Resonate

Wilton Greens Stage 2A

Noise and Vibration Planning Assessment

S230479RP1 Revision A

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Document Information

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Revision Table

Report revision	Date	Description	Author	Reviewer
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Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
Day	Between 7 am and 10 pm as defined in the NSW DECCW Road Noise Policy.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of loudness.
dB(A)	Units of the A-weighted sound level.
DECCW	The Department of Environment, Climate Change and Water.
L_{10}	Noise level exceeded for 10 % of the measurement time. The L_{10} level represents the typical upper noise level and is often used to represent traffic or music noise.
L_{90}	Noise level exceeded for 90 % of the measurement time. The L_{90} level is commonly referred to as the background noise level.
L_{eq}	Equivalent Noise Level—Energy averaged noise level over the measurement time.
L_{max}	The maximum instantaneous noise level.
Night	Between 10.00 p.m. on one day and 7.00 a.m. on the following day as defined DECCW Road Noise Policy
Noise source	Premises or a place at which an activity is undertaken, or a machine or device is operated, resulting in the emission of noise
R_W	Weighted Sound Reduction Index—A laboratory measured value of the acoustic separation provided by a single building element (such as a partition). The higher the R_W the better the noise isolation provided by a building element.
TNR	Traffic Noise Reduction as defined in Australian Standard AS 3671.

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1 Introduction

Resonate Consultants (Resonate) has been engaged by Arcadis Australia Pacific Pty Limited (Arcadis) to conduct a noise and vibration planning assessment (NVPA) associated with Stage 2A of the South East Wilton precinct on behalf of Risland Australia Pty Ltd (Risland). This report is required to support a Development Application (DA) for the Stage 2A development.

Stage 2A of Wilton Greens is exposed to road traffic noise from Picton Road and Hume Motorway as well as potentially from the proposed Maldon-Dombarton Rail corridor. Feasibility studies for the Maldon-Dombarton Rail corridor indicated, if financially viable, the rail link would be constructed to accommodate heavy freight trains.

The purpose of this report is to address anticipated noise and vibration impacts and propose potential mitigation strategies for the subdivision development of Stage 2A. This report is intended to assist in future Development Applications for the residences in Stage 2A and provide advice to assist purchasers, developers, and the Council in designing future residential spaces.

The report's structure includes:

- Identifying noise-affected receivers.
- Measuring existing road traffic noise from Picton Road and Hume Motorway.
- Predicted future traffic volumes for Picton Road, Hume Motorway and main internal roads (by others).
- Evaluating noise assessment objectives according to the State Environmental Planning Policy (Transport and Infrastructure) 2021.
- Model and assess projected road traffic noise.
- Review possible noise and vibration impacts linked to the operational phase of the Maldon-Dombarton Rail corridor. The assessment of potential rail noise and vibration impacts is indicative and to provide an order of magnitude relating to noise and vibration levels and potential mitigation options which are assumed to be the responsibility of the Maldon-Dombarton Rail project proponent.
- Where required develop indicative noise and vibration mitigation strategies for receivers that exceed the noise and vibration criteria.

2 Proposed development

2.1 Background

The Wilton Growth Area is located at the junction of the Hume Motorway and Picton Road in the Wollondilly Shire Council (WSC) Local Government Area (LGA). It comprises seven precincts which will provide housing, jobs, public transport, and community facilities. The Wilton Growth Area and its precincts are shown in Figure 1.

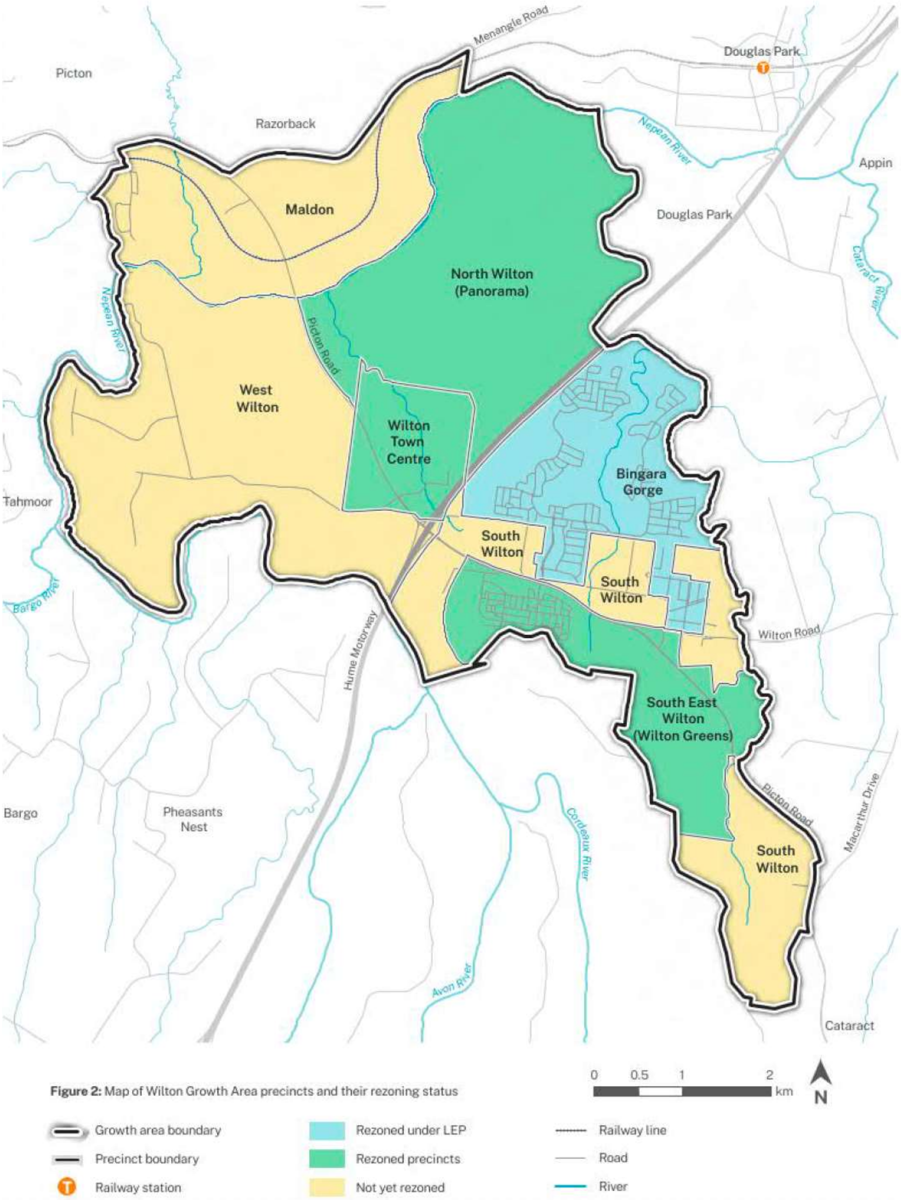

Figure 1 Wilton Growth Area Precincts (excerpt from Wilton Growth Area Update, June 2023, NSW Department of Planning and Environment)

Risland is developing a project called Wilton Greens in the South East Wilton Precinct. Stage 1 is approved and is under construction, and plans for Stages 2 and 3 have been given to WSC. An extract of the Neighbourhood Plan is shown in Figure 2 which indicates the location of the development stages. Stage 2A forms part of the Stage 2.

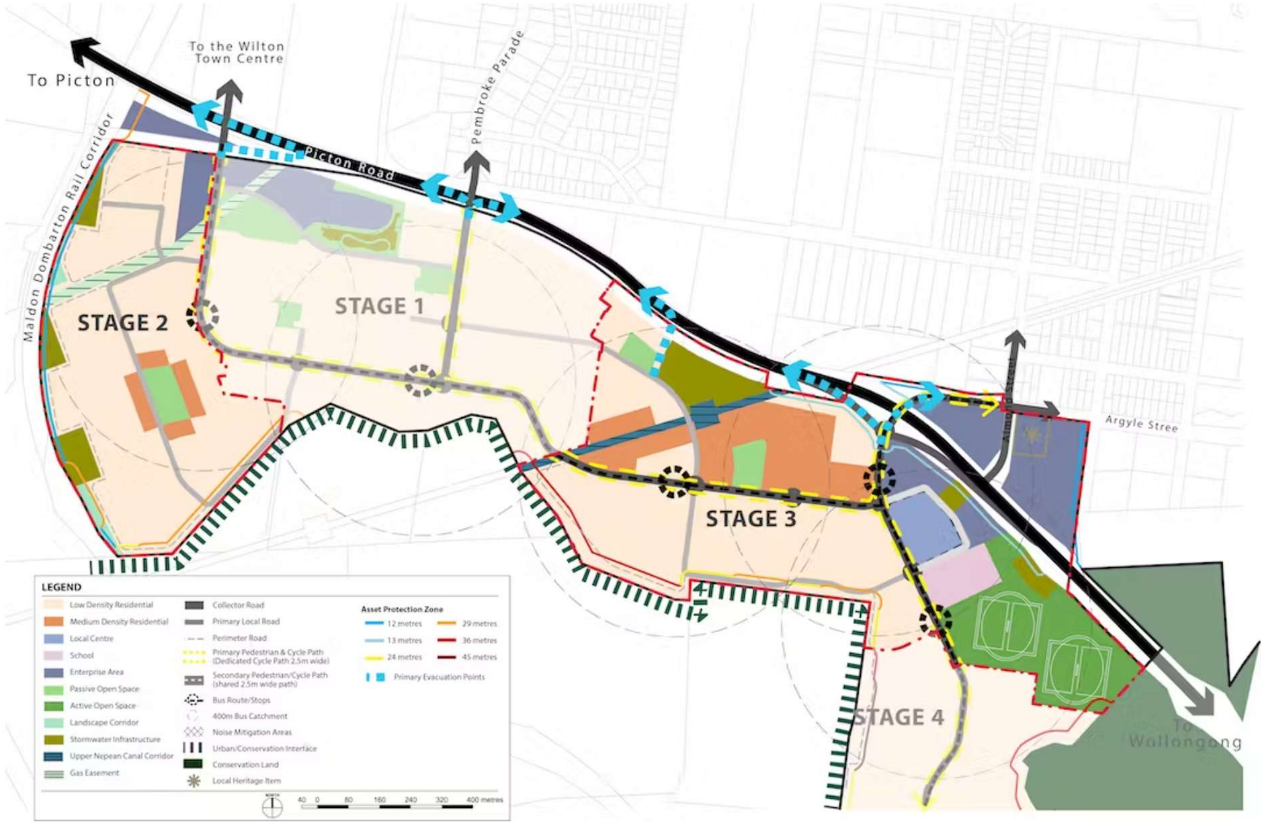

Figure 2 South West Wilton Precinct Neighbourhood Plan No. 1

2.2 Site description

The Project is known as the South East Wilton Precinct Stage 2A and will provide 362 residential lots, which will be accessed via the Stage 1 internal road network. Access to Picton Road will be via the new Picton Road / Pembroke Parade signalised intersection which was part of the Stage 1 development. The Stage 2A project is presented below in Figure 3.

Figure 3 Wilton Greens Stage 2A Subdivision layout and staging plan (excerpt from Indesco DA drawings)

Preliminary assessments have identified that the study area is affected by road traffic noise originating from Picton Road and Hume Motorway. Picton Road serves as a transportation route connecting Wollongong and Port Kembla as well as from Hume Motorway to the west of the site. It's understood that future plans for Picton Road involve the addition of extra bidirectional traffic lanes.

Running to the west and south of the South-East Precinct subdivision land is a corridor designated for the Maldon-Dombarton Rail line. At its closest point, the separation distance between the Stage 2A residential lots and the rail corridor ranges between approximately 30 m and 70 m.

A map showing the location in the Proposal, its surroundings and noise measurement locations is provided in Figure 4.

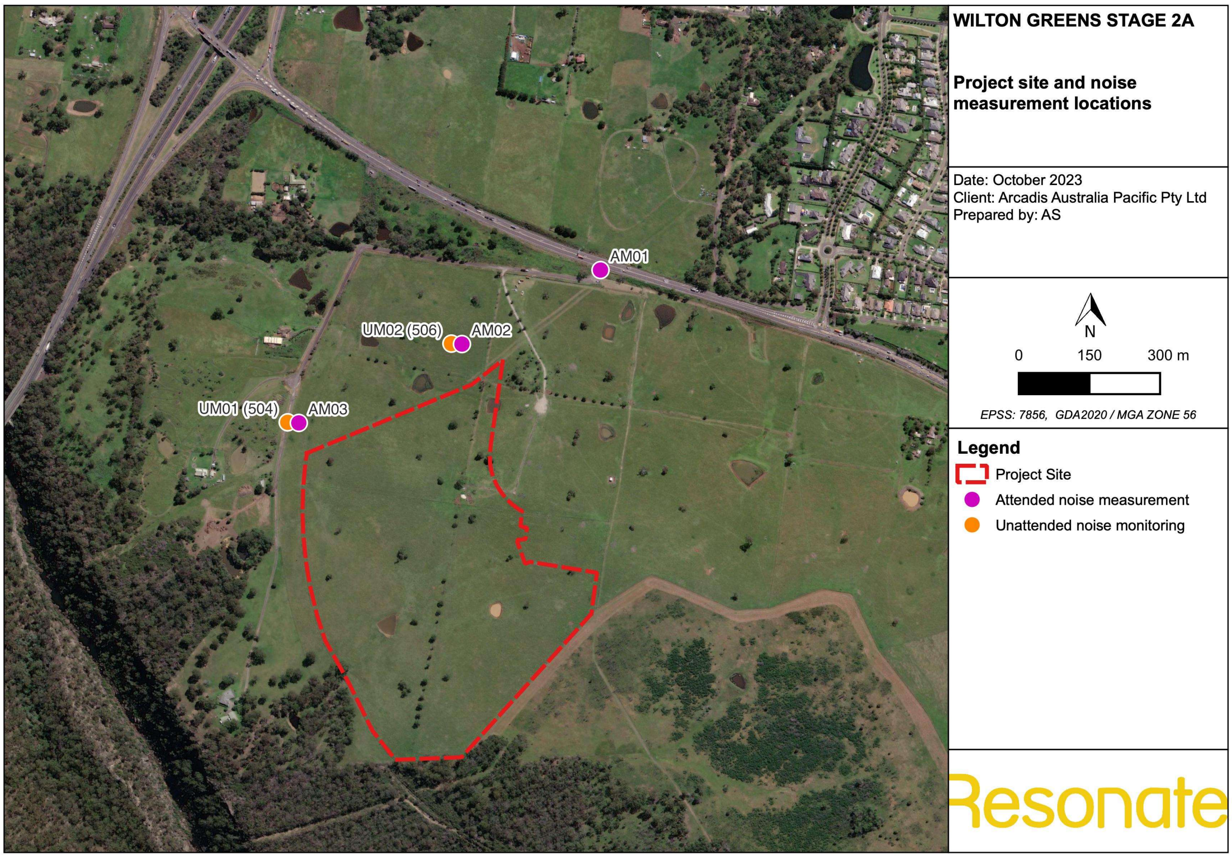

Figure 4 Wilton Greens Stage 2A Subdivision and noise measurement locations

3 Baseline noise survey

3.1 Unattended noise monitoring

In order to characterise the existing acoustical environment of the area unattended noise monitoring was conducted between the dates of Saturday 22 July 2023 and Saturday 29 July 2023 at the logging locations shown in Figure 4. Noise monitoring was conducted to determine the noise level contribution from Picton Road.

Instrumentation for the unattended survey comprised of two Rion NL-42 environmental noise loggers with serial numbers 15-203-504 (UM01) and 15-203-506 (UM02) and fitted with microphone windshield. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. The monitor equipment for noise monitor UM02 (506) when retrieved was found to be damaged by wildlife on site. However, the other noise monitor UM01, calibration of the logger was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A).

The measured noise data was filtered to remove data affected by the nearby Stage 1 construction works and inclement weather conditions including precipitation and wind speeds greater than 5 m/s at an elevation of 1.5 m. 15-minute weather data from the nearest Bureau of Meteorology (BoM) automatic weather station at Campbelltown (station number: 068257), were used to perform this filtering. Noting that the wind speed data that was collected at this station is at the standard instrument height of 10 m, the method outlined in *Converting Bureau of Meteorology Wind Speed Data to local Wind Speeds at 1.5m Above Ground Level,* (Gowan, Karantonis and Rofail, 2004) was used to convert this information to equivalent wind speeds 1.5 metres above ground level. The weather data used in processing the measured noise data has been presented in the noise logger data graphs in Appendix A.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively. Detailed results at the monitoring location are presented in graphical format in Appendix A. The graphs show measured values of L_{A1}, L_{A10}, L_{A90} and L_{Aeq} for each 15-minute monitoring period.

