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Cowra Hospital Redevelopment

Construction Noise and Vibration Management Plan

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1 INTRODUCTION

Acoustic Logic (AL) has been engaged to prepare a construction noise and vibration management plan for the proposed alterations and additions to Cowra Hospital, located at 64 Liverpool Street, Cowra.

The key issues addressed within this report are as follows:

- Identification of the noise and vibration standards and statutory requirements which will be applicable to this project.
- Identification of potentially impacted nearby sensitive noise receivers to the development.
- Identify likely sources of noise and vibration generation during construction and predicted noise levels at nearby development.
- Formulation of a strategy to comply with the standards identified and mitigation treatments in the event that compliance is not achievable.

2 SITE DESCRIPTION

The site is bound by Ina Drive to the east, Liverpool Street to the south and Brisbane Street to the west and is adjacent to the Tresillian Family Aged Care to the north, located at 2 Ina Drive. The proposal is to include demolition and excavation of existing structure and construction of a new 2-storey development to the north of the existing hospital. The existing hospital is proposed to remain fully operational during the construction process.

The closest affected sensitive receivers within the vicinity of the site are as follows:

- **R1:** Multiple residential receivers to the west of the hospital, maintained on Brisbane Street.
- **R2:** Residential dwellings maintained on Liverpool Street, across Ina Drive and to the south-east of the project site.
- **R3:** Residential receivers maintained on Ina Drive, to the east of the project site.
- **C1:** 'Tresillian Family Care Centre,' a commercial receiver adjacent to the site's northern boundary.
- **C2:** Various commercial receivers maintained to the south of the project site, across Liverpool Street.
- **H1:** The existing and operational component of the project site, "Cowra Hospital," to the south of the proposed Stage's 1 through 3 areas of works. Acoustic Logic notes that whilst the existing hospital is considered to be the same site as the proposed construction works and is scheduled to be demolished during stage 4 of works, the existing hospital is to remain operational during Stage's 1 through 3 of the proposed works. Due to the noise and vibration sensitivity of the hospital to the proposed works, the existing hospital will be treated as a sensitive receiver in line with the requirements of the Interim Construction Noise Guideline. Similarly, the new hospital will be considered to be a sensitive receiver during Stage's 4 and 5 of proposed works.

See an aerial photo in Figure 1 below for detailed receiver locations and monitor locations.

Figure 1: Aerial Site Map with Nearest Sensitive Receivers and Unattended Monitoring Locations (Sourced from Google Maps)

3 CONSTRUCTION ACTIVITIES

The information provided to this office of the primary noise producing activities associated with the site are as follows below:

- **Early Works REF (Demolition Zone A – Stage 1):**
    - Demolition of existing structure above ground maintained within Zone A, timing of demolition of individual structures maintained within Zone is to be assessed within Staging Strategy.
    - Existing structure and footings in ground, as well as paths, paving, existing trees and in-ground services to be retained during early works demolition.
    - AL assumes the use of excavators with bucket and hammer attachments for demolition of existing structure.
    - Trucks and articulated vehicles to move materials and components.
- **Main Works REF (Demolition Zones A and B – Stage 2):**
    - Services relocation and provision of temporary switchboard.
    - Demolition of existing structures in Demolition Zone A retained within Early works demolition.
    - Construction of temporary Building A to be used by the hospital for some operations during works.
    - Demolition of Zone B (above and below ground).
    - AL assumes the use of excavators with bucket and hammer attachments for demolition of existing structure.
    - Trucks and articulated vehicles to move materials and components.
- **Main Works REF (Construction):**
    - Installation of substation and emergency generator.
    - AL assumes the use of excavators with bucket attachments for any required excavation works.
    - AL assumes the use of auger piling rig for sub-structure.
    - Use of tower crane for material handling.
    - Trucks/concrete trucks and articulated vehicles to move materials and components.
    - Concrete trucks with one vehicle movement within a given 15-minute period.
    - Use of general hand tools (Angle Grinders, Jackhammers, Drills, etc.)
- **Stage 3 (Demolition):**
    - Demolition of Zone C (above and below ground).
    - AL assumes the use of excavators with bucket and hammer attachments for demolition of existing structure.
    - Trucks and articulated vehicles to move materials and components.

- **Stage 4 (Demolition):**
    - Demolition of Zone D, inclusive of the existing hospital (above and below ground).
    - AL assumes the use of excavators with bucket and hammer attachments for demolition of existing structure.
    - Trucks and articulated vehicles to move materials and components.
- **Stage 5 (Finalisation):**
    - Construction of on-grade carpark and pedestrian/carpark street access from Brisbane Street.
    - AL assumes the use of excavators with bucket attachments for any required excavation works.
    - Assume use of asphalter and vibratory impactor for carpark.
    - Trucks and articulated vehicles to move materials and components.
    - Use of general hand tools (Angle Grinders, Jackhammers, Drills, etc.)

Vehicles have been assumed to access the site and deliver goods via Brisbane Street.

See Figure 2 below for an aerial view of the construction zone layout provided to this office.

