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Barker College - Master Plan

SSDA Acoustic Assessment - Concept Approval and Stage 1 Works

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1 INTRODUCTION

Acoustic Logic (AL) has been engaged to conduct an acoustic assessment of potential noise and vibration impacts associated with the proposed development at Barker College - Master Plan.

The SEARs issued for SSD-31822612 requests for a noise and vibration assessment per the below extract.

Issue and Assessment Requirements – Stage 1 Development

5. Noise and Vibration

- *Provide a quantitative assessment of the main noise and vibration generating noise sources and activities during construction in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines.*
- *Outline measures to minimise and mitigate the potential construction noise impacts on nearby sensitive receivers including proposed management and mitigation measures that would be implemented.*

Issue and Assessment Requirements – Concept Proposal

11. Noise and Vibration

Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise (including any public-address system, events, and out of hours use of school facilities) and vibration impacts on nearby sensitive receivers and structures, considers noise intrusion, and outline the proposed management and mitigation measures that would be implemented.

In accordance with the SEARs, this document addresses noise impacts associated with the following:

- Noise intrusion to project site from adjacent roadways
- Noise emissions from mechanical plant to service the project site (in principle)
- Potential noise and vibration sources during the construction and operational phases of the development, and
- Details of noise mitigation, management and monitoring measures.

AL have utilised the following documents and regulations in the noise assessment of the development:

- NSW Planning SEARs document (Ref: SSD-31822612)
- Australian Standard AS2107:2016 *Recommended Design Sound Levels and Reverberation Times for Building Interiors*
- NSW Environmental Protection Authority (EPA) *Noise Policy for Industry* (NPI) 2017
- German Standard DIN 4150-3 (1999-02), and
- NSW Environmental Protection Authority (EPA) *Assessing Vibration – A Technical Guideline.*

This assessment has been conducted using the Neeson Murcutt + Neille architectural drawings (dated 8th July 2022) for SSDA Submission.

2 SITE DESCRIPTION

Investigation has been carried out by this office in regards to the existing properties and noise impacts surrounding the proposed development, which is detailed below:

- Existing residential blocks to the surrounding the site
- Existing commercial receivers to the north and east, and
- Existing educational facilities to the south within the development envelope.

AL notes that a large majority of surrounding receivers are within the overall Barker College development footprint.

The nearest noise receivers around the site include:

- **R1:** Residential Receiver 1 – Residential receivers to the north at 65 Pacific Highway
- **R2:** Residential Receiver 2 – Residential receivers to the east at 7-33 Unwin Road and 2A-26 Yardley Avenue
- **R3:** Residential Receiver 3 – Residential receiver to the south at 30 Unwin Road
- **R4:** Residential Receiver 4 – Residential receivers to the south at 31-31A Clarke Road and 4-12 Marillian Avenue
- **R5:** Residential Receiver 5 – Residential receivers to the west at 14-26 College Crescent
- **C1:** Commercial Receiver 1 – Commercial receivers to the north along Pacific Highway
- **C2:** Commercial Receiver 2 – Commercial receiver to the east at 1A Clarke Road, and
- **E1:** Educational/ Active Recreational Receiver 1 – Unwin Park and St Leo's College Recreational Centre to the south east at 1 Clarke Road and 37-63 Unwin Road.

It is noted that **R1** is heavily affected by traffic noise from Pacific Highway. As such, compliance to receivers **R2-R5** will ensure compliance to **R1**.

A site map, measurement description and surrounding receivers are presented in Figure 1 below. Figure 2 details specific stages of the proposed development within the overall Barker College development envelope.

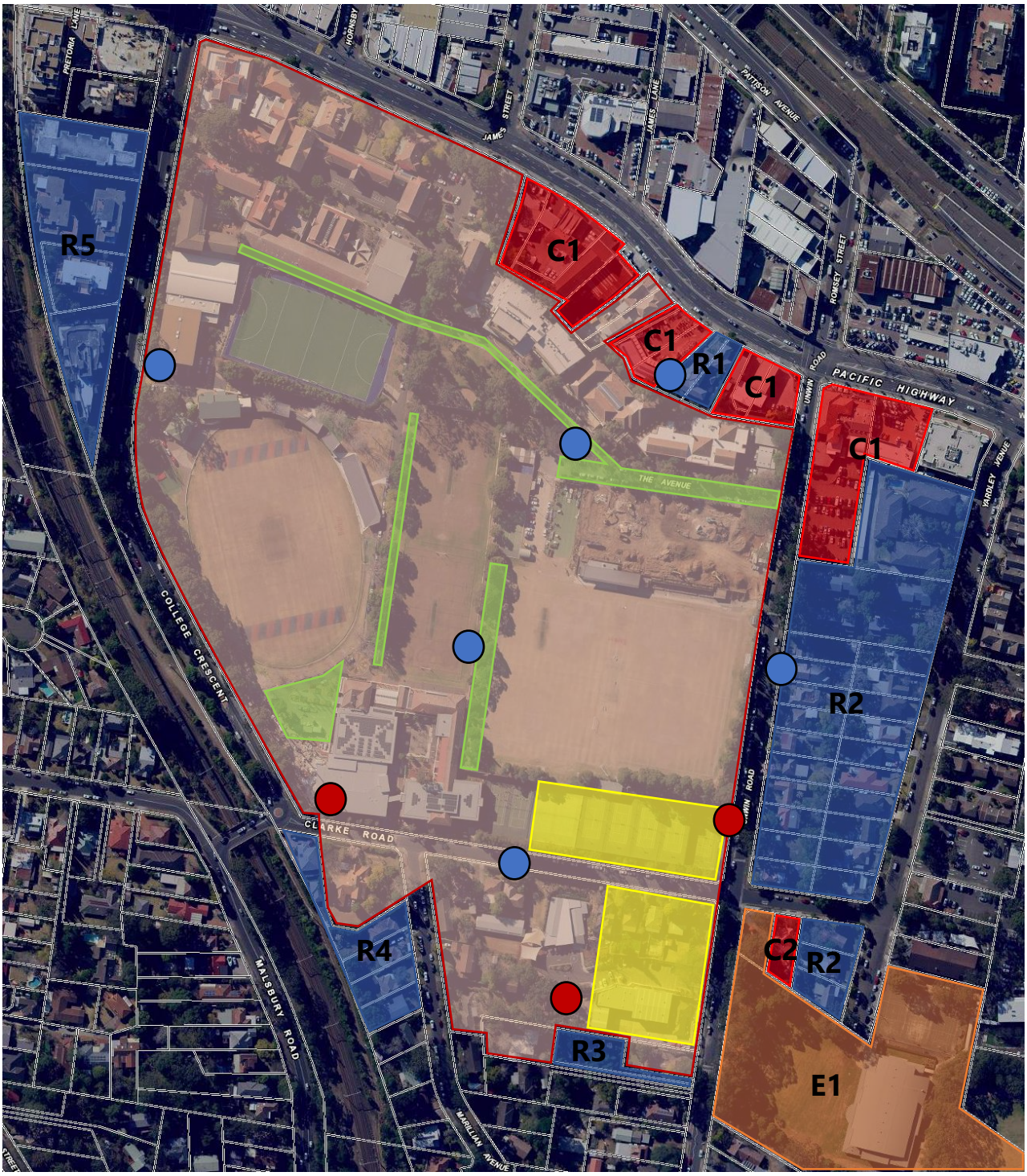


Figure 1 – Project Site
Source: NSW Six Maps

Barker College Development Envelope
Project Site Stage 1
Project Site Stage 2
Residential Receivers
Commercial Receivers
Educational/ Active Recreational Receivers
Unattended Noise Monitors
Attended Measurements

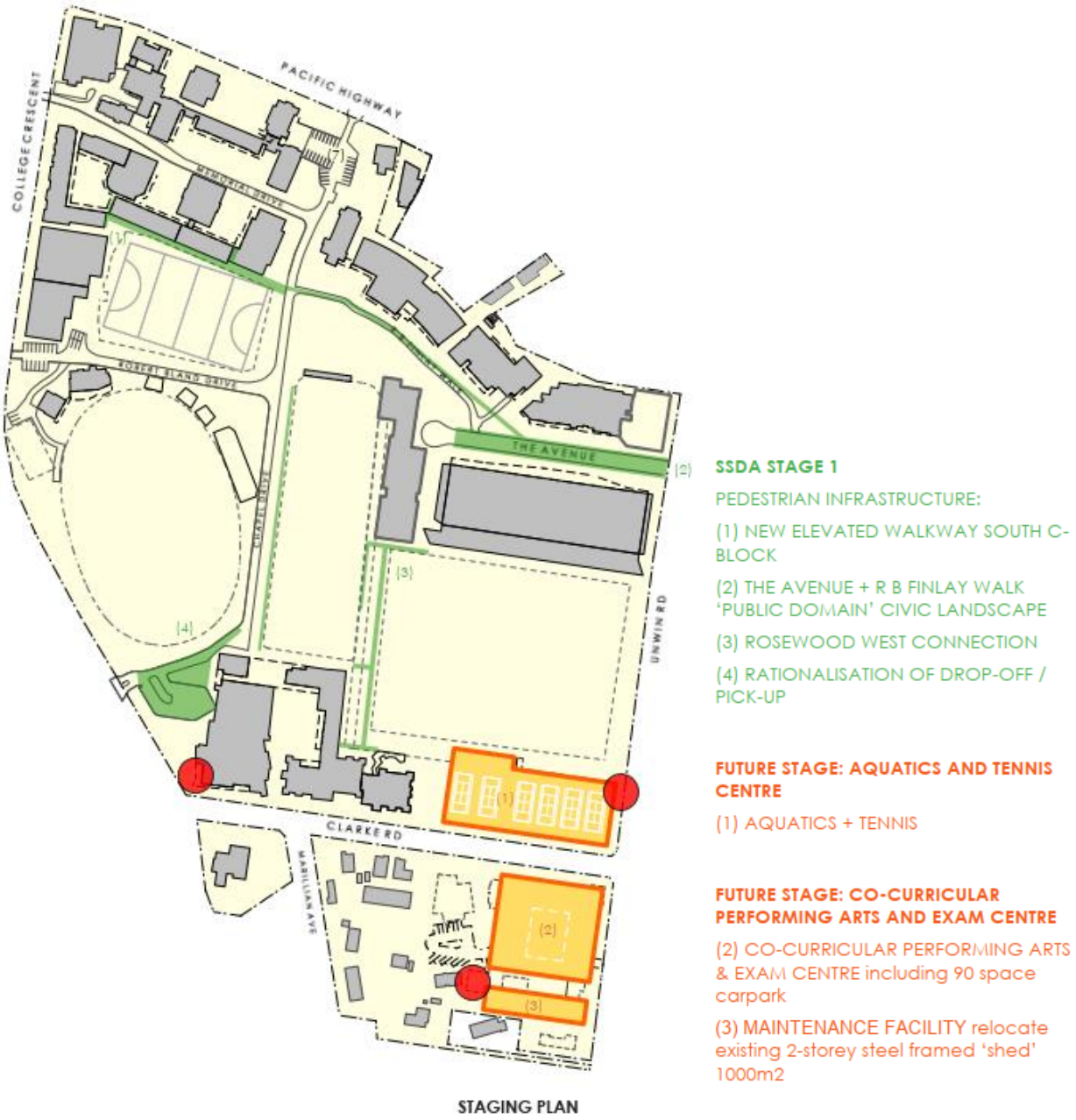


Figure 2 – Staging Plan
Source: Neeson Murcutt + Neille

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three principal measurement parameters are used, namely L_{10}, L_{90} and L_{eq}. The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15-minute period. L_{eq} is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

The L_{max} parameter represents the loudest sound pressure level during the measurement period.

4 ENVIRONMENTAL NOISE SURVEY

NSW EPA's Rating Background Noise Level (RBL) assessment procedure requires determination of background noise level for each day (the ABL) then the median of the individual days as set out for the entire monitoring period.

Appendices in this report present results of unattended noise monitoring conducted at the project site. Weather affected data was excluded from the assessment. The processed RBL (lowest 10th percentile noise levels during operation time period) are presented in Table 4-1.

Measurement Position

Three unattended noise monitors were located around the potentially most noise affected residents:

- One unattended noise monitor was located on the eastern boundary of the current Clarke Road Tennis Courts opposite residents at **R2** (29-33 Unwin Road)
- One unattended noise monitor was located on the southern boundary of the Barker College development envelope near **R3** (30 Unwin Road), and
- One unattended noise monitor was located at Barker Junior School on the corner of Clarke Road and College Crescent near **R4** (31 Clarke Road).

Attended short term measurements of traffic noise have been previously undertaken by this office which aid to supplement the unattended noise monitoring. Refer to Figure 1 for detailed locations. All attended measurements were taken 1.5m above the local ground height.

Measurement Period

Unattended noise monitoring was conducted from Tuesday 10th of May 2022 to Wednesday 25th of May 2022. Attended noise measurements were undertaken on Wednesday 30th of June 2021 between the hours of 4:30pm and 5:30pm.

Measurement Equipment

Equipment used consisted of Acoustic Research Laboratories Pty Ltd noise monitors. Monitors were set to A-weighted fast response and programmed to store 15-minute statistical noise levels throughout the monitoring periods. The monitors were calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise monitoring data is provided in Appendix One – Unattended Noise Monitoring.

Attended Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

4.1 SUMMARISED MEASURED NOISE LEVELS

Summarised measured rating background noise levels surrounding the proposed development are presented below. Periods of adverse weather that were determined to have affected the noise data have been eliminated when determining the rating background noise level at the site in accordance with Fact Sheets A & B of the NPI.

Table 4-1 – Measured Rating Background Noise Levels (RBL)

Monitor	Time of day	Rating Background Noise Level dB(A)$_{L90(Period)}$
Clarke Road Tennis Courts near **R2**	Day (7am – 6pm)	44
	Evening (6pm – 10pm)	40
	Night (10pm – 7am)	34
Unwin Road near **R3**	Day (7am – 6pm)	40
	Evening (6pm – 10pm)	40
	Night (10pm – 7am)	34
Barker Junior School near **R4/R5**	Day (7am – 6pm)	51
	Evening (6pm – 10pm)	43
	Night (10pm – 7am)	34

Table 4-2 – Measured Traffic Noise Levels

Location	Time of Day	Noise Level – L_{eq}
Clarke Road Tennis Courts near **R2** Residents along Unwin Road	Day (7am – 10pm)	58 dB(A) $L_{eq\ (15hr)}$
	Night (10pm – 7am)	52 dB(A) $L_{eq\ (9hr)}$
Barker Junior School near **R4** Residents along Clarke Road and College Crescent	Day (7am – 10pm)	62 dB(A) $L_{eq\ (15hr)}$
	Night (10pm – 7am)	56 dB(A) $L_{eq\ (9hr)}$

Based on the attended noise measurements and unattended noise monitoring conducted for the site, the below noise levels are predicted at the façade of the concept stage buildings.

Table 4-3 – Predicted Façade Noise Levels

Location	Time of Day	Noise Level – L_{eq}
Aquatics & Tennis Centre and Co-curricular Performing Arts and Exam Centre (Unwin Road & Clarke Road façades)	Day (7am – 10pm)	58 dB(A) $L_{eq\ (15hr)}$
	Night (10pm – 7am)	52 dB(A) $L_{eq\ (9hr)}$

5 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigation indicates that the major external noise sources around project site are from traffic movements along Unwin Road and Clarke Road, to the eastern and southern boundaries of the site. As Stage 2 works are in concept stage, appropriate criteria for future noise intrusion analysis have been documented below. Measured traffic noise levels indicate that internal noise levels are readily achievable for the proposed usages and is supported from an acoustic perspective.

5.1 NOISE INTRUSION CRITERIA

A noise intrusion assessment is to be conducted following concept approval based on the requirements of Australian Standard AS2107:2016 *Recommended Design Sound Levels and Reverberation Times for Building Interiors*. Barker College may choose to design to more stringent noise levels as part of an internal set of principal project requirements, however the following noise level criteria will be required to satisfy statutory requirements.

5.1.1 AS2107:2016 *Recommended Design Sound Levels and Reverberation Times for Building Interiors*

AS2107:2016: *Recommended Design Sound Levels and Reverberation Times for Building Interiors* specifies allowable internal noise levels for internal spaces within educational buildings. Table 1, in Section 5 of AS2107:2016, gives the following maximum internal noise levels for specific relevant spaces.

Table 5-1 – Recommended Design Sound Levels

Space /Activity Type	Recommended Design Sound Level Range
Assembly Halls Over 250 Seats	30-35 dB(A)$L_{eq(when\ in\ use)}$*
Seminar/ Conference Rooms	35-40 dB(A)$L_{eq(when\ in\ use)}$
Corridors and Lobbies	< 50 dB(A)$L_{eq(when\ in\ use)}$
Engineering Workshops – Teaching	< 45 dB(A)$L_{eq(when\ in\ use)}$
Engineering Workshops – Non-teaching	< 60 dB(A)$L_{eq(when\ in\ use)}$
Medical Rooms (First Aid)	40-45 dB(A)$L_{eq(when\ in\ use)}$
Music Practice Rooms	40-45 dB(A)$L_{eq(when\ in\ use)}$
Music Studios	30-35 dB(A)$L_{eq(when\ in\ use)}$
Office Areas	40-45 dB(A)$L_{eq(when\ in\ use)}$
Professional and Administrative Offices	35-40 dB(A)$L_{eq(when\ in\ use)}$
Teaching Spaces	35-45 dB(A)$L_{eq(when\ in\ use)}$
Staff Common Rooms	40-45 dB(A)$L_{eq(when\ in\ use)}$
Sports Hall	< 50 dB(A)$L_{eq(when\ in\ use)}$
Toilets/ Changerooms/ Showers	< 55 dB(A)$L_{eq(when\ in\ use)}$
Indoor Pools	50-60 dB(A)$L_{eq(when\ in\ use)}$
Café	40-50 dB(A)$L_{eq(when\ in\ use)}$

*The documented hall is marked as a recital hall which is to be designed with specialist advice for internal noise levels as opposed to the assembly hall recommendation of AS2107. Iteration of this criteria appropriate for usage by Barker College is to be further reviewed following concept approval.

5.1.2 Summarised External Noise Intrusion Criteria

The internal noise criteria adopted for each internal space is therefore summarised below based on the relevant State, Council and Australian Standard requirements.

Table 5-2 – Adopted Internal Noise Levels

Space /Activity Type	Recommended Design Sound Level Range
Assembly Halls Over 250 Seats	35 dB(A)$L_{eq(when\ in\ use)}$*
Seminar/ Conference Rooms	40 dB(A)$L_{eq(when\ in\ use)}$
Corridors and Lobbies	50 dB(A)$L_{eq(when\ in\ use)}$
Engineering Workshops – Teaching	45 dB(A)$L_{eq(when\ in\ use)}$
Engineering Workshops – Non-teaching	60 dB(A)$L_{eq(when\ in\ use)}$
Medical Rooms (First Aid)	45 dB(A)$L_{eq(when\ in\ use)}$
Music Practice Rooms	45 dB(A)$L_{eq(when\ in\ use)}$
Music Studios	35 dB(A)$L_{eq(when\ in\ use)}$
Office Areas	45 dB(A)$L_{eq(when\ in\ use)}$
Professional and Administrative Offices	40 dB(A)$L_{eq(when\ in\ use)}$
Teaching Spaces	45 dB(A)$L_{eq(when\ in\ use)}$
Staff Common Rooms	45 dB(A)$L_{eq(when\ in\ use)}$
Sports Hall	50 dB(A)$L_{eq(when\ in\ use)}$
Toilets/ Changerooms/ Showers	55 dB(A)$L_{eq(when\ in\ use)}$
Indoor Pools	55 dB(A)$L_{eq(when\ in\ use)}$
Café	45 dB(A)$L_{eq(when\ in\ use)}$

*The documented hall is marked as a recital hall which is to be designed with specialist advice for internal noise levels as opposed to the assembly hall recommendation of AS2107. Iteration of this criteria appropriate for usage by Barker College is to be further reviewed following concept approval.

6 NOISE EMISSION CRITERIA

The noise emission from the project site shall comply with the requirements of the following documents:

- NSW Planning SEARs document (Ref: SSD-31822612)
- NSW EPA *Road Noise Policy* (RNP) 2011, and
- NSW EPA *Noise Policy for Industry* (NPI) 2017.

6.1 NSW PLANNING SEARS DOCUMENT (REF: SSD-31822612)

The NSW Planning Secretary's Environmental Assessment Requirements (Application SSD-31822612) states the following in regard to noise emissions from the proposed site:

Issue and Assessment Requirements – Stage 1 Development

5. Noise and Vibration

- *Provide a quantitative assessment of the main noise and vibration generating noise sources and activities during construction in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines.*
- *Outline measures to minimise and mitigate the potential construction noise impacts on nearby sensitive receivers including proposed management and mitigation measures that would be implemented.*

Issue and Assessment Requirements – Concept Proposal

11. Noise and Vibration

Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise (including any public-address system, events, and out of hours use of school facilities) and vibration impacts on nearby sensitive receivers and structures, considers noise intrusion, and outline the proposed management and mitigation measures that would be implemented.

6.2 NSW EPA ROAD NOISE POLICY 2011

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA Road Noise Policy.

Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby property.

Table 6-1 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Local Roads	Day (7am to 10pm)	55 dB(A) $L_{eq(1hr)}$
	Night (10pm to 7am)	50 dB(A) $L_{eq(1hr)}$

However, if existing noise levels exceed those in the table above, Section 3.4 of the Road Noise Policy is applicable, which requires noise impacts are reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible. The following table therefore presents the adopted criteria based on unattended noise monitoring.

Table 6-2 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Residents along Unwin Road	Day (7am to 10pm)	60 dB(A) $L_{eq(1hr)}$
	Night (10pm to 7am)	54 dB(A) $L_{eq(1hr)}$
Residents along Clarke Road and College Crescent	Day (7am to 10pm)	64 dB(A) $L_{eq(1hr)}$
	Night (10pm to 7am)	58 dB(A) $L_{eq(1hr)}$

6.3 NSW EPA NOISE POLICY FOR INDUSTRY (NPI) 2017

The EPA NPI has two criteria which both are required to be satisfied, namely Intrusiveness and amenity. The NPI sets out acceptable noise levels for various localities. The policy indicates four categories to assess the appropriate noise level at a site. They are rural, suburban, urban and urban/industrial interface. Under the policy the nearest residential receivers would be assessed against the urban criteria.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

6.3.1 Intrusiveness Level

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Table 4-1. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

6.3.2 Project Amenity Level

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The EPA's NPI sets out acceptable noise levels for various localities. The recommended noise amenity area is based upon the measured background noise levels at the sensitive receiver. Based on the measured background noise levels detailed in Table 4-1, the Noise Policy for Industry suggests the adoption of the 'urban' categorisation.

The NPI requires project amenity noise levels to be calculated in the following manner:

$$L_{Aeq,15min} = \textit{Recommended Amenity Noise Level} + 3\ dB(A)$$

The amenity levels appropriate for the receivers surrounding the site are presented in Table 6-3 and Table 6-4.

Table 6-3 – EPA Amenity Noise Levels

Type of Receiver	Time of day	Amenity Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(15\ minute)}$
Residential – urban **R1**, **R4**, **R5**	Day	60	58
	Evening	50	48
	Night	45	43
Residential – suburban **R2**, **R3**	Day	55	53
	Evening	45	43
	Night	40	38

Table 2.2 of the NPI also details the recommended amenity noise level for industrial receivers as shown below.

Table 6-4 – EPA NPI Noise Emission Criteria (Non-Residences Surrounding Project Site)

Type of Receiver	Time of day	Recommended Noise Level dB(A) $L_{eq(period)}$	Recommended Noise Level dB(A) $L_{eq(15\ min)}$
Commercial premises	When in use	65	63
Active Recreation	When in use	55	53
School classroom – internal	Worst 1 Hour When in use	35 (internal)	35 (internal)

The NSW EPA Noise Policy for Industry (2017) defines:

- Day as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.
- Evening as the period from 6pm to 10pm.
- Night as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

6.3.3 Sleep Arousal Criteria

The Noise Policy for Industry recommends the following noise limits to mitigate sleeping disturbance:

> *Where the subject development / premises night -time noise levels at a residential location exceed:*
>
> - *$L_{eq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{Fmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level even assessment should be undertaken.*

Table 6-5 – Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
All residential receivers	34 dB(A) L_{90}	40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}

6.4 SUMMARISED NOISE EMISSION CRITERIA

Table 6-6 – EPA NPI Noise Emission Criteria (Residents Surrounding Project Site)

Residential Receiver	Time of day	Rating Background Noise Level (RBL) dB(A)$L_{eq(period)}$	Intrusiveness Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(15\ minute)}$	NPI Criteria for Sleep Disturbance
R2	Day (7am – 6pm)	44	**49**	53	N/A
	Evening (6pm – 10pm)	40	45	**43**	N/A
	Night (10pm – 7am)	34	39	**38**	**40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}**
R3	Day (7am – 6pm)	40	**45**	53	N/A
	Evening (6pm – 10pm)	40	45	**43**	N/A
	Night (10pm – 7am)	34	39	**38**	**40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}**
R4 & R5	Day (7am – 6pm)	51	**56**	58	N/A
	Evening (6pm – 10pm)	43	**48**	48	N/A
	Night (10pm – 7am)	34	**39**	43	**40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}**

The project noise trigger levels are indicated by the bolded values in the table above.