The noise data obtained from the noise logger UM02 has been processed to establish representative ambient noise levels at the monitoring locations during the day and night time periods defined in the RNP. The monitored noise levels are detailed in Table 1 below for the unattended noise monitoring locations shown in Figure 4.

Table 1 Unattended noise monitoring results

Location	Measured noise level – $L_{eq(Period)}$ dB(A)	
	Day (15 hour) 7:00 am - 10:00 pm	Night (9 hour) 10:00 pm - 7:00 am
UM01 (S/N:504)	52	51
UM02 (S/N:506)(1)	-	-

(1) Noise monitor equipment was damaged by wildlife on site and upon review the data was deemed unusable for assessment.

3.2 Operator attended noise measurements

Operator attended noise measurements were conducted at the noise logging location and near Picton Road on Tuesday 1 August 2023. Attended noise measurement at the logger location (AM02 & AM03) was conducted to understand the broader acoustical environment better and to determine if the unattended noise logging device was under the influence of any extraneous noise sources other than Picton Road. The attended noise measurements at location AM01 were conducted to determine the existing road traffic noise levels during peak AM traffic.

Instrumentation for the attended noise survey comprised of a Brüel and Kjaer 2250 sound level meter (serial number 3028219) fitted with microphone windshield. Calibration of the meter was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). The sound level meter carried appropriate and current NATA (or manufacturer) calibration certificates.

The results of operator attended noise measurements are presented in Table 2 below. The attended noise measurement locations are indicated in Figure 4.

Table 2 Operator attended noise measurements

Location	Date	Period	Measured noise level - $L_{eq(15\ minute)}$ dB(A)
AM01 (3m from the kerb)	01/08/23	8:30 am – 8:45 am	76
AM02 (near UM02)	01/08/23	9:00 am – 9:15 am	52
AM03 (near UM01)	01/08/23	9:30 am – 9:45 am	50

4 Criteria

The procedures, criteria, and objectives used to evaluate noise intrusion for the development are outlined in the following documents:

- NSW *State Environment Planning Policy (Transport and Infrastructure) 2021 (SEPP)*
- NSW Environmental Protection Agency (EPA) *Road Noise Policy (RNP)*
- NSW Department of Planning and Environment (DPE) *Development near Rail Corridors and Busy Roads – Interim Guideline (DNRCBR)*

4.1 State Environment Planning Policy (Transport and Infrastructure) 2021

The NSW State Environmental Planning Policy (Transport and Infrastructure) 2021, in Clause 2.100, pertains to the evaluation of noise and vibration for residential properties located near rail corridors. Additionally, Clause 2.120 of the same policy addresses road traffic noise and vibration impacts for non-road developments that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles.

The NSW State Environmental Planning Policy (Transport and Infrastructure) 2021 establishes the noise design assessment targets for road traffic and rail noise in residential developments as follows:

a) For any bedroom within the residential premises, the objective is to achieve 35 dBA during any period between 10:00 PM and 7:00 AM.
b) For all other areas within the residential premises, excluding spaces like the garage, kitchen, bathroom, or hallway, the objective is to maintain noise levels at 40 dBA at any time.

4.2 Road Noise Policy

The NSW EPA Road Noise Policy (RNP) issued by the EPA outlines approaches to assess and mitigate traffic related noise originating from new and redeveloped road projects. The RNP's noise objectives are assessed at external building facades and are linked to specific project types, road classifications and land uses. The RNP criteria related to the project is summarised in Table 3, the RNP also notes land use developers must meet internal noise goals in the Transport and Infrastructure ISEPP (Department of Planning NSW 2021) for sensitive developments near busy roads.

Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment Criteria – dB(A)	
		Day 7 am - 10 pm	Night 10 pm - 7 am
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use development.	$L_{Aeq\ (15\ hour)}$ 60 (external)	$L_{Aeq\ (9\ hour)}$ 55 (external)
Local roads	Existing residences affected by noise from new local road corridors.	$L_{Aeq\ (1\ hour)}$ 55 (external)	$L_{Aeq\ (1\ hour)}$ 50 (external)

4.3 Development near Rail Corridors and Busy Road – Interim Guideline

The NSW Department of Planning - Development near Rail Corridors and Busy Roads - Interim Guideline (2008) (DNRCBR) establishes target levels for evaluating noise from rail and road sources concerning both residential and non-residential buildings. An overview of the DNRCBR assessment levels is outlined in Table 4. In cases involving sensitive developments near busy roads, DNRCBR refers to the target assessment levels for best practical guidance.

Table 4 DNRCBR target noise assessment levels

Type of occupancy	Noise level – dB(A)	Time period
Residential buildings		
Sleeping areas (bedrooms)	$L_{Aeq\ (9\ hour)}$ 35	10:00 pm to 7:00am
Other habitable rooms (excluding garages, kitchens, bathrooms and hallways)	$L_{Aeq\ (9\ hour\ \&\ 15\ hour)}$ 40	Anytime
Non-residential buildings		
Educational institutions including child care centres	L_{Amax} 40	When in use
Places of Worship	L_{Amax} 40	When in use
Hospitals (Wards)	L_{Amax} 35	When in use
Hospitals (Other noise sensitive areas)	L_{Amax} 45	When in use

If the internal target design levels for rail or road infrastructure, when windows/doors are open, surpass the criteria outlined in Table 4 by more than 10 dB, the DNRCBR suggests that ventilation planning for the affected rooms should enable occupants to keep the windows/doors shut if they prefer, while still meeting the ventilation standards of the Building Code of Australia. When windows/doors are open to facilitate natural ventilation, the anticipated reduction in noise along exposed building facades would generally be around 10 dB. Standard window/door configurations featuring standard weight per size glazing typically provide an external noise reduction of approximately 20 dB when the windows/doors are closed.

4.3.1 Screening tests

The DNRCBR offers screening test methodologies to determine the necessity of in-depth examinations regarding the potential impact of road and rail traffic noise exposure on dwellings.

Rail noise

In relation to rail freight services, the DNRCBR (Section 3.5.1) provides guidance on the degree of noise assessment required when noise-sensitive developments are situated close to a rail line. The DNRCBR recommends conducting a noise assessment for residences located within a distance of 60 m (for freight trains travelling less than 80 km/h) and 80 m (for freight trains travelling greater than or equal to 80 km/h) from operational tracks.

Rail vibration

The illustration of Figure 3.2 of the DNRCBR presented in Figure 5 depicts the vibration evaluation zone for typical development sites adjacent to rail corridors or above rail tunnels. It might be necessary to enlarge this assessment zone in specific areas where vibration problems are already acknowledged. Projects within this designated area will require a vibration assessment.

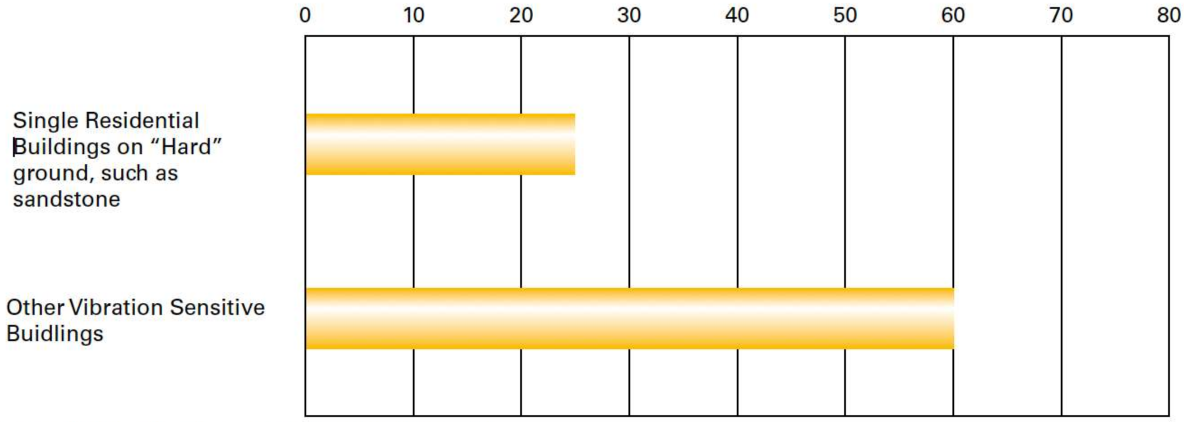

Figure 3.2: Distance from the nearest operational track (m)

Figure 5 Screening test for assessing rail vibration exposure

Road traffic noise

The screening test to assess road traffic for the project is presented in Figure 3.3a of the DNRCBR, it considers direct line of sight of the road, the road traffic volumes and the distance between the road and façade of the buildings being assessed. The screening test has no consideration for noise mitigation provided by noise barriers such as acoustic mounds and walls or intervening buildings. Based on the traffic volume of Picton Road, the screening test presented in Figure 6 show that single or dual occupancy dwellings within 300 meters of the Picton Road corridor require acoustic treatment and therefore a more detailed assessment to mitigate road traffic noise exposure.

The mitigation categories proposed are based on windows and doors closed and therefore consideration of ventilation requirements for habitable areas exposed to road traffic noise will be required to be assessed to ensure they also meet the requirements of the Building Code of Australia.

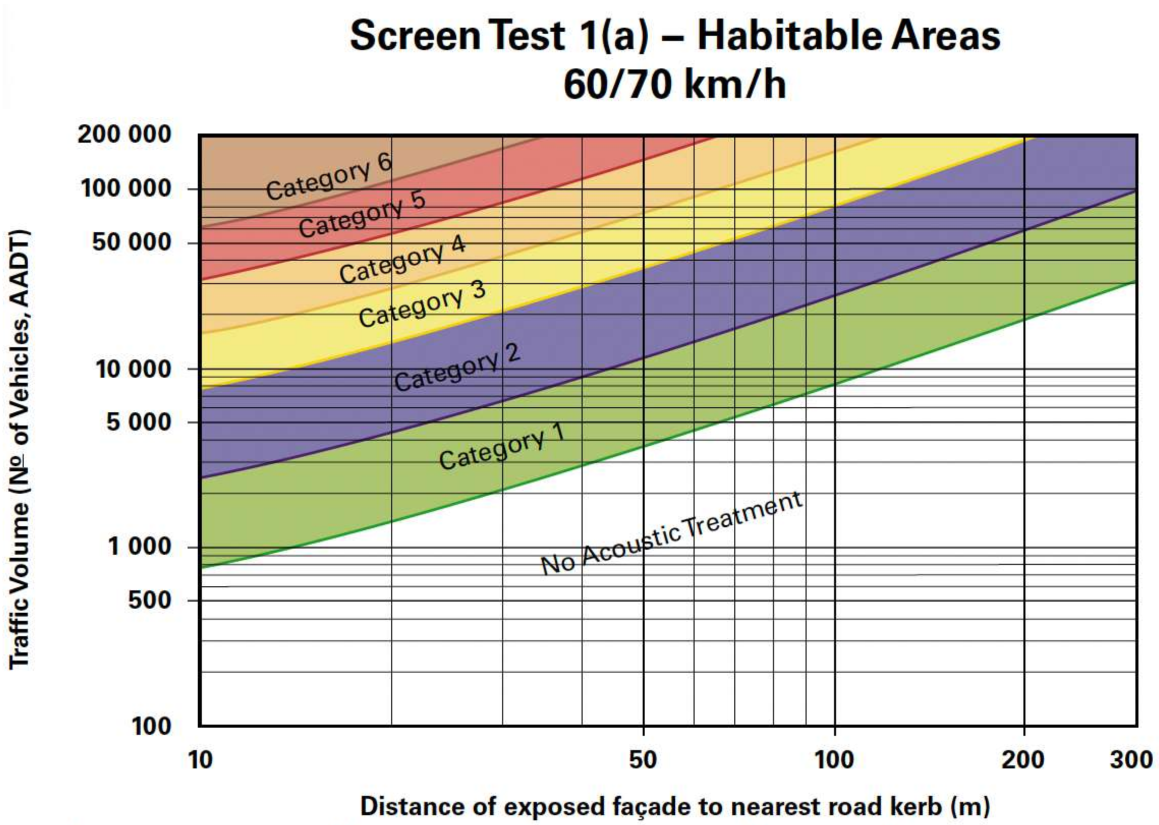

Figure 3.3(a): Screen tests for habitable areas of single/dual occupancy dwellings (if any exposed façade is direct line-of-sight)

Figure 6 Screening test for assessing road traffic noise exposure

4.4 Project specific criteria

Based on the aforementioned guidelines, the internal noise benchmarks recommended in SEPP (Transport and Infrastructure) 2021 and DNRCBR were adopted for the assessment of traffic noise originating from Picton Road.

To address traffic noise from the main internal roads shown in Figure 7 the RNP $L_{Aeq\ (1\text{-}hour)}$ internal target noise criteria was adopted.

For the purpose of evaluating potential noise and ground vibration from the operation of the proposed Maldon-Dombarton Rail corridor, the specifications in SEPP (Transport and Infrastructure) 2021 and DNRCBR were taken into consideration.

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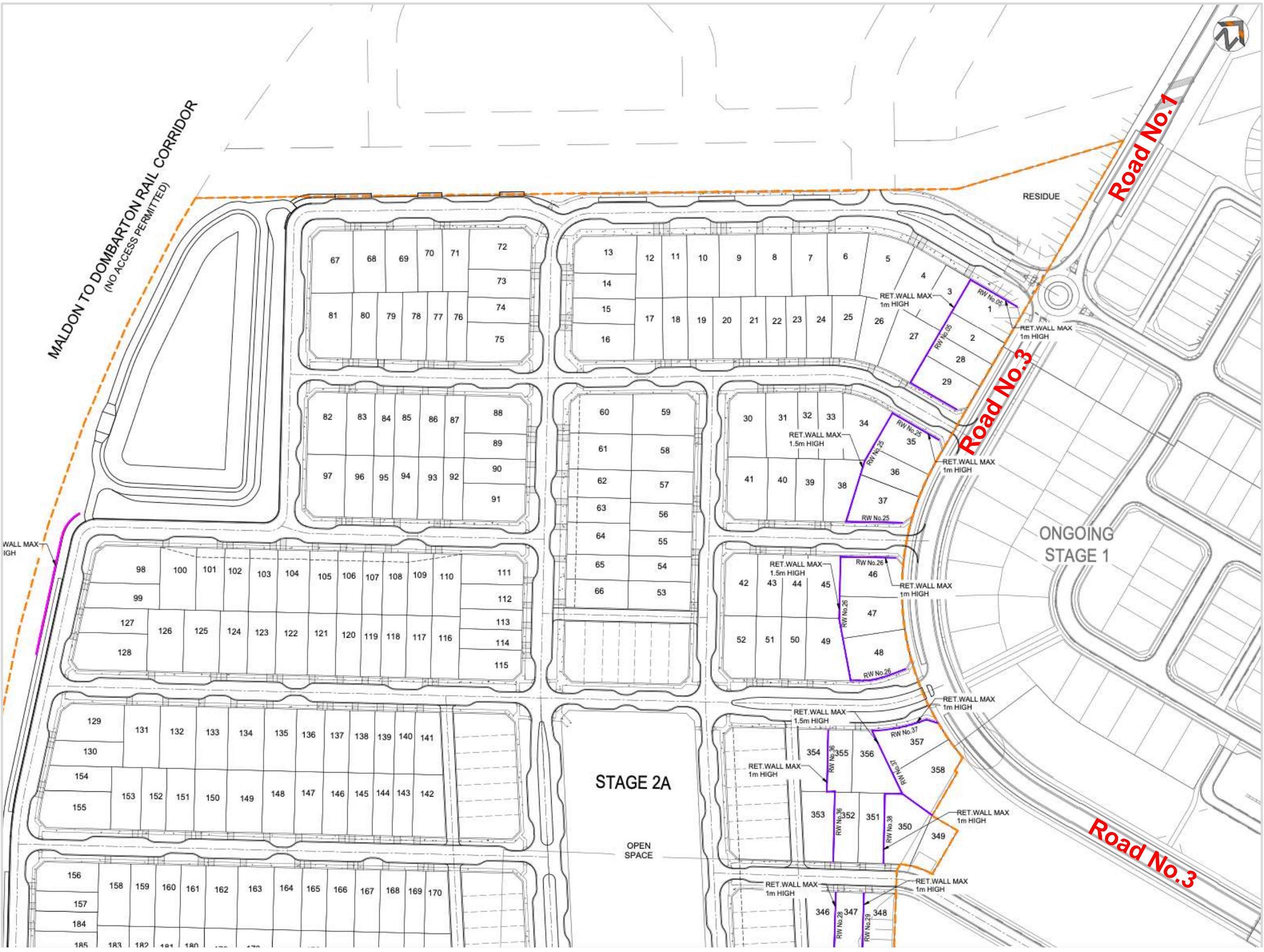


Figure 7 Main internal roads impacting Stage 2A (Road No.1 & Road No.3)

5 Road traffic noise assessment

5.1 Methodology

The noise model for Stage 2A road traffic noise impacts was derived using the UK Department of Transport's CoRTN algorithm using SoundPLAN V9.0. The use of CoRTN in SoundPLAN is routine for road traffic noise assessments in NSW. The noise modelling considers factors like the directionality of the source, the landscape, absorption by the air and ground, attenuation over distance, and the attenuation effects of noise barriers.