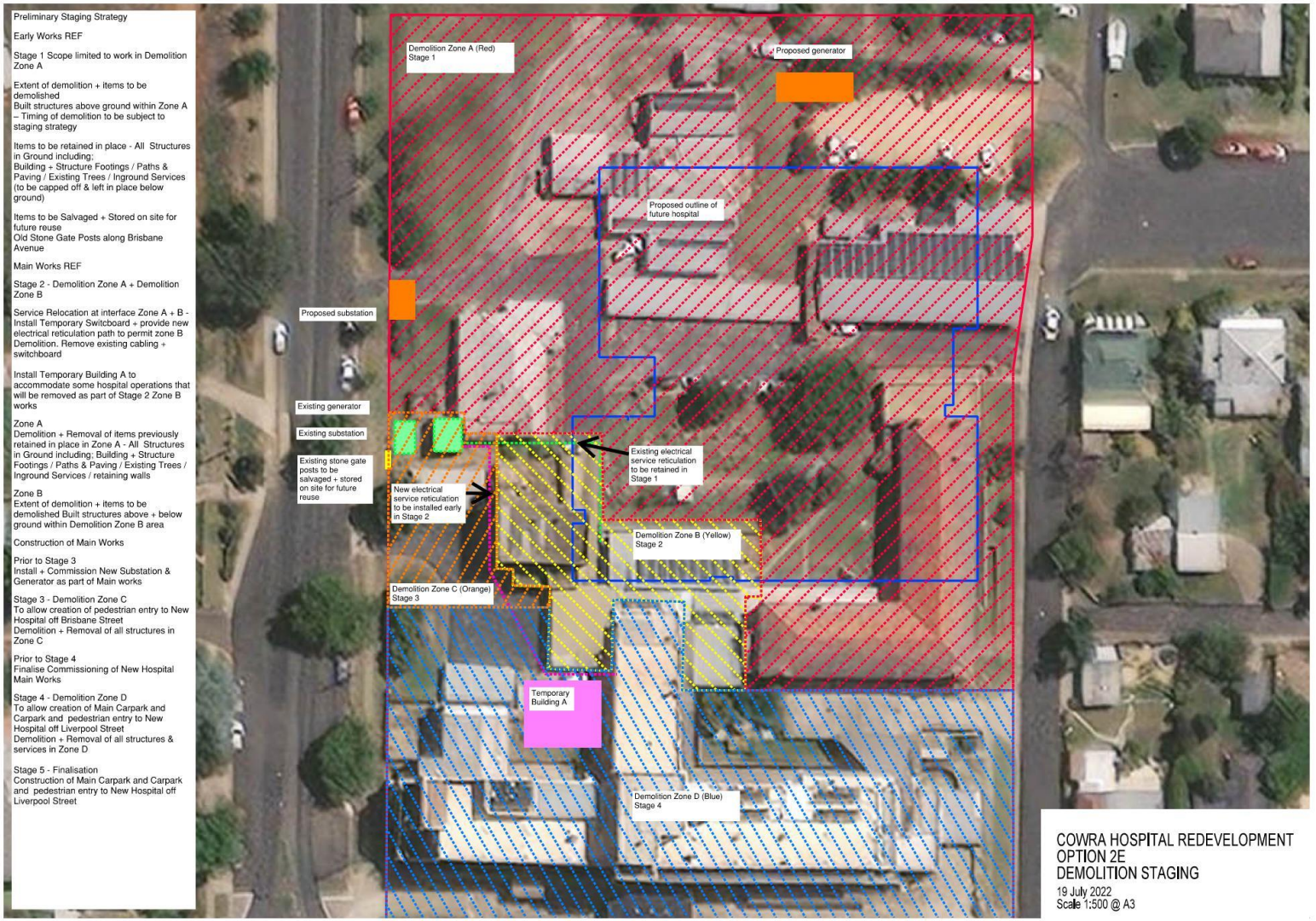


Figure 2: Aerial Demolition Plan with Construction Zones

4 HOURS OF WORK

In the absence of a notice of determination being available for the project at the point of the report, the NSW EPA's Interim Construction Noise Guideline (2009) standard hours of construction works have been adopted within this report, and are presented below:

- **Monday to Friday - 7am - 6pm.**
- **Saturday - 8am - 1pm.**
- **No work on Sunday or Public Holidays.**

5 AMBIENT NOISE SURVEY

Background noise levels have been measured through long-term noise monitoring conducted by this office for the development. The results of this survey are detailed below.

5.1 MEASUREMENT EQUIPMENT

Long-term noise monitoring was undertaken with noise monitors provided Acoustic Research Laboratories Pty Ltd. The loggers were programmed to store 15-minute statistical noise levels throughout the monitoring period and was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

Attended internal background noise measurements within the existing hospital were undertaken to supplement the unattended environmental noise monitoring. 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.

5.2 MEASUREMENT LOCATIONS

Three unattended noise monitors were installed within the immediate surroundings of the hospital, with detailed monitor locations provided within Figure 1.

5.3 MEASUREMENT PERIOD

Unattended noise monitoring at all 3 monitor locations was conducted between Wednesday 13th of July 2022 and Wednesday 27th of July, 2022.

5.4 MEASURED EXTERNAL BACKGROUND NOISE LEVELS

NSW EPA's 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.

Appendix 1 provides the results of the unattended background noise monitoring. Rain affected data was excluded from the assessment. The wind data presented has been obtained at a height of 10m. Due to surface friction, there is a wind gradient between ground and a 10m height. As the logger was placed in location where there were trees and existing buildings surrounding the noise monitors, the wind speed at 1.5m above ground level (logger microphone height) is estimated to be 1/2 of the 10m wind speeds. This correction factor has been applied before assessing the 5m/s wind criterion for valid background data. The processed Rating Background Noise Levels (lowest 10th percentile noise levels during operation time period) are presented in Table 2 below.

Based on the monitoring and measurements, the Rating Background Noise Levels (lowest 10th percentile noise levels during operation time period) are established for the surrounding receivers and are presented in the table below.

Table 1 - Rating Background Noise Levels

Time of Day	Rating Background Noise Level dB(A)$L_{90(Period)}$	
	2 Ina Drive, Cowra	**66 Liverpool Street, Cowra**
Day (7:00am-6:00pm)	39	39

5.5 ATTENDED INTERNAL BACKGROUND NOISE MEASUREMENTS

5.5.1 Equipment Used

Attended noise monitoring was conducted using:

- Norsonic N-140 Type 1 sound level meter.

The sound level meters were calibrated at the beginning and the end of the measurement; no significant drift was detected. Measurements were taken on fast time response.

5.5.2 Locations Monitored

The attended measurements were conducted on Wednesday 13th of July 2022 from 1:00pm to 3:00pm. Individual measurements were conducted in spaces nominated within the table below.

5.5.3 Results

The attended measurement results are presented in the table below.

Table 5 – Measured Background Noise Levels at Attended Measurement Locations

Measurement Location	Time of day	Measured Ambient Noise Level dB(A)L_{90}
Dental Clinic	Wednesday the 13th of July 2022 1:00pm to 3:00pm	43
X-Ray Room		46
Pathology Laboratory		60
Labour Ward		41
Palliative Care Ward		47

6 NOISE AND VIBRATION MANAGEMENT LEVELS

6.1 EPA INTERIM CONSTRUCTION NOISE GUIDELINE

Given the scale of the proposed works, the "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used.

The quantitative assessment method requires:

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

6.1.1 Residential Receivers

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 effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.

- "*Highly noise affected level"*. Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

6.1.2 Commercial Receivers

6.1.2.1 C1 and C2

"The external noise levels should be assessed at the most-affected occupied point of the premises:

- *Offices and retail outlets – External $L_{Aeq(15\ min)}$ = 70 dB(A)."*

6.1.2.2 H1 – Existing Hospital (Stage 1-Stage 3) and New Hospital (Stage 4-Stage 5)

For Hospital wards and operating theatres, the Interim Construction Noise Guideline 2009 (ICNG) denotes an internal noise management level of 45dB(A). Exclusive of these two spaces, the ICNG does not denote criteria for other spatial uses within a hospital, however, does note the following with regards to other noise sensitive land uses:

> *"Other noise-sensitive businesses… The proponent should undertaken a special investigation to determine suitable noise on a project-by-project basis…"*

Acoustic Logic attended the project site to measure the existing background noise levels in particular locations within the existing hospital building to establish appropriate criteria for these spaces, and the results of this internal ambient noise testing have been presented within Section 5.5.3 of this report. An internal noise management level of the measured background noise level + 5dB(A) for the spaces presented will be adopted for this assessment.