Table 6-7 – EPA NPI Noise Emission Criteria (Non-Residences Surrounding Project Site)

Type of Receiver	Time of day	Recommended Noise Level dB(A) $L_{eq(15\ min)}$
Commercial premises	When in use	63
Active Recreation	When in use	53
School classroom – internal	Worst 1 Hour When in use	35 (internal)

7 NOISE EMISSION ASSESSMENT

7.1 NOISE FROM MECHANICAL PLANT WITHIN PROPOSED SITE GENERALLY

Detailed plant selection and location has not been undertaken at this stage. Satisfactory levels will be achievable through appropriate plant selection, location and if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Noise emissions from all mechanical services to the closest residential and commercial receivers should comply with the requirements of Section 6.4. Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

7.1.1 Preliminary Mechanical Treatment Advice

An indicative assessment of initial design of primary plant items is presented below.

- Generators may be used for standby power, these may require attenuation to radiators and air intakes, as well as silencers/mufflers to the exhaust.
- Refrigeration equipment:
    - Refrigeration plant (chillers) are proposed to be located on the rooftop of the Aquatics & Tennis Centre behind full height screens. The refrigeration plant is shielded by the building design from local residents and will mitigate noise to surrounding industrial receivers. Indicatively, the screens shall be at minimum as high as the tallest plant item.
    - Night time operational speeds may need to be restricted.
- A rooftop plant enclosure is also proposed on the rooftop of the Co-curricular Performing Arts + Exam Centre behind full height screens. The refrigeration plant is shielded by the building design from local residents and will mitigate noise to surrounding industrial receivers. Indicatively, the screens shall be at minimum as high as the tallest plant item.
- Major fans (typically with a sound power over 80dB(A) – such as kitchen exhaust, major toilet exhaust and major relief air fans) may require acoustic treatment if located externally near sensitive receivers. It is recommended that axial (as opposed to roof mounted fans) are to be used as this will enable acoustic treatment to be incorporated within ductwork running to atmosphere and with attenuators if necessary. Indicatively a one diameter long attenuator or with 2m of internally lined ductwork.

Cumulative assessment of plant noise with other noise sources is recommended when conducting acoustic design of plant items.

Compliance with EPA acoustic criteria (as set out in Section 6.4) will be achievable, provided that detailed acoustic review of plant items is undertaken once plant is selected, and acoustic treatments similar to those outlined above are adopted. **Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels**.

7.2 NOISE GENERATED BY ADDITIONAL TRAFFIC ON PUBLIC ROADS

Assessment of noise generated by additional traffic on public roads has been undertaken based on the traffic trip generation information provided in the traffic report for the development prepared by TTPP (*Ref: 20443*, dated March 2022).

The existing peak hour trip generation rate was estimated by TTPP through a survey response. The resultant estimated existing trip generation rate from the survey response was used to assess traffic flow with regard to an improved drop-off and pick-up flow arrangement to estimate the net additional peak hour traffic associated with the proposed development as shown in Table 7.1 of the report and replicated in Table 7-1 below.

Table 7-1 – Additional Peak Hour School Traffic Generation Estimate

Group	Net Increase in Population	AM Trip Rate	PM Trip Rate	AM Peak Trips (veh/hr)			PM Peak Trips (veh/hr)		
				In	Out	Two Way	In	Out	Two Way
Junior Students (K-Y6)	+72	0.53	0.59	19	19	38	21	21	42
Secondary Students (Y7-12)	+96	0.21	0.10	10	10	20	5	5	9
Staff	+12	0.39	0.18	5	0	5	0	2	2
Total				**34**	**29**	**63**	**26**	**28**	**53**

TTPP therefore indicates that the proposal is expected to generate an additional 63vph and 53vph during the AM and PM peak periods respectively. Access/egress to the site has also been predicted in the traffic assessment with the following parameters being used for acoustic modelling as extracted from Figure 7.6 and Figure 7.8 of the report.

Table 7-2 – Traffic Flow Predictions

Movement Direction	Future Base Traffic Volumes – AM Peak	Future Base + Development Traffic Volumes – AM Peak	Future Base Traffic Volumes – PM Peak	Future Base + Development Traffic Volumes – PM Peak
Unwin Road Southbound	354	375	306	313
Unwin Road Northbound	301	319	231	248
Clarke Road Eastbound	333	364	234	260
Clarke Road Westbound	272	282	277	285
College Crescent Southbound	740	767	703	727
College Crescent Northbound	746	752	671	678

Predictions of traffic noise generation have been made with a modelling assumption that cars are travelling at 40 km/h along all roads due to school zone restrictions with a sound power level of 94 dB(A). The AM Peak volumes have been utilised for conservative assessment.

Noise emissions have been predicted at the worst affected residential receivers and compared against the acoustic criteria set out in Section 6.2. Noise levels have been predicted based on the relative increase of traffic volumes as presented in the table above with an assumption that residents are at minimum 10m from the kerb.

Table 7-3 – Cumulative Traffic Noise Including Additional Traffic Generation

Movement Direction	Future Base Traffic Noise Level – dB(A)L_{eq}	Future Base + Development Noise Level – dB(A)L_{eq}	Compliance
Unwin Road Southbound	Day: 60.1 dB(A)$L_{eq(1hr)}$	Day: 60.4 dB(A)$L_{eq(1hr)}$	Complies (≤ 62.1 dB(A) $L_{eq(1hr)}$ day time criteria)
Unwin Road Northbound	Day: 59.4 dB(A)$L_{eq(1hr)}$	Day: 59.7 dB(A)$L_{eq(1hr)}$	Complies (≤ 61.4 dB(A) $L_{eq(1hr)}$ day time criteria)
Clarke Road Eastbound	Day: 59.9 dB(A)$L_{eq(1hr)}$	Day: 60.3 dB(A)$L_{eq(1hr)}$	Complies (≤ 61.9 dB(A) $L_{eq(1hr)}$ day time criteria)
Clarke Road Westbound	Day: 59.0 dB(A)$L_{eq(1hr)}$	Day: 59.2 dB(A)$L_{eq(1hr)}$	Complies (≤ 61.0 dB(A) $L_{eq(1hr)}$ day time criteria)
College Crescent Southbound	Day: 63.3 dB(A)$L_{eq(1hr)}$	Day: 63.5 dB(A)$L_{eq(1hr)}$	Complies (≤ 65.3 dB(A) $L_{eq(1hr)}$ day time criteria)
College Crescent Northbound	Day: 63.4 dB(A)$L_{eq(1hr)}$	Day: 63.4 dB(A)$L_{eq(1hr)}$	Complies (≤ 65.4 dB(A) $L_{eq(1hr)}$ day time criteria)

The potential for additional traffic noise generation from the site is negligible in the context of the existing traffic noise along Unwin Road, Clarke Road and College Crescent.

7.3 OPERATIONAL NOISE SOURCES – DISCUSSION

An in-principle assessment of operational noise emissions can be discussed to provide insight into potential acoustic concerns with the concept proposal of the Aquatic & Tennis Centre and Co-curricular Performing Arts + Exam Centre.

- Noise emissions from the Aquatic & Tennis Centre will be primarily dominated by usage of the pool and tennis court areas.
    - It is noted that the pool area is enclosed, therefore noise emissions will be readily controlled through the appropriate selection of construction materials.
    - The show courts will be partially enclosed, however, the club courts will exist as external tennis courts sitting above the pool at an elevated level above ground RL.
    - Usage of the new tennis courts is likely to decrease noise emissions relative to the existing Clarke Road Tennis Courts due to the elevation providing a barrier effect to local surrounding residents. Nevertheless, an acoustic barrier can be erected along the proposed chain-link fence bounding the courts to provide an imperforate barrier for noise mitigation.
    - Proposed operating hours of the centre may include the early morning period of 6am-7am through to 10pm. Detailed noise calculations can be undertaken after concept stage.
- Noise emissions from the Co-curricular Performing Arts + Exam Centre will be primarily dominated by usage of the music practise rooms and the recital hall.
    - It is noted that the recital hall is enclosed and located within the centre of the structure, therefore noise emissions will be readily controlled through multiple layers of building construction through the appropriate selection of construction materials.
    - Music practise rooms shall be designed to provide flexibility in usage of the space. It is noted that music practise rooms can emit high noise levels, therefore thicker glazed elements shall be explored to mitigate any loss of acoustic amenity to local residents.
    - Proposed operating hours of the centre may include the early morning period of 6am-7am through to 10pm. Detailed noise calculations can be undertaken after concept stage.

On this basis, noise from the use of the facilities can be justified, noting the following recommendations:

- It is recommended that a detailed review of noise emissions associated with both facilities be undertaken post concept approval to incorporate acoustic mitigation measures into the architectural design prior to the issue of a construction certificate to ensure operational noise levels meet the noise emission requirements detailed in Section 6.4.
- It is recommended that a review and detailed design of all mechanical plant associated with the site be undertaken prior to the issue of a construction certificate to ensure plant noise levels meet the noise emission requirements detailed in Section 6.4. Any review of mechanical plant noise should take into consideration the operational noise levels from the site, such that the cumulative noise does not exceed the PNTL's.

8 CONSTRUCTION NOISE AND VIBRATION OBJECTIVES

All construction noise and vibration objectives presented below relate to both Stage 1 works and future construction associated with future stages.

8.1 NOISE OBJECTIVES

Noise associated with construction activities on the site will be assessed in conjunction with the following documents and guidelines:

- NSW DECC *Interim Construction Noise Guideline* (ICNG) 2009 and
- Australian Standard 2436-2010 "*Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*".

8.1.1 NSW DECC Interim Construction Noise Guideline 2009

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise management levels (based on ambient noise monitoring);
- Review of operational noise levels at nearby development; and
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)Leq(15min).*
- *"Highly noise affected level". Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)Leq(15min) at nearby residences.*

In addition to the above management levels for residential receivers, the ICNG nominates a Management Level of 70dB(A) $L_{eq(15min)}$ at commercial receiver facades (typical office, retail). And a Management Level of RBL + 5 dB(A) for any work done outside of standard hours.

Where noise from the construction works is above the "noise affected" level, the proponent shall apply any feasible and reasonable work practices to minimise noise. The "noise affected level is representative of a level where there may be some community reaction to noise.

If noise emissions are likely to exceed 75 dB(A)$L_{eq(15min)\ \text{"highly noise affected"}}$ at the boundary of surrounding affected residential receivers, the receiver is deemed to be "highly noise affected". The "highly noise affected" level is representative of a level where strong community reaction to noise is expected. Introduction of management controls such as scheduling of noisy periods, or respite periods is then recommended.

Section 4.1.2 and 4.1.3 of the EPA Interim Construction Noise Guideline also nominates management levels for other sensitive land uses (other than residences). Criteria relevant to this assessment is detailed below.

Table 8-1 – Noise Emission Goal at Commercial/Sensitive Property Boundaries

Location	"Noise Affected" Level – dB(A)$L_{eq(15min)}$ Standard Hours
Surrounding Commercial Receivers	70 externally at façade
Classrooms at schools and other educational institutions	45 internally

It is noted that the ICNG noise management levels apply to receivers outside the development. As the closest afterschool care and classrooms are owned by the proponent (Barker College), any management of noise and vibration with these buildings will be liaised directly with representatives of the proponent.

8.1.2 Australian Standard AS2436:2010 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*"

The Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites, AS2436:1981 nominates the following:

a. That reasonable suitable noise criterion is established,

b. That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and

c. The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the construction site.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic comprises between construction sites and potential noise affected receivers.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Adopt management conditions as per AS2436 in the event of a non-compliance.

8.2 VIBRATION OBJECTIVES

Vibration caused by construction at any residence or structure outside the subject site will be assessed with reference to the following:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*; and
- For human exposure to vibration, Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

The criteria and the application of this standard are discussed in separate sections below.

8.2.1 Structure Borne Vibrations

German Standard DIN 4150-3 (1999-02) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

The table below lists the peak particle velocity, which is the maximum absolute value of the velocity signals for the three orthogonal components. This is measured as a maximum value of any of the three orthogonal component particle velocities when measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 8-2 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

8.2.2 Assessing Amenity

The NSW EPA's *Assessing Vibration – A Technical Guideline* is based on the guidelines contained in British Standard BS 6472-1992 *Guide to Evaluate Human Exposure to Vibration Buildings (1Hz to 80Hz)*. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and manage vibration from the site. Where vibration exceeds, or is likely to exceed, the recommended levels then an assessment of reasonable and feasible methods for the management of vibration should be undertaken.

Table 8-3 – BS 6472 Vibration Criteria

		RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	**Time**	**Preferred**	**Maximum**	**Preferred**	**Maximum**	**Preferred**	**Maximum**
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices	Day or night-time	0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices	Day or night-time	0.64	1.28	13	26	18	36
Workshops		0.64	1.23	13	26	18	36

Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g., continuous construction or maintenance activity. (DECC, 2006).

Note 2: Impulsive vibration relate to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g., occasional loading and unloading, or dropping of heavy equipment. (DECC, 2006).

8.3 PRELIMINARY CONSTRUCTION ACTIVITY ASSESSMENT

Typical equipment/processes anticipated to be used for the construction of the subject development are presented below for preliminary analysis, noting that specific processes will be selected by the builder during the construction stage. Noise impacts from these activities on the amenity of the surrounding identified sensitive receivers, will be predicted in this section. Typically, the most significant sources of noise or vibration generated during a construction project will be demolition, excavation, civil works (compaction, asphalting) and piling.

The A-weighted sound power levels for the expected typical loudest equipment/processes for each stage of development are outlined in the table below.

Table 8-4 – Proposed Construction Activities and Associated Typical Sound Power Levels

Construction Stage	Equipment /Process	Typical Sound Power Level dB(A)
Demolition	Jackhammers	121
	Concrete Saw	117
	Machine Mounted Hydraulic Drill	113
	Excavator & Trucks	107
Excavation	Piling (bored)	111
	Vibratory Roller	108
	Excavator & Trucks	107
	Mobile Crane	104
	Powered Hand Tools (Electric)	102
Construction	Concrete Pump Truck	108
	Excavator & Trucks	107
	Mobile Crane	104
	Powered Hand Tools (Electric)	102

The noise levels presented in the above table are derived from the following sources:

1. On-site measurements
2. Table A1 of Australian Standard 2436-2010, and
3. *Data held by this office from other similar studies.

Noise levels take into account correction factors (for tonality, intermittency where necessary). These processes have been selected for indicative analysis and are subject to builder selection during construction stage.

The predicted noise levels during excavation and construction will depend on:

- The activity undertaken.
- The distance between the work site and the receiver. For many of the work areas, the distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.

Predicted noise levels are presented below. Predictions take into account the following:

- Noise reduction as a result of distance.
- Barrier effects resulting from shielding of the surrounding buildings (where applicable).

The following predictions represent a worst-case scenario for each respective item. The highest predicted noise levels assume direct line of sight with no barrier effects (such as second storey receivers with direct line of sight to the operating construction machinery).

Table 8-5 – Predicted Noise Generation to R1 Residential Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment*
Jackhammer (Demolition only)	61-77	Exceeds 54 dB(A) Noise Management Level and exceeds 75 dB(A) Highly Noise Affected Level when working close to the northern boundary
Concrete Saw (Demolition only)	57-73	Exceeds 54 dB(A) Noise Management Level but under 75 dB(A) Highly Noise Affected Level
Machine Mounted Hydraulic Drill (Demolition only)	53-69	Exceeds 54 dB(A) Noise Management Level when working close to the northern boundary but under 75 dB(A) Highly Noise Affected Level
Piling (bored) (Excavation only)	51-67	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	48-64	
Excavator & Trucks	47-36	
Mobile Crane	45-61	
Powered Hand Tools (Electric)	42-58	

*Daytime RBL has been conservatively assessed per the noise monitor at **R2**.

Table 8-6 – Predicted Noise Generation to R2 Residential Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Jackhammer (Demolition only)	61-82	Exceeds 54 dB(A) Noise Management Level and exceeds 75 dB(A) Highly Noise Affected Level when working close to the eastern boundary
Concrete Saw (Demolition only)	57-78	
Machine Mounted Hydraulic Drill (Demolition only)	53-74	Exceeds 54 dB(A) Noise Management Level when working close to the northern boundary but under 75 dB(A) Highly Noise Affected Level
Piling (bored) (Excavation only)	51-72	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	48-69	
Excavator & Trucks	47-68	
Mobile Crane	45-66	
Powered Hand Tools (Electric)	42-63	

Table 8-7 – Predicted Noise Generation to R3 Residential Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Jackhammer (Demolition only)	48-83	Exceeds 50 dB(A) Noise Management Level when working close to the southern boundary and exceeds 75 dB(A) Highly Noise Affected Level when working close to the southern boundary
Concrete Saw (Demolition only)	44-79	
Machine Mounted Hydraulic Drill (Demolition only)	40-75	Exceeds 50 dB(A) Noise Management Level when working close to the southern boundary but under 75 dB(A) Highly Noise Affected Level
Piling (bored) (Excavation only)	38-73	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	35-70	
Excavator & Trucks	34-69	
Mobile Crane	32-67	
Powered Hand Tools (Electric)	29-64	

Table 8-8 – Predicted Noise Generation to R4 Residential Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Jackhammer (Demolition only)	60-76*	Exceeds 61 dB(A) Noise Management Level when working close to the southern boundary but under 75 dB(A) Highly Noise Affected Level
Concrete Saw (Demolition only)	56-72	
Machine Mounted Hydraulic Drill (Demolition only)	52-68	
Piling (bored) (Excavation only)	50-66	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	47-63*	Under 61 dB(A) Noise Management Level
Excavator & Trucks	46-62*	
Mobile Crane	44-60	
Powered Hand Tools (Electric)	41-57	

*A 1-2 dB(A) exceedance is imperceptible to the human ear and is considered negligible.

Table 8-9 – Predicted Noise Generation to R5 Residential Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Jackhammer (Demolition only)	58-73	Exceeds 61 dB(A) Noise Management Level when working close to the western boundary but under 75 dB(A) Highly Noise Affected Level
Concrete Saw (Demolition only)	54-69	
Machine Mounted Hydraulic Drill (Demolition only)	50-65	
Piling (bored) (Excavation only)	48-63*	Under 61 dB(A) Noise Management Level
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	45-60	
Excavator & Trucks	44-59	
Mobile Crane	42-57	
Powered Hand Tools (Electric)	39-54	

*A 1-2 dB(A) exceedance is imperceptible to the human ear and is considered negligible.

Table 8-10 – Predicted Noise Generation to C1 Commercial Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Jackhammer (Demolition only)	61-78	Exceeds 70 dB(A) Noise Management Level when working close to the northern boundary
Concrete Saw (Demolition only)	57-74	
Machine Mounted Hydraulic Drill (Demolition only)	53-70	Under 70 dB(A) Noise Management Level
Piling (bored) (Excavation only)	51-68	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	48-65	
Excavator & Trucks	47-64	
Mobile Crane	45-62	
Powered Hand Tools (Electric)	42-59	

Table 8-11 – Predicted Noise Generation to C2 Commercial Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Jackhammer (Demolition only)	58-80	Exceeds 70 dB(A) Noise Management Level when working close to the northern boundary
Concrete Saw (Demolition only)	54-76	
Machine Mounted Hydraulic Drill (Demolition only)	50-72*	Under 70 dB(A) Noise Management Level
Piling (bored) (Excavation only)	48-70	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	45-67	
Excavator & Trucks	44-66	
Mobile Crane	42-64	
Powered Hand Tools (Electric)	39-61	

*A 1-2 dB(A) exceedance is imperceptible to the human ear and is considered negligible.

Table 8-12 – Predicted Noise Generation to E1 Educational Receiver

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (Internal Areas)	Comment
Jackhammer (Demolition only)	47-62	Exceeds 45 dB(A) Noise Management Level
Concrete Saw (Demolition only)	43-58	Exceeds 45 dB(A) Noise Management Level when working close to the southeastern boundary
Machine Mounted Hydraulic Drill (Demolition only)	39-54	
Piling (bored) (Excavation only)	37-52	
Vibratory Roller (Excavation) & Concrete Pump Truck (Construction)	34-49	
Excavator & Trucks	33-48	
Mobile Crane	31-46*	Under 45 dB(A) Noise Management Level
Powered Hand Tools (Electric)	28-43	

*A 1-2 dB(A) exceedance is imperceptible to the human ear and is considered negligible.

Internal noise levels were predicted by taking a conservative 10dB(A) reduction through a naturally ventilated open window. Noise reduction through a closed façade is likely to be in the range of 20-30dB(A).

8.4 PRELIMINARY CONSTRUCTION RECOMMENDATIONS

In light of the above, we recommend:

1. **Community Consultation/Notification:** Notification (leaflet or similar) of all residents within 100m of the development is to be done prior to commencement of works.

2. **Respite Periods:** To protect the amenity of nearby residential receivers, respite periods may be implemented where construction activities exceed the 'highly noise affected level (75 dB(A) $L_{eq(15min)}$). Specific recommendations of respite periods are to be addressed in a full construction noise and vibration management plan during construction stage if requested. In general:

    a. It is noted that the construction plant which is predicted to exceed the 'highly noise affected level' would only be in use intermittently during the demolition and excavation stage. As part of any proposed respite conditions, it is recommended to limit demolition and excavation works to not be carried out on Saturdays to reduce noise impacts outside of standard hours.

    b. It is noted that respite periods will extend the length of demolition, excavation and construction works and may provide heavier loss of amenity compared to non-imposed excavation.

3. **Liaison with Barker College:** Noise from construction processes to buildings within the greater Barker College will be managed through liaison with representatives of the school and the builder directly to minimise impacts within the greater development.

4. **Vibration Monitoring**: In the event of ongoing complaints of excessive vibration, vibration monitoring is to be implemented along the property boundary closest to the vibration receiver who issued the complaint for a short period to ascertain whether vibration parameters have been exceeded.

5. **Noise Monitoring:** In the event of ongoing complaints of excessive noise, noise monitoring is to be implemented along the property boundary closest to the noise receiver who issued the complaint for a short period to ascertain whether noise parameters are above reasonable levels per the site-specific noise management levels/ highly noise affected level.

6. **Quiet Work Methods/Technologies:**

    a. Materials handling/vehicles:

        i. Trucks to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.

        ii. Avoid careless dropping of construction materials into empty trucks.

        iii. Trucks, trailers and concrete trucks (if feasible) shall turn off their engines during idling to reduce noise impacts.

7. **Complaints Handling:** Procedures to handle and review complaints can be implemented.

8. **Site Induction:**

    a. A copy of the Construction Noise and Vibration Management Plan is to be available to contractors. The location of the CNVMP shall be advised in any site induction.

Site induction shall also detail the site contact in the event of noise complaint.

9 CONCLUSION

This report presents an acoustic assessment of noise and vibration impacts associated with Barker College - Master Plan.

Internal noise criteria have been established to satisfy the requirements of Australian Standard AS2107:2016 *Recommended Design Sound Levels and Reverberation Times for Building Interiors*.

External noise emissions criteria have been established in this report to satisfy the requirements from the following documents:

- NSW Planning SEARs document (Ref: SSD-31822612)
- NSW EPA *Road Noise Policy* (RNP) 2011, and
- NSW EPA *Noise Policy for Industry* (NPI) 2017.

Construction noise and vibration objectives have been established in this report to satisfy the requirements of the following documents:

- NSW DECC *Interim Construction Noise Guideline* (ICNG) 2009
- Australian Standard 2436-2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*
- German Standard DIN 4150-3 (1999-02), and
- NSW EPA *Assessing Vibration – A Technical Guideline*.

Preliminary assessment and mitigation techniques have been recommended. A full construction noise and vibration management plan can be conducted during construction stage if required.