The CoRTN model estimates L_{A10}, 1 hour levels, whereas the SEPP, RNP, and DCP require L_{Aeq} levels. A 3dB[1] difference was used to determine the L_{Aeq} levels from the LA10 levels. Noise source elevations were established at 0.5m for cars, 1.5m for large vehicles, and 3.6m for the exhausts of large vehicles. Adjustments of -0.6dB for large vehicle engines and -8.6dB for truck exhausts were made to the CoRTN values.

The noise modelling included the following:

- Future Picton Road traffic volumes for year 2036 (Wilton South East - Daily traffic volume forecasts report by WSP, dated November 2018).
- Future Hume Motorway traffic volumes for year 2034 (North Wilton Sub-Arterial Road and Stage 1 Subdivision Noise Assessment report by Atkins Acoustics, dated October 2019).
- Future main internal roads traffic volume (Wilton South East Precinct Stage 1 Road and Rail Noise Planning Assessment by Atkins Acoustics, dated December 2018).
- Existing traffic volumes for Picton Road (Transport for NSW, Traffic volume viewer, Station ID 6179).
- Ground topography for the subdivision.
- Subdivision lot and road layout.
- Projected traffic speeds of 80 km/h for Picton Road and 50 km/h for main internal collector roads.
- +2.5dB building façade correction for predicted noise contours at 1.5 metre and 4.5 metre heights.

5.2 Road traffic volumes

Current traffic data from 2023 for Picton Road is sourced from Count Station 6179. The documented weekday 24-hour traffic count is at 22,396 vehicles, of which 46.1% were heavy vehicles. On average, over a seven day week, the 24-hour count was 21,239 vehicles with 38.4% being heavy vehicles. Figure 5 showcases the hourly traffic data in both directions and the vehicle types for Picton Road in 2023.

[1] RMS Model Verification Guideline

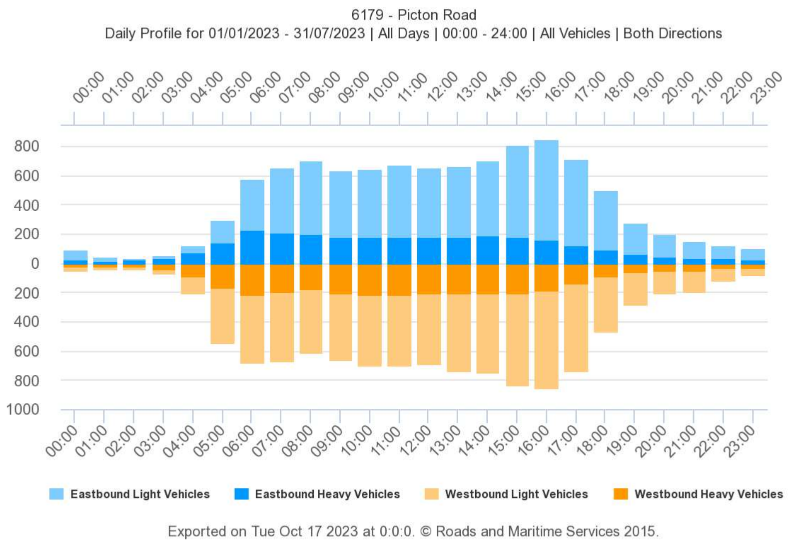


Figure 8 Picton Road Daily Traffic Profile (2023)

Traffic estimates for Picton Road to the east of Pembroke Parade for the year 2036 can be found in the report titled 'WSP Wilton South East - Daily traffic volume forecasts', dated 30 November 2018, as presented in Table 5.

Table 5 Picton Road traffic volumes (2036)

Direction	Weekday Daily (vehicles)			Daytime (7:00am - 10:00am)			Night-time (10:00pm – 7:00am)		
	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy
Eastbound	12700	10100	2600	11000	8500	2400	1700	1000	700
Westbound	11200	8700	2500	9200	7000	2200	2100	1400	600
Total	23900	18800	5100	20200	15500	4600	3800	2400	1300

Traffic volumes for the Hume Motorway located to the east of Stage 2A can be found in the report titled 'North Wilton Sub-Arterial Road and Stage 1 Subdivision Noise Assessment' by Atkins Acoustics, dated October 2019, as presented in Table 6

Table 6 Hume Motorway traffic volumes (2034)

Direction	Weekday Daily (vehicles)			Daytime (7:00am - 10:00am)			Night-time (10:00pm – 7:00am)		
	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy
Total	66800	55444	11358	55444	36039	19405	11358	9314	2044

Projected L_{Aeq} 1-hour peak traffic estimates for the main internal roads for Stage 1 in the South-East Precinct that relate to Stage 2A are summarised in Table 7, with locations depicted in Figure 7.

Table 7 Peak hour traffic volumes for main internal roads

Road description	Peak Hour Traffic Volumes
Road No.1 (between Picton Road and Road 2)	907
Road No.3 (between Road 2 and Roads 8/11)	667
Road No.3 (between Road 8/11 and Roads Road 4)	560

5.3 Noise model verification

The noise model was verified using 2023 traffic data, the current road layout, and existing landform contours. This validation aimed to compare predicted levels with noise measurements taken at specific measurement locations. The predicted and measured noise levels are presented in Table 4.

Table 8 Noise model validation

Location	Measured noise level		Predicted noise level		Measured - Predicted	
	$L_{Aeq\ 15\ hour}$	$L_{Aeq\ 9\ hour}$	$L_{Aeq\ 15\ hour}$	$L_{Aeq\ 9\ hour}$	$L_{Aeq\ 15\ hour}$	$L_{Aeq\ 9\ hour}$
UM01 (504)	52	51	51	49	1	2

The results of the noise model validation in Table 8 shows that the difference between the measured and predicted noise levels are within the acceptable range of ± 2 dB(A), therefore no further model correction factors are required.

5.4 Predicted external road traffic noise levels

The noise modelling indicates that the traffic noise from the Hume Motorway and Picton Road will propagate across Stage 2A and surpass the recommended external noise levels for the residences within Stage 2A.

The predicted noise contours from nearby busy roads are provided in Appendix B and are based on the future traffic volumes (2036) on Picton Road and future traffic volumes from the Hume Motorway (2034) have been assessed. The noise contours do not consider any sound reduction due to buildings or structures within the subdivision. Any buildings and structures erected within the subdivision between Picton Road and/or the Hume Motorway and potential noise-sensitive receivers would likely offer added noise reduction for those receivers. The noise contours also include a +2.5 dB facade correction.

For the residences within Stage 2A the predicted daytime traffic noise levels form the Hume Motorway and Picton Road range from $L_{Aeq\ 15\ hour}$ 50-60 dB and exceed the external noise level criteria of $L_{Aeq\ 15\ hour}$ 50 dB. The predicted noise levels for the night-time are $L_{Aeq\ 9\ hour}$ 45-55 dB and exceed the external noise level criteria of $L_{Aeq\ 9\ hour}$ 45 dB for the northern half of Stage 2A.

The predicted noise contours in Appendix B identify the residential lots that exceed the external noise level criteria and will require additional noise mitigation to achieve the internal noise levels of the DNRCBR. Based on the assessment procedures of the DNRCBR and the Australian Standard AS 3671 'deemed to satisfy' constructions to attenuate the traffic noise are presented in Appendix B.

Residential lots within Stage 2A that front the main internal roads (Road 1 and Road 3) identified in Figure 7 have a predicted daytime peak hour traffic noise level $L_{Aeq\ 1\ hour}$ 60-63 dB on the ground floor and $L_{Aeq\ 1\ hour}$ 60-65 dB on the first floor. To achieve the RNP internal design noise level ($L_{Aeq\ 1\ hour}$ 40 dB) Traffic Noise Reduction (TNR) of up to 20-25 dB(A) is required.

5.5 Construction treatment categories

The process to establish the necessary traffic noise reductions and the construction elements needed to meet the DNRCBR internal noise levels are noted in Australian Standard 3671. Table 5 lists the typical traffic noise reduction categories used for evaluating preliminary building design elements.

Table 9 Traffic noise reduction categories

Description	Traffic Noise Reduction, dB(A)	Recommended constructions
Category 1	< 10	Standard constructions: openings including open windows and doors may comprise up to 10% of the exposed façade.
Category 2	10 - 20	Standard construction, except for light weight elements such as fibrous cement or metal cladding or all-glass facades. Windows, doors and other openings must be closed. Mechanical ventilation installed.
Category 3	20 - 25	Acoustically upgraded wall and roof constructions. Windows/doors chosen and installed with Q-Lon or equivalent acoustic seals. All windows/doors and openings sealed. Mechanical ventilation installed.
Category 4	25 - 30	Acoustically upgraded wall and roof constructions. Windows/doors chosen and installed with Q-Lon or equivalent acoustic seals. All windows/doors and openings sealed. Mechanical ventilation installed.
Category 5	> 30	Special acoustic design advice required. Mechanical ventilation installed.

6 Rail noise and vibration assessment

The feasibility study for the Maldon-Dombarton Rail Link from September 2011 indicated that by integrating two passing loops of 1500m each, the rail line could accommodate an estimated 25 freight train movements daily.

Concerning freight train noise, both the ARTC and Sydney Trains are licensed by the NSW EPA. One of the main goals of these EPA licenses is to steadily decrease noise from freight trains through the adoption of Pollution Reduction Programs. Within the scope of these Environmental Protection Licenses, specific noise thresholds are established for a range of operational scenarios.

To evaluate potential noise and vibration risks and consider mitigation solutions, the Department of Planning offers acoustic planning guidelines in their document titled "Development near Rail Corridors and Busy Roads – Interim Guideline" (DNRCBR).

In cases where there's no noise contour mapping derived from real operational conditions, DNRCBR directs evaluations using zones determined by the distance from the active rail track (excluding the corridor). These zones serve as preliminary acoustic evaluation areas where sensitive land uses might be negatively impacted.

- DNRCBR does not mandate noise assessments for sensitive land developments located over 60m away from a railway track with a speed restriction under 80 km/h.
- For ground vibration the DNRCBR assessment zone for residential developments is within 25 metres of the railway corridor.

The distance from the nearest lot boundaries to the available rail corridor is typically in the range of 30m (distance from lot boundary to nearest corridor boundary) to 70m (distance from lot boundary to furthest corridor boundary). It must be noted that there is no current available design information to indicate exactly what the track layout would be through this section of the rail corridor.

It is assumed that should the Maldon-Dombarton recommence development, potential rail noise and vibration impacts would be assessed, and mitigation provided to the Wilton Greens Stage 2A development.

For context, the Maldon-Dombarton Rail link would be considered a new rail line and would be assessed against the NSW EPA Rail Infrastructure Noise Guideline (RING) which for new rail developments would have assessment criteria of daytime $LA_{eq\ 15\ hour}$ of 60 dB and night-time $L_{Aeq\ 9\ hour}$ 55 dB and L_{Amax} 80 dB, assessed at 1 metre from the façade. We also note that the track may be located on a curve and that curve squeal would need to be considered in any future assessment of impacts by the Maldon to Dombarton to the residences of Stage 2A.

For rail vibration, future residential developments would be located outside the 25m screening distance and therefore further vibration assessment is not required.

Notwithstanding and noting that the future rail track could potentially be located inside the 60m noise screening distance depending on the design of the rail corridor, an estimation of potential noise levels from freight activity at the nearest Stage 2A lot boundaries has been undertaken based on the following assumptions:

- 2x Freight trains (2 locomotives and 1000m of freight wagons for each train):
  - 25 trains per day, which would equate to approximately:
    - 16 during the 15 hour daytime period
    - 9 during the 9 hour night-time period
- Train speed: 80 km/h
- Curve squeal correction: 0 dB
- Receiver is 1.5m in height at various offset distances.

- No buildings or structures are between the active rail track and distances assessed. Any buildings and structures erected within the subdivision between rail track and potential noise-sensitive receivers would likely offer added sound protection for those receivers.

The results of the indicative predicted noise levels from freight trains are presented in Table 10 for various offset distances from the rail corridor.

Table 10 Estimated indicative noise impacts from freight rail track

Distance from rail track	Day $L_{Aeq\ 15\ hour}$			Night $L_{Aeq\ 9\ hour}$			Night L_{Amax}	
	Estimated external noise level	DNRCBR External Criteria	RING External Criteria	Estimated external noise level	DNRCBR External Criteria	RING External Criteria	Estimated external noise level	RING External Criteria
30m	61	50	60	61	45	55	85	80
70m	57	50	60	57	45	55	81	80
150m	53	50	60	53	45	55	77	80
250m	51	50	60	51	45	55	75	80
525m	47	50	60	47	45	55	69	80

It is noted that the distance to the nearest residences from the rail corridor for Stage 2A is approximately 30m. Based on the estimated external noise level at 30m of 61 dB(A) and no screening from structures between the rail track and these residential receivers, the residences at this distance should have 'deemed to satisfy' indicative noise treatments of Category 3 for living areas and Category 4 for bedrooms presented in Appendix B to meet the requirements of the DNRCBR. Category 1 to Category 2 treatments would be required at distances beyond this.

The results in Table 10 show that the RING external criteria would be met at minimum distances of 150m from the rail track. Further noise mitigation in the form of buildings and structures erected within the subdivision between the rail track and potential noise-sensitive receivers would likely further reduce the noise levels at residential receivers within Stage 2A. The RING would require consideration of mitigation measures including at source measures (such as quieter rollingstock and judicious maintenance), path controls such as noise mounds and noise walls followed by at property acoustic treatments.

Resonate

7 Discussion

7.1 Hume Motorway and Picton Road

The Hume Motorway and Picton Road predicted daytime traffic noise levels from these roads are to be $L_{Aeq\ 15\ hour}$ 50-60 dB which exceeds the recommended external design level of $L_{Aeq\ 15\ hour}$ 50 dB for habitable areas. Similarly, for the night-time period, the predicted noise levels are $L_{Aeq\ 9\ hour}$ 45-55 dB which exceeds the external target of $L_{Aeq\ 9\ hour}$ 45 dB for sleeping areas.

Therefore, acoustically upgraded building elements and a requirement to keep windows/doors closed are essential to further mitigate the external noise levels. To achieve the internal noise levels of the DNRCBR ($L_{Aeq\ 15\ hour}$ 40 dB and $L_{Aeq\ 9\ hour}$ 35 dB) TNR of up to 20 dB for living spaces and up to 25 dB for sleeping areas are required.

7.2 Main internal roads

For residential lots bordering the main internal roads (as shown in Figure 10) and traffic volumes specified in Table 6, the anticipated daytime peak hour noise levels are between $L_{Aeq\ 1\ hour}$ 60-63 dB on the ground floor and $L_{Aeq\ 1\ hour}$ 60-65 on the first floor, which exceed the external noise of $L_{Aeq\ 1\ hour}$ 40 dBA. To meet the internal noise levels of the DNRCBR ($L_{Aeq\ 15\ hour}$ 40) a TNR of up to 25 dB for living areas will be required.