6.1.3 Summary of Relevant Noise Management Levels

A summary is presented below.

Table 2 – Noise Management Levels

Receiver Type	Receiver / Room Usage	Noise Management Level
Residential	R1, R2 and R3	*Noise Affected Level* 49 dB(A) $L_{eq(15min)}$ (Externally) *Highly Noise Affected Level* 75 dB(A) $L_{eq(15min)}$ (Externally)
Commercial	C1 and C2	70 dB(A) $L_{eq(15min)}$ (Externally)
Hospital (H1)	General Wards and Operating Theatres	45dB(A) $L_{eq(15min)}$ (Internally)
	Dental Clinic	48dB(A) $L_{eq(15min)}$ (Internally)
	X-Ray Room	51dB(A) $L_{eq(15min)}$ (Internally)
	Pathology Laboratory	65dB(A) $L_{eq(15min)}$ (Internally)
	Labour Ward	46dB(A) $L_{eq(15min)}$ (Internally)
	Palliative Care Ward	52dB(A) $L_{eq(15min)}$ (Internally)

If noise levels exceed the management levels identified in the table above, reasonable and feasible noise management techniques will be reviewed.

6.2 CONSTRUCTION VIBRATION CRITERIA

Vibration criteria for the nearest receivers will be based on the following documents:

- DIN 4150, *'Vibration in Buildings (1999-02)';*
- EPA *"Assessing Vibration: A technical guideline"*; and
- ASHRAE Handbook 2007.

6.2.1 DIN 4150

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in the table below.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as 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 1 – 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

6.2.2 Assessing Amenity

Table 2.2 of EPA "Assessing Vibration: A technical guideline" specified the following vibration goal for human comfort:

Table 2 – Preferred and Maximum Weighted RMS Values for Vibration Acceleration (m/s^2) 1-80 Hz

Location	Assessment Period	Preferred Values Z-axis	Preferred Values X & Y-axis	Maximum Values Z-axis	Maximum Values X & Y-axis
Continuous Vibration					
Critical Areas	Day time	0.005	0.0036	0.010	0.0072
Residences	Day time	0.010	0.0071	0.020	0.014
Office	Day time	0.020	0.014	0.040	0.028
Impulsive Vibration					
Critical Areas	Day time	0.005	0.0036	0.010	0.0072
Residence	Day time	0.3	0.21	0.6	0.42
Office	Day time	0.64	0.46	1.28	0.92

Acceptable values for intermittent vibration shall comply with the requirements in Table 2.4 of EPA "Assessing Vibration: A technical guideline" detailed as below.

Table 3 - Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Day time preferred value	Day time maximum value
Critical Areas	0.10	0.20
Residences	0.20	0.40
Office	0.40	0.80

6.2.3 Hospital Specific Vibration Limits

This office has been advised that vibration sensitive equipment is located within the existing hospital.

No specific allowable vibration levels have been provided to this office. Given this, the appropriate vibration curve from the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook based on the equipment type will be used.

The ASHRAE Handbook specifies vibration levels associated with potential disruption to the use of sensitive equipment within a building. The maximum vibration velocities [$mm.s^{-1}$] recommended from 1-100Hz is given in Figure 37 of the ASHRAE used in conjunction with recommended equipment requirements curves given in table 46. Figure 37 and table 46 from the 2007 ASHRAE document is presented below in Figure 6 and Table 4 respectively.

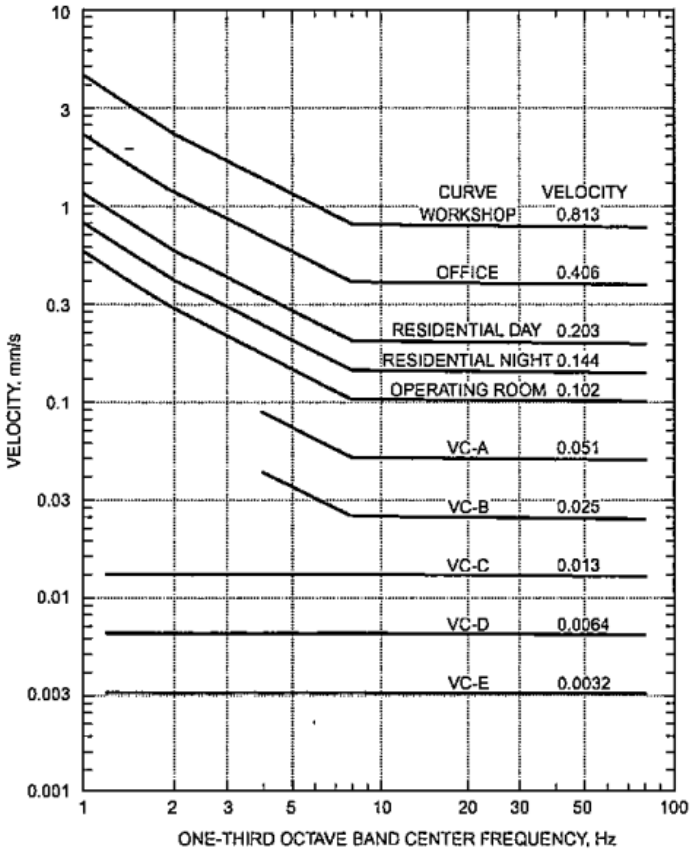


Fig. 37 Building Vibration Criteria for Vibration Measured on Building Structure

Figure 6 – Fig. 37 from 2007 ASHRAE Handbook: Vibration Criteria Curves

Table 4 – Tab. 46 from 2007 ASHRAE Handbook: Equipment Vibration Criteria

Equipment Requirements	Curve
Adequate for computer equipment, probe test equipment, and microscopes less than 40x magnification	0.203 (Residential – day)
Bench Microscopes up to 100x magnification; laboratory robots	0.102 (Operating Room)
Bench microscopes up to 400x magnification; optical and other precision balances; coordinate measuring machines; metrology laboratories; optical comparators; microelectronics manufacturing equipment; proximity and projection aligners, etc.	0.051 (VC – A)
Microsurgery, eye surgery, neurosurgery; bench microscopes at magnification greater than 400x magnification; optical equipment on isolation tables; microelectronic manufacturing equipment, such as inspection and lithography equipment (including steppers) to 3mm line widths	0.025 (VC – B)
Electron microscopes up to 30,000x magnification; microtomes; magnetic resonance imagers; microelectronics manufacturing equipment, such as lithography and inspection equipment to 1mm detail size	0.013 (VC – C)
Electron microscopes at magnification greater than 30,000x magnification; mass spectrometers; cell implant equipment; microelectronic manufacturing equipment such as, aligners, steppers and other critical equipment for photolithography with line widths of 1/2μm; includes electron beam systems	0.0064 (VC – D)
Un-isolated laser and optical research systems; microelectronics manufacturing equipment, such as aligners, steppers and other critical equipment for photolithography with line widths of 1/4μm; includes electron beam systems	0.0032 (VC – E)

a. See Figure for corresponding vibration curve.

