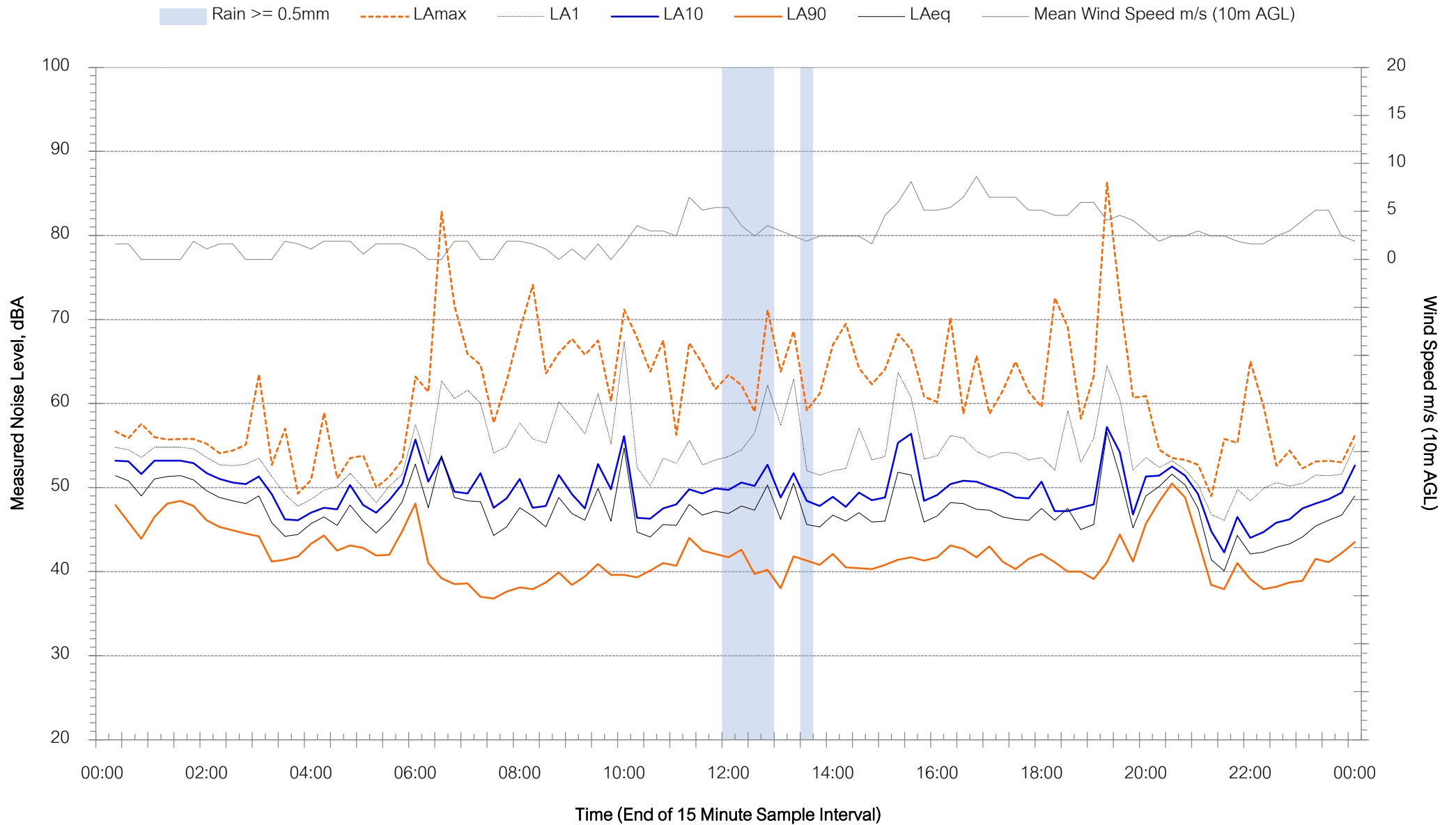
Background Noise Levels

The Southern Parkway, Forster - Tuesday 22 February 2022



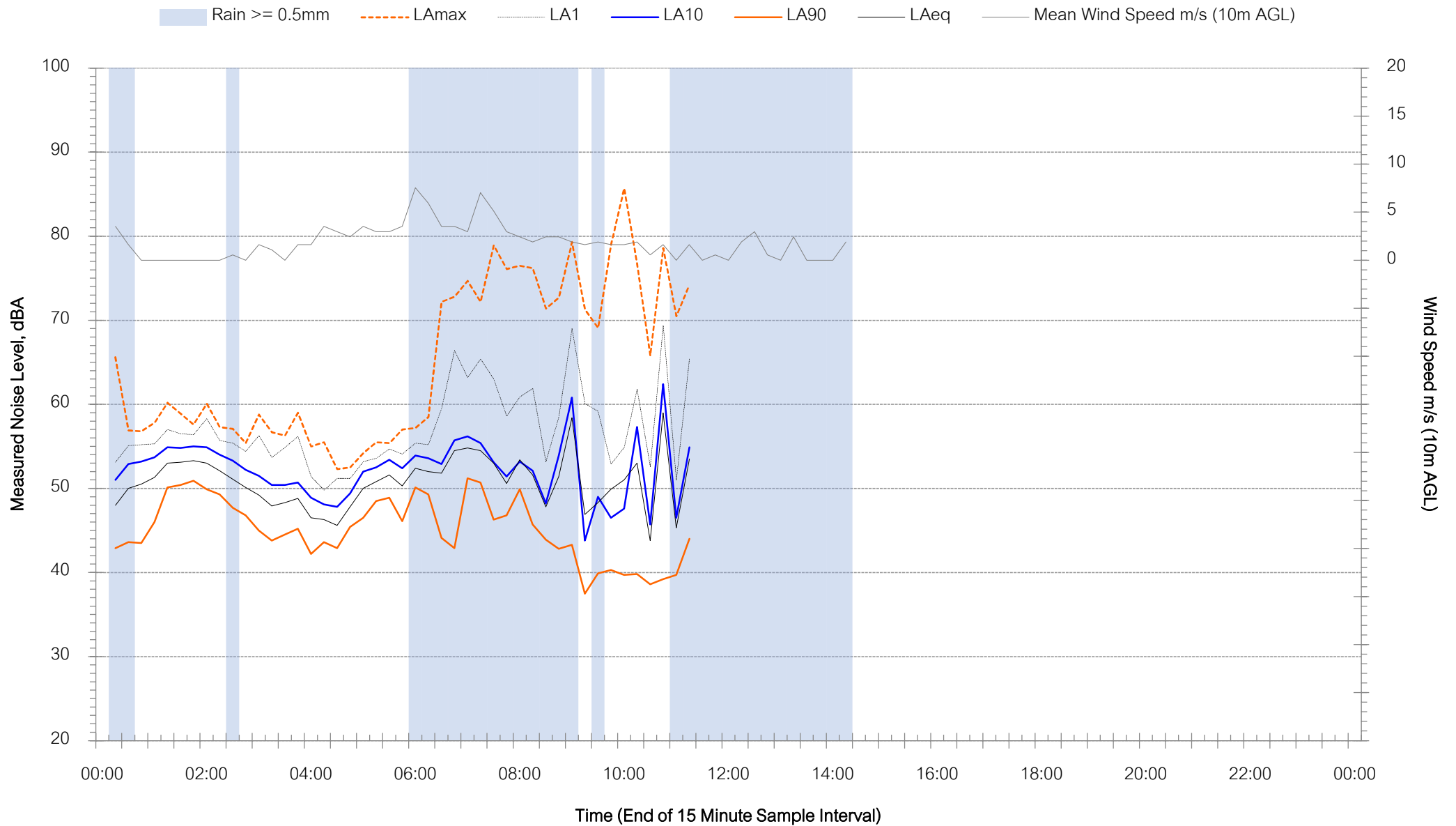
Background Noise Levels

The Southern Parkway, Forster - Wednesday 23 February 2022



Background Noise Levels

The Southern Parkway, Forster - Thursday 24 February 2022



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