7.3 Maldon-Dombarton Rail corridor

An indicative the assessment is provided in section 6 and shows that noise mitigation from the rail corridor would likely be required to prevent adverse noise impacts for the nearby residences within Stage 2A whether it is provided up front or retrospectively by the rail project development. Potential mitigation options which are assumed to be the responsibility of the Maldon-Dombarton Rail project proponent was also provided in Section 6.

For rail vibration, the future Stage 2A residential developments would be located outside the DNRCBR 25m screening distance and therefore further vibration assessment is not required in accordance with the DNRCBR.

7.4 Mechanical ventilation

Generally, noise reduction across a typical residential building façade with windows/doors open (covering up to 10% of the floor area) is approximately 10 dB. Therefore, in residences where the external traffic noise levels surpasses the suggested interior levels by more than 10 dB, windows/doors need to remain closed. When windows/doors are closed, noise reductions are approximately 20 dB(A) for standard constructions. In areas where more than 20 dB of noise reduction is required, additional acoustic design mitigations are required. This additional mitigation would include acoustic upgrades of window/door glazing, types of facades, and roofs/ceilings. If windows/doors are required to remain closed to meet internal noise level requirements, alternate ventilation methods must be installed and should satisfy the requirements of the Building Code of Australia (BCA).

7.5 Road traffic noise control treatments for residential accommodation

In order to achieve the recommended DNRCBR internal noise levels for the Stage 2A residences 'deemed to satisfy' indicative noise treatments have been determined for residences that exceed the recommended external façade noise levels. These indicative noise treatment recommendations are provided in the context of a typical modern residential 'project home' with living areas on the ground floor and sleeping areas on the first floor.

The noise treatment recommendations are based on adjustments to a standard brick veneer structure with internal plasterboard linings or a double brick construction. They also consider roofs made of concrete/terracotta tiles or metal deck with acoustic insulation and plasterboard ceilings. The acoustic recommendations also factor in exterior solid core doors equipped with acoustic seals as well as mechanical ventilation in accordance with the BCA. For residences that require a category 3 and/or category 4 noise treatments it is essential that builders, developers or project managers obtain acoustic performance verification prior to installation.

Table 9 and Figure 10 displays an overview of residential lots identified that require 'deemed to satisfy' indicative noise treatment categories for road traffic noise levels to meet the internal noise level requirements of the DNRCBR. Appendix C presents detail on the recommendations for each noise treatment category.

Figure 9 Recommended noise treatment categories for ground floor living areas (note screening from buildings not considered)

Figure 10 Recommended noise treatment categories for first floor sleeping areas (note screening from buildings not considered)

It should be noted that the above figures assume all sleeping areas would be located on the first floor. If sleeping areas are located on ground floor then treatments should be applied on the ground floor in accordance with the plan shown in Figure 10.

Notwithstanding, the future design and construction of future individual dwellings should consider the noise and vibration environment specific to the proposed building floor plan.

8 Conclusion

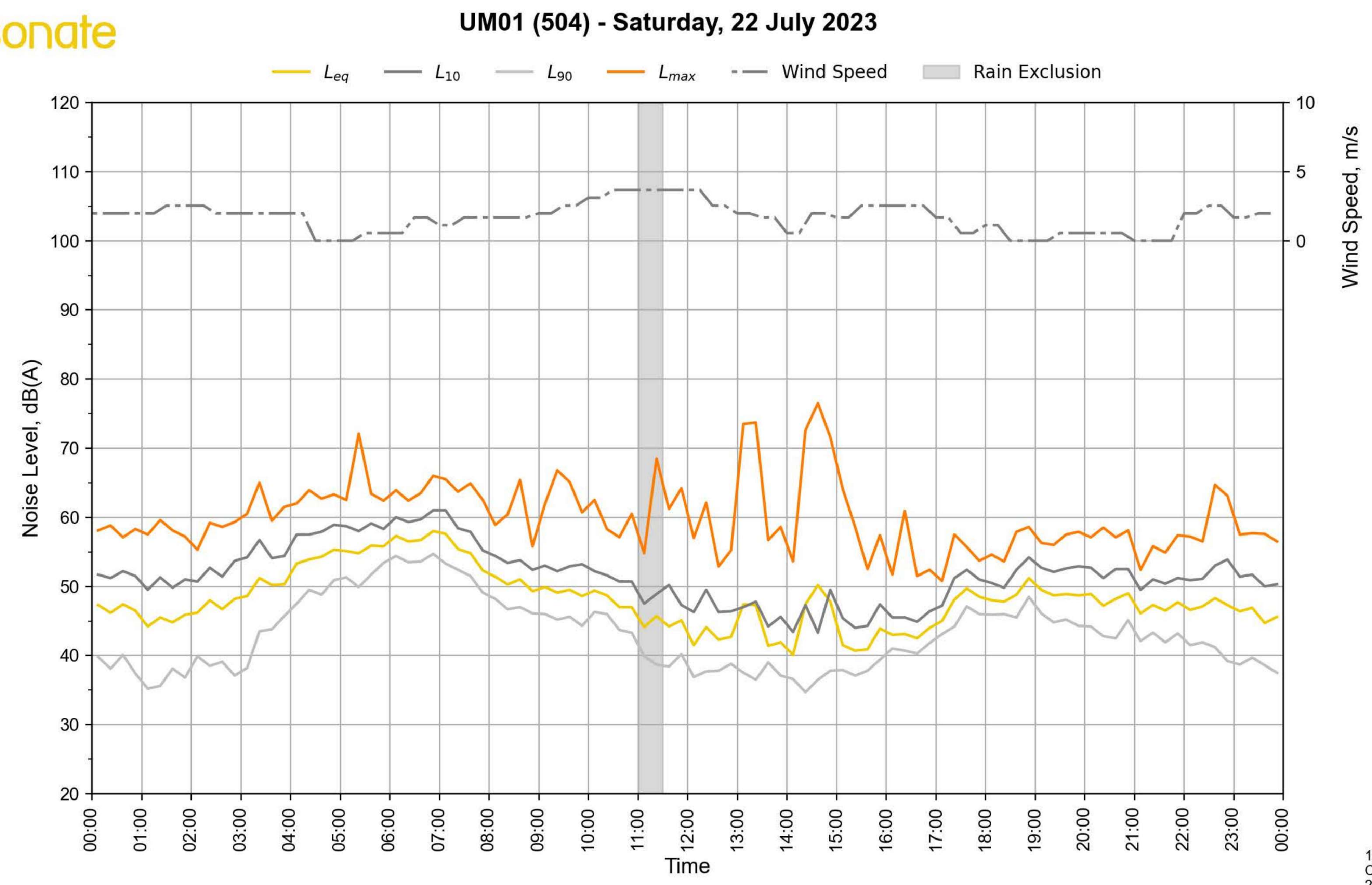
Resonate was engaged by Arcadis to conduct a noise and vibration planning assessment (NVPA) associated with Stage 2A of the South East Wilton precinct on behalf of Risland. This report is required to support a Development Application for the Stage 2A development.

Stage 2A of Wilton Greens is impacted by road traffic noise from Picton Road, Hume Motorway and the main internal roads, as well as potential noise and vibration impacts from the proposed Maldon-Dombarton Rail corridor. Both the road and rail noise and vibration impacts to Stage 2A were assessed in Section 5 and Section 6 respectively. Discussions on the noise and vibration assessment outcomes are provided in Section 7.

Based on these outcomes the Stage 2A residential lots that are predicted to exceed internal criteria of the DNRCBR for habitable areas and sleeping areas have been identified in Section 7.5. Recommended noise treatment categories are provided in Figure 9 and Figure 10 for these residential lots to meet the internal noise level requirements of the DNRCBR. The recommendations for each noise treatment category are outlined in Appendix C.

Appendix A – Unattended noise monitoring

Resonate



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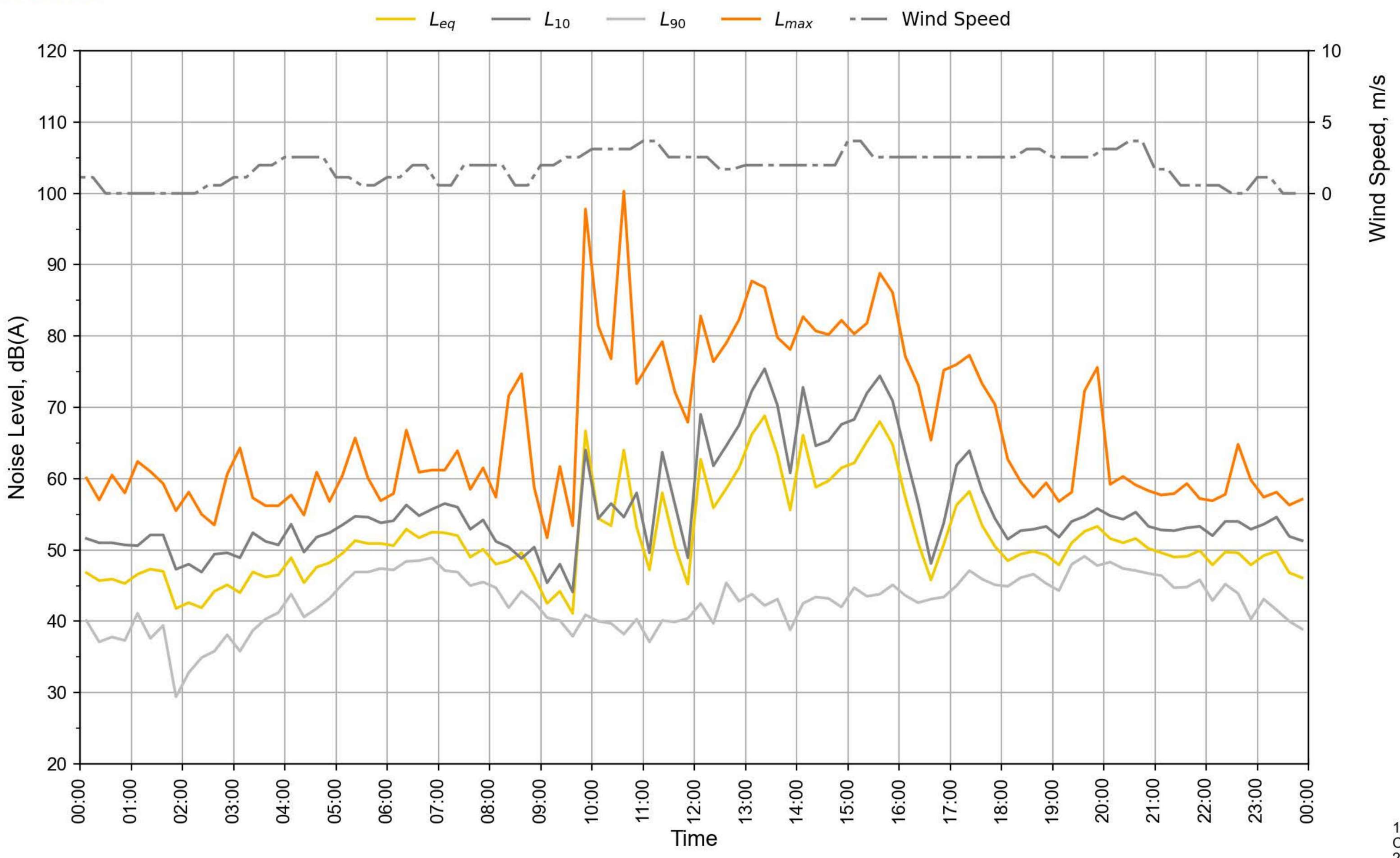

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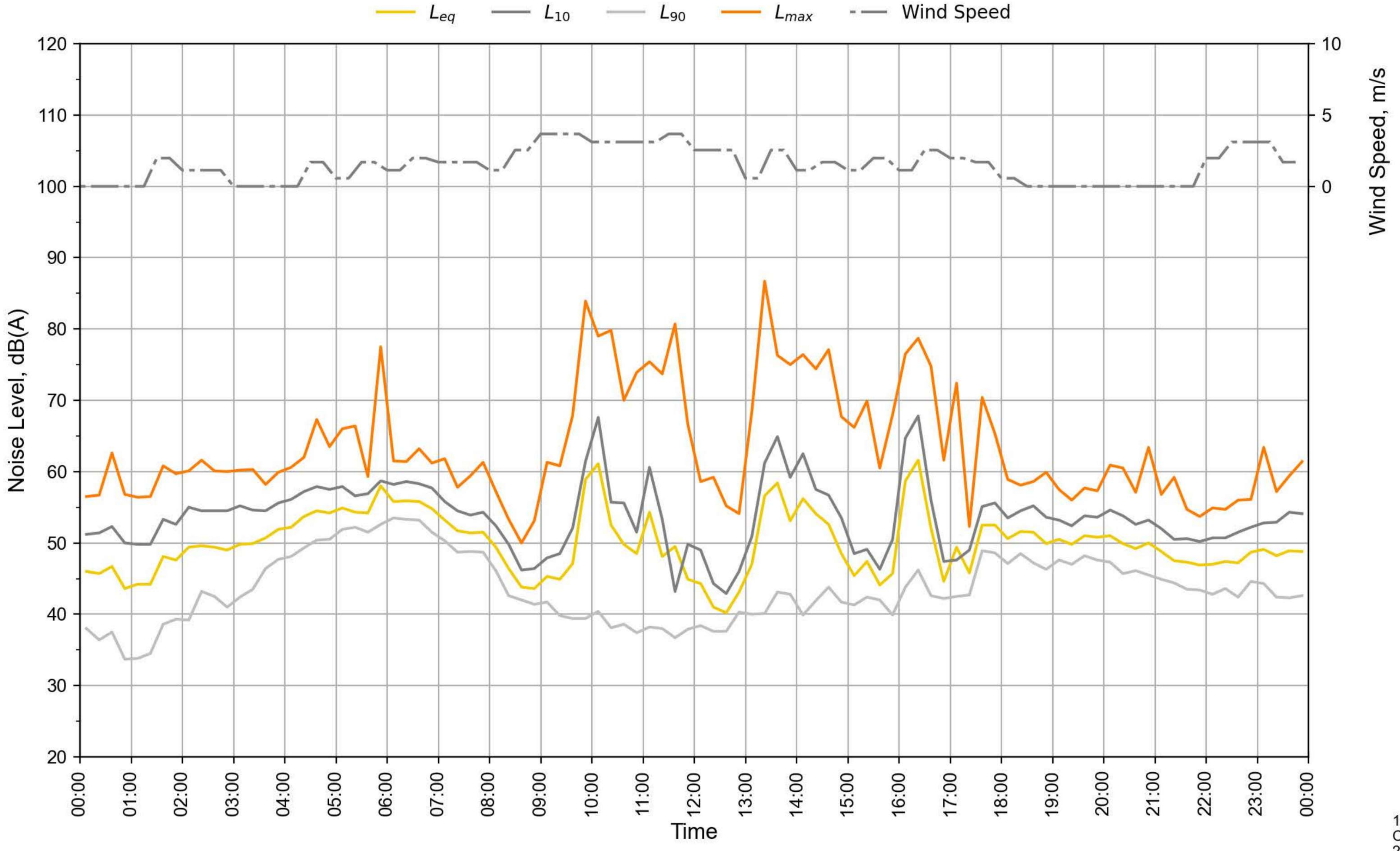