All vibration monitoring results recorded on site are presented against the vibration curves listed above. The appropriate level of vibration will ultimately be determined by the staff operating the equipment and whether or not the level of distortion created by the excavation works is acceptable. We note that the VC curves are a representation of the level of disruption to the activities and/or operations undertaken by the machine and not the limit where damage would be expected to occur to the unit.

6.2.4 Hospital Specific Vibration Limits – Additional Medical Equipment

A site investigation and attended ambient vibration measurements were carried out by this office on Wednesday, 4th May 2022 within the existing Cowra Hospital. The following areas were identified to contain vibration sensitive equipment:

1. Ground Floor

a. Dental Surgery.

b. Pathology Laboratory.

c. General X-Ray.

2. **Level 1**

    a. Palliative Care Ward.

3. **Level 2**

    a. Operating Theatres.

Based on the ambient baseline vibration measurements undertaken within the nominated areas above, the following vibration measurements were recorded:

Dental Surgery: 0.2mm/s Peak Particle Velocity (PPV).

Pathology Laboratory: 0.09mm/s Peak Particle Velocity (PPV).

General X-Ray: 0.09mm/s Peak Particle Velocity (PPV).

Palliative Care Ward: 0.1mm/s Peak Particle Velocity (PPV).

Operating Theatre: 0.02mm/s Peak Particle Velocity (PPV).

6.2.5 Summarised Recommended Vibration Limits

The summarised vibration criteria are presented in the table below.

Table 5 – Recommended Vibration Limit

Vibration Receiver	Recommended Vibration Limits PPV (mm/s)
Operating Theatre	VC – B Curve of Figure 37 of the ASHRAE vibration criteria – Maximum 0.02 (Existing Ambient)
General X-Ray	0.09
Dental Surgery	0.2
Pathology Laboratory	0.09
Palliative Care Ward	0.1
Residential Buildings	5
Commercial / Other Spaces in Hospital	20

7 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Noise impacts will be determined from primary processes and equipment. The sound power levels of these activities are presented below.

Table 6 - Sound Power Levels of the Proposed Equipment

Stage	Equipment/Process	Sound Power Level dB(A)
Demolition Works – Zone 1 – Zone 4	Excavator with Hydraulic Hammer Attachment	118
	Excavator with Bucket Attachment	105
	Auger Piling Rig	103
	Concrete Saw	118*
	Articulated Truck Movement	105
	Truck Idle	95
Structure and Internal Finishes	Mobile Crane	105
	Concrete Truck Movement	108
	Concrete Pump	108
	Concrete Truck Idle	105
	Angle Grinder	105
	Drill/General Hand Tools	95
	Jackhammer	105
	Articulated Truck Movement	105
	Truck Idle	95
Finalisation (On-Grade Carpark)	Vibratory Impactor	105
	Roller	105
	Angle Grinder	105
	Drill/General Hand Tools	95
	Jackhammer	105
	Articulated Truck Movement	105
	Light Truck Movement	96
	Truck Idle	95

**A tonality correction factor of 5dB(A) has been applied in line with the requirements of EPA documentation.*

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

- Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

8 NOISE EMISSION ASSESSMENT

8.1 PREDICTED NOISE EMISSIONS

An assessment of the principal sources of noise emissions has been undertaken to identify the activities that may produce noise and/or vibration impacts so that appropriate ameliorative measures can be formulated. SoundPlan noise modelling has been conducted based on information provided to this office of construction methodology and activities likely to be undertaken and presents the cumulative predicted external noise levels to the nearest surrounding receivers.

Noise levels from construction works have been predicted at the nearby development and assessed against EPA the "Noise Management Level", as identified in section 6.

With regard to the noise level generated at the nearest receivers, noise levels will vary depending where on the construction site the work in undertaken. To address this, a range of predicted noise levels is provided. Predicted noise levels are presented below.

The predicted noise levels are based on the assumption that the recommendations in section 9 have implemented/observed.

8.2 SOUNDPLAN MODELLING

Noise levels have been predicted at the receiver locations using SoundPlan™ 8.0 modelling software implementing the ISO 9613-2:1996 "Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation" noise propagation standard.

Noise enhancing meteorological effects have been adopted as recommended by the NPfI, noting that the ISO 9613 modelling approach assumes that all receivers are 'downwind' (i.e., that noise enhancing wind and temperature inversion conditions are in effect at all times).

Ground absorption was conservatively calculated with a ground factor of 0 for all areas except for localised lawns and greenery with a ground factor of 0.6 as recommended in *Engineering Noise Control* (Bies & Hanson).

In line with Factsheet C of the NPfI, penalties for annoying noise characteristics should be applied at the receiver, where applicable. Based on the predicted noise levels, no penalty should be applied (either for tonality, intermittency, or otherwise).

Figure's 3 through 17 present the results of the SoundPlan Noise modelling, and they are summarised in Table's 7 and 8 below.