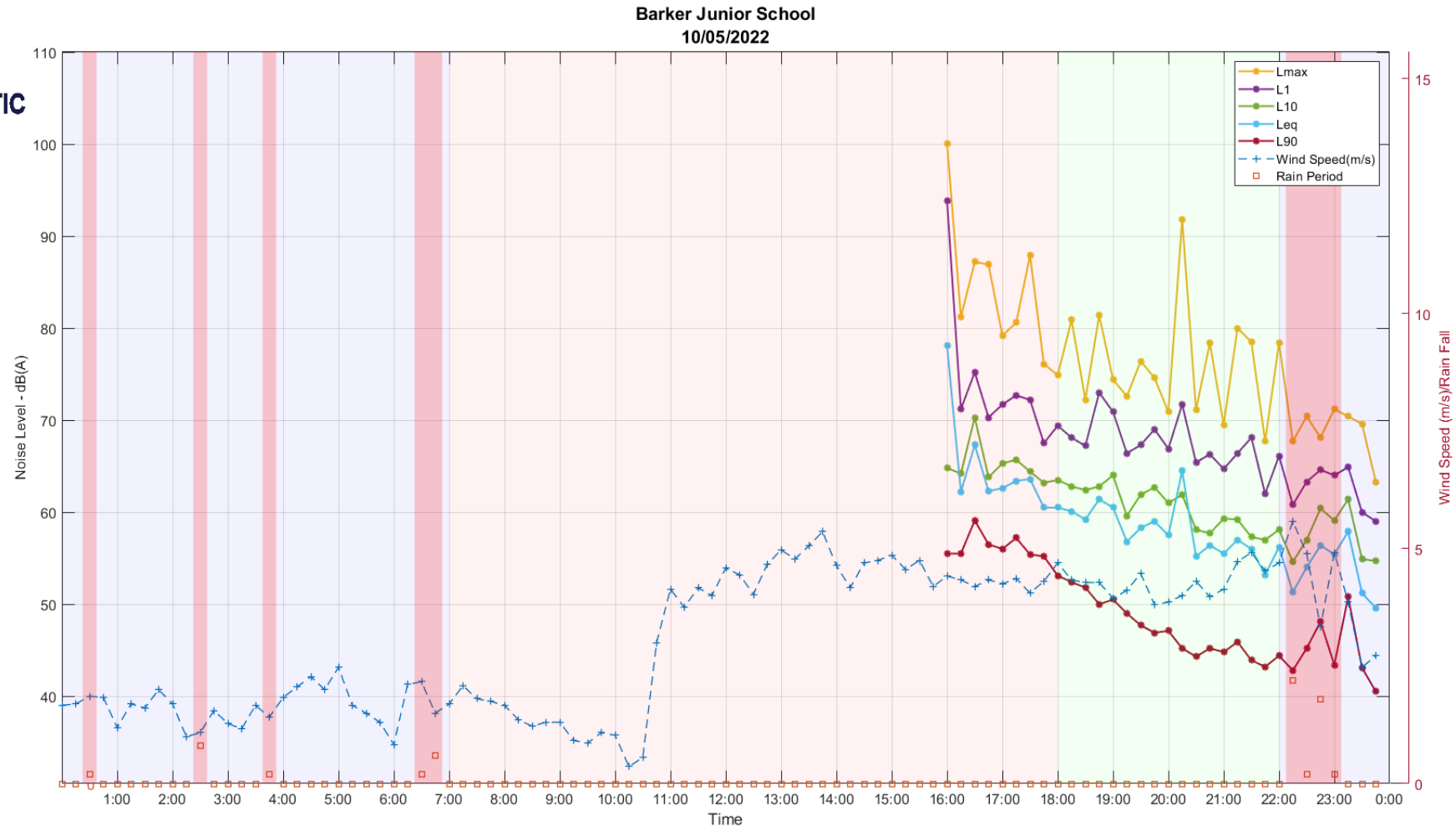
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Weber Yeh

APPENDIX ONE – UNATTENDED NOISE MONITORING

BARKER JUNIOR SCHOOL


Barker Junior School
10/05/2022
Lmax
L1
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
110
100
90
80
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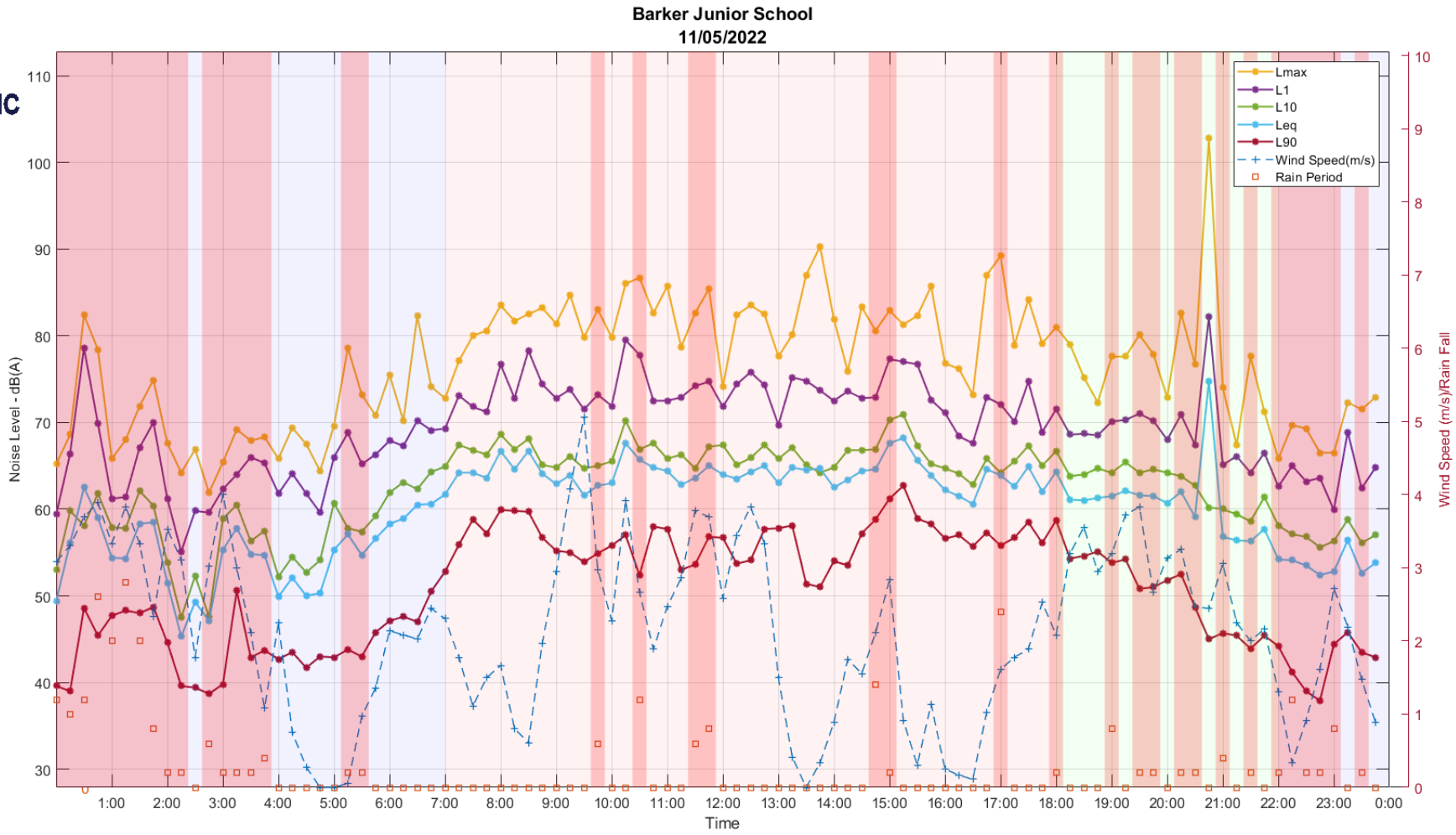
Barker Junior School
11/05/2022
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
Lmax
L1
L10
Leq
L90
Wind Speed(m/s)
Rain Period
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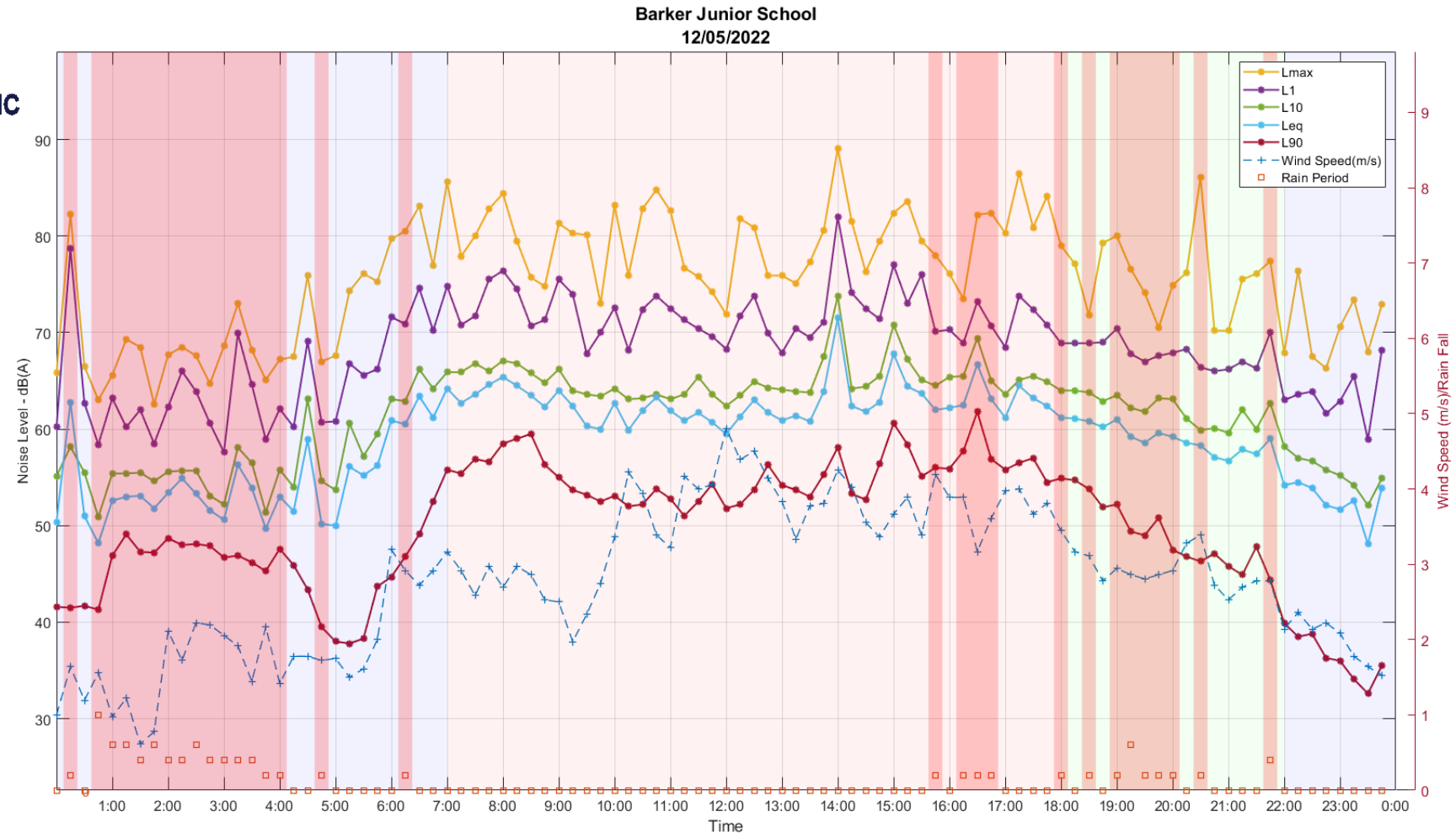
Barker Junior School
12/05/2022
Lmax
L1
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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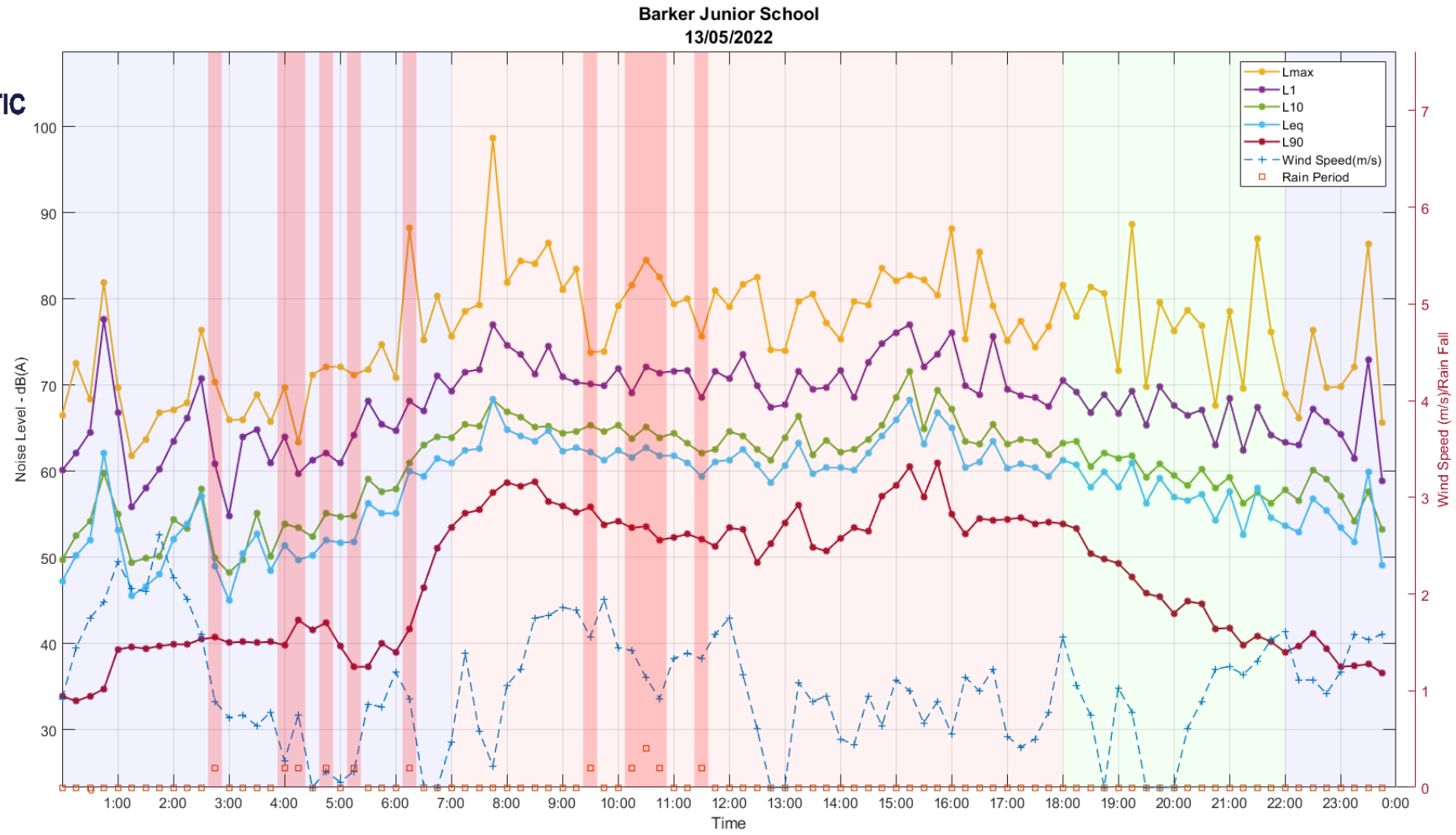
Barker Junior School
13/05/2022
Lmax
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L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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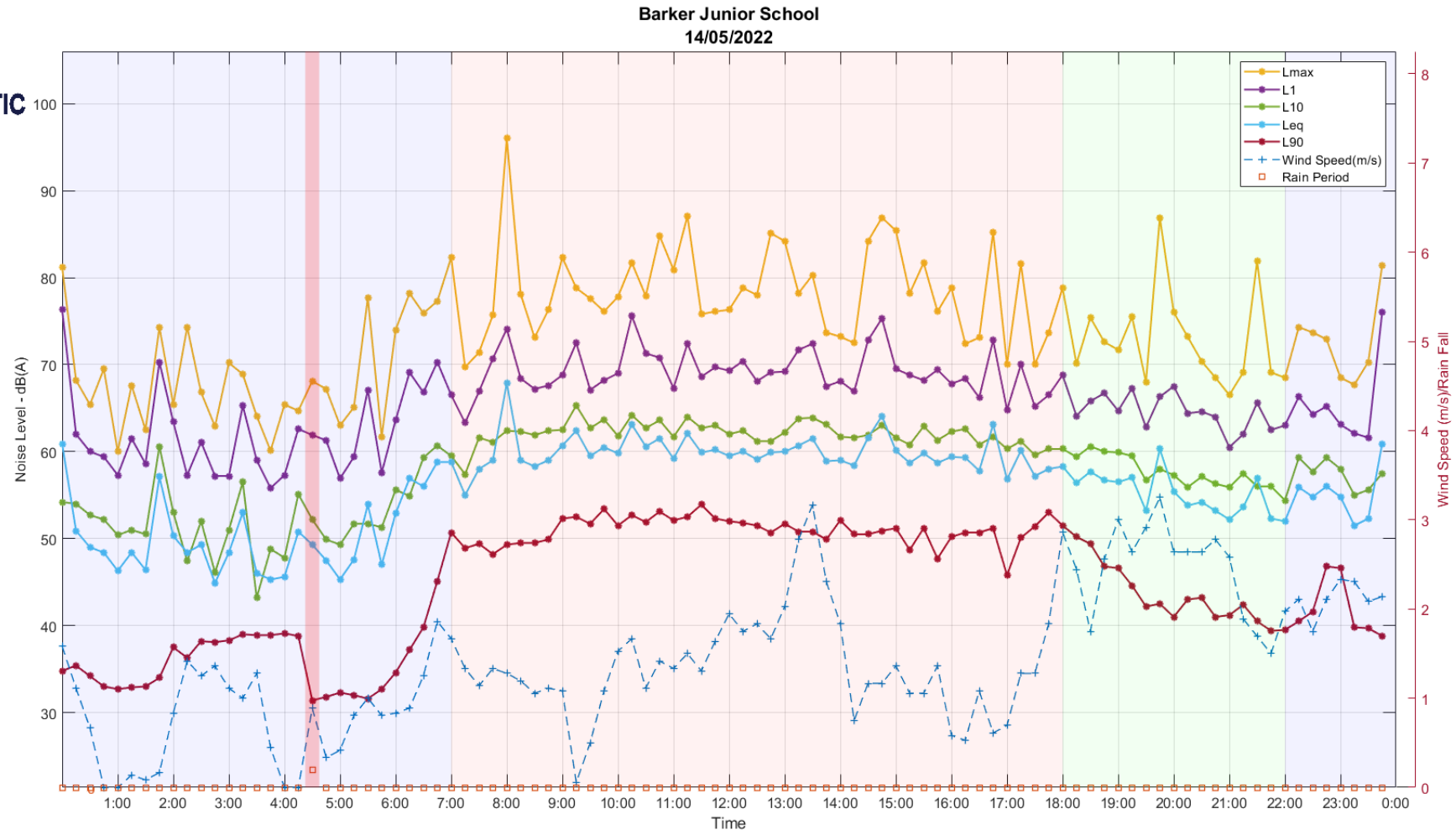
Barker Junior School
14/05/2022
Lmax
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Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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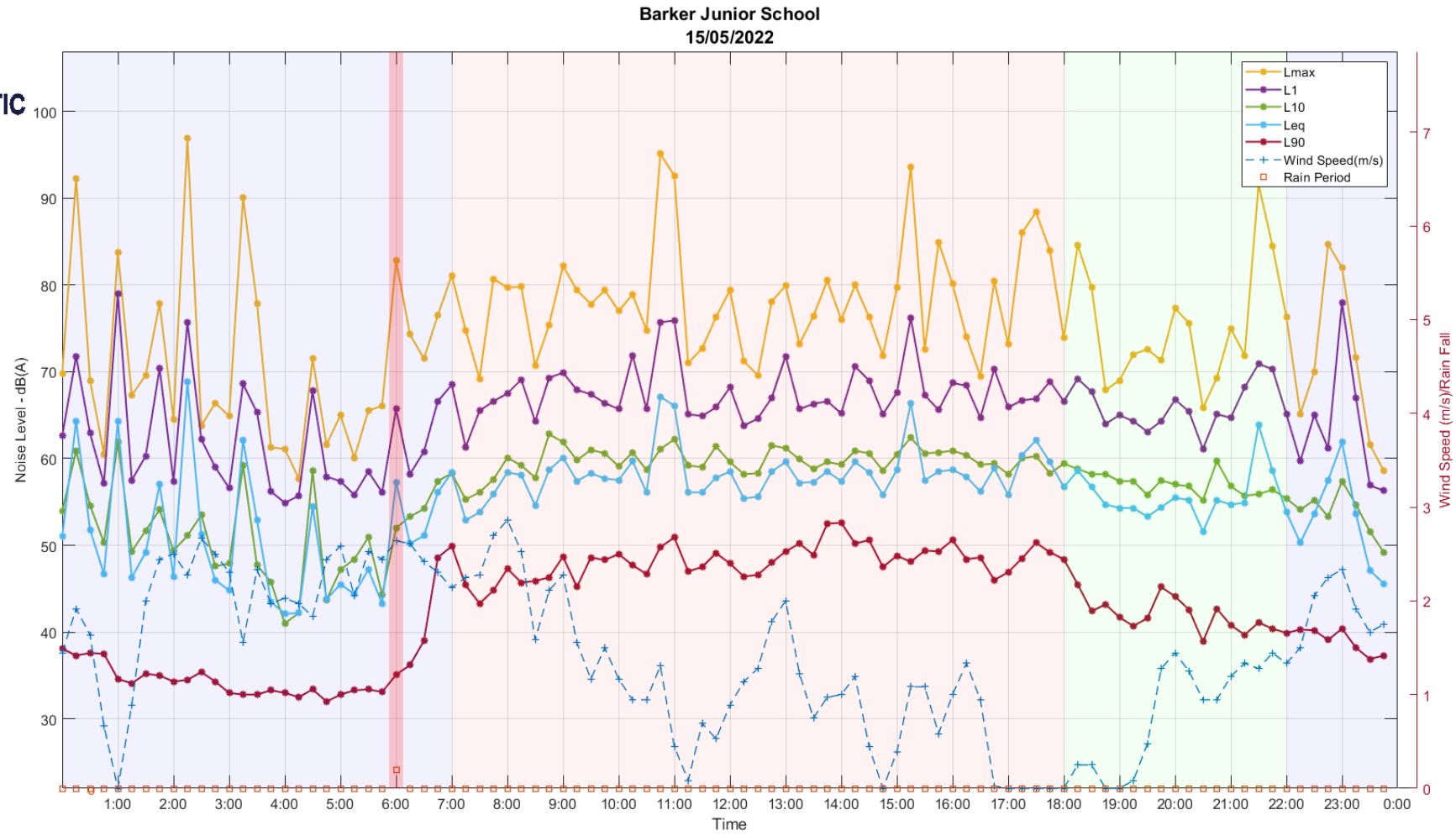
Barker Junior School
15/05/2022
Lmax
L1
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
7
6
5
4
3
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1:00
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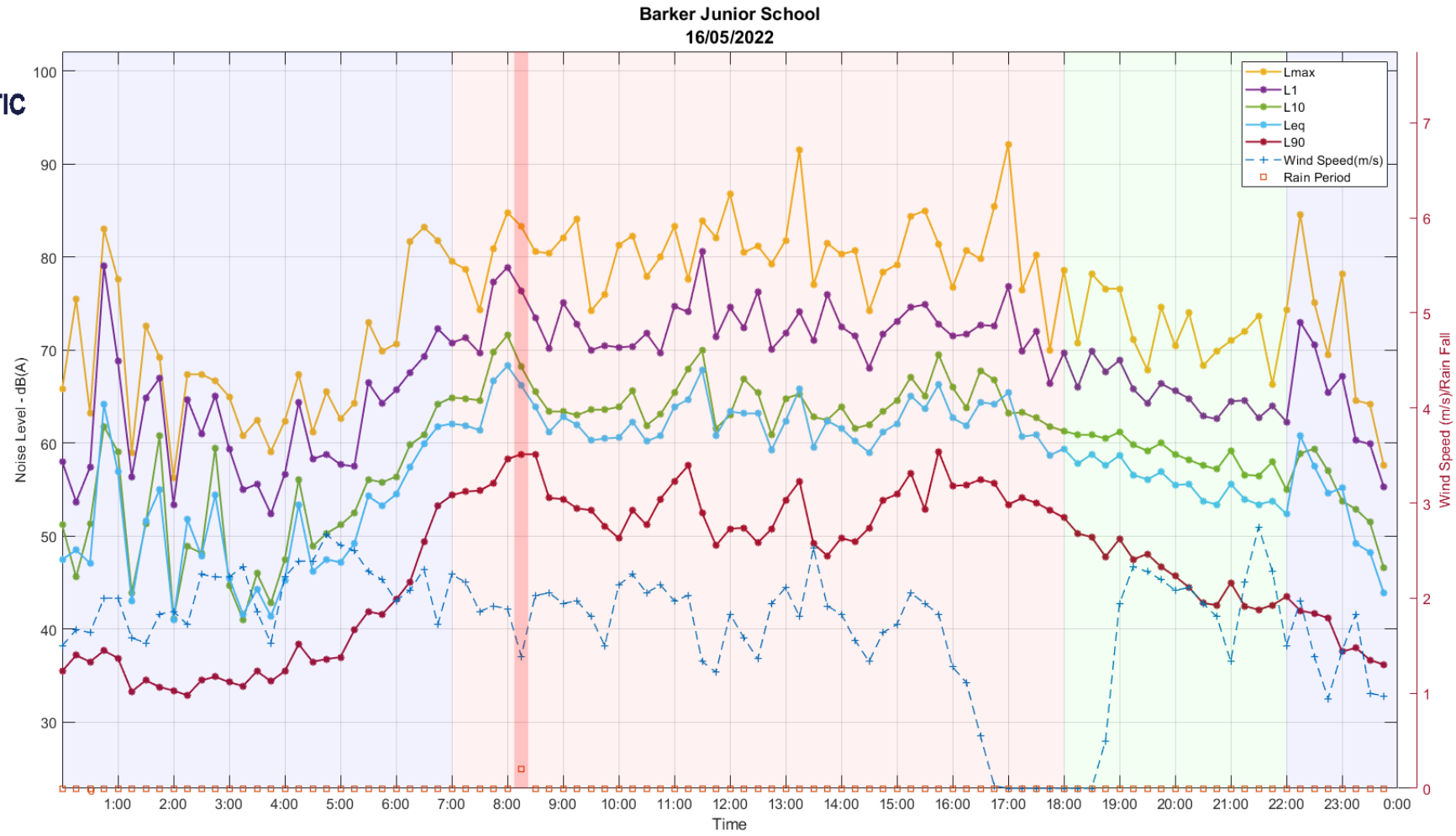
Barker Junior School
16/05/2022
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
Lmax
L1
L10
Leq
L90
Wind Speed(m/s)
Rain Period
100
90
80
70
60
50
40
30
7
6
5
4
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1:00
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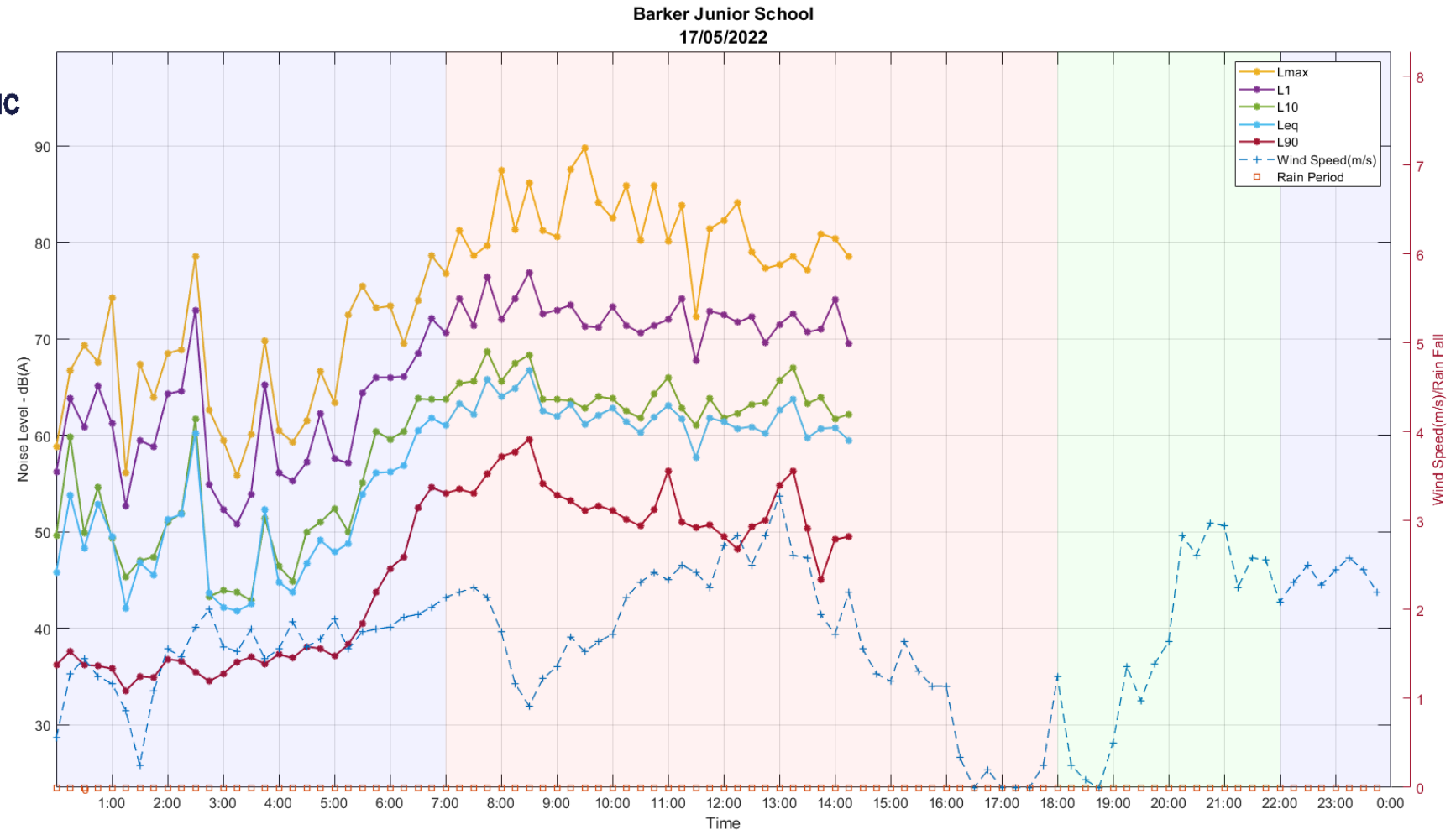
Barker Junior School
17/05/2022
Lmax
L1
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed(m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
5:00
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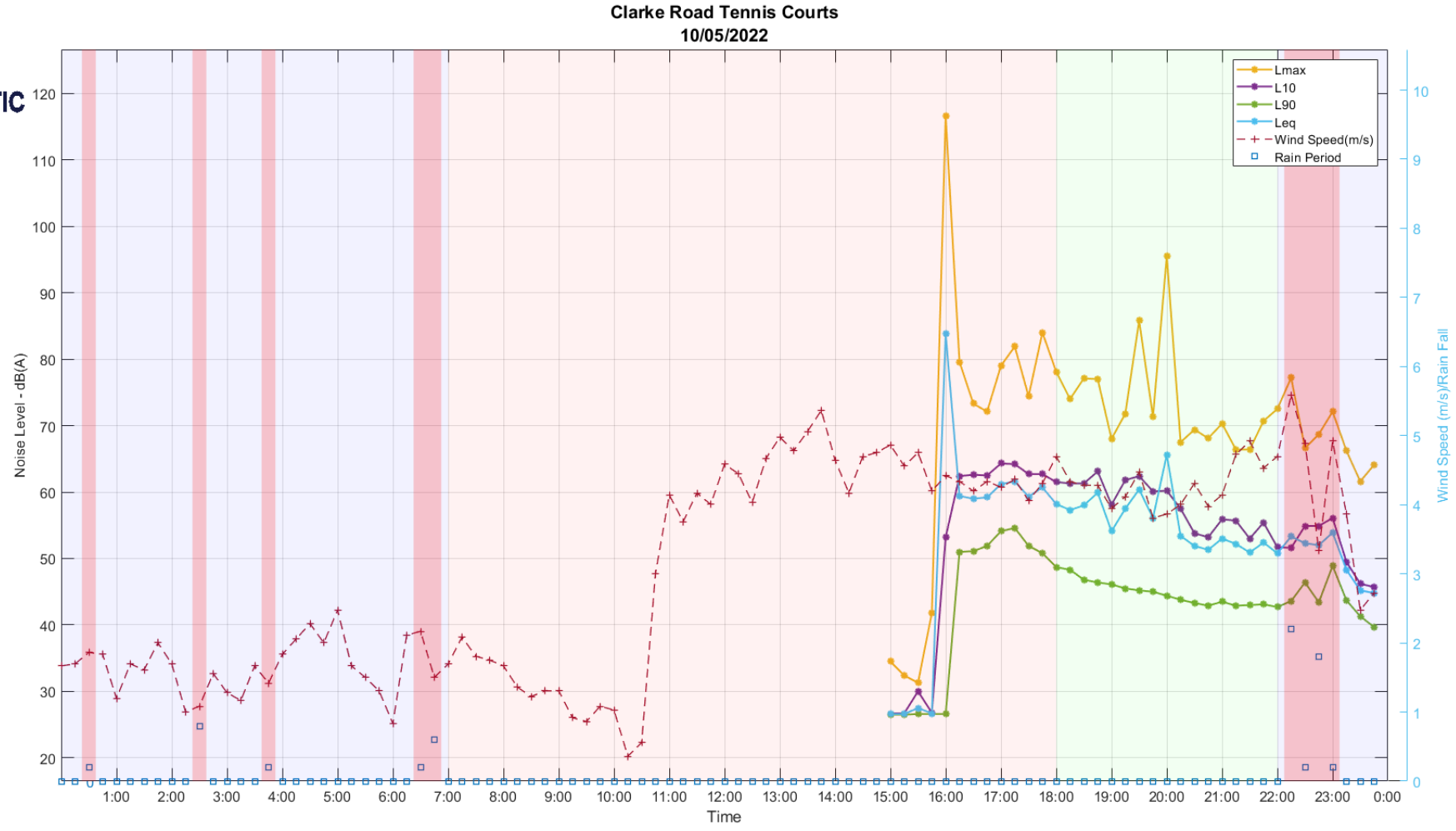
CLARKE ROAD TENNIS COURTS