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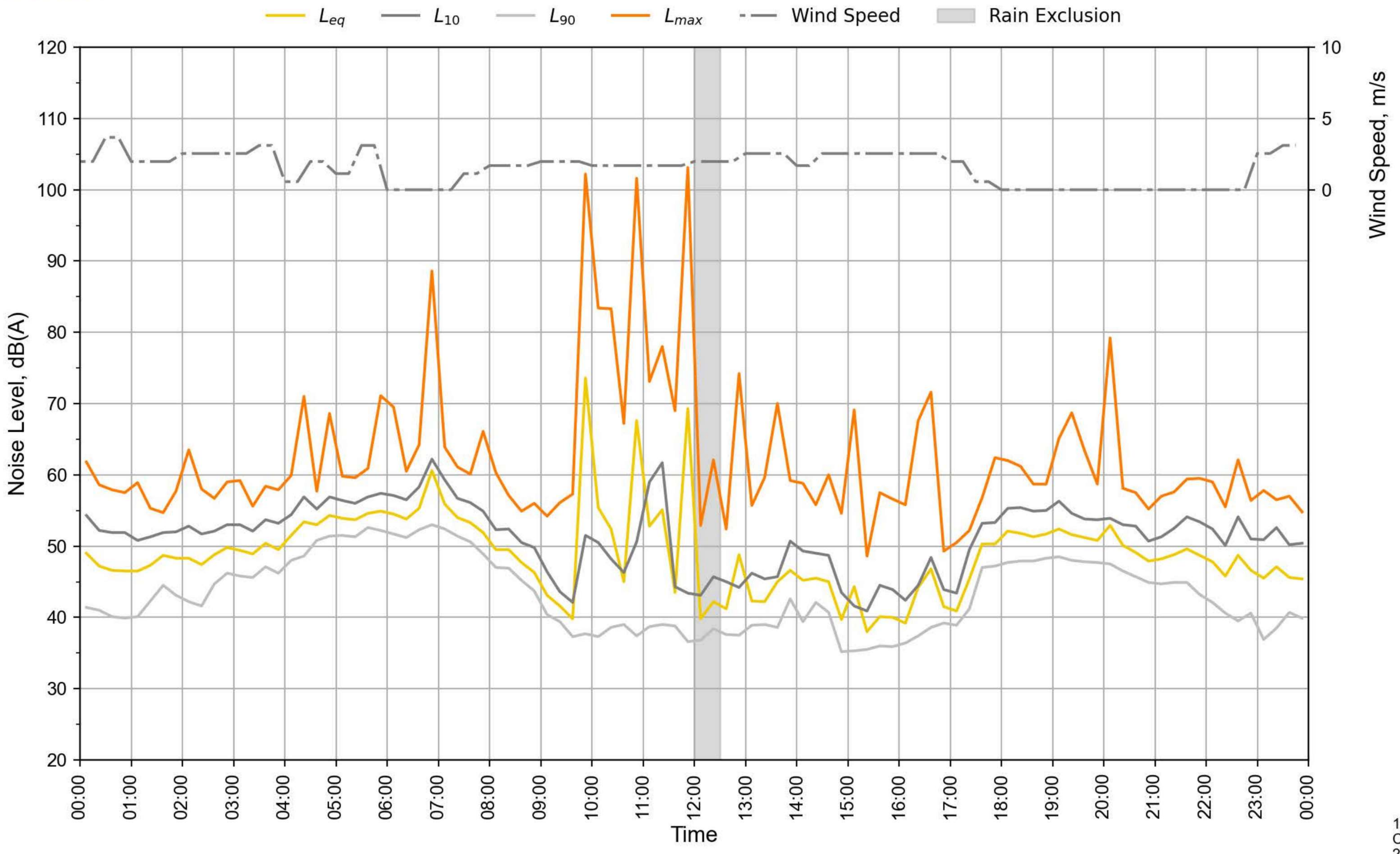

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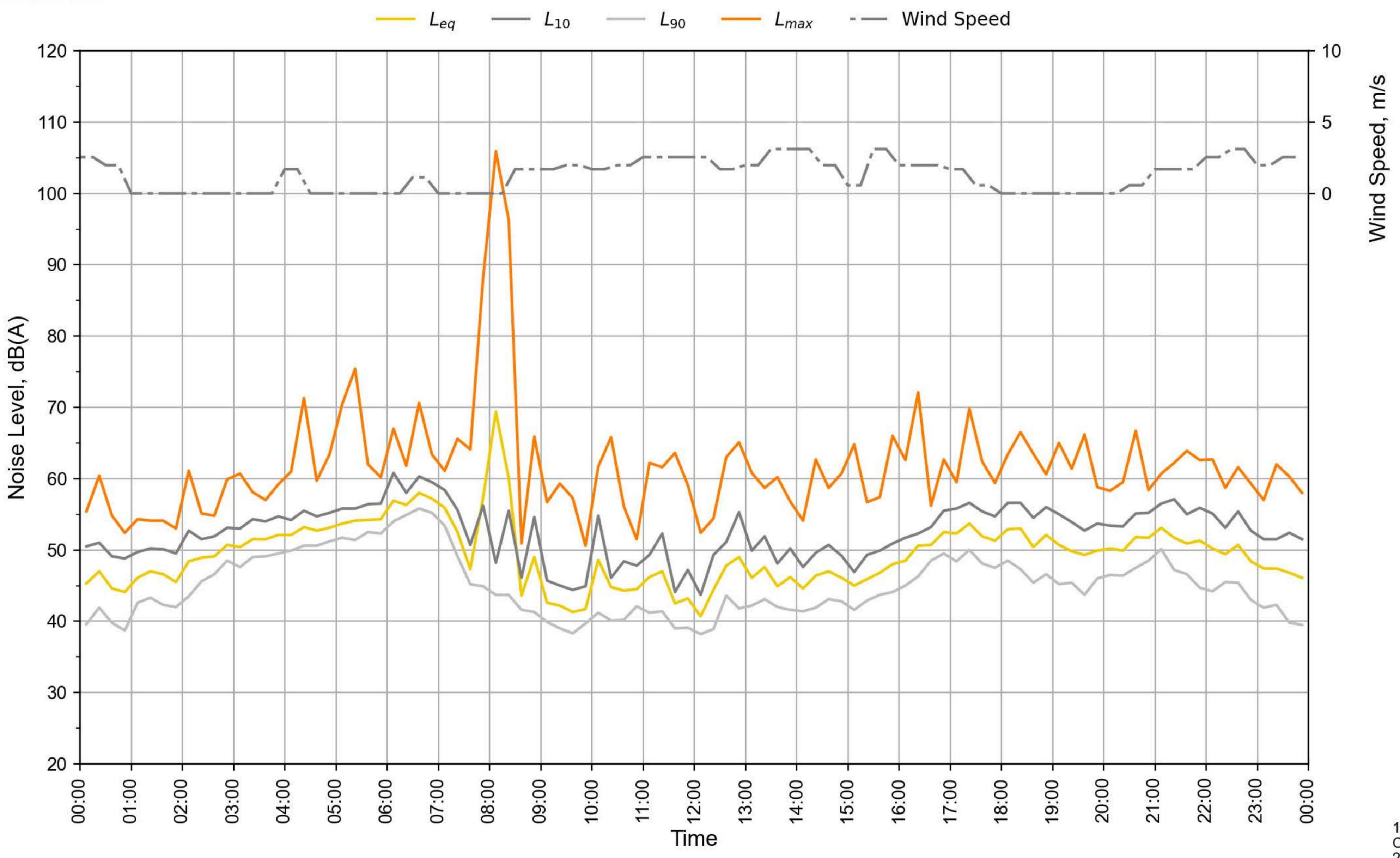

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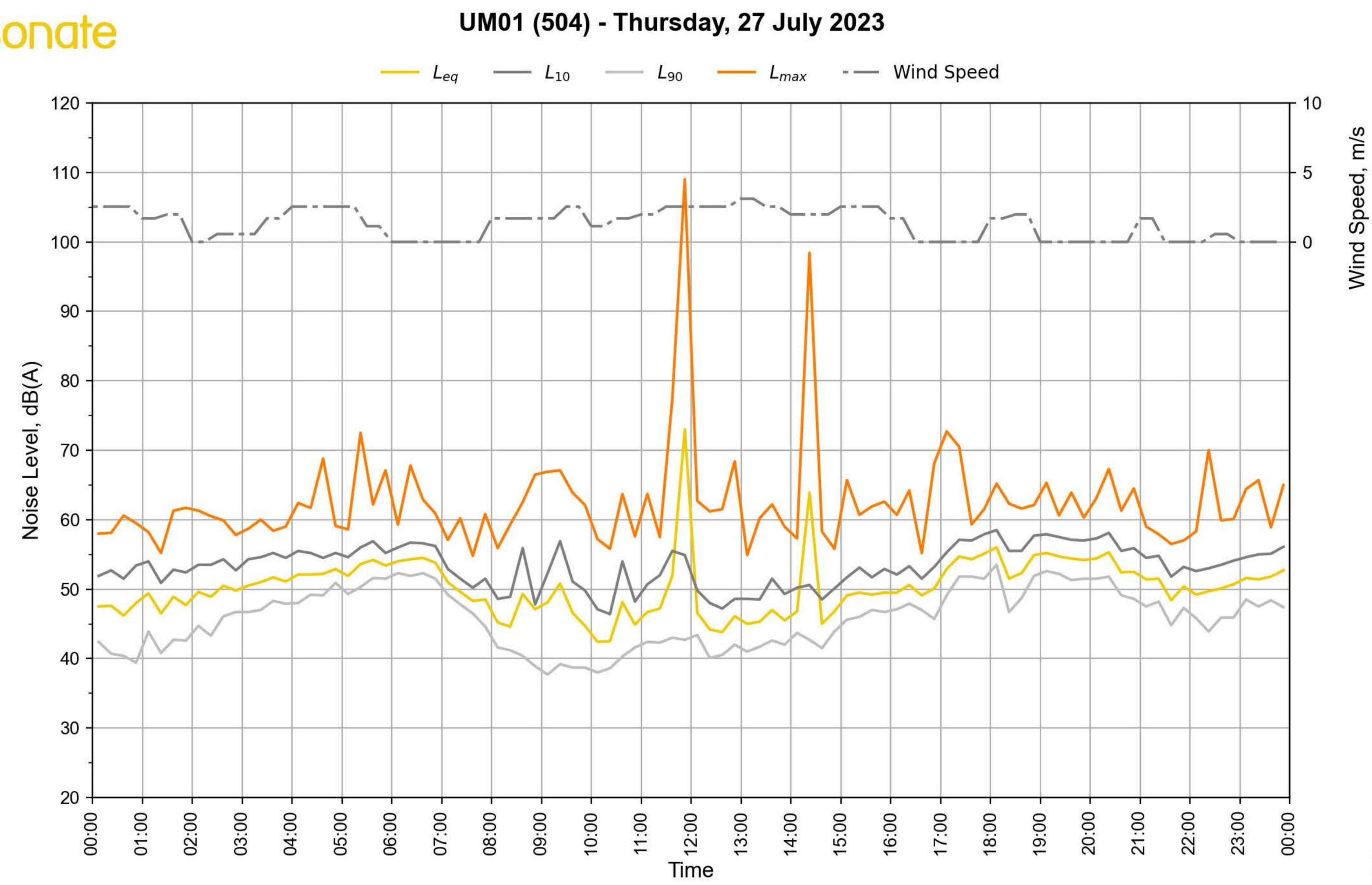

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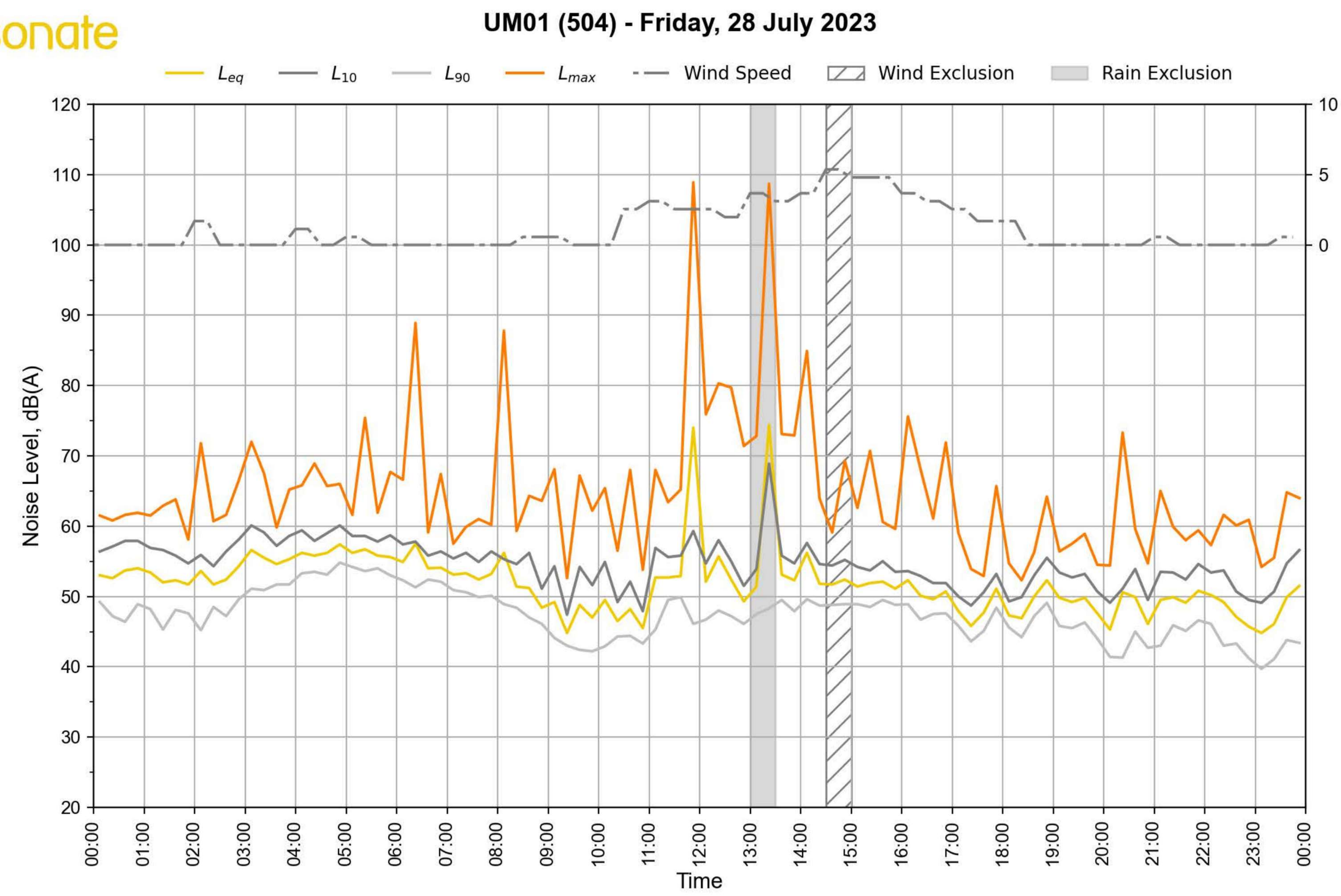

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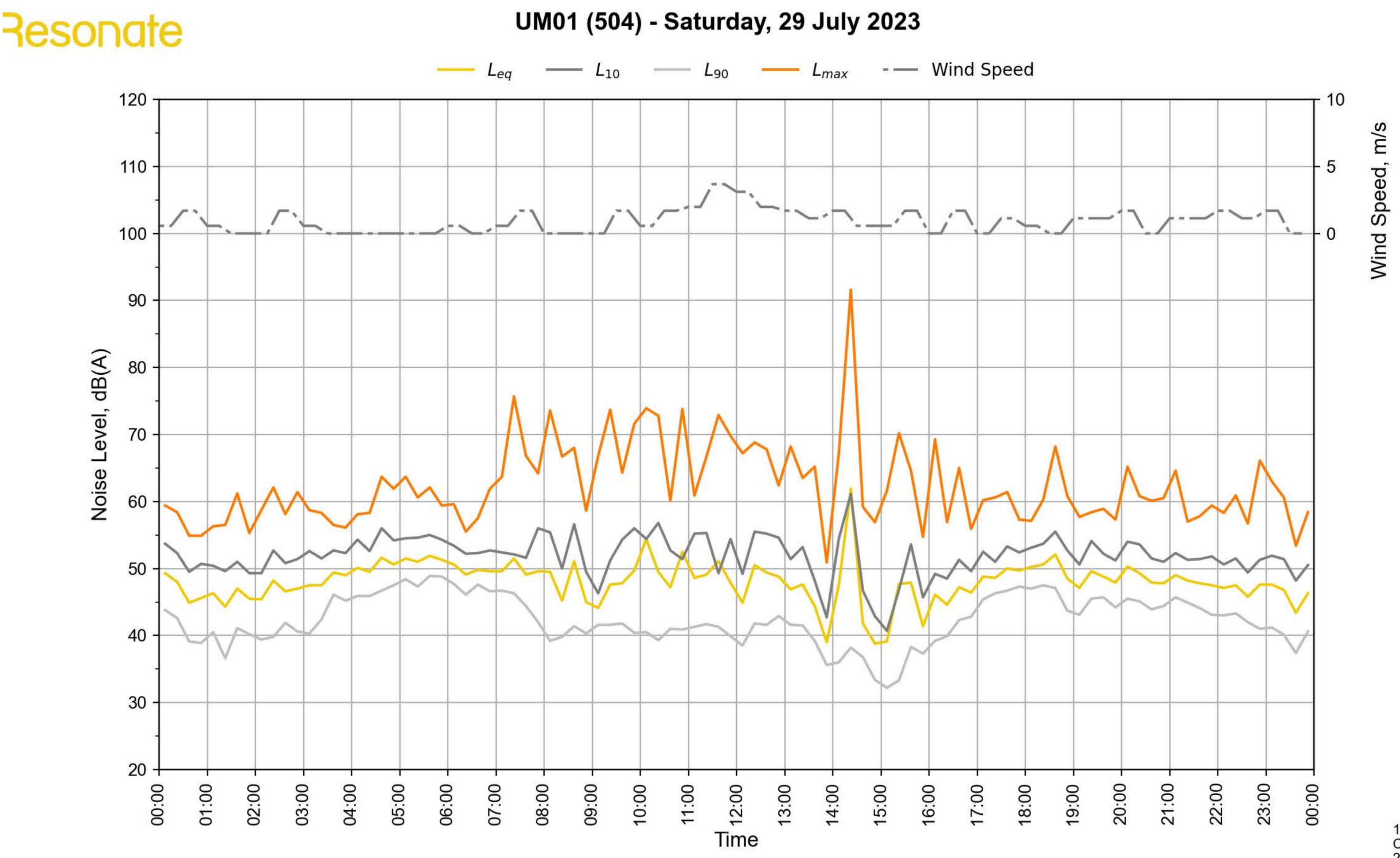