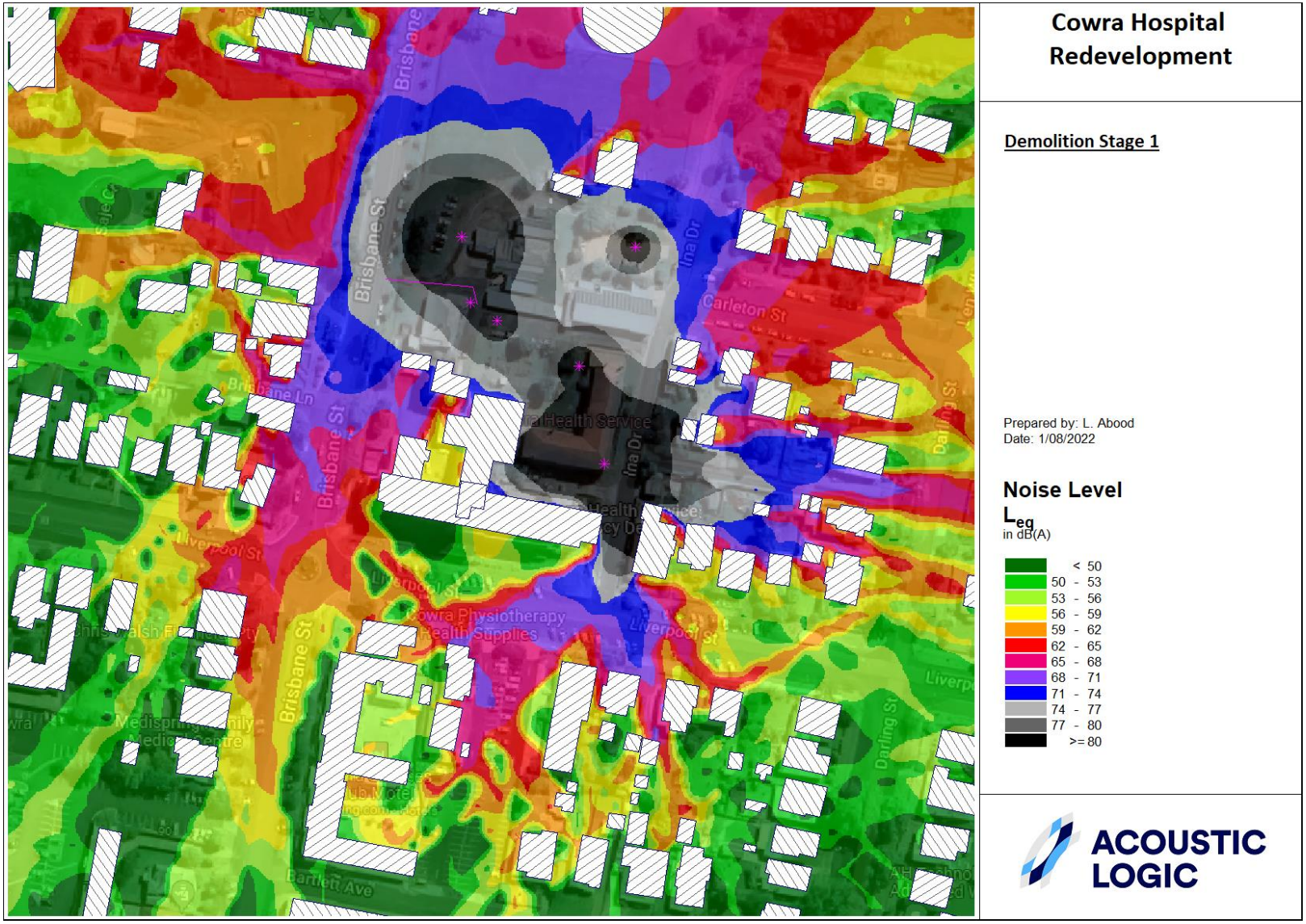


Figure 3: Demolition Stage 1

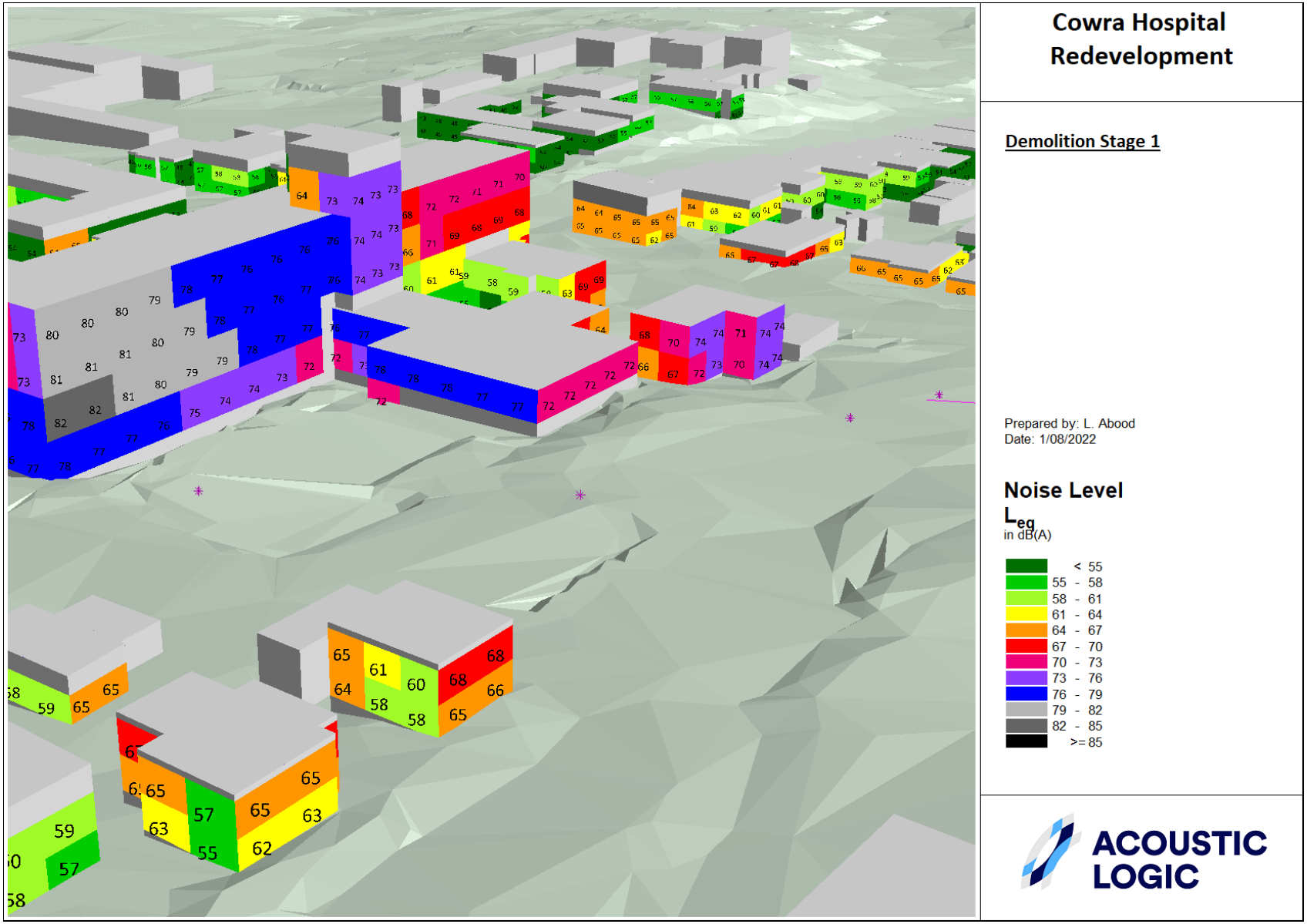


Figure 4: Demolition Stage 1 – R1 and H1