Clarke Road Tennis Courts
10/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
90
80
70
60
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40
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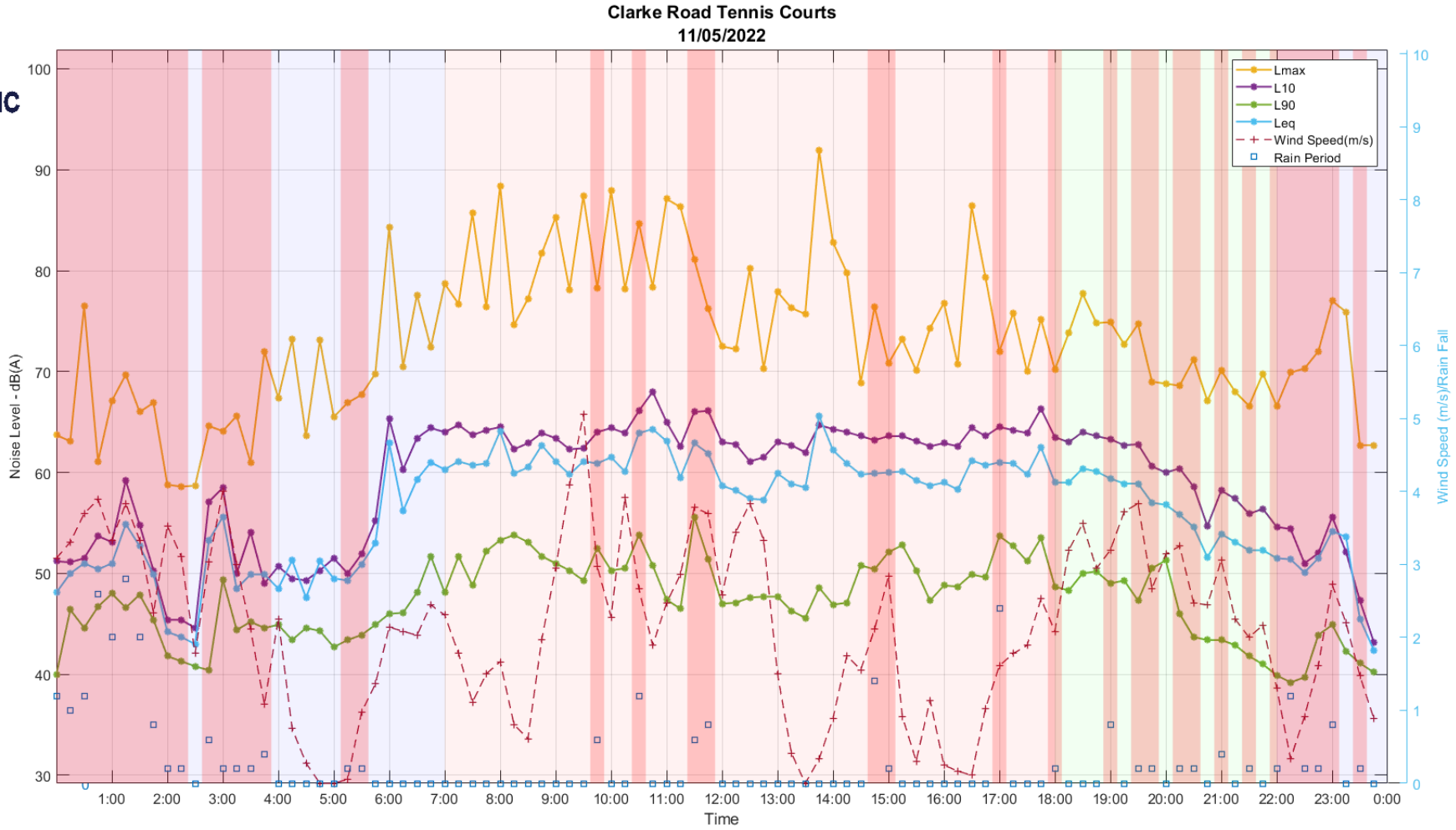
Clarke Road Tennis Courts
11/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
10
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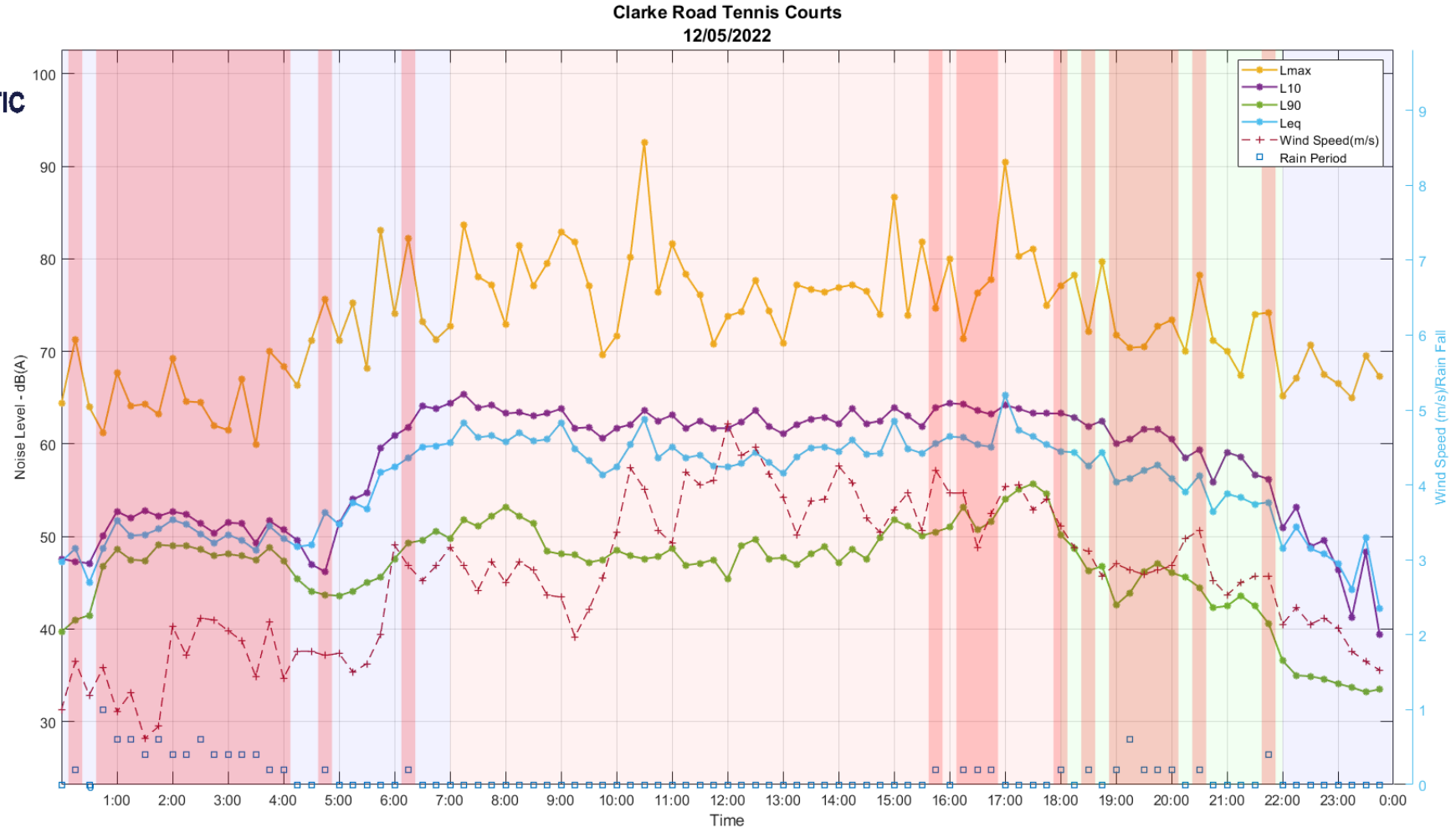
Clarke Road Tennis Courts
12/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
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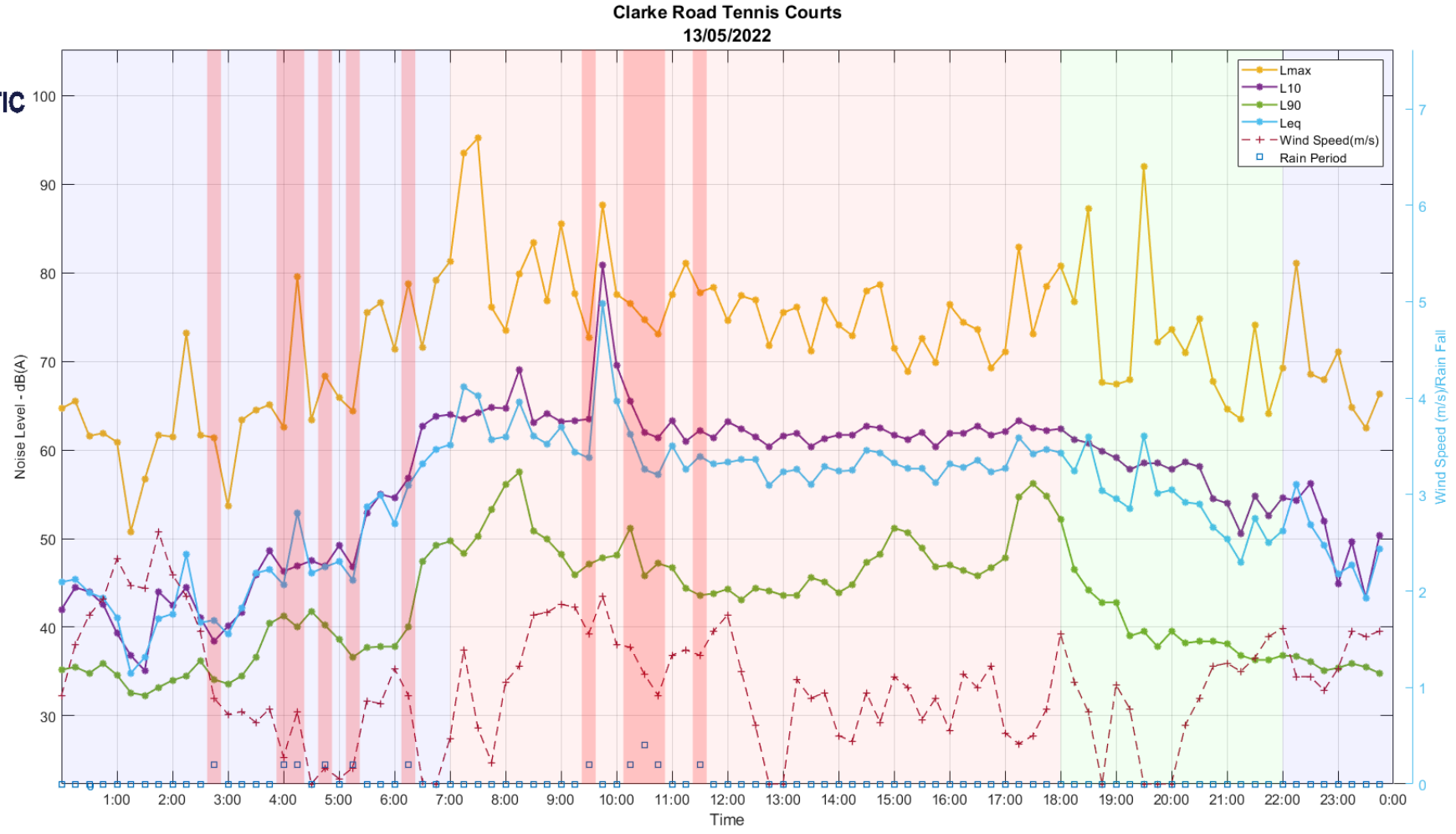
Clarke Road Tennis Courts
13/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
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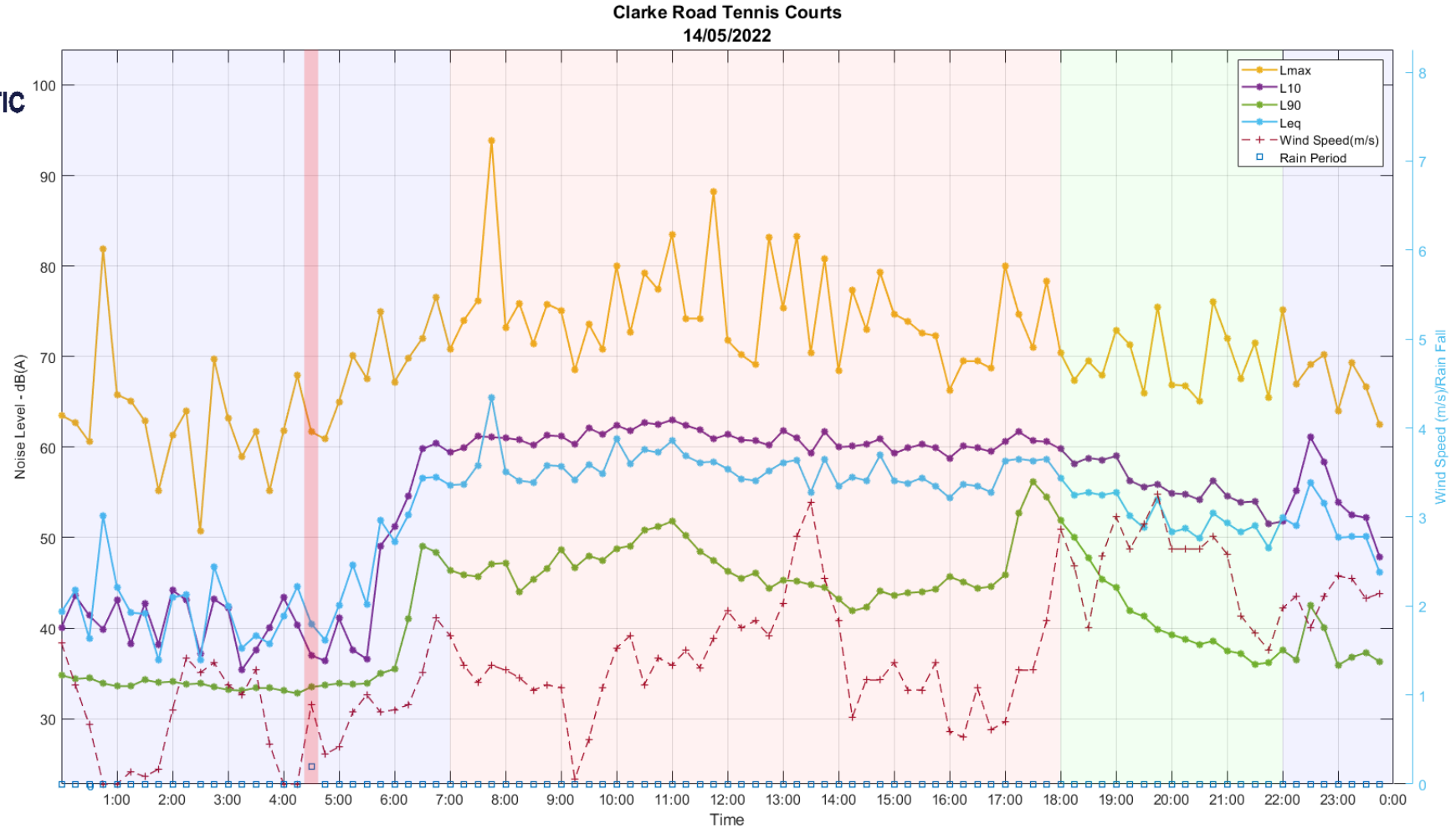
Clarke Road Tennis Courts
14/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
8
7
6
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4
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1:00
2:00
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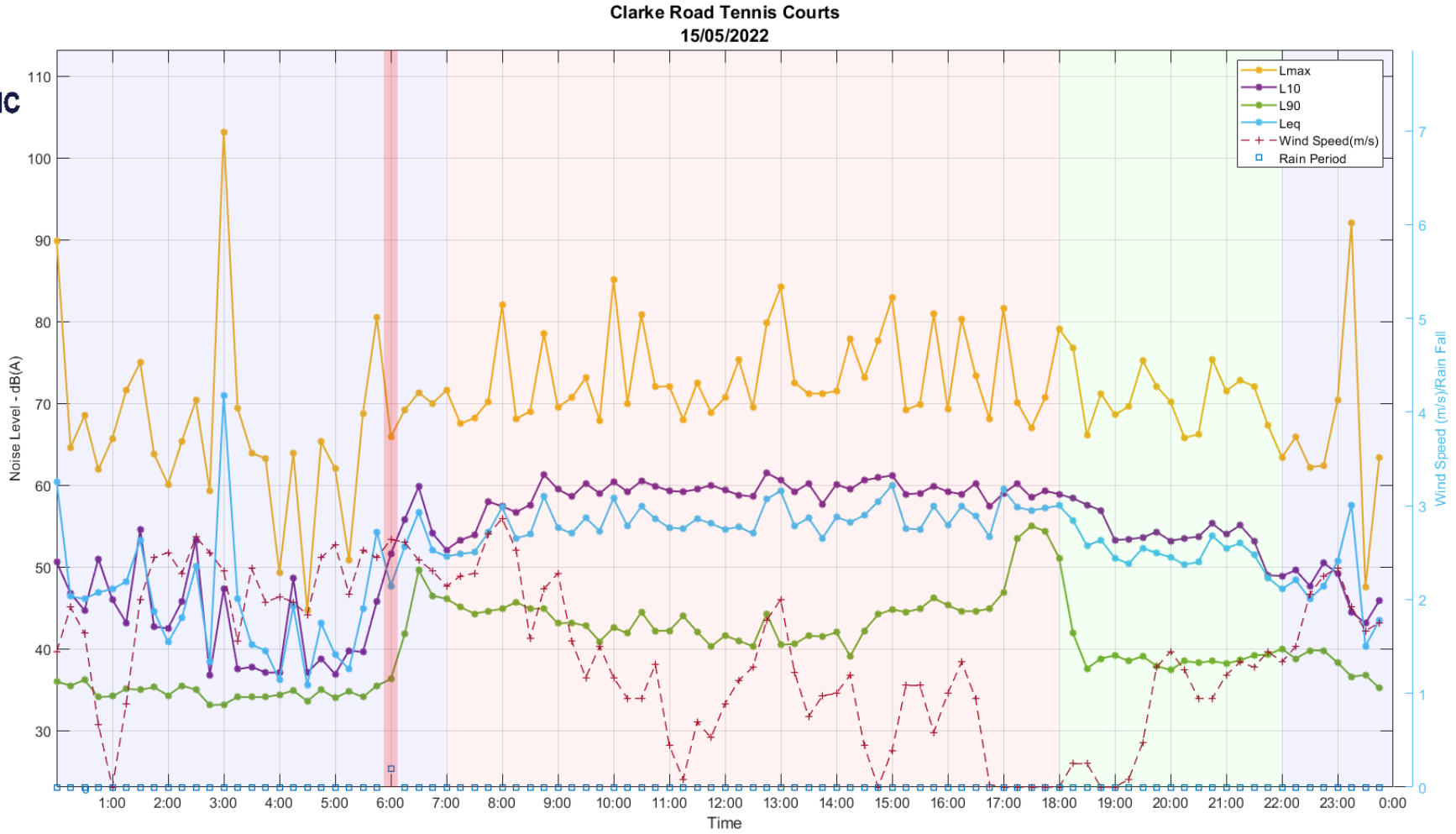
Clarke Road Tennis Courts
15/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
110
100
90
80
70
60
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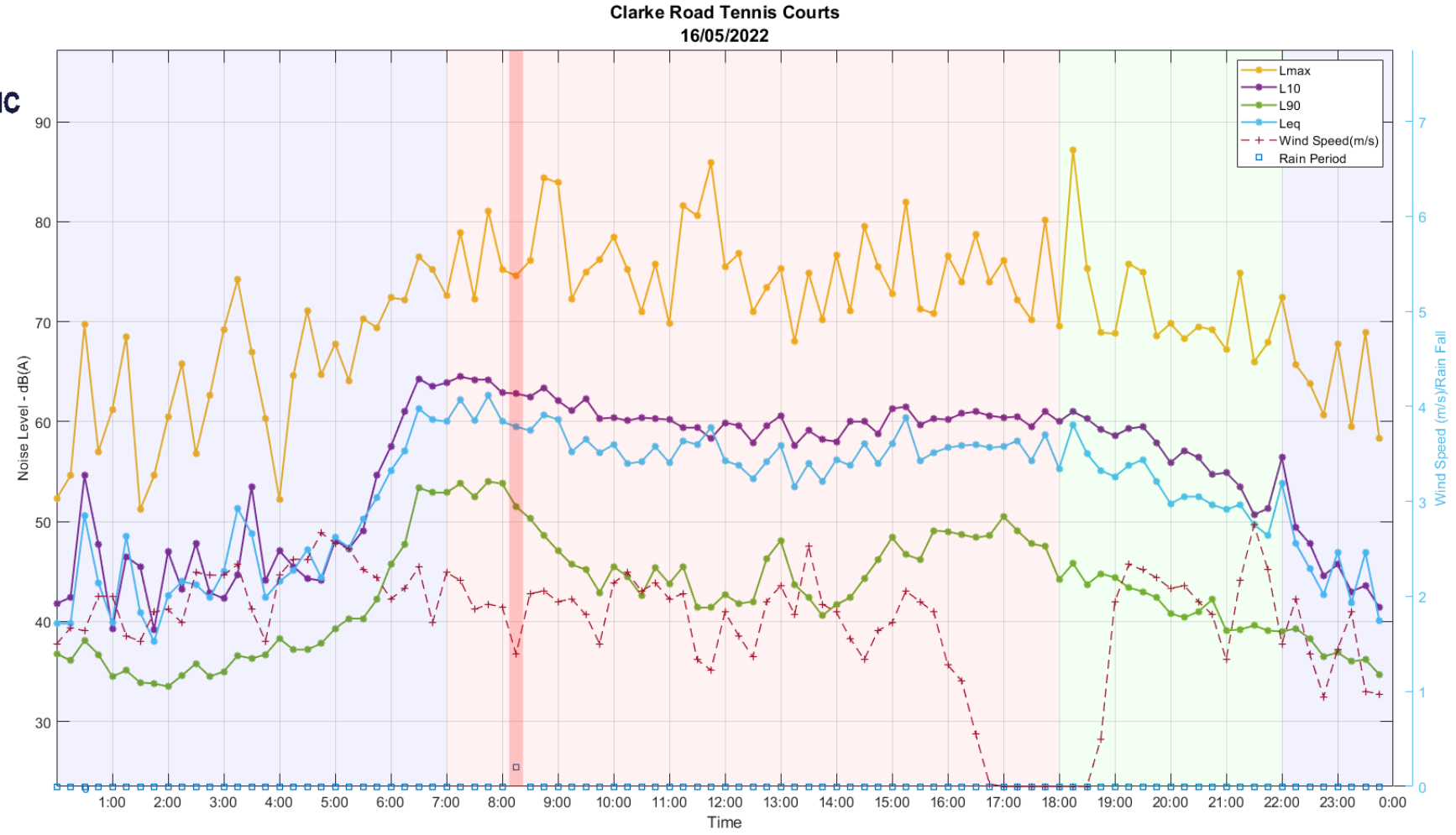
Clarke Road Tennis Courts
16/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
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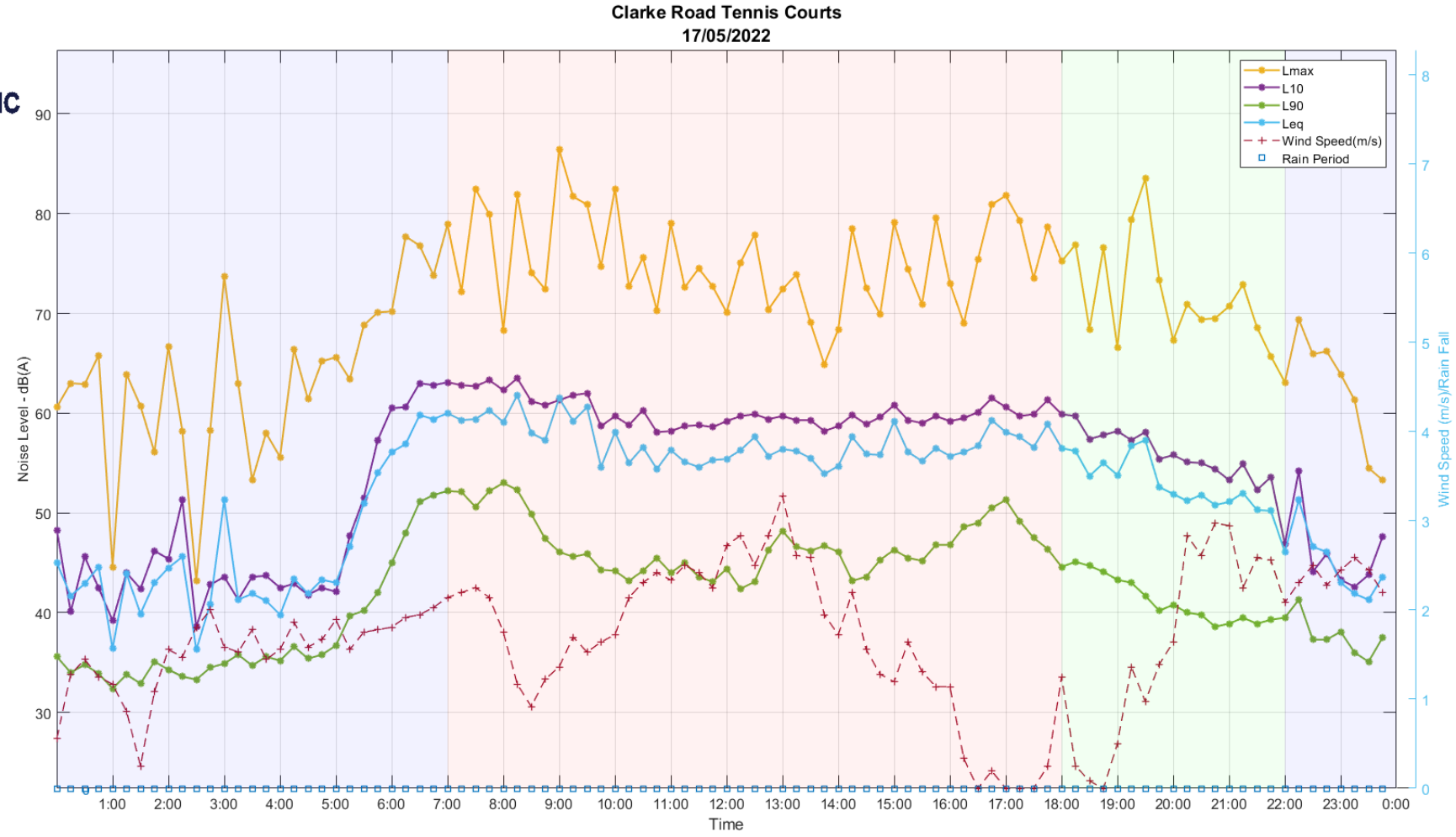
Clarke Road Tennis Courts
17/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
30
40
50
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0
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1:00
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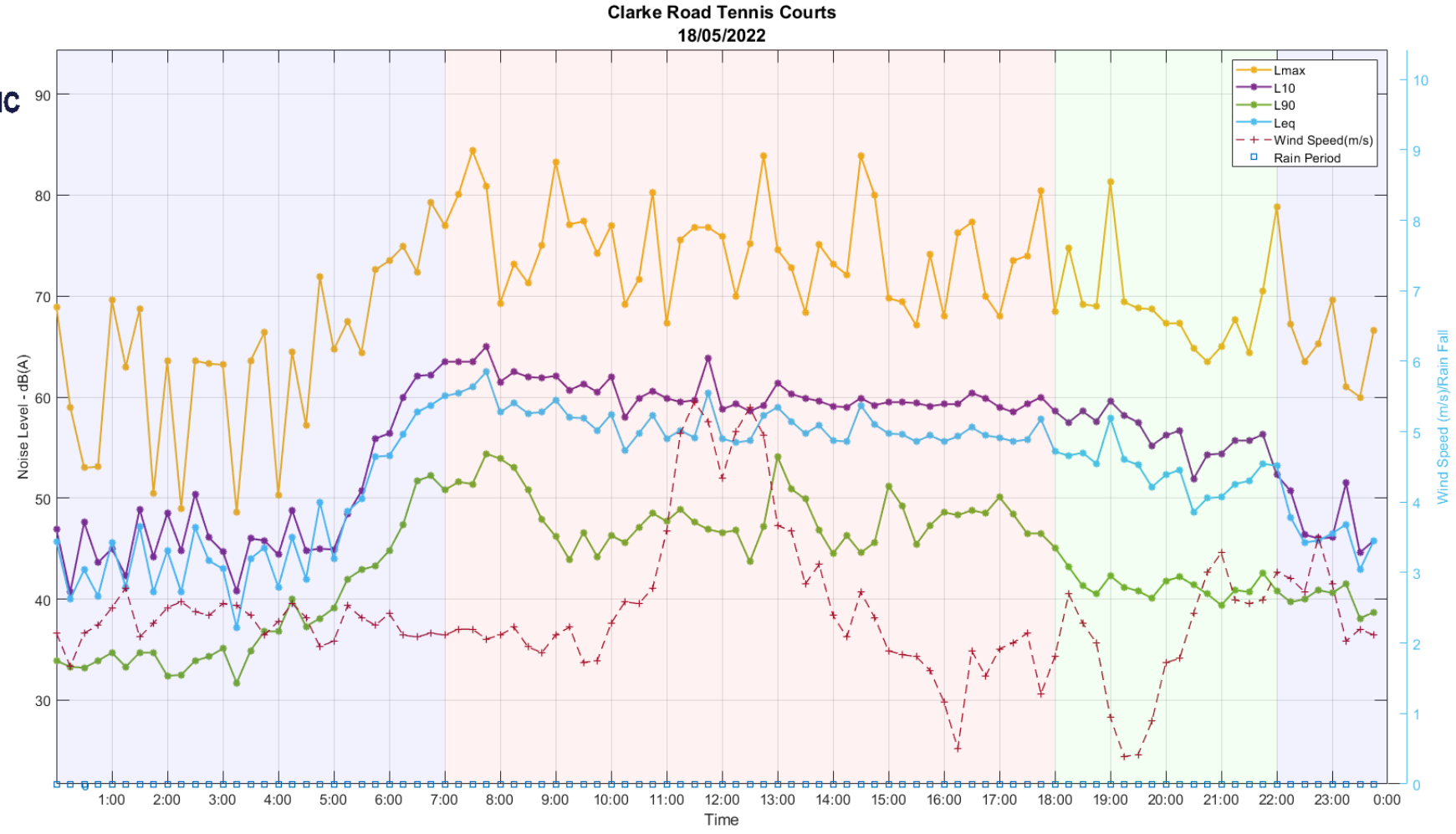
Clarke Road Tennis Courts
18/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
30
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9
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7
6
5
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1:00
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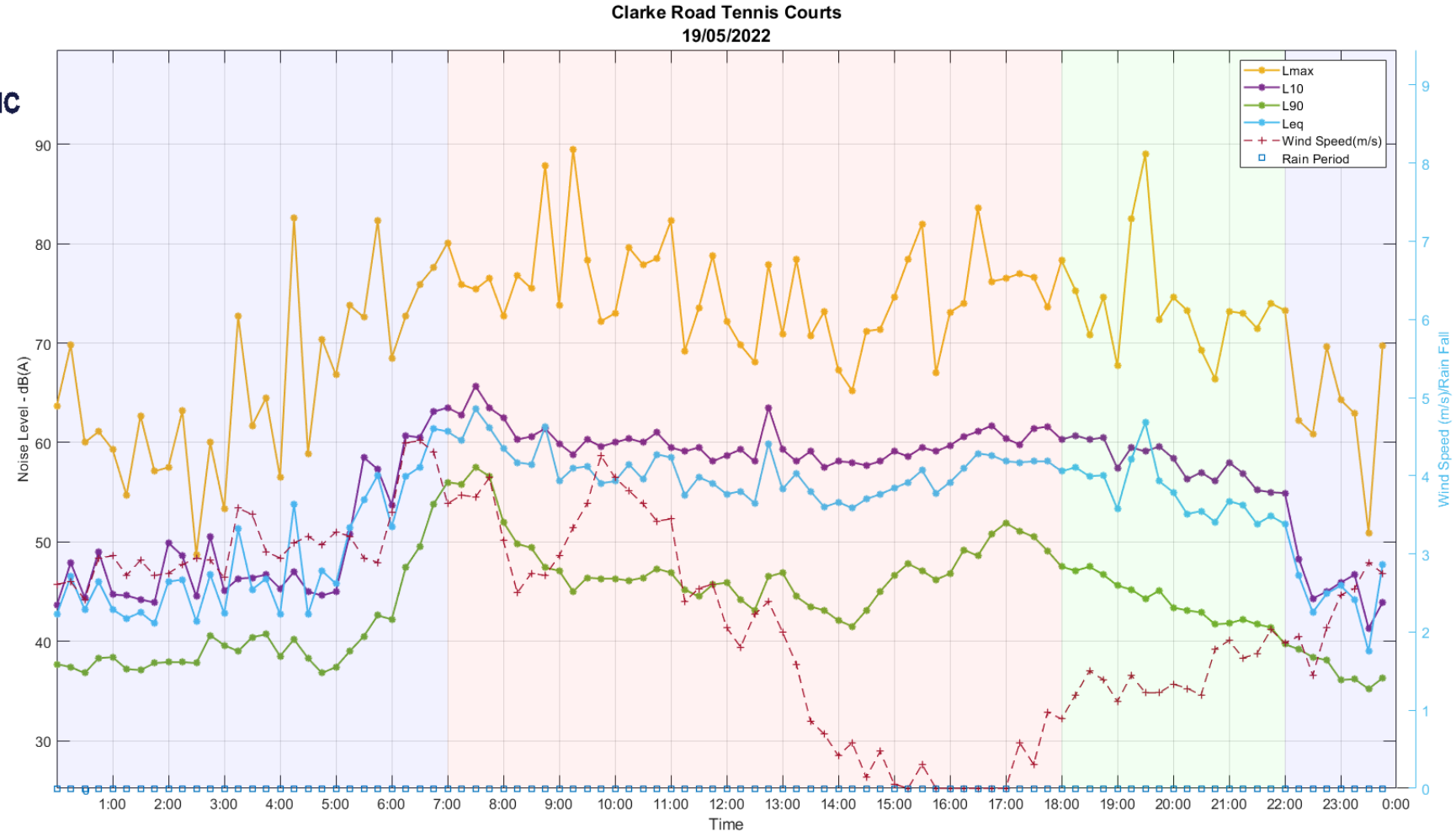
Clarke Road Tennis Courts
19/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
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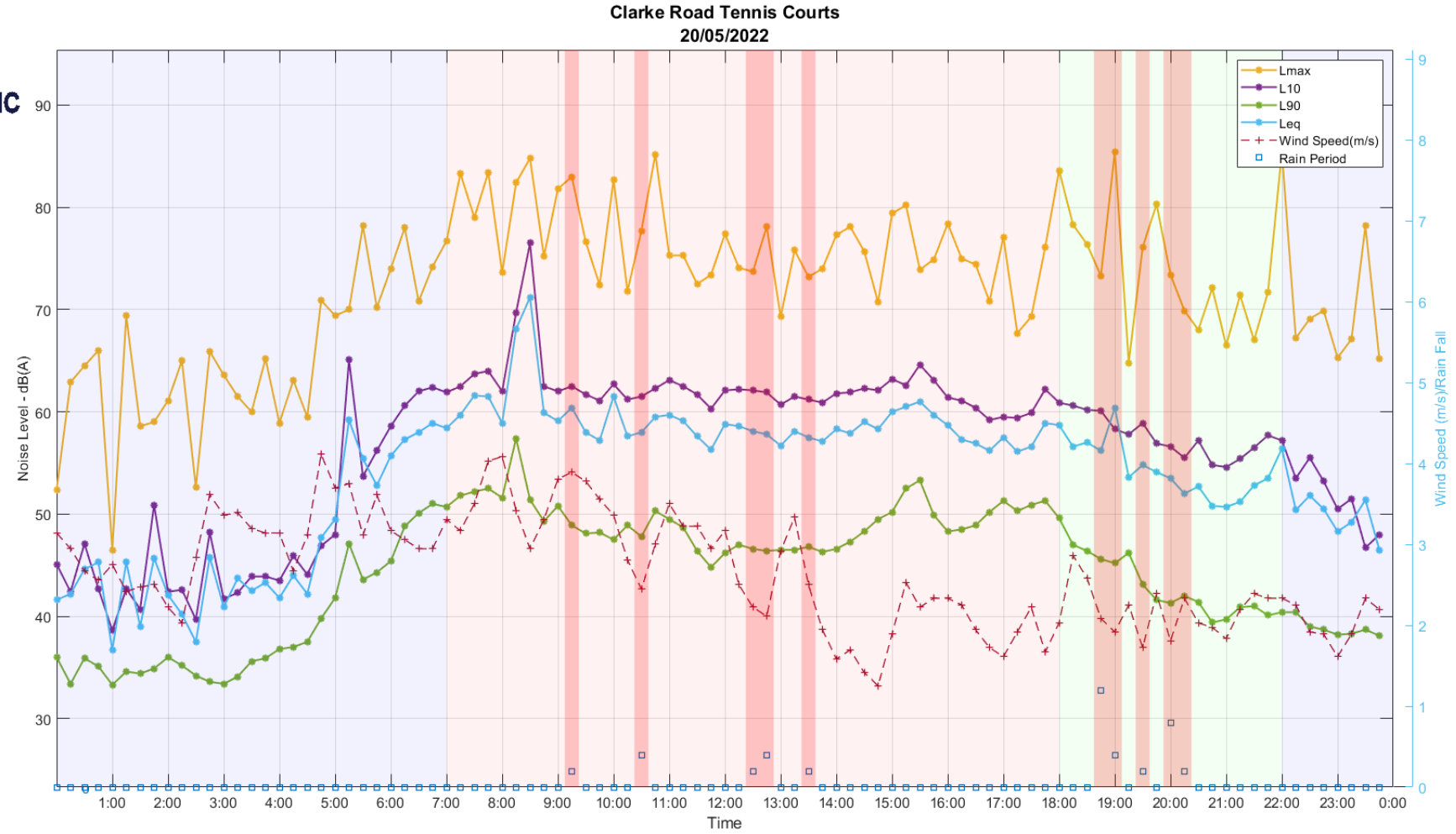
Clarke Road Tennis Courts
20/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
5:00
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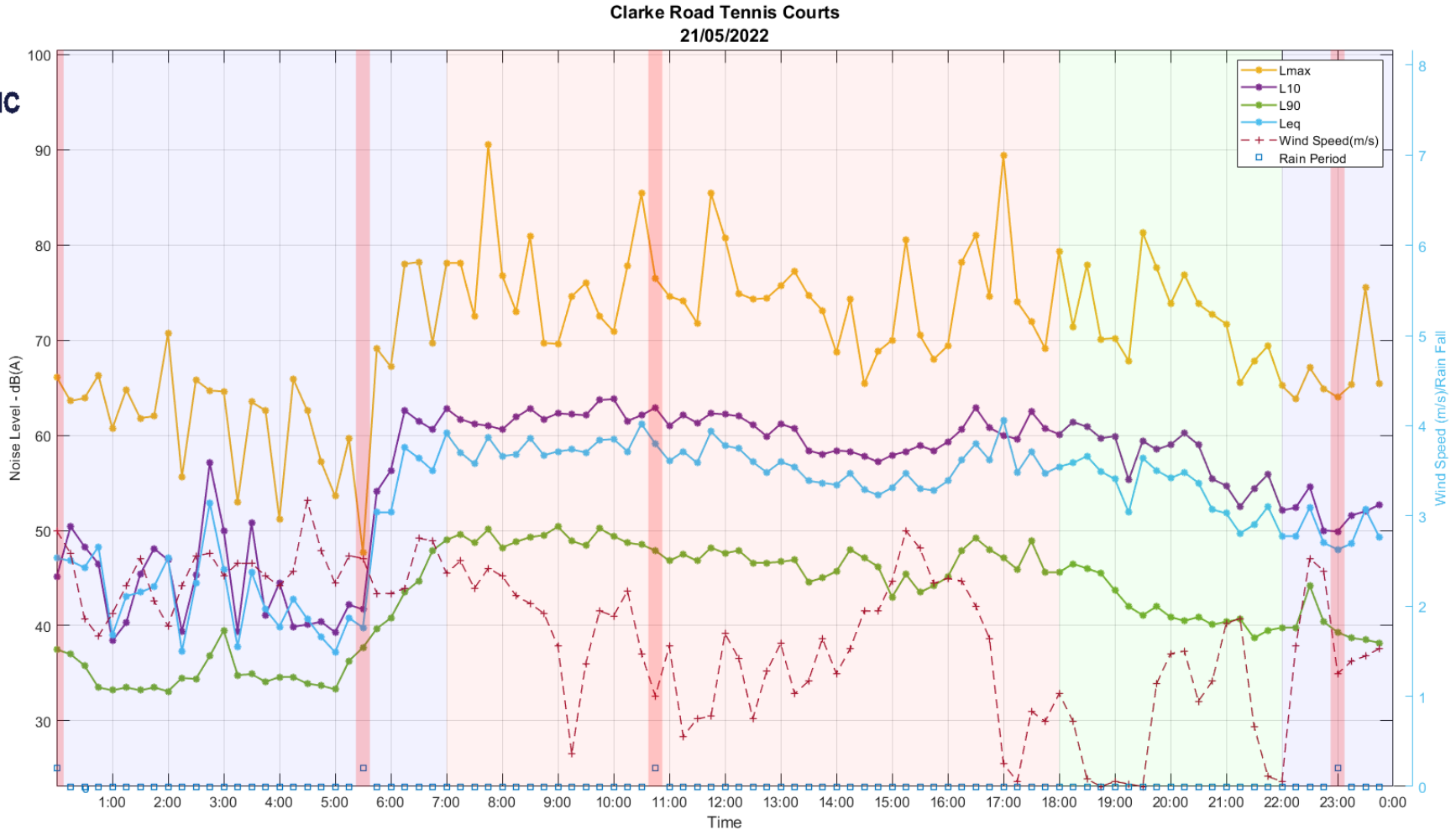
Clarke Road Tennis Courts
21/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
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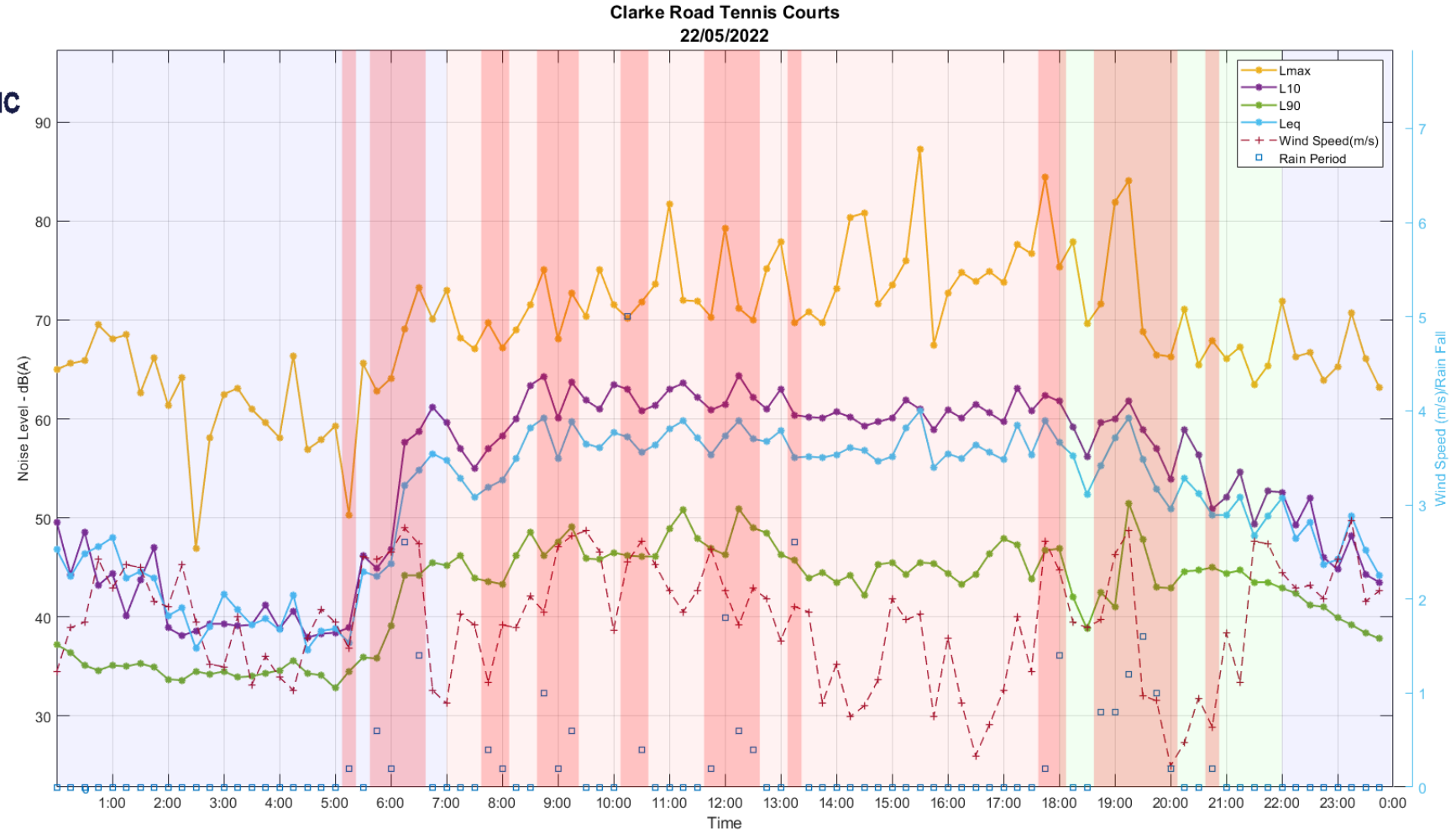
Clarke Road Tennis Courts
22/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
5:00
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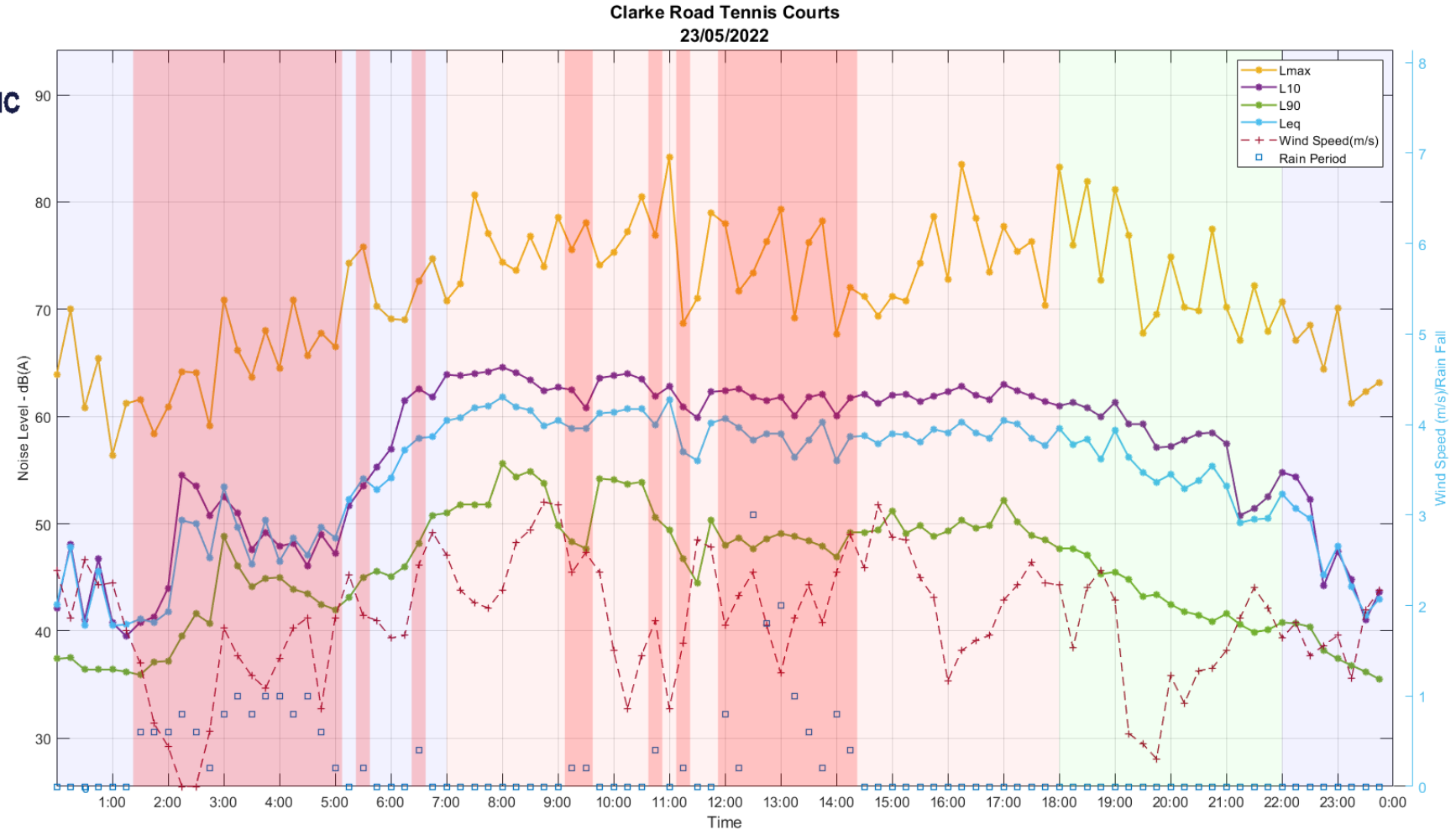
Clarke Road Tennis Courts
23/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
30
8
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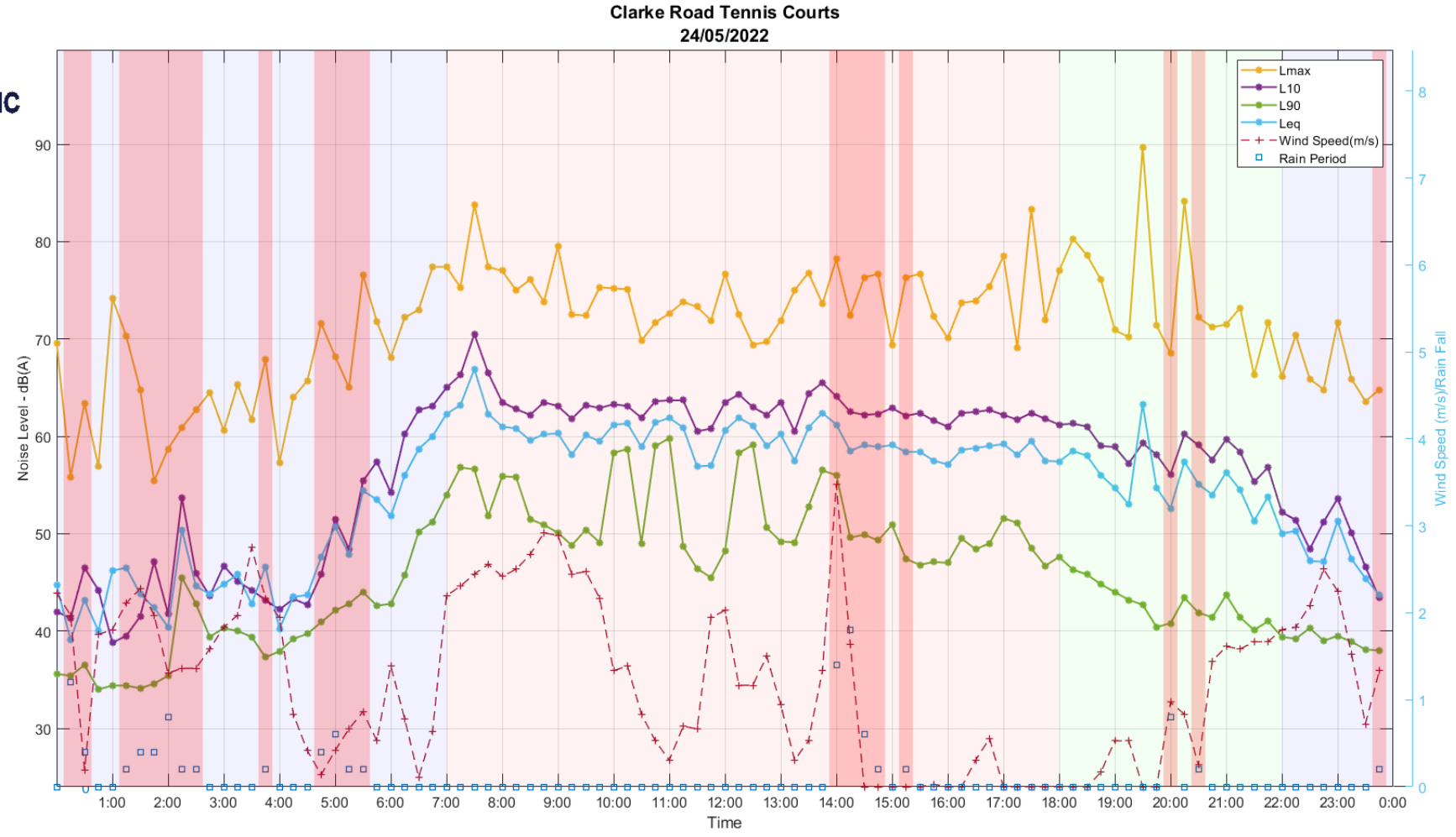
Clarke Road Tennis Courts
24/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
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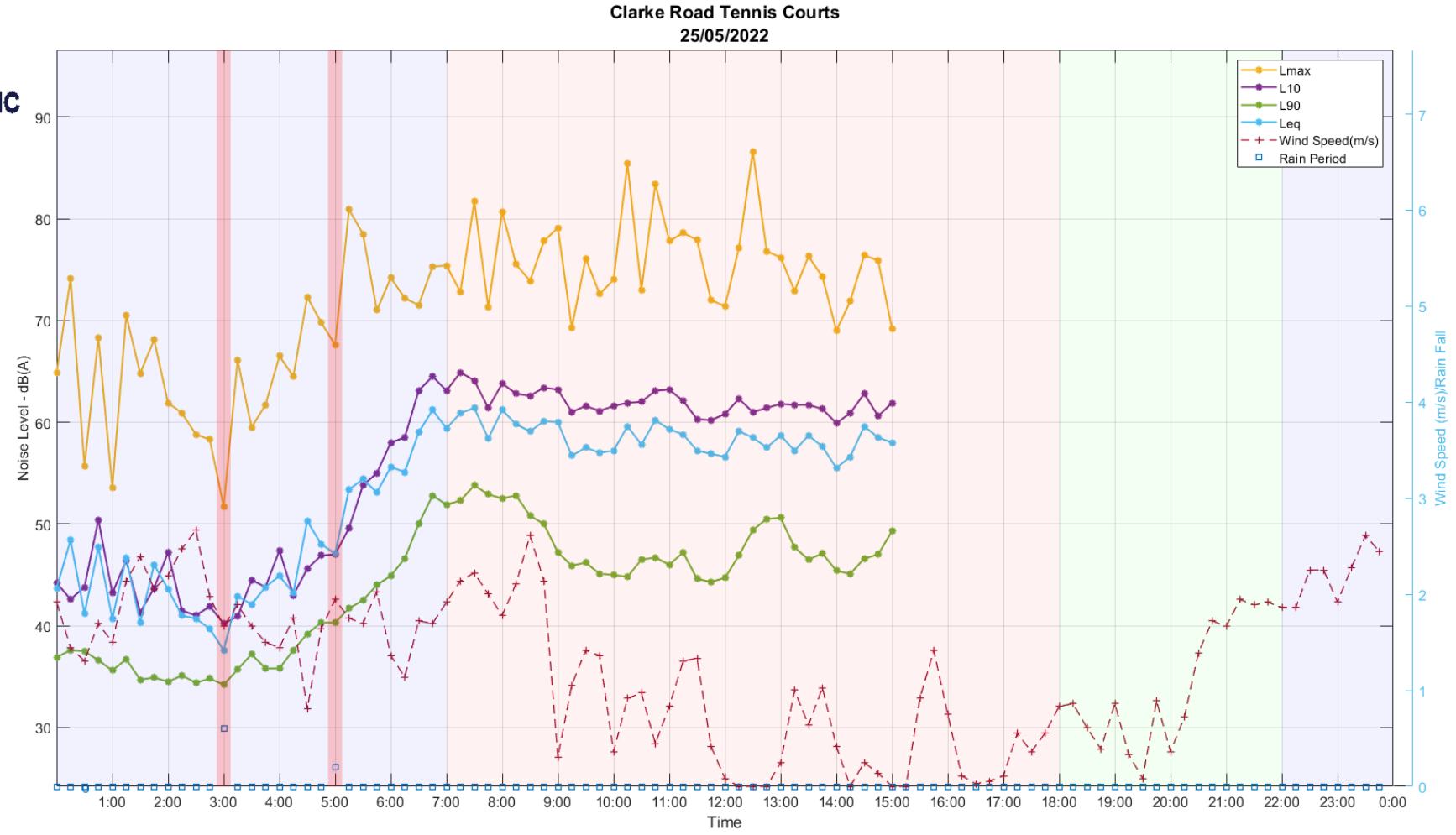
Clarke Road Tennis Courts
25/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
30
7
6
5
4
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1:00
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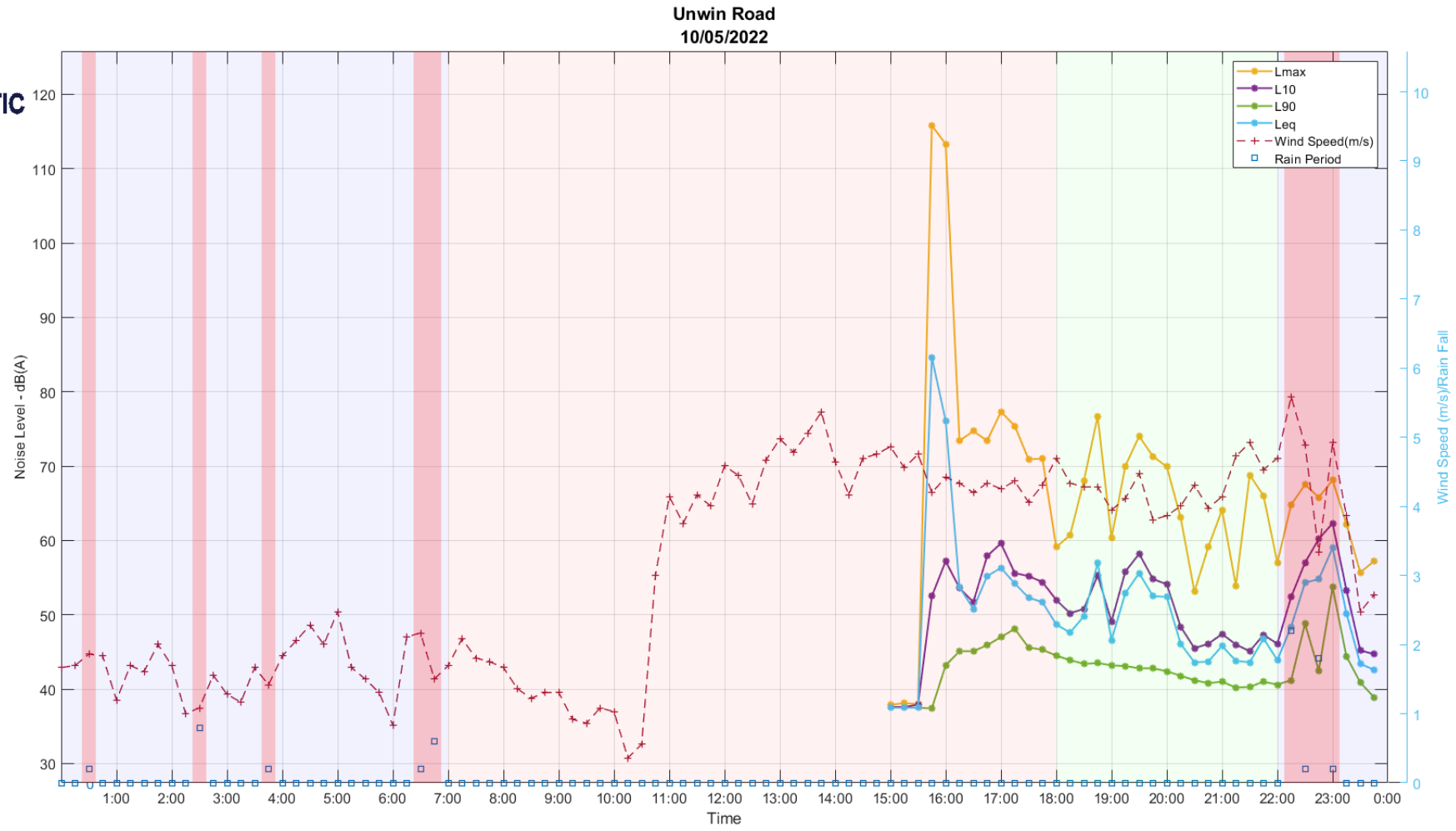
UNWIN ROAD