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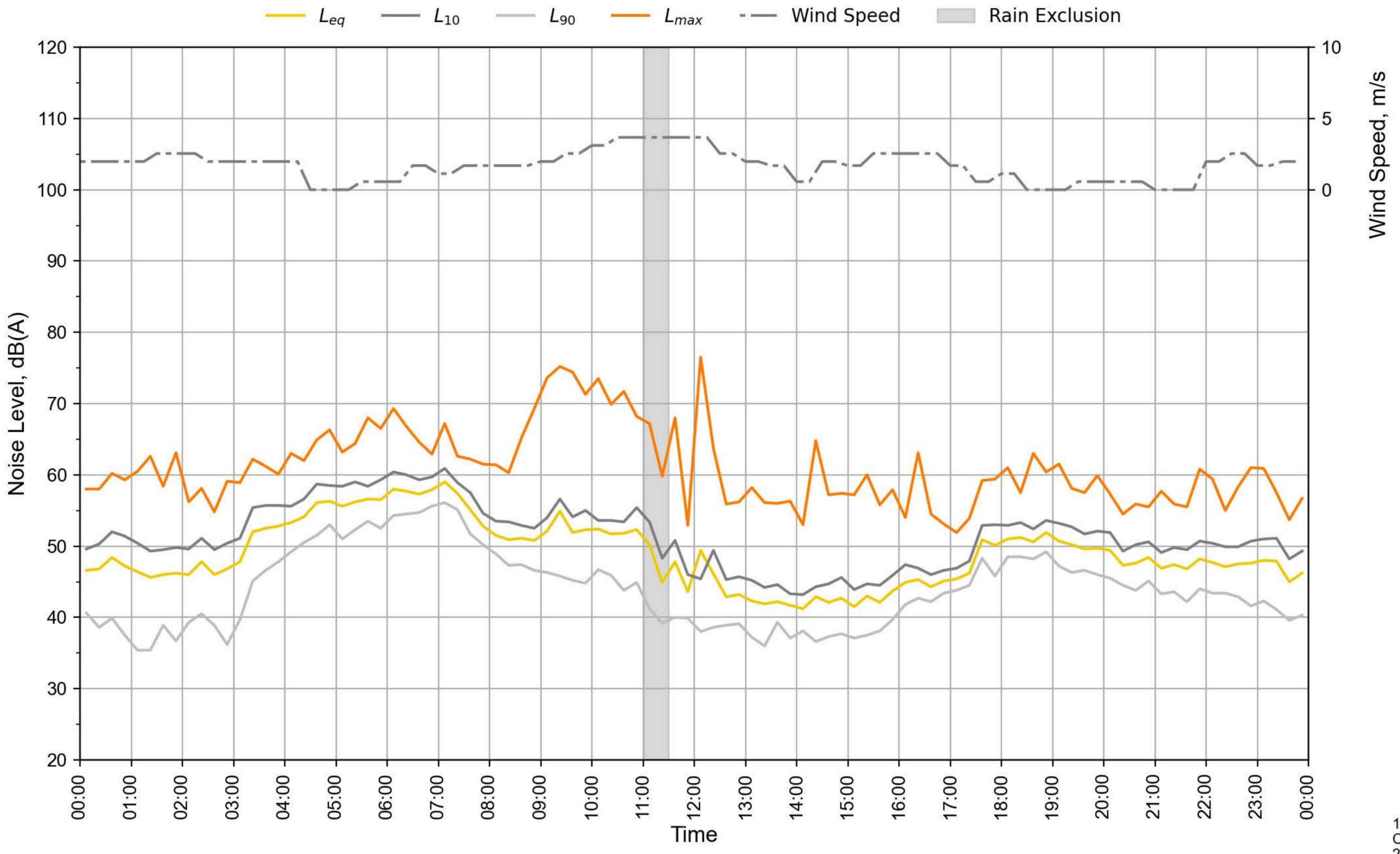

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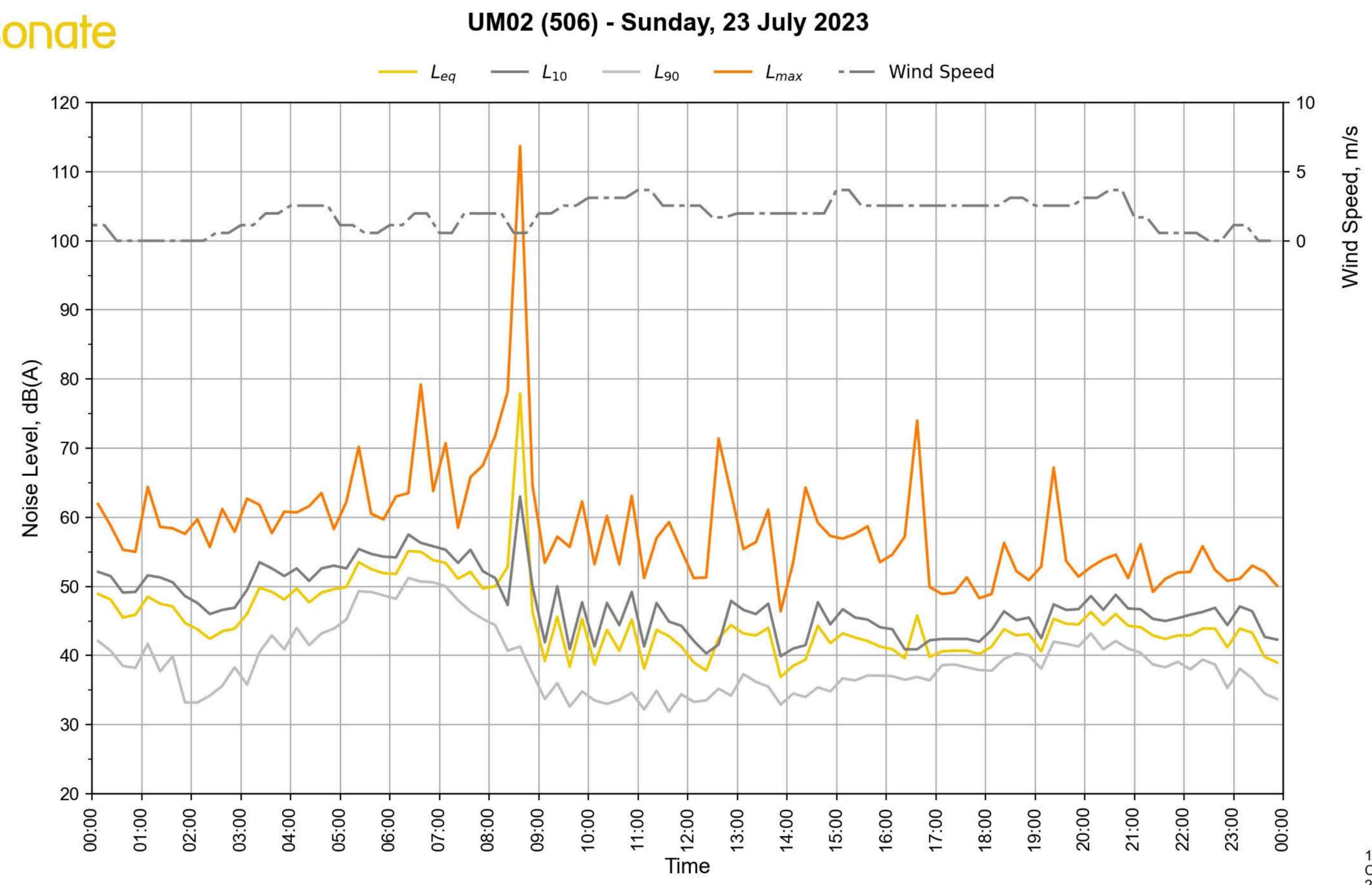

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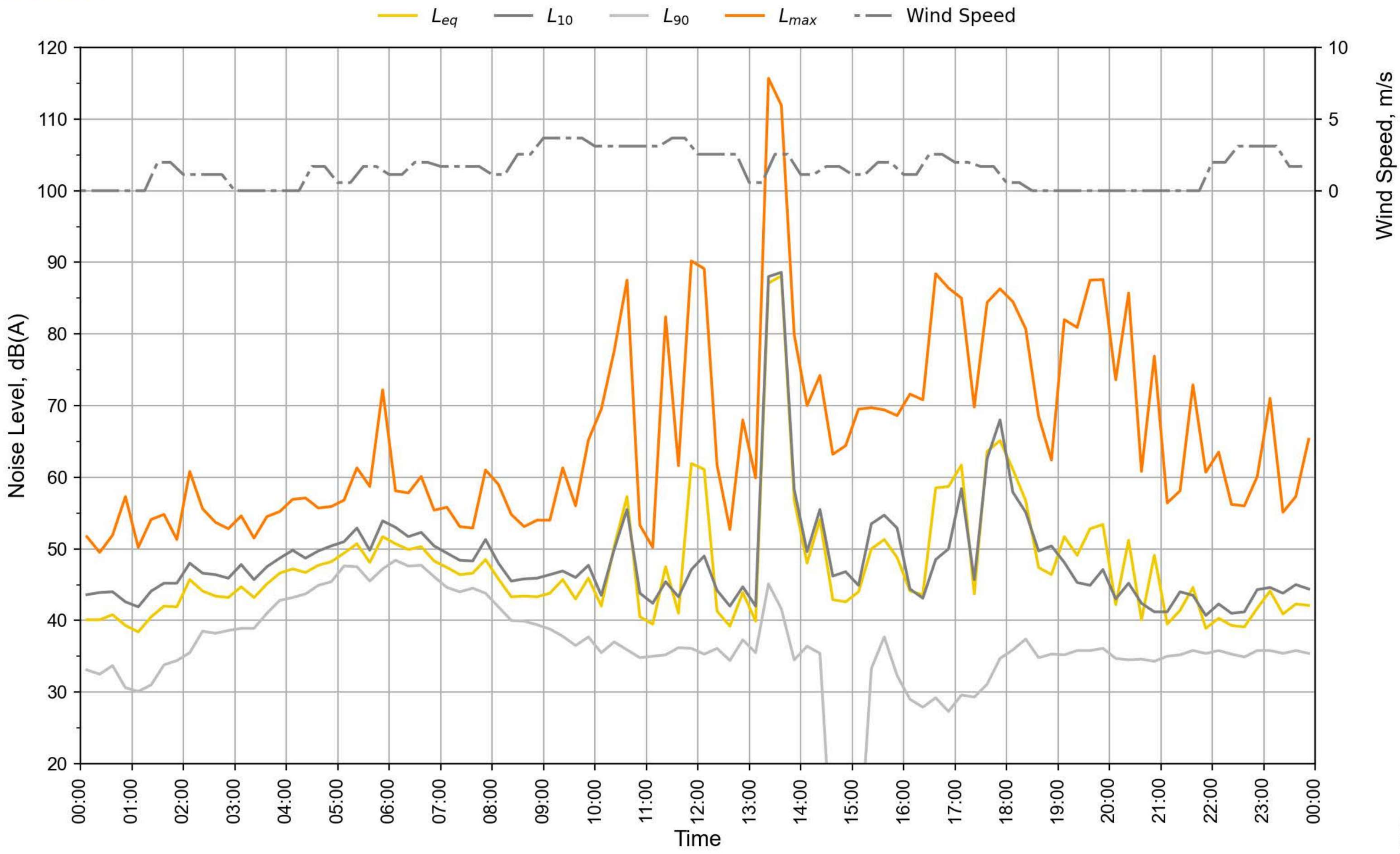

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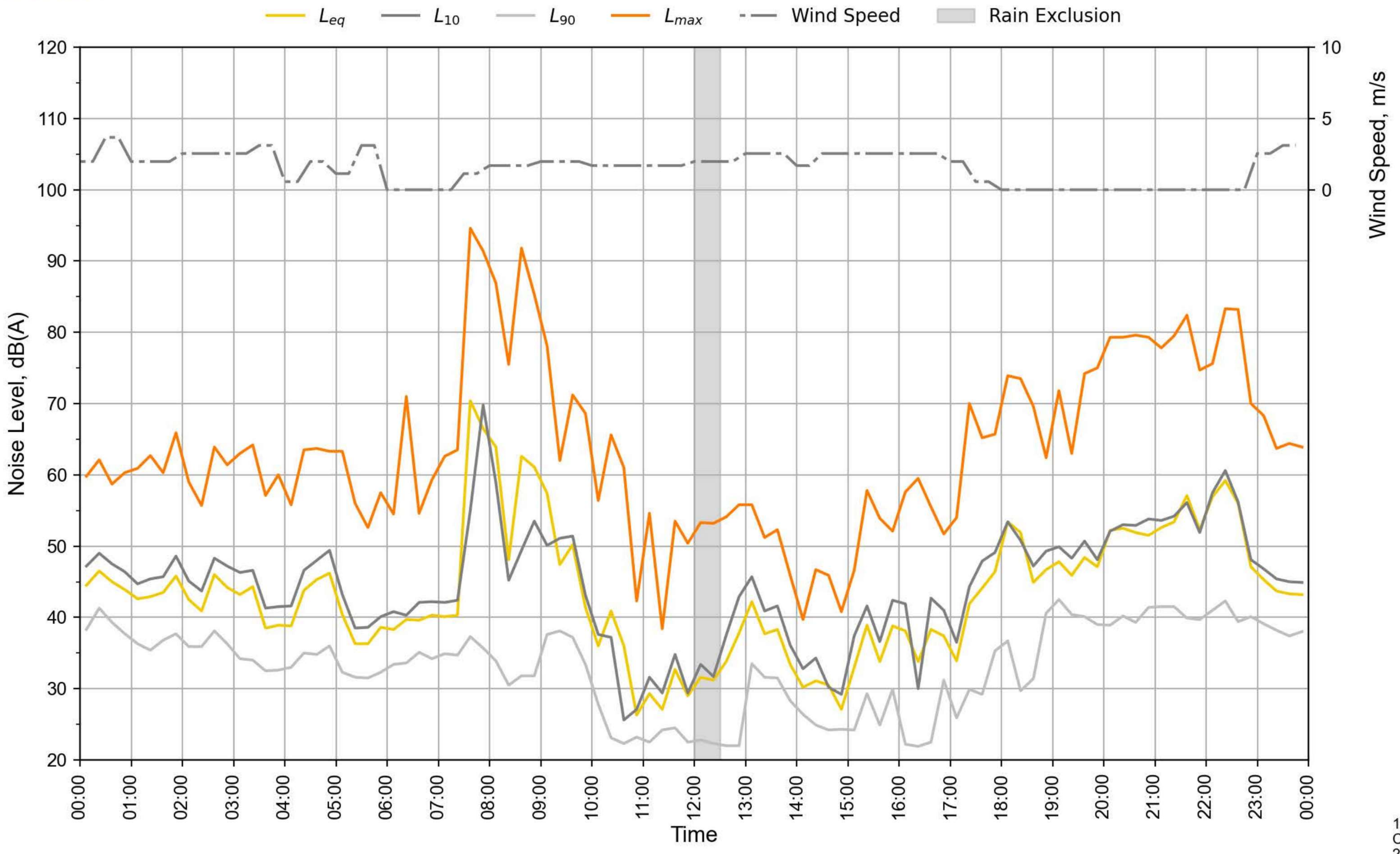