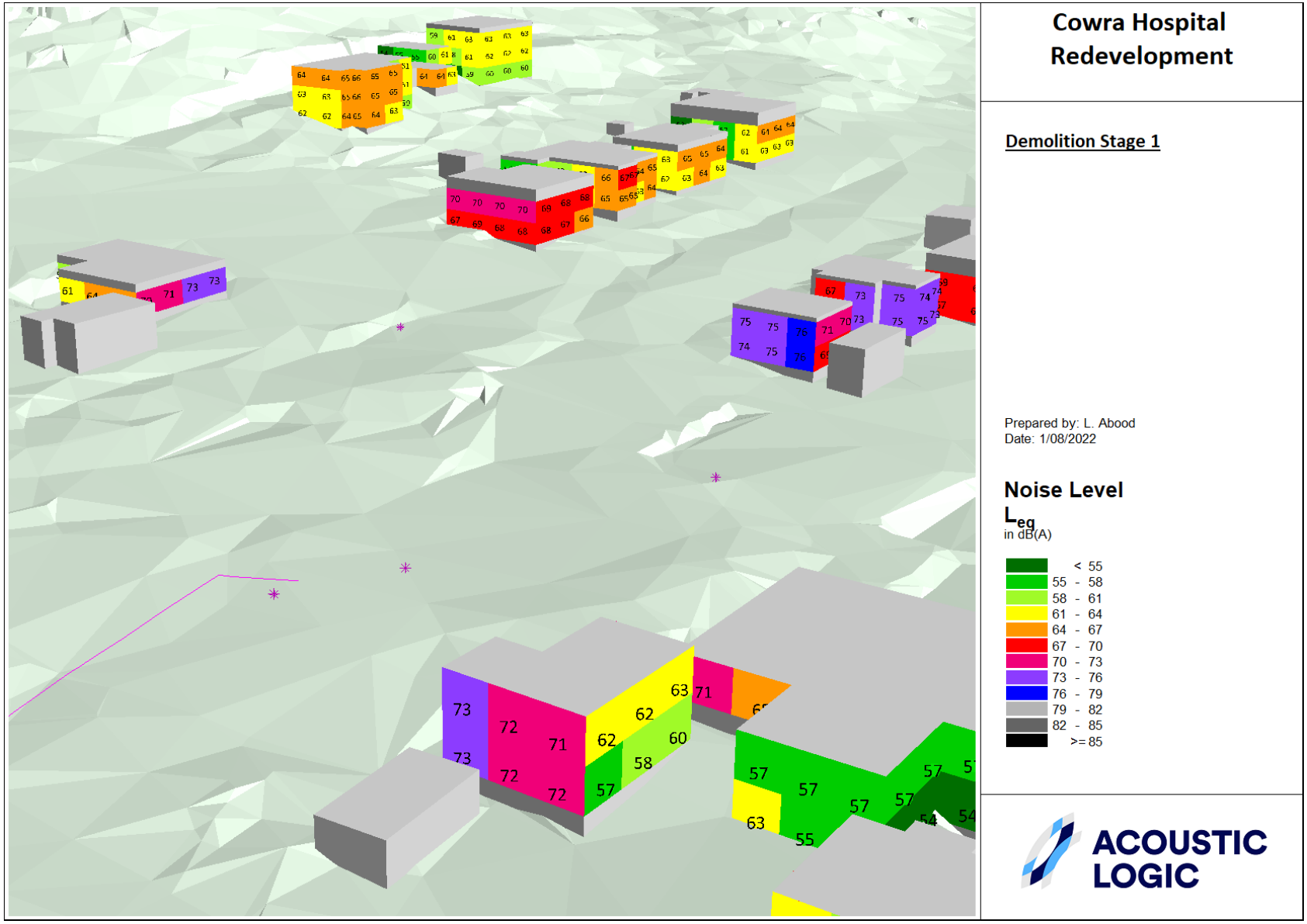


Figure 5: Demolition Stage 1 – R2, R3 and C1

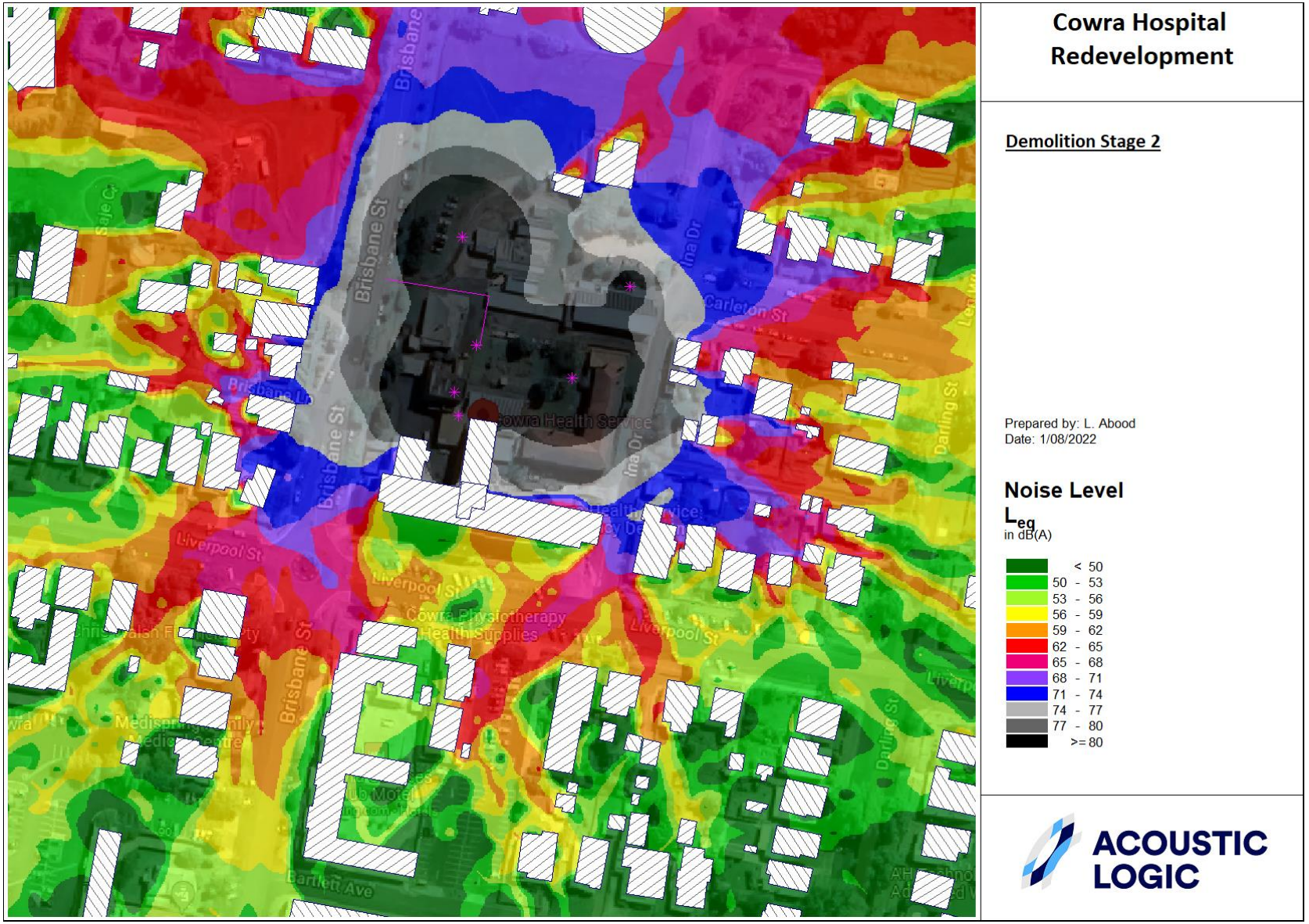