Unwin Road
10/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
90
80
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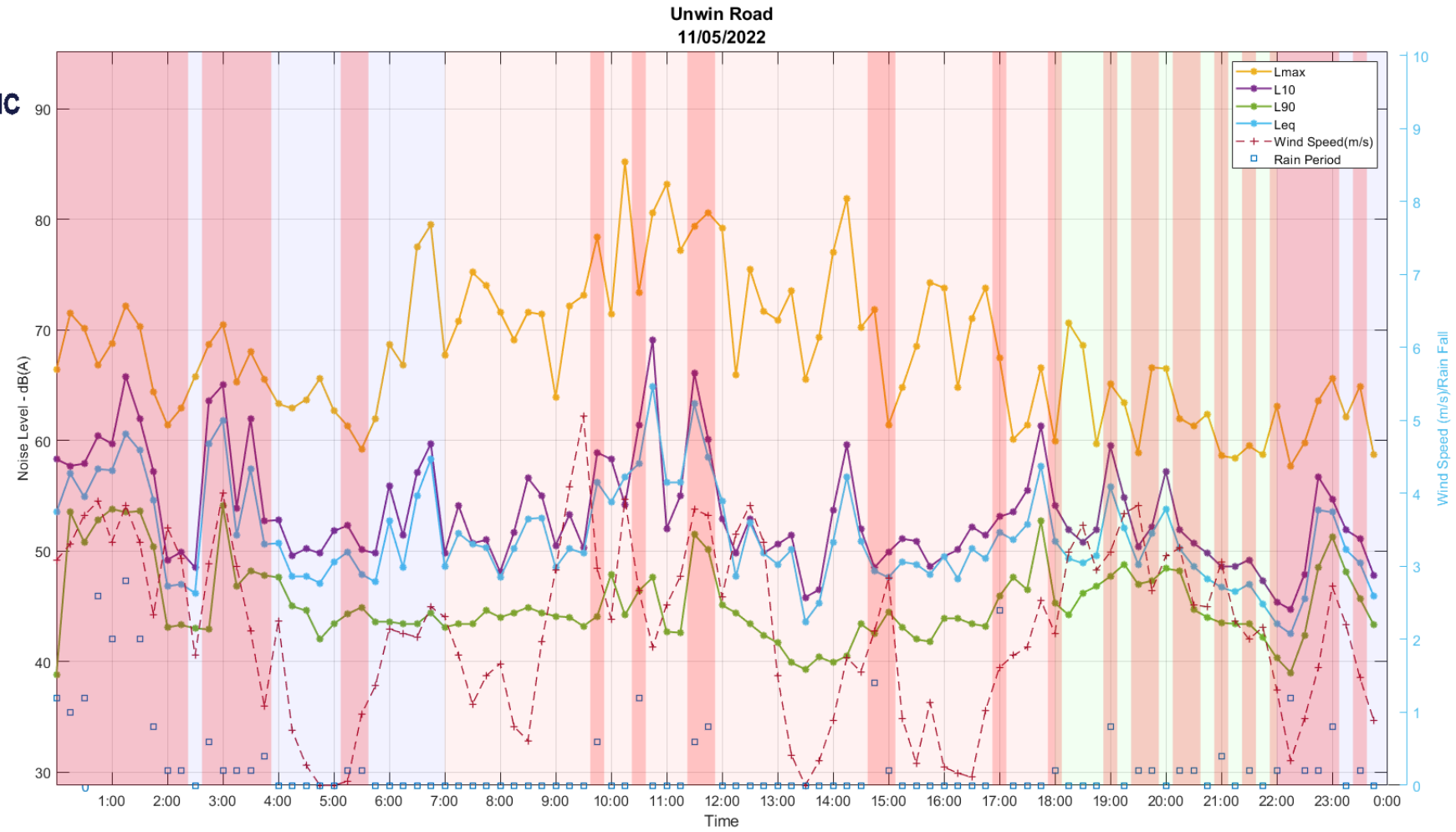
Unwin Road
11/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
30
40
50
60
70
80
90
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1
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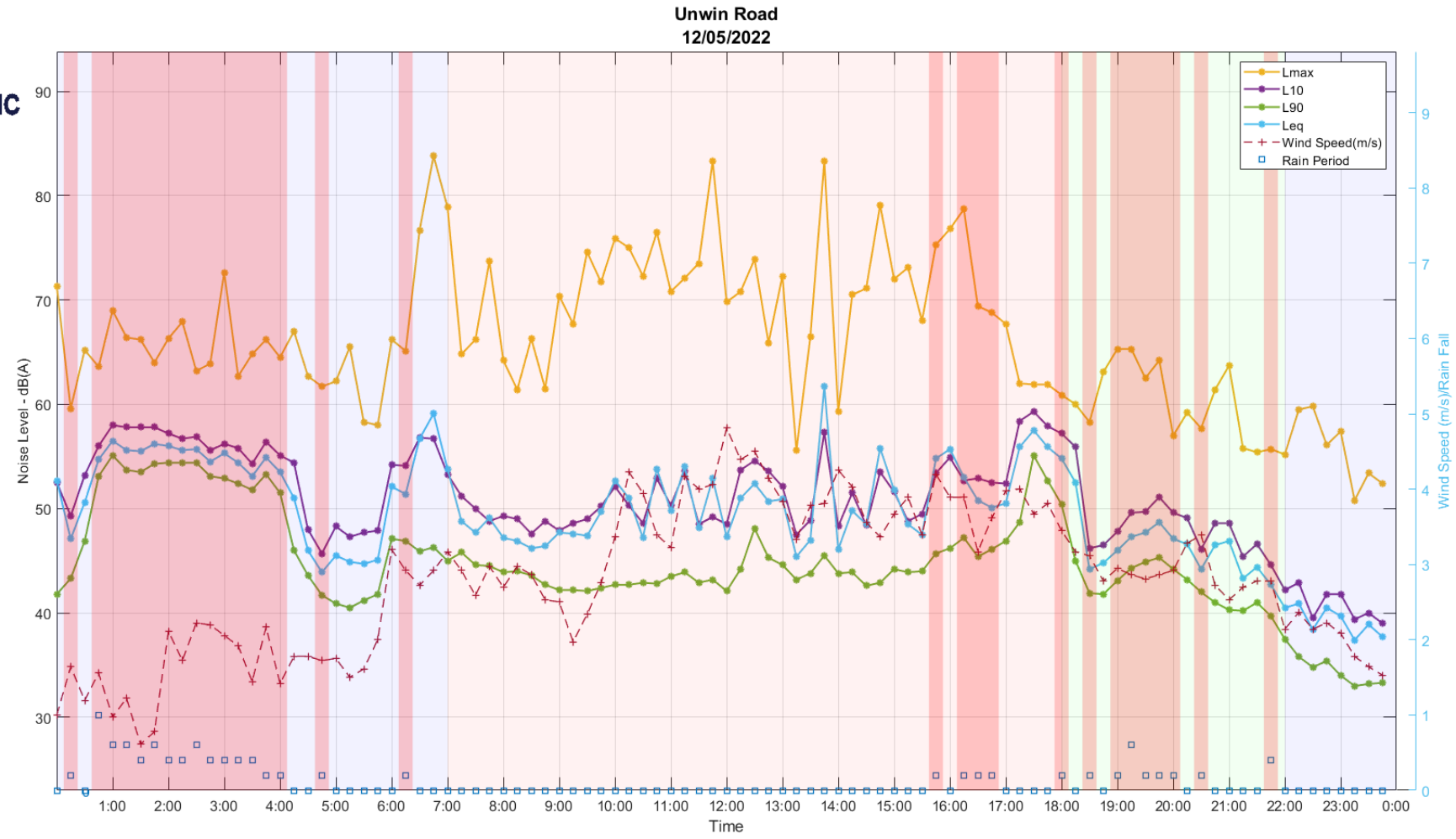
Unwin Road
12/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
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9
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23:00
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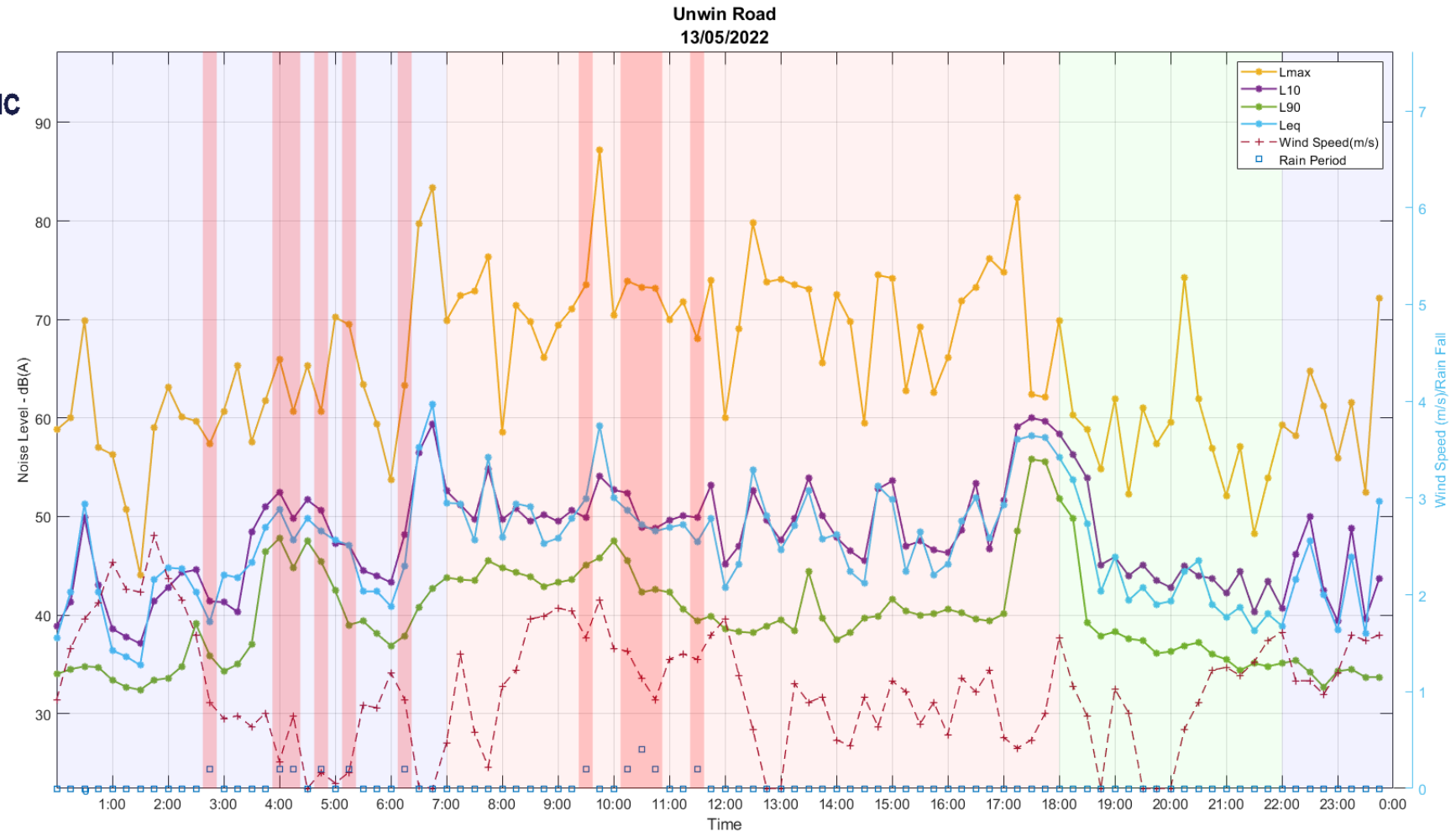
Unwin Road
13/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
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21:00
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23:00
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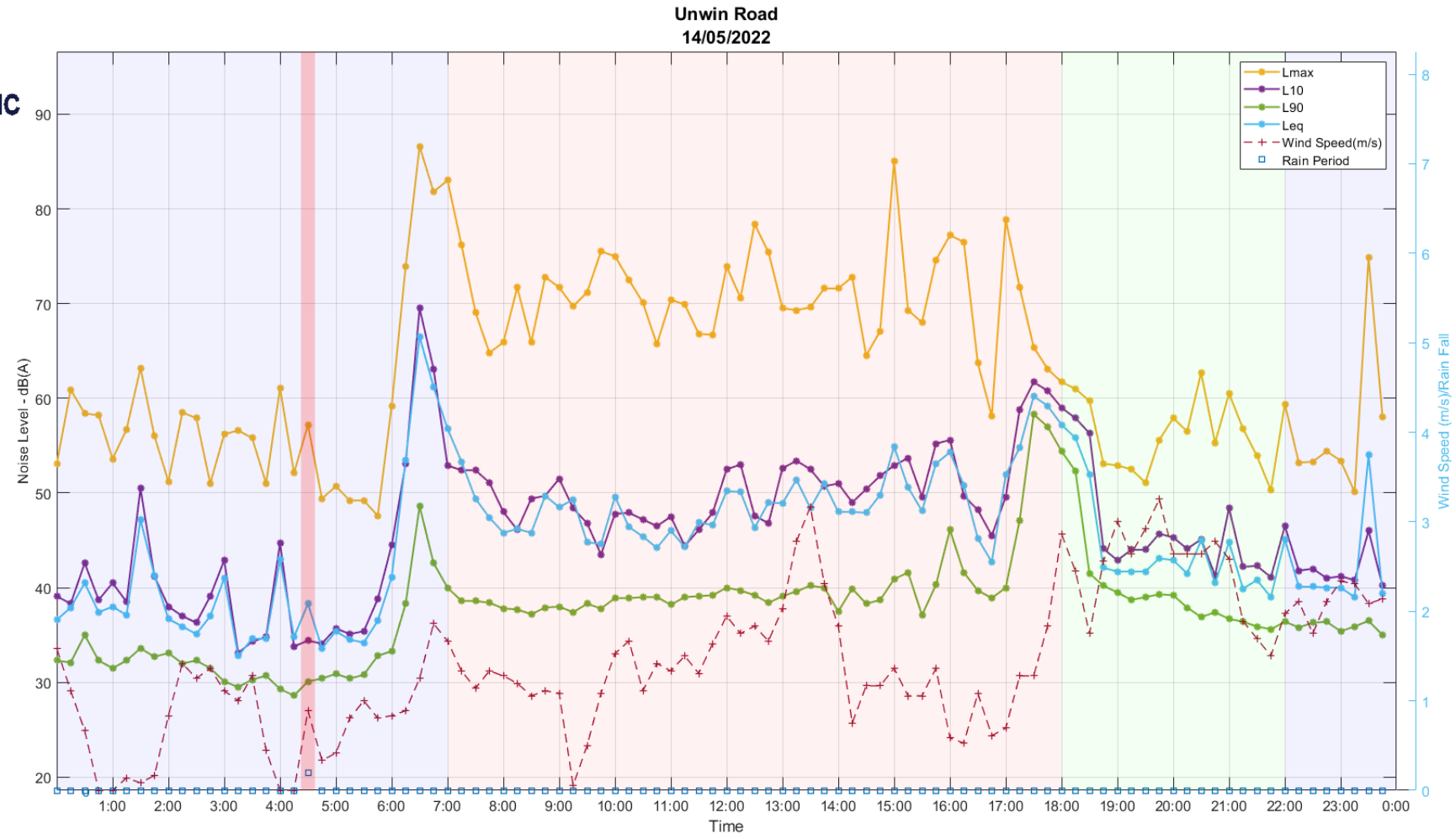
Unwin Road
14/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
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10:00
11:00
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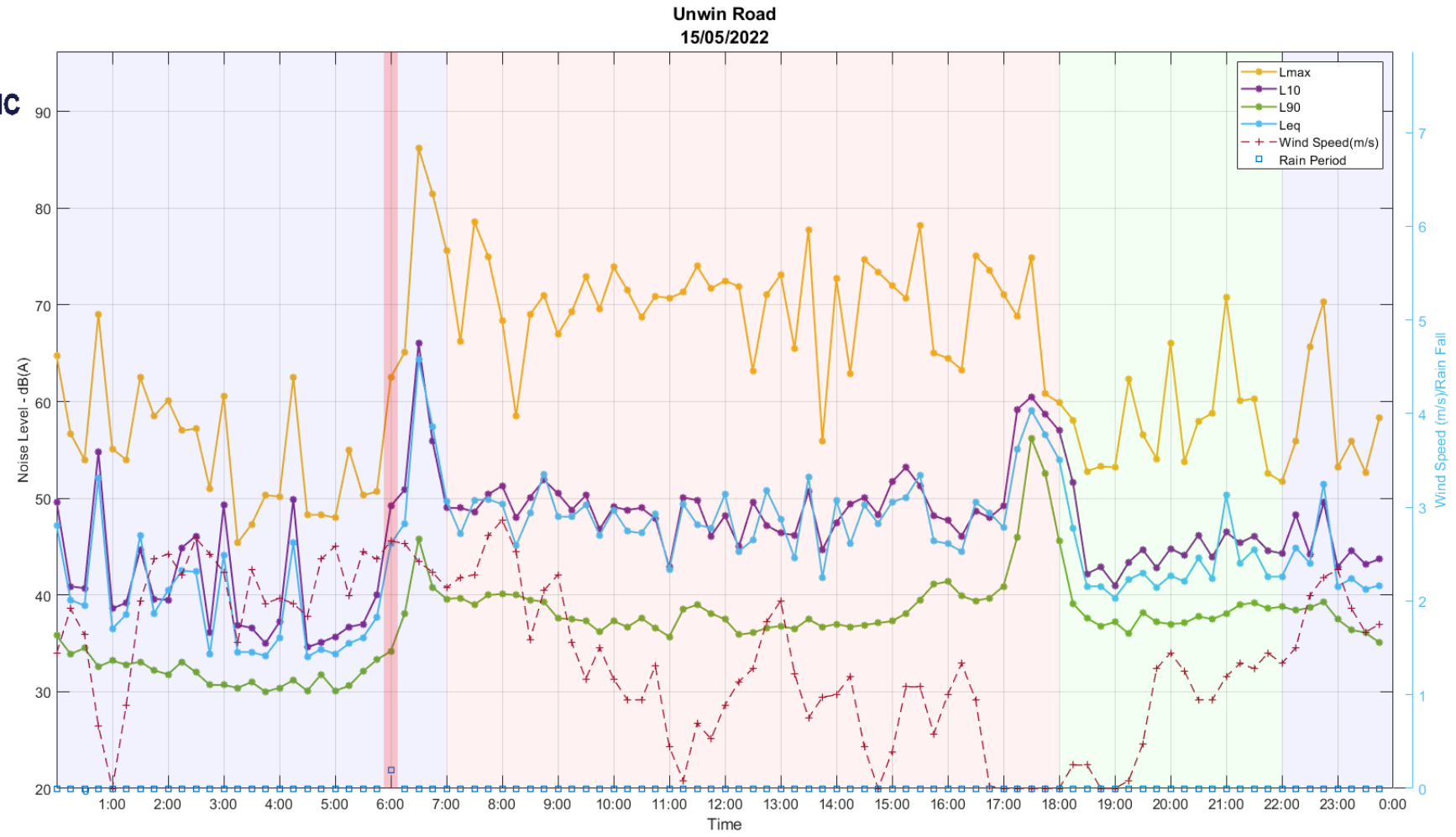
20:00
21:00
22:00
23:00
0:00