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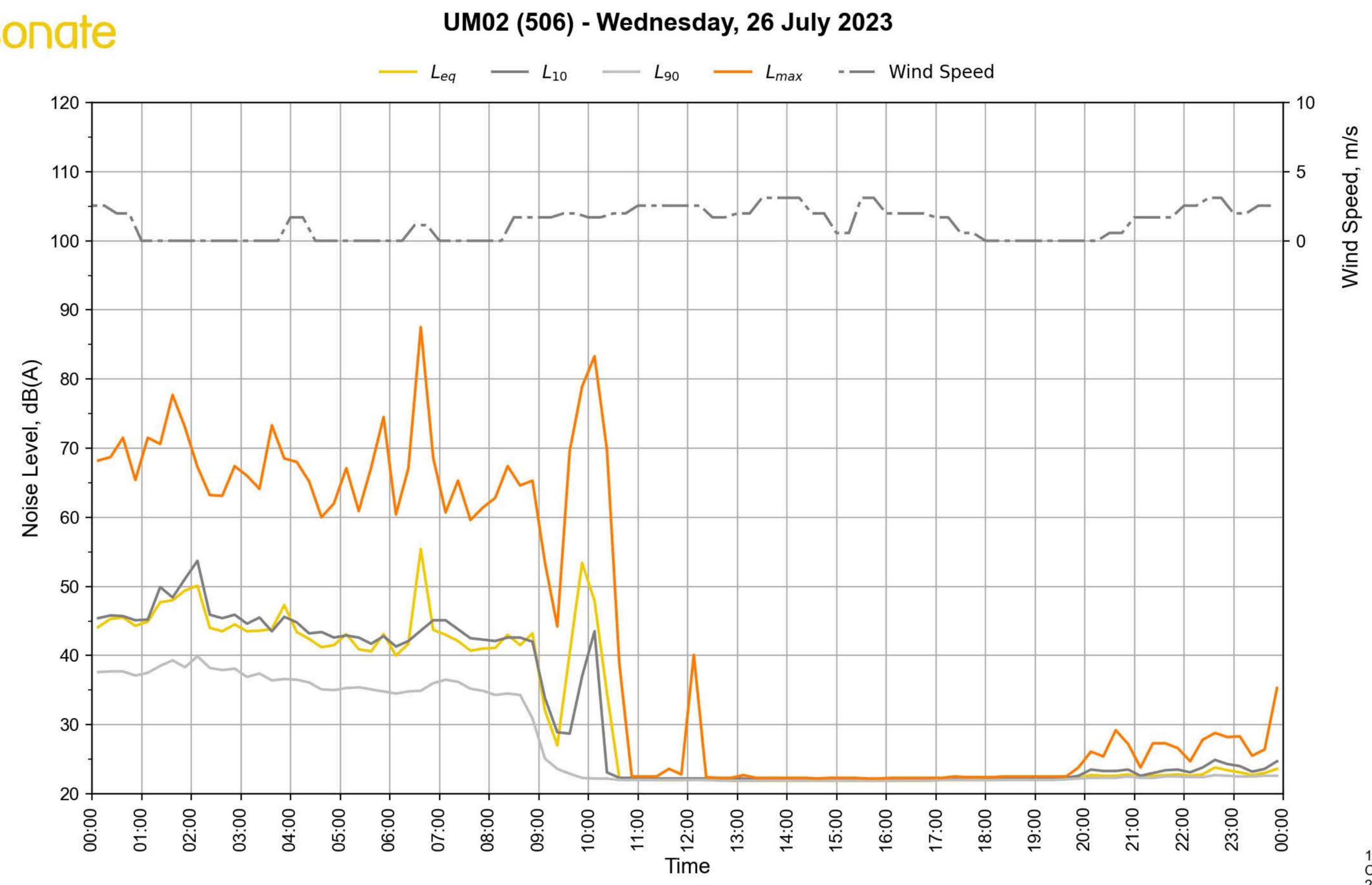

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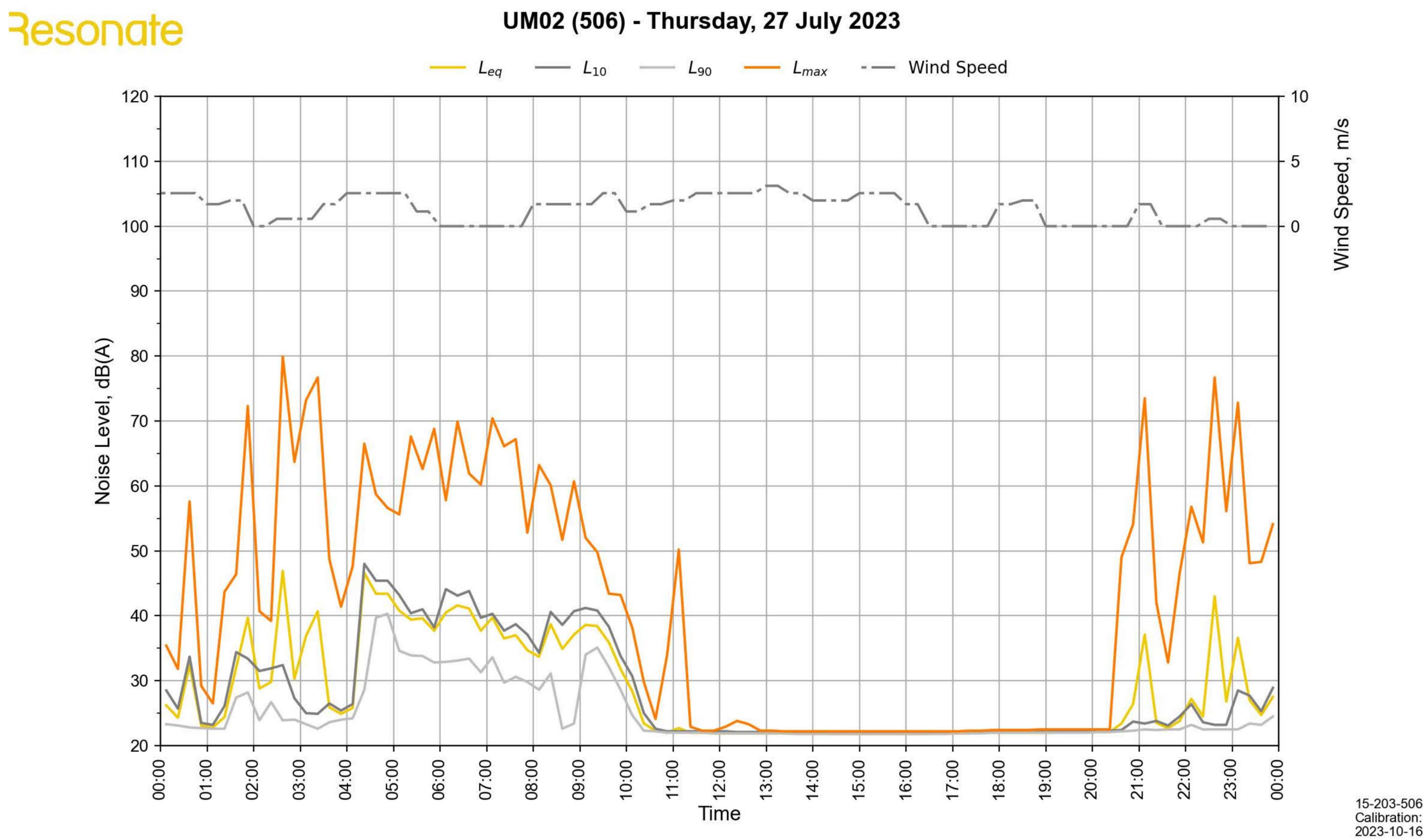
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L_{90}
L_{max}
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Noise Level, dB(A)
Wind Speed, m/s
Time
120
110
100
90
80
70
60
50
40
30
20
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
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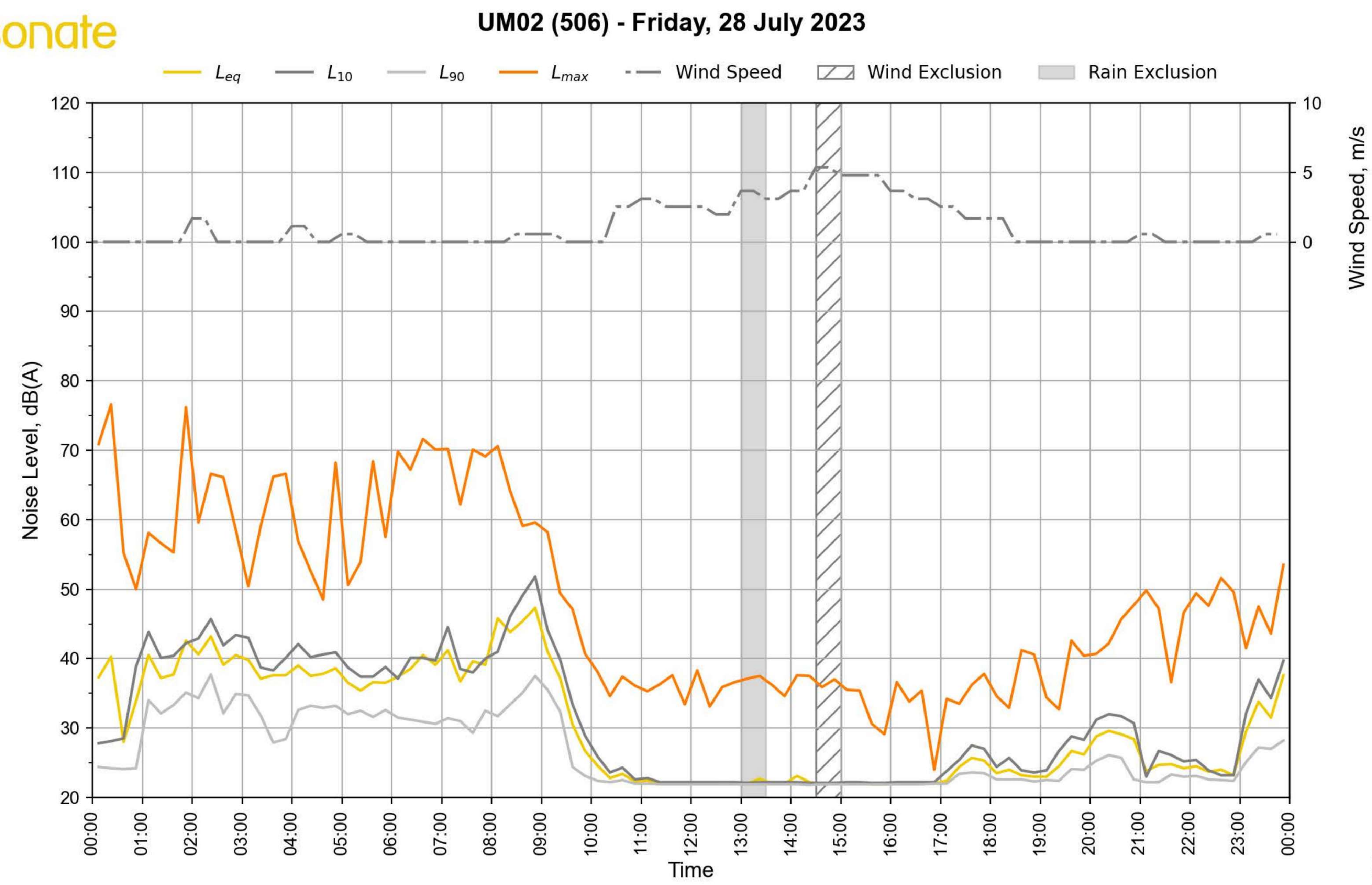

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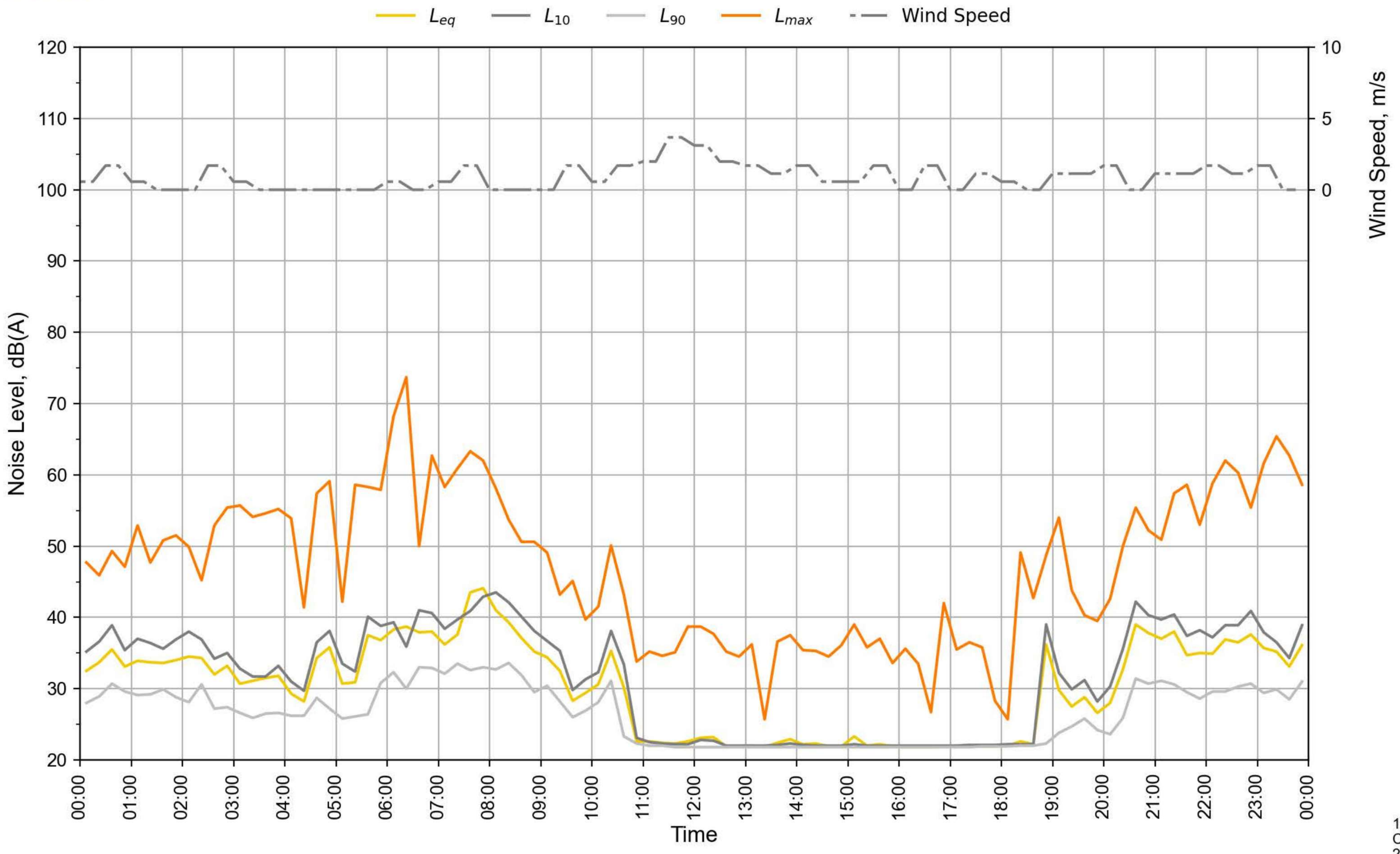

15-203-506
Calibration:
2023-10-16

Appendix B – Road traffic predicted noise contours

Wilton Greens Stage 2A

First floor night time LAeq (9 hour) road traffic noise levels from Hume Motorway and Picton Road.

Date: October 2023
Client: Arcadis
Prepared by: AS

Legend

Site boundary

Predicted noise levels dB(A):

- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85
- 85-90

N

0 100 200 300 m

GDA2020/MGA zone 56 EPSG:7856

Resonate

Wilton Greens Stage 2A

Ground floor night time LAeq (9 hour) road traffic noise levels from Hume Motorway and Picton Road.