Figure 6: Demolition Stage 2

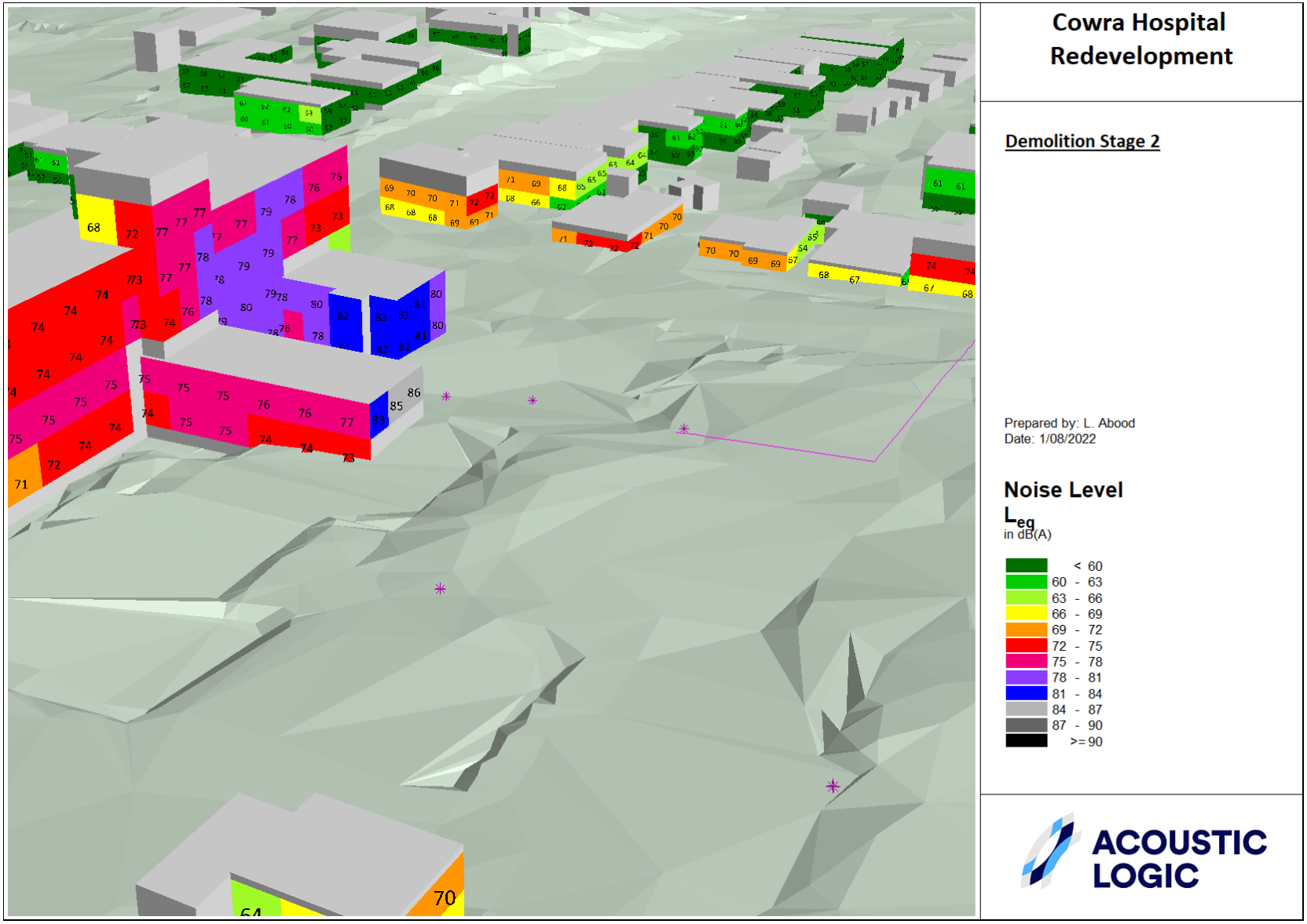


Figure 7: Demolition Stage 2 – R1 and H1