Unwin Road
15/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
30
20
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
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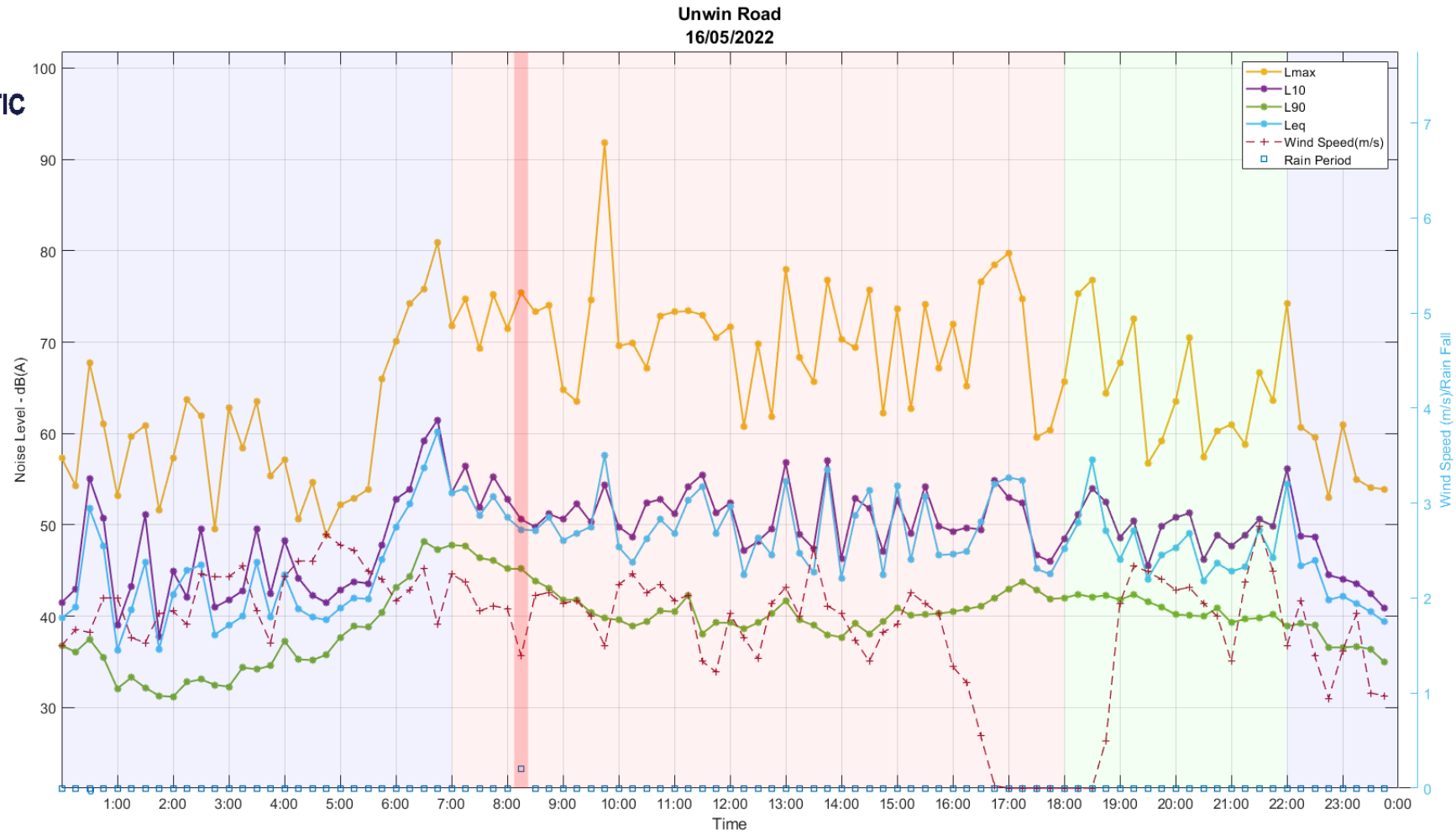
22:00
23:00
0:00