Date:	October 2023
Client:	Arcadis
Prepared by:	AS

Legend

Site boundary

Predicted noise levels dB(A):

- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85
- 85-90

N

0 100 200 300 m

GDA2020/MGA zone 56 EPSG:7856

Resonate

Wilton Greens Stage 2A

First floor day time LAeq (15 hour) road traffic noise levels from Hume Motorway and Picton Road.

Date: October 2023
Client: Arcadis
Prepared by: AS

Legend

Site boundary

Predicted noise levels dB(A):

- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85
- 85-90

N

0 100 200 300 m

GDA2020/MGA zone 56 EPSG:7856

Resonate

Wilton Greens Stage 2A

Ground floor day time LAeq (15 hour) road traffic noise levels from Hume Motorway and Picton Road.

Date:	October 2023
Client:	Arcadis
Prepared by:	AS

Legend

Site boundary

Predicted noise levels dB(A):

- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85
- 85-90

N

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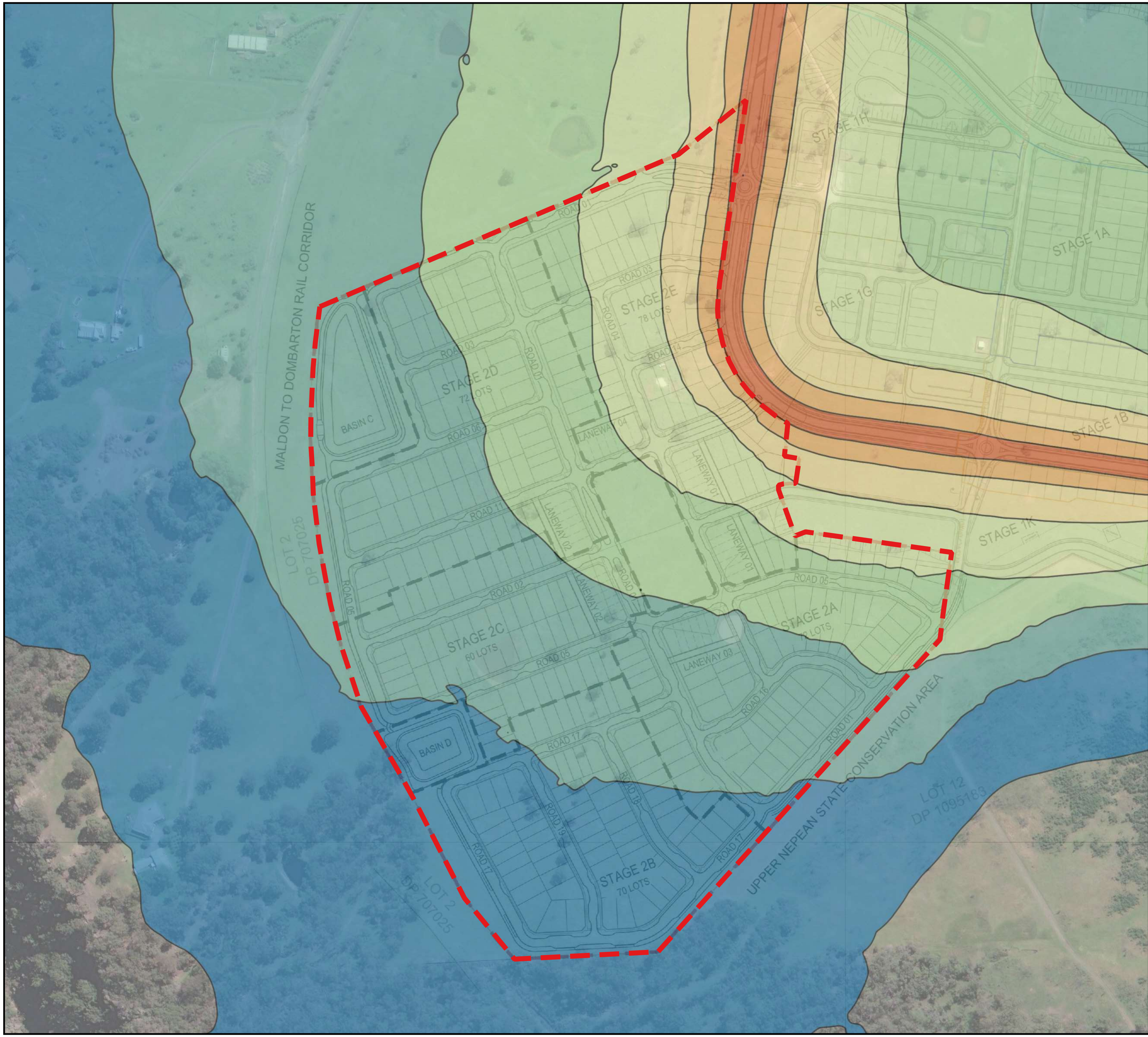
GDA2020/MGA zone 56 EPSG:7856

Resonate

Wilton Greens Stage 2A

First floor LAeq (1 hour) road traffic noise levels from main internal roads



Date:	October 2023
Client:	Arcadis
Prepared by:	AS

Legend

Site boundary

Predicted noise levels dB(A):

- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85
- 85-90

N

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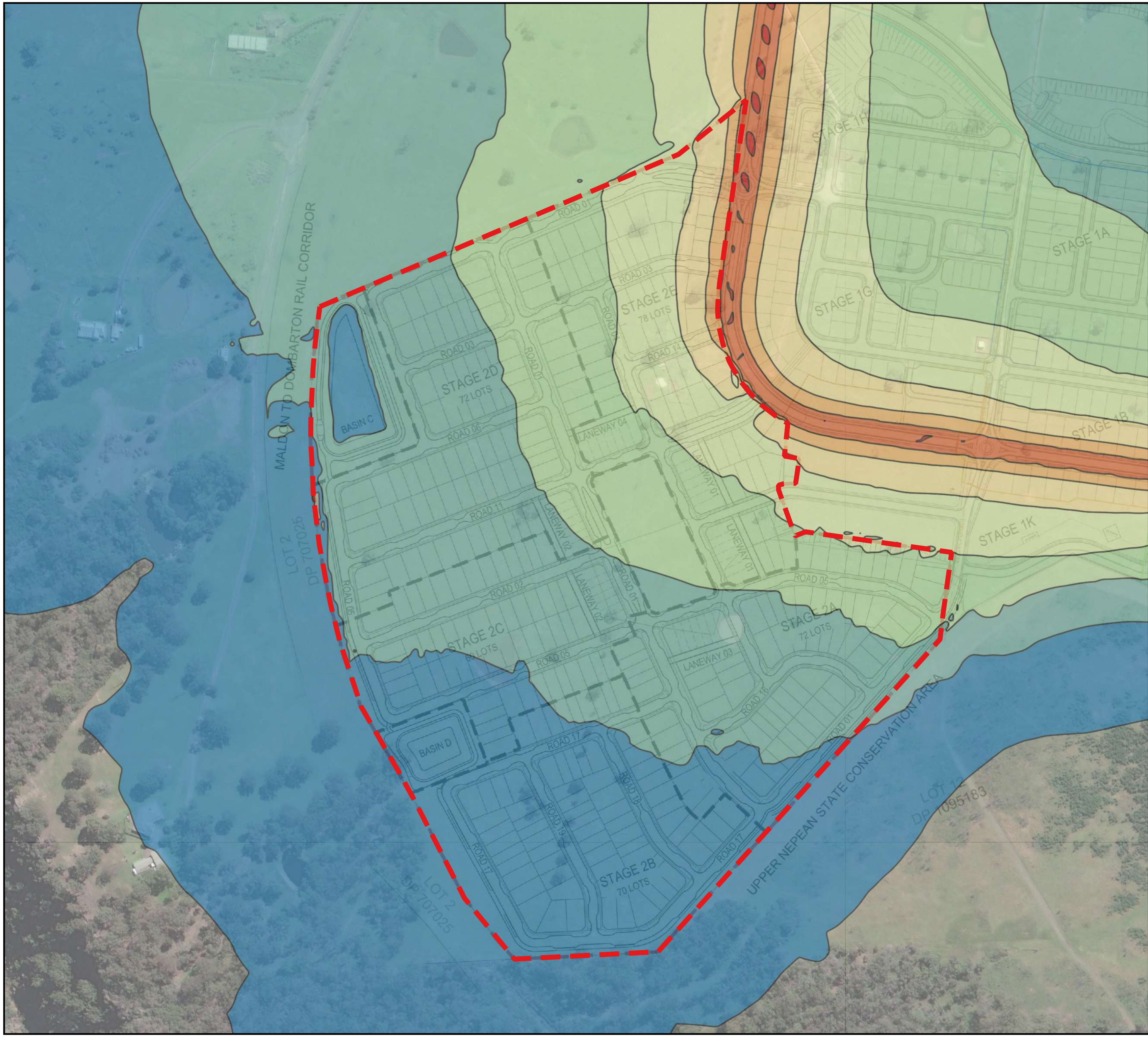
GDA2020/MGA zone 56 EPSG:7856

Resonate



Wilton Greens Stage 2A

Ground floor LAeq (1 hour) road traffic noise levels from main internal roads

Date:	October 2023
Client:	Arcadis
Prepared by:	AS

Legend

Site boundary

Predicted noise levels dB(A):

- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85
- 85-90

N

0 50 100 150 200 m

GDA2020/MGA zone 56 EPSG:7856

Resonate

Appendix C – 'Deemed to Satisfy' indicative noise treatment category

The following noise treatment categories are designed to meet the indoor noise criteria of the DNBRCBR. The noise treatment category to use is chosen based on the period of the day and the external façade noise level.

For design review assistance with the acoustic performance of glazing elements, please note the following:

- R_w 22-28 can usually be attained with single-glazed 6mm glass.
- R_w 28-32 with 6.38mm laminated glass.
- R_w 32-34 with 10.38mm laminated glass.
- R_w 34-36 with either 12.38mm glass or 6.5mm VLam Hush, both set in frames that have acoustic ratings and seals.

For an acoustic performance up to Rw38, the use of 8.5mm VLam Hush can be achieved, specifically when installed within a frame that's acoustically designed, manufactured and rated. This is typically suitable for awning or casement windows and hinged doors. For acoustic performances exceeding Rw36, it's standard to use double-glazed or dual window/door systems.

Room	Orientation	Recommended noise treatments
Category 1: L_{Aeq}, Day up to 50 dB / L_{Aeq}, Night up to 45 dB		
Bedroom	Facing	• Standard wall, roof and ceiling constructions • Nominal glazing external windows and doors with acoustic rated seals
	Side	• Standard wall, roof and ceiling constructions • Nominal glazing external windows and doors with acoustic rated seals
	Opposite	• No recommendations
Living room	Facing	• Standard wall, roof and ceiling constructions • Nominal glazing external windows and doors with acoustic rated seals
	Side	• Standard wall, roof and ceiling constructions • Nominal glazing external windows and doors with acoustic rated seals
	Opposite	• No recommendations
Category 2: L_{Aeq}, Day up to 50-60 dB / L_{Aeq}, Night up to 45-55 dB		
Bedroom	Facing	• Standard wall, roof and ceiling constructions • 6mm glazing for external windows and doors with acoustic rated seals • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Side	• Standard wall, roof and ceiling constructions • 6mm glazing for external windows and doors with acoustic rated seals • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Opposite	• No recommendations

Room	Orientation	Recommended noise treatments
Living room	Facing	• Standard wall, roof and ceiling constructions • 6mm glazing for external windows and doors with acoustic rated seals • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Side	• Standard wall, roof and ceiling constructions • 6mm glazing for external windows and doors with acoustic rated seals • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Opposite	• No recommendations
Category 3: L_{Aeq}, Day up to 60-65 dB / L_{Aeq}, Night up to 55-60 dB		

Bedroom	Facing	• External walls to achieve R_w 45
		• Casement or awning windows
		• Glazed windows and doors:
		  – Minimum R_w 31 total glazing up to 40% of room floor area
		  – R_w 29 if glazing 20% of floor area or less
		• Roof and ceiling to achieve R_w 40:
		  – 1x layer of 13mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3
		• No vents to outside walls/eaves
		• Closed eaves
		• Closed windows/doors
		• Mechanical ventilation/air conditioning

	Side	• External walls to achieve R_w 45
		• Casement or awning windows
		• Glazed windows and doors:
		  – Minimum R_w 31 total glazing up to 40% of room floor area
		  – R_w 29 if glazing 20% of floor area or less
		• Roof and ceiling to achieve R_w 40:
		  – 1x layer of 13mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3
		• No vents to outside walls/eaves
		• Closed eaves
		• Closed windows/doors
		• Mechanical ventilation/air conditioning

Room	Orientation	Recommended noise treatments
	Opposite	• Standard wall, roof and ceiling constructions • 6mm glazing for external windows and doors with acoustic rated seals • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
Living room	Facing	• External walls to achieve R_w 45 • Casement or awning windows • Solid core door with acoustic seals R_w 32 • Glazed windows and doors: – Minimum R_w 28 total glazing up to 40% of room floor area – R_w 30 up to 60% of room floor area – R_w 33 up to 80% of room floor area • Roof and ceiling to achieve R_w 40: – 1x layer of 13mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3 • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Side	• External walls to achieve R_w 45 • Casement or awning windows • Solid core door with acoustic seals R_w 32 • Glazed windows and doors: – Minimum R_w 25 total glazing up to 40% of room floor area – R_w 27 up to 60% of room floor area – R_w 30 up to 80% of room floor area • Roof and ceiling to achieve R_w 40: – 1x layer of 13mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3 • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Opposite	• Standard wall, roof and ceiling constructions • 6mm glazing for external windows and doors with acoustic rated seals • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning

<table>
<tr><th>Room</th><th>Orientation</th><th>Recommended noise treatments</th></tr>
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• Casement or awning windows
• No external doors
• Glazed windows and doors:
– Minimum R_w 36 total glazing up to 40% of room floor area
– R_w 34 up to 20% of room floor area or less
• Roof and ceiling to achieve R_w 45:
– 2x layer of 10mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3
• No vents to outside walls/eaves
• Closed eaves
• Closed windows/doors
• Mechanical ventilation/air conditioning</td></tr>
<tr><td>Side</td><td>• External walls to achieve R_w 50
• Casement or awning windows
• No external doors
• Glazed windows and doors:
– Minimum R_w 33 total glazing up to 40% of room floor area
– R_w 31 up to 20% of room floor area or less
• Roof and ceiling to achieve R_w 45:
– 2x layer of 10mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3
• No vents to outside walls/eaves
• Closed eaves
• Closed windows/doors
• Mechanical ventilation/air conditioning</td></tr>
<tr><td>Opposite</td><td>• External walls to achieve R_w 45
• Casement or awning windows
• Glazed windows and doors:
– Minimum R_w 28 total glazing up to 40% of room floor area
– R_w 26 if glazing 20% of floor area or less
• Roof and ceiling to achieve R_w 40:
– 1x layer of 13mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3
• No vents to outside walls/eaves
• Closed eaves
• Closed windows/doors
• Mechanical ventilation/air conditioning</td></tr>
</table>

Room	Orientation	Recommended noise treatments
Living room	Facing	• External walls to achieve R_w 50 • Casement or awning windows • Solid core doors with acoustic seals R_w 32 • Glazed windows and doors: – Minimum R_w 33 total glazing up to 40% of room floor area – R_w 35 up to 60% of room floor area – R_w 38 up to 80% of room floor area • Roof and ceiling to achieve R_w 45: – 2x layer of 10mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3 • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Side	• External walls to achieve R_w 50 • Casement or awning windows • Solid core doors with acoustic seals R_w 32 • Glazed windows and doors: – Minimum R_w 30 total glazing up to 40% of room floor area – R_w 32 up to 60% of room floor area – R_w 35 up to 80% of room floor area • Roof and ceiling to achieve R_w 45: – 2x layer of 10mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3 • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning
	Opposite	• External walls to achieve R_w 45 • Casement or awning windows • Glazed windows and doors: – Minimum R_w 31 total glazing up to 40% of room floor area – R_w 29 if glazing 20% of floor area or less • Roof and ceiling to achieve R_w 40: – 1x layer of 13mm plasterboard + 50mm thick glasswool insulation with minimum 14 kg/m^3 • No vents to outside walls/eaves • Closed eaves • Closed windows/doors • Mechanical ventilation/air conditioning