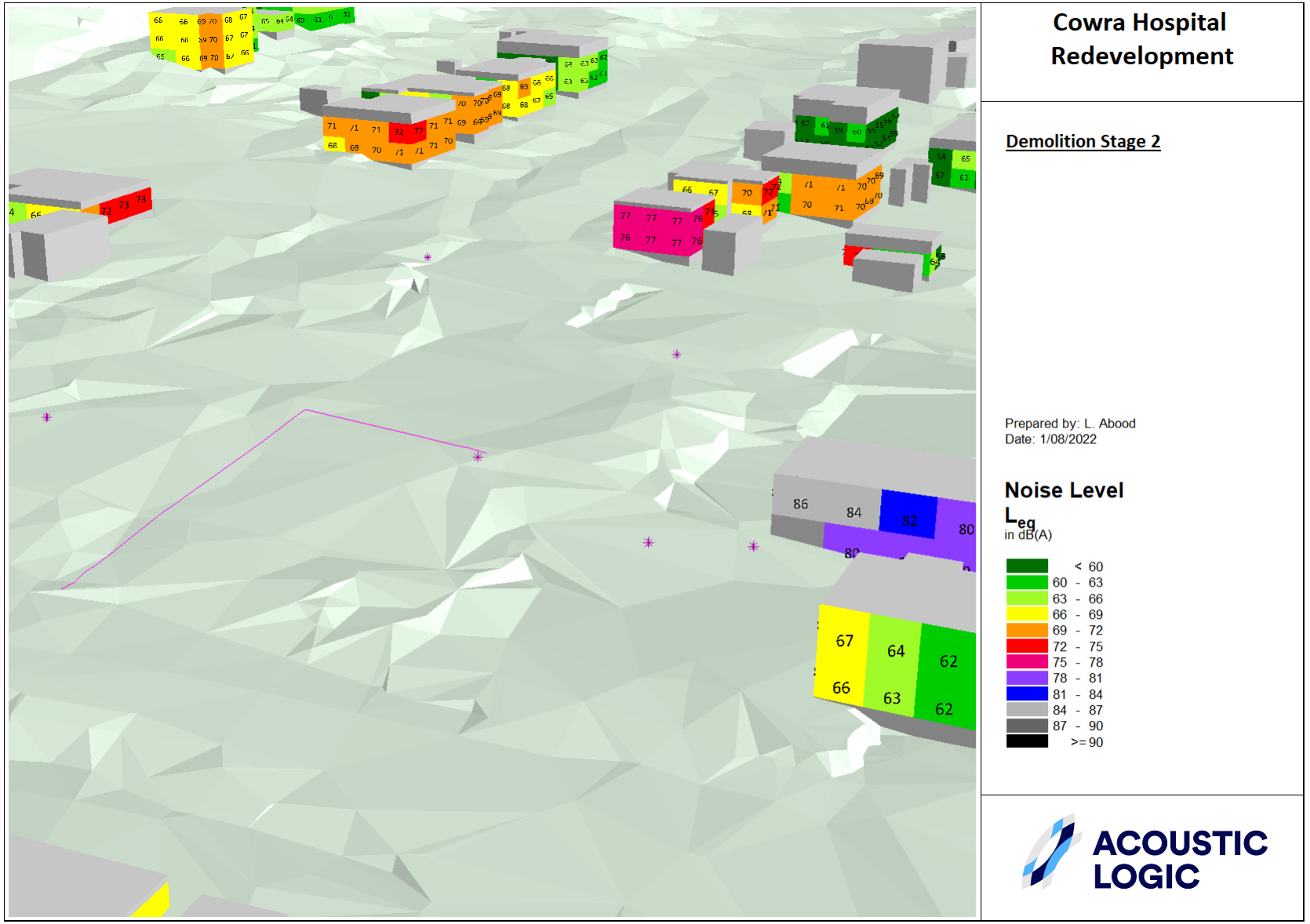


Figure 8: Demolition Stage 2 – R2, R3 and C1

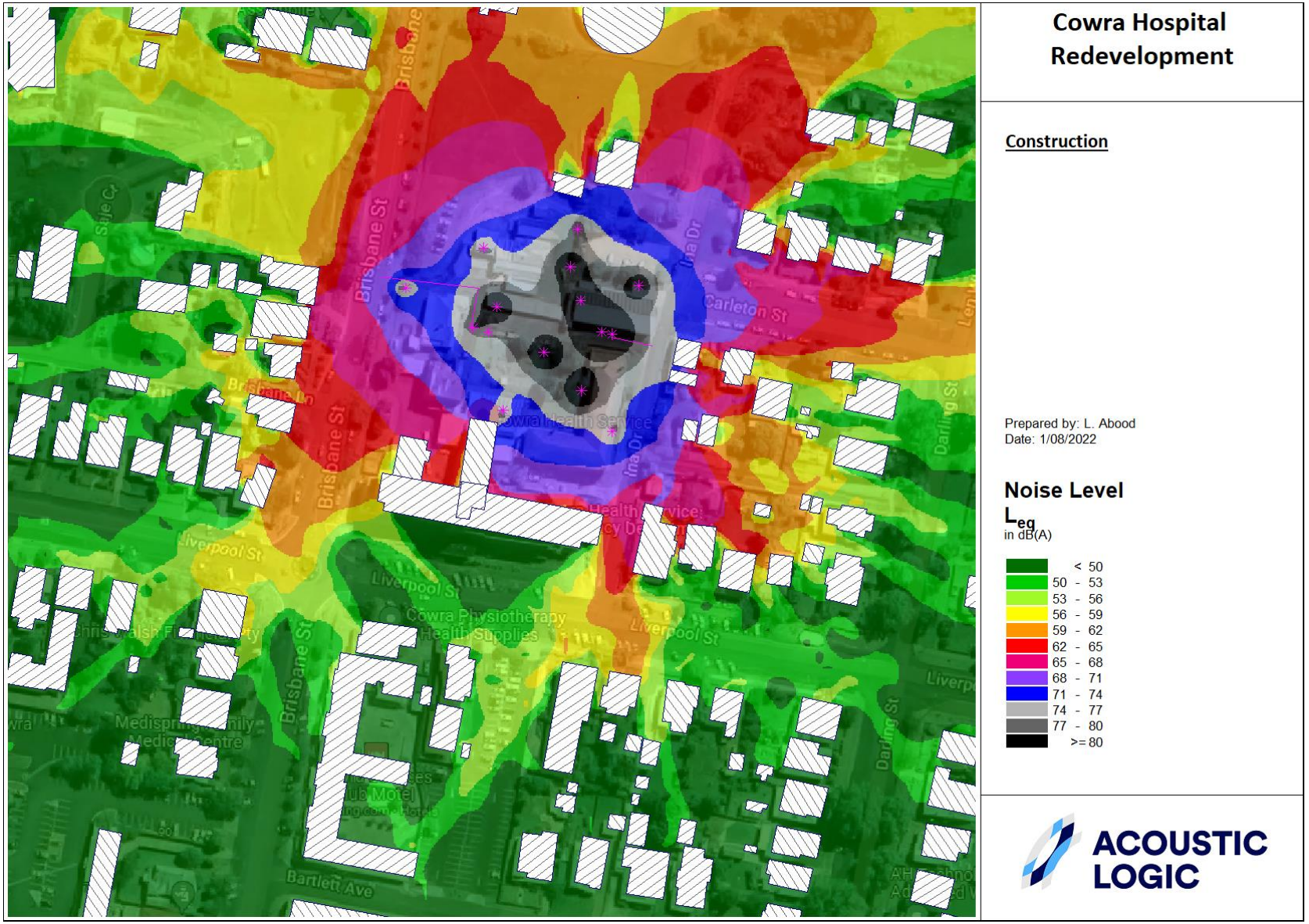


Figure 9: Construction