Unwin Road
16/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
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22:00
23:00
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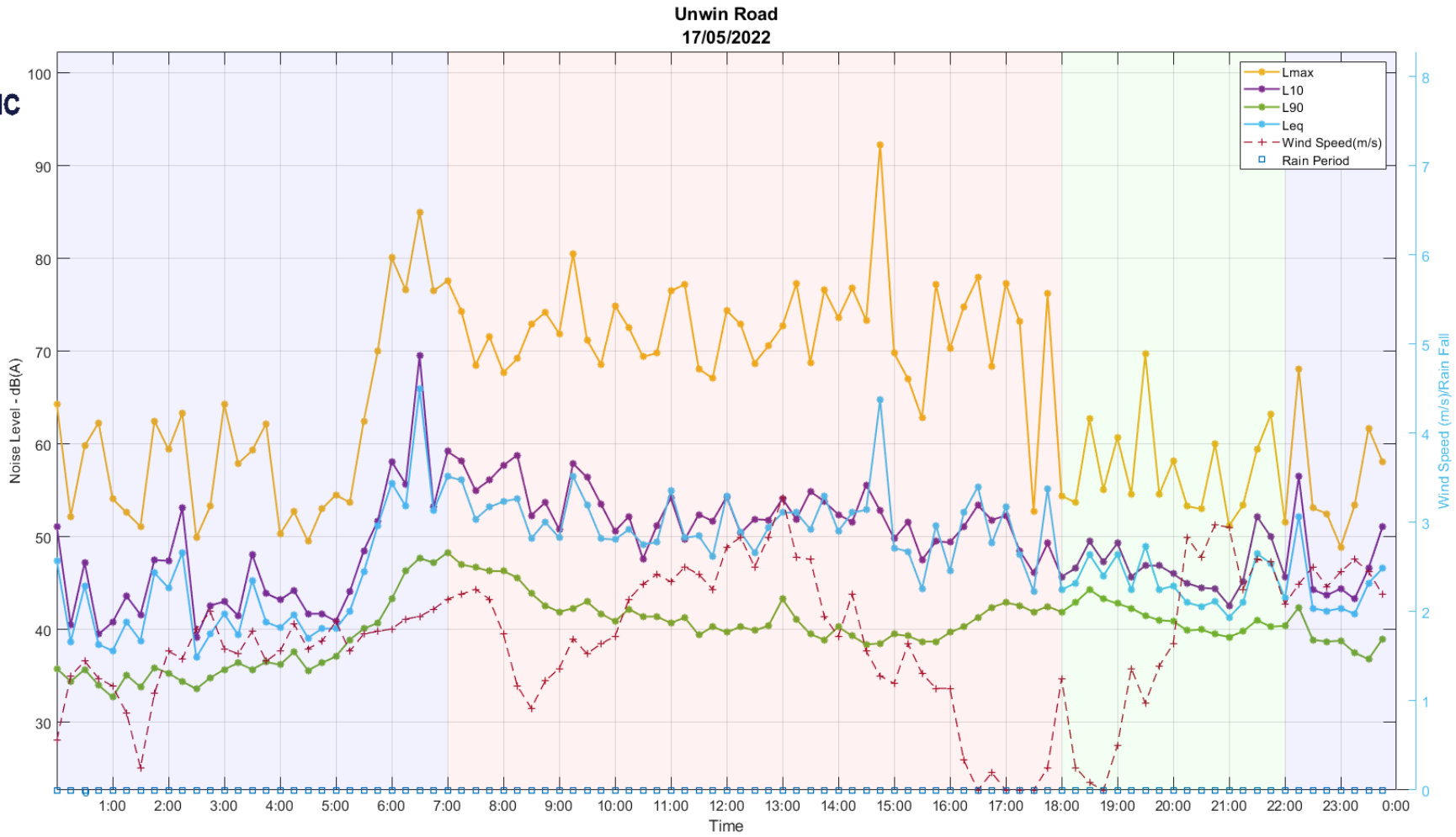
Unwin Road
17/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
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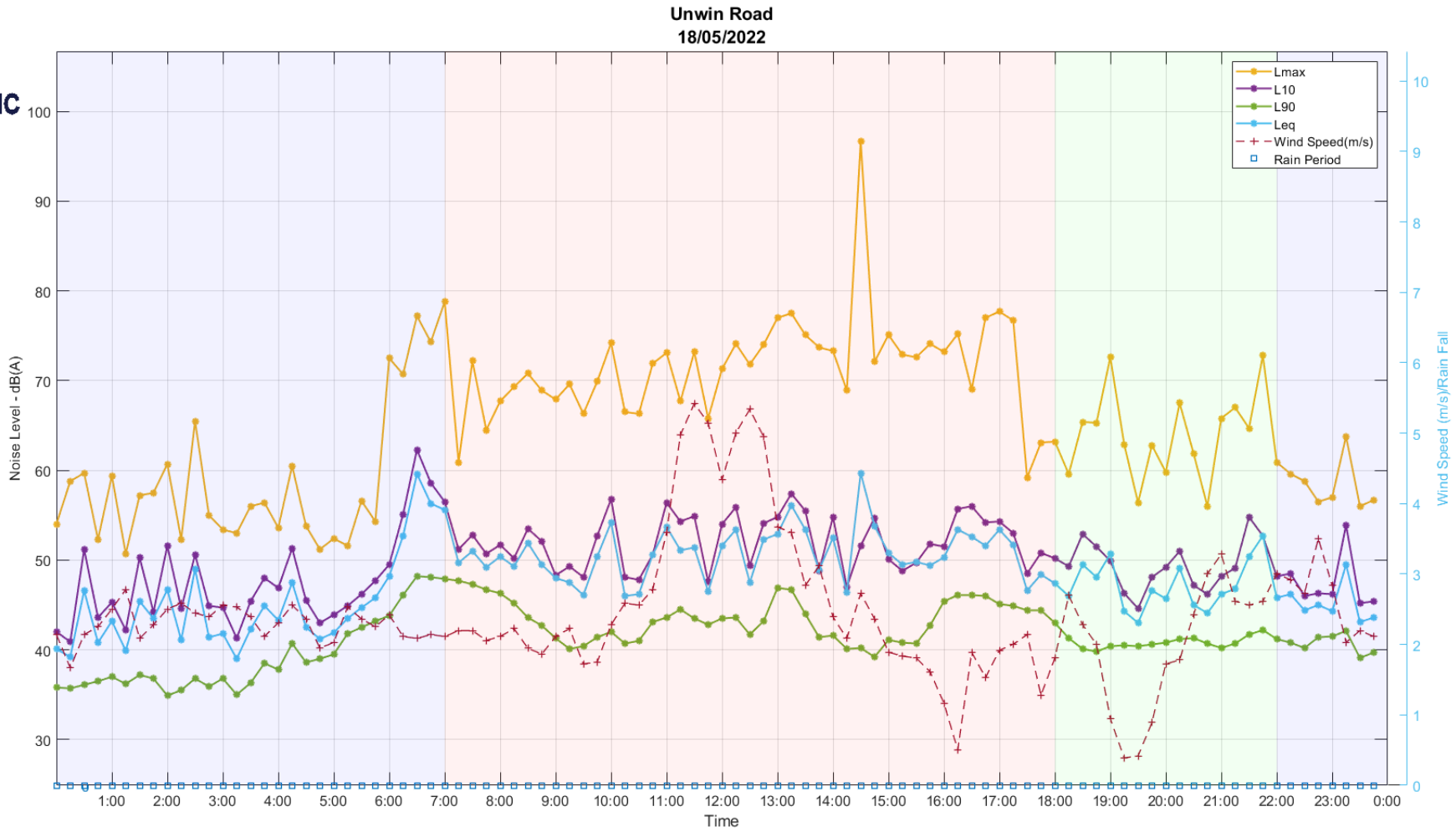
23:00
0:00


Unwin Road
18/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
10
9
8
7
6
5
4
3
2
1
0
1:00
2:00
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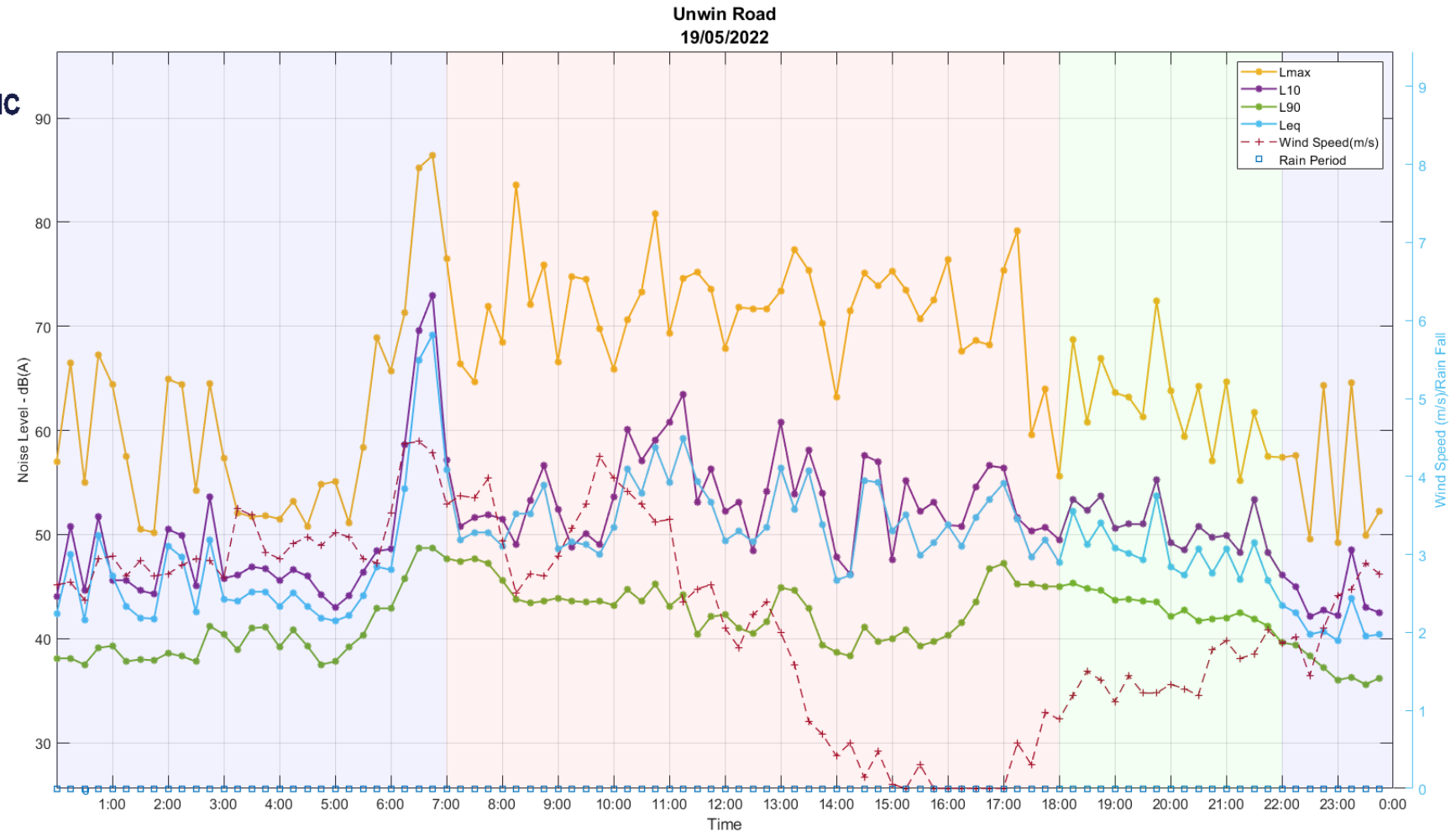
Unwin Road
19/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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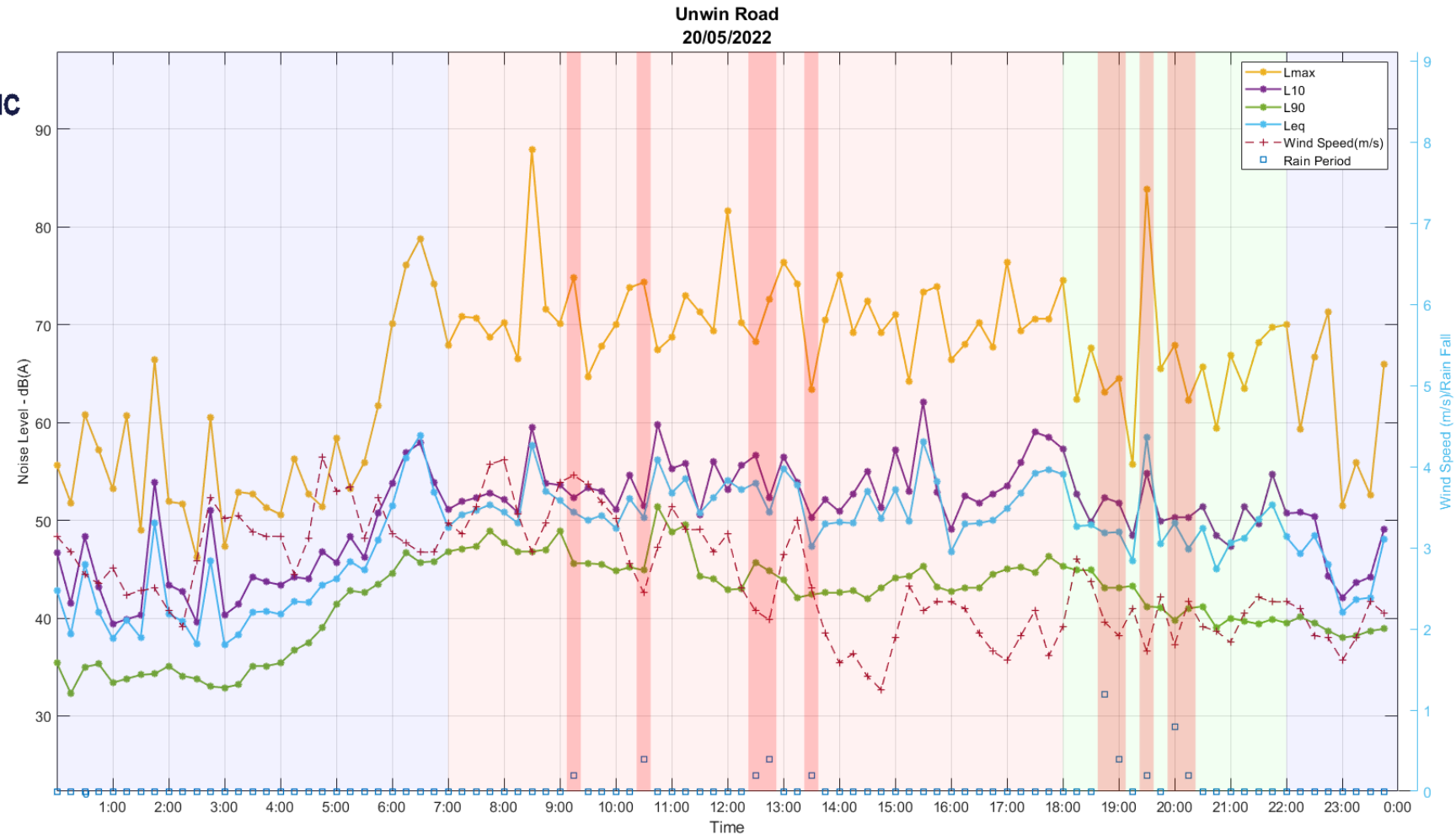
23:00
0:00


Unwin Road
20/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
3:00
4:00
5:00
6:00
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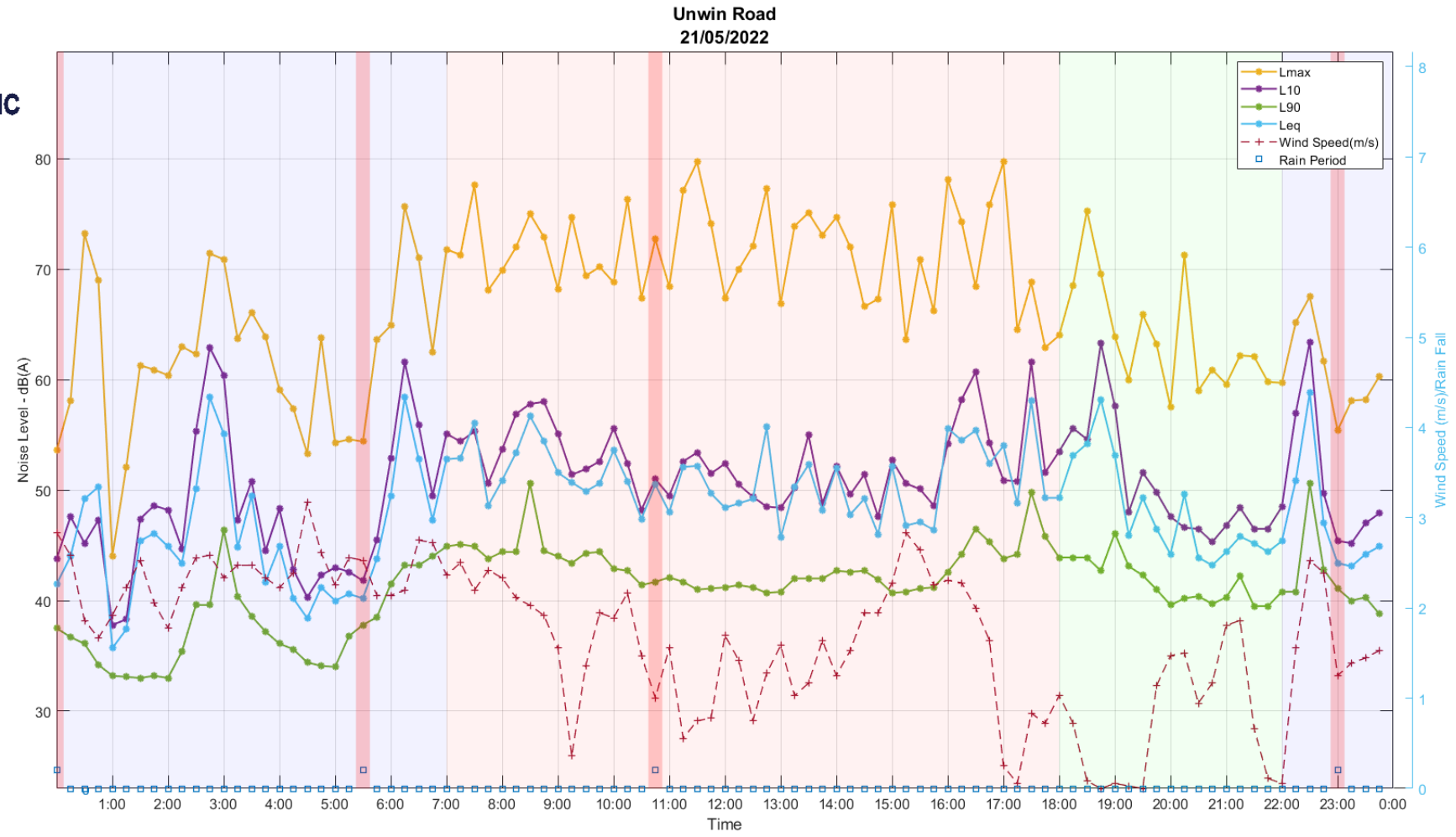
Unwin Road
21/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
80
70
60
50
40
30
8
7
6
5
4
3
2
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1:00
2:00
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4:00
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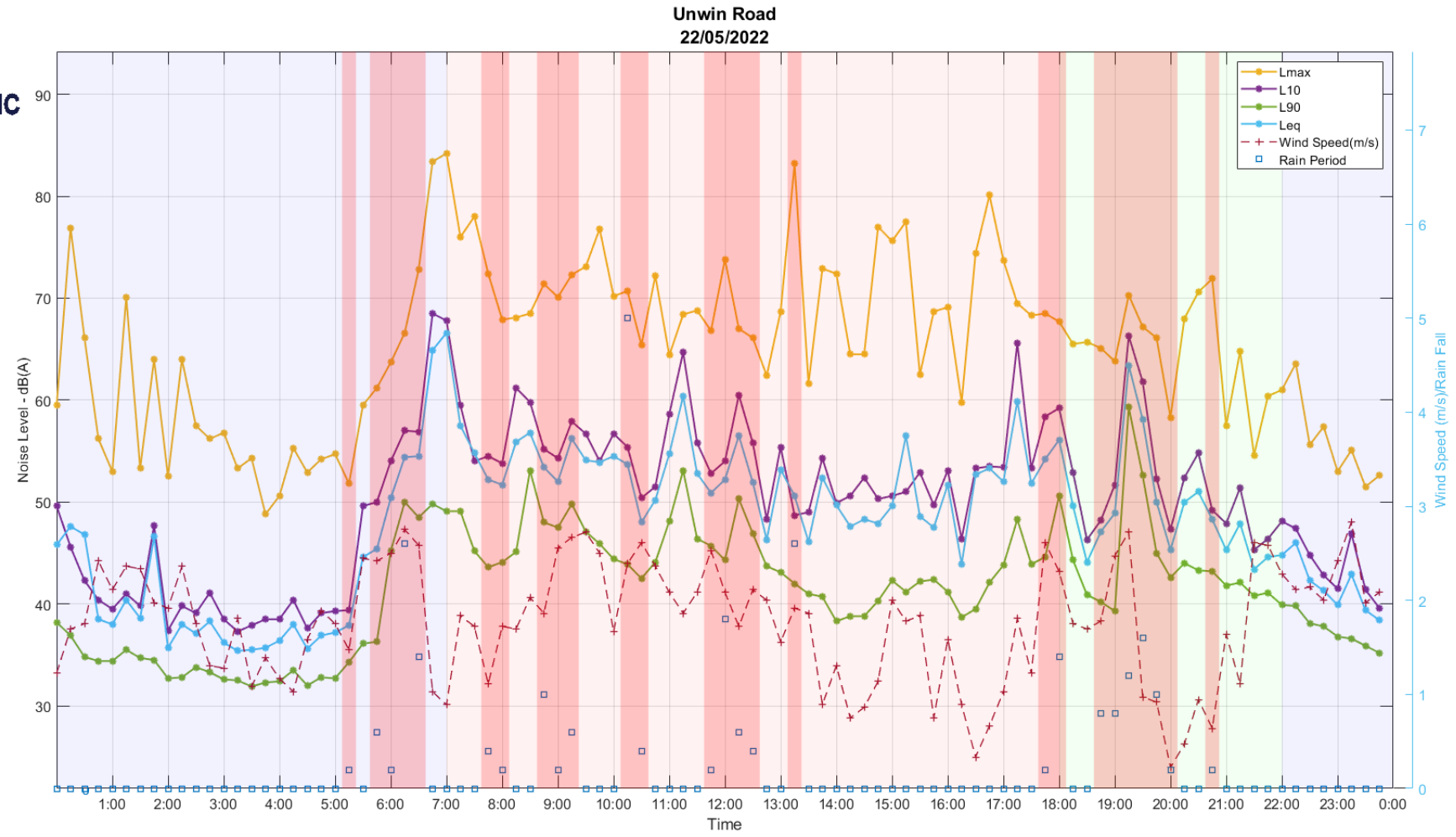
Unwin Road
22/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
30
7
6
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4
3
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1
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1:00
2:00
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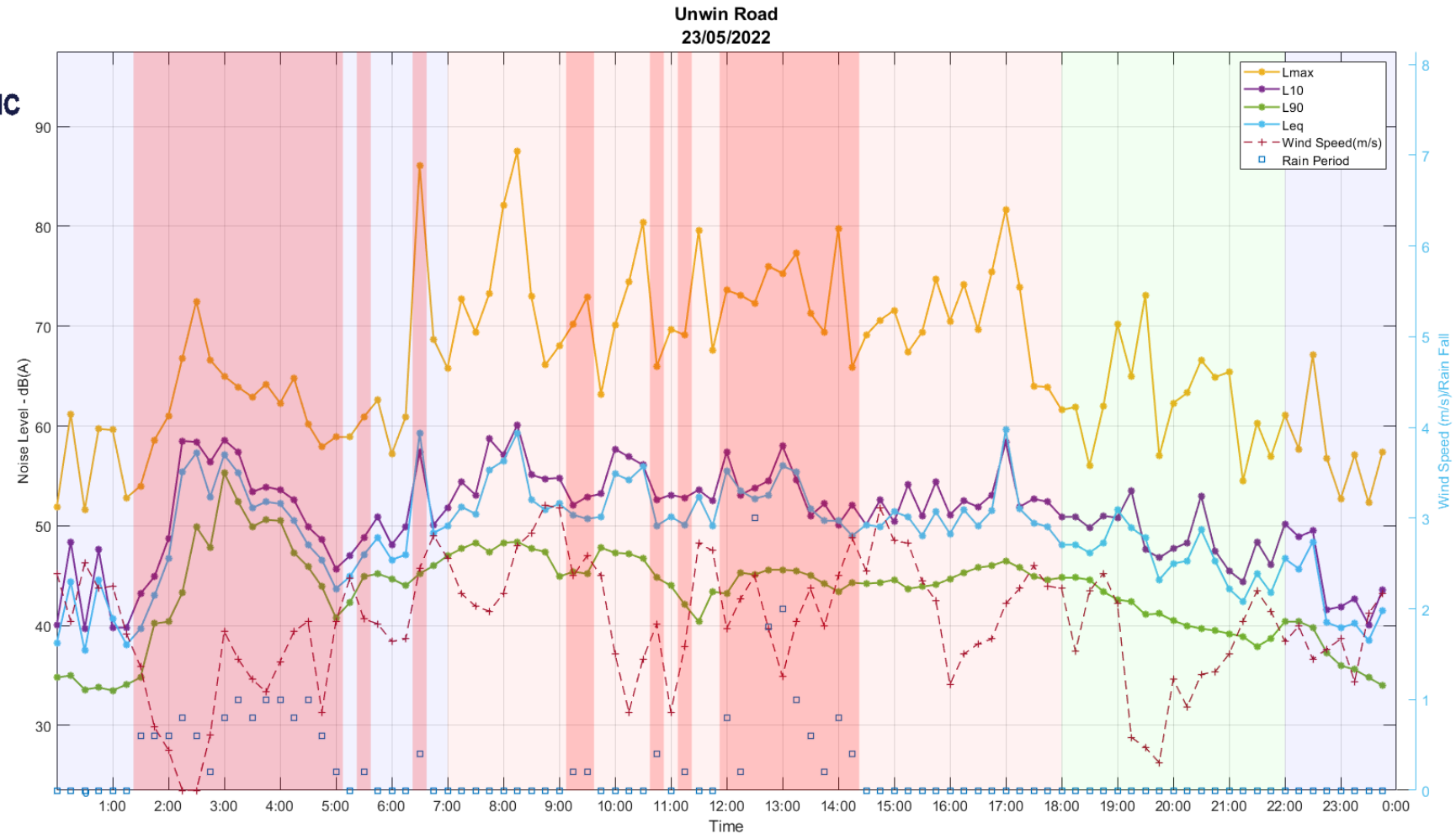
Unwin Road
23/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
1:00
2:00
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4:00
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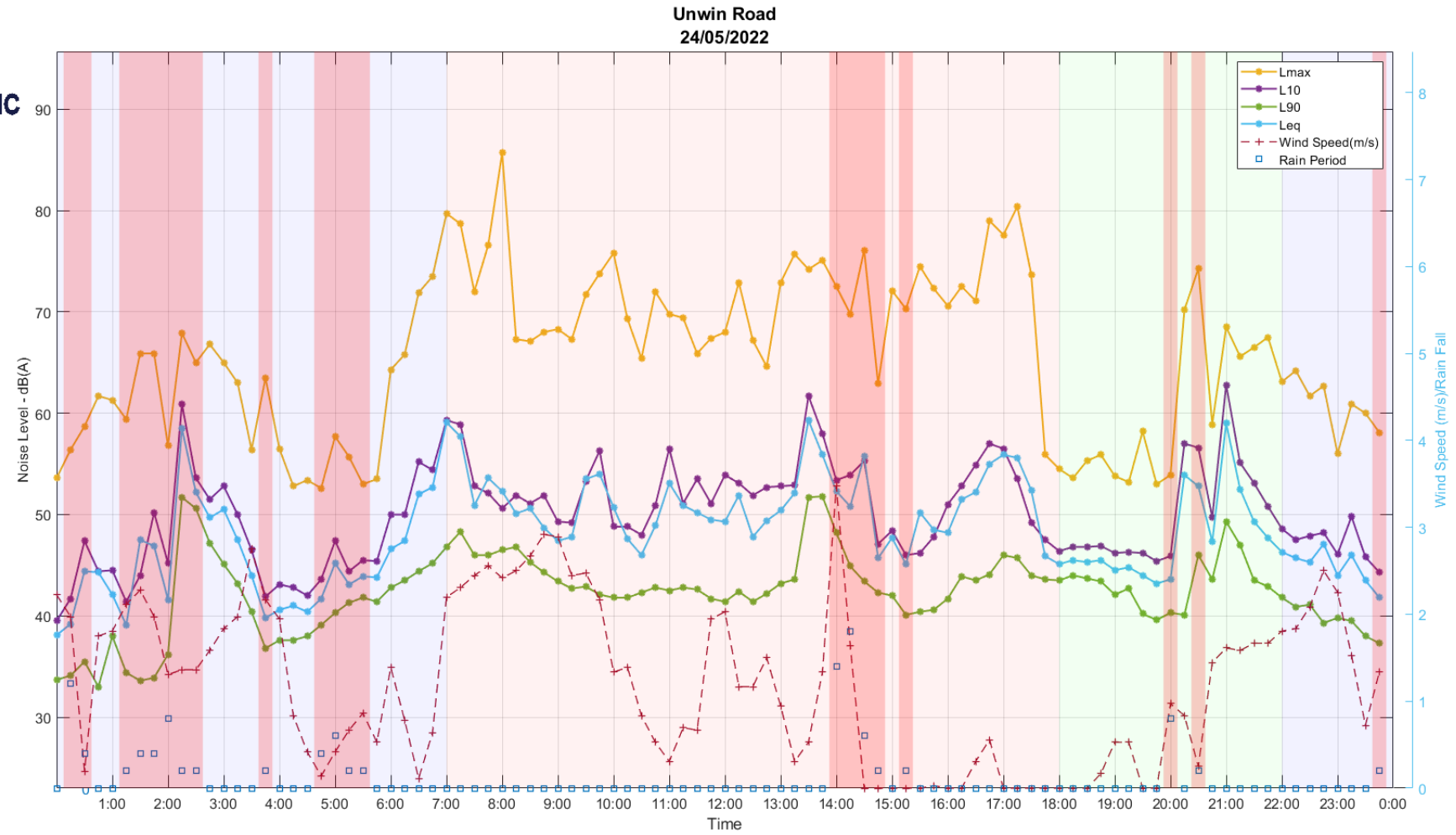
Unwin Road
24/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
30
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1:00
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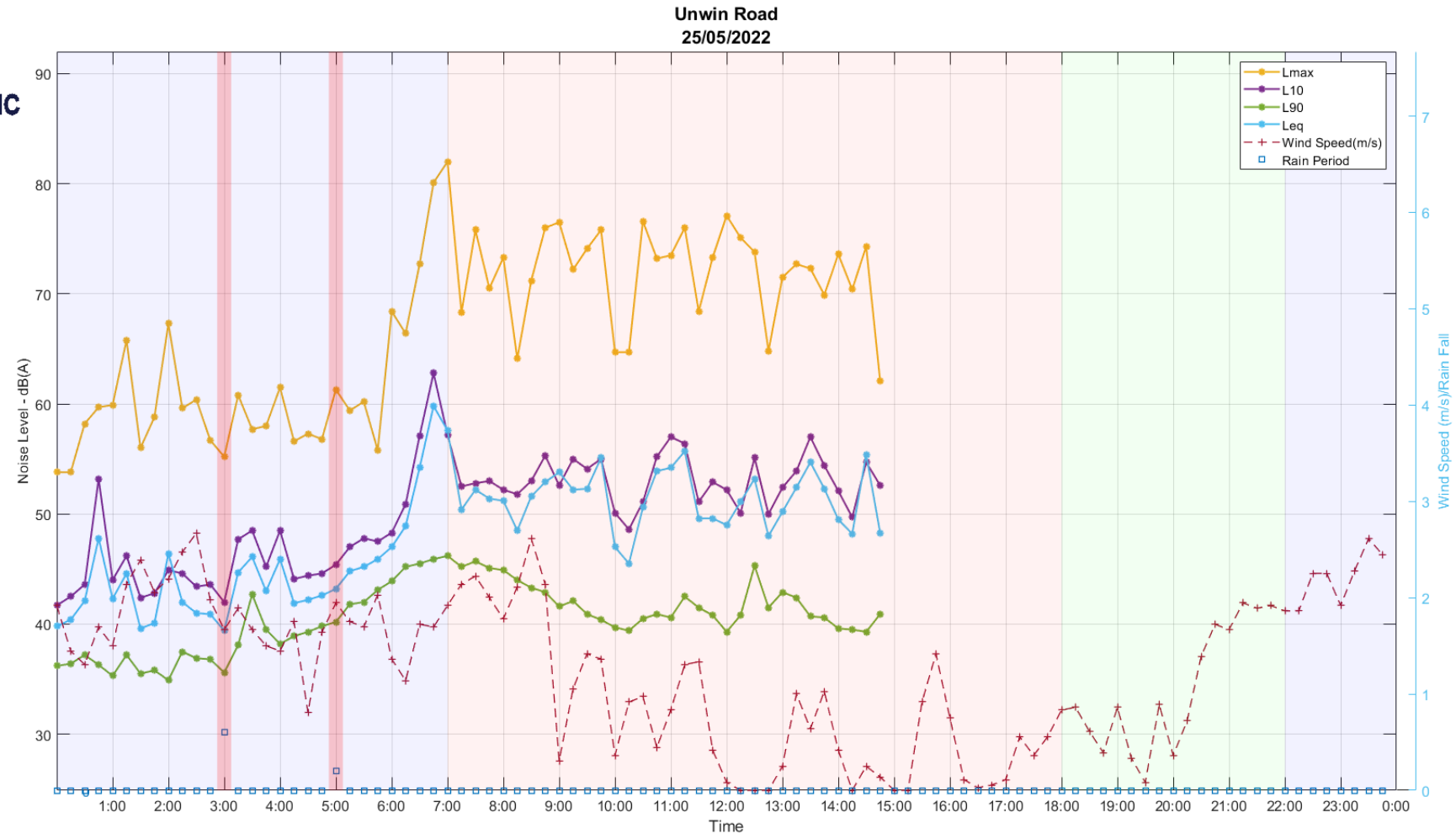
Unwin Road
25/05/2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
90
80
70
60
50
40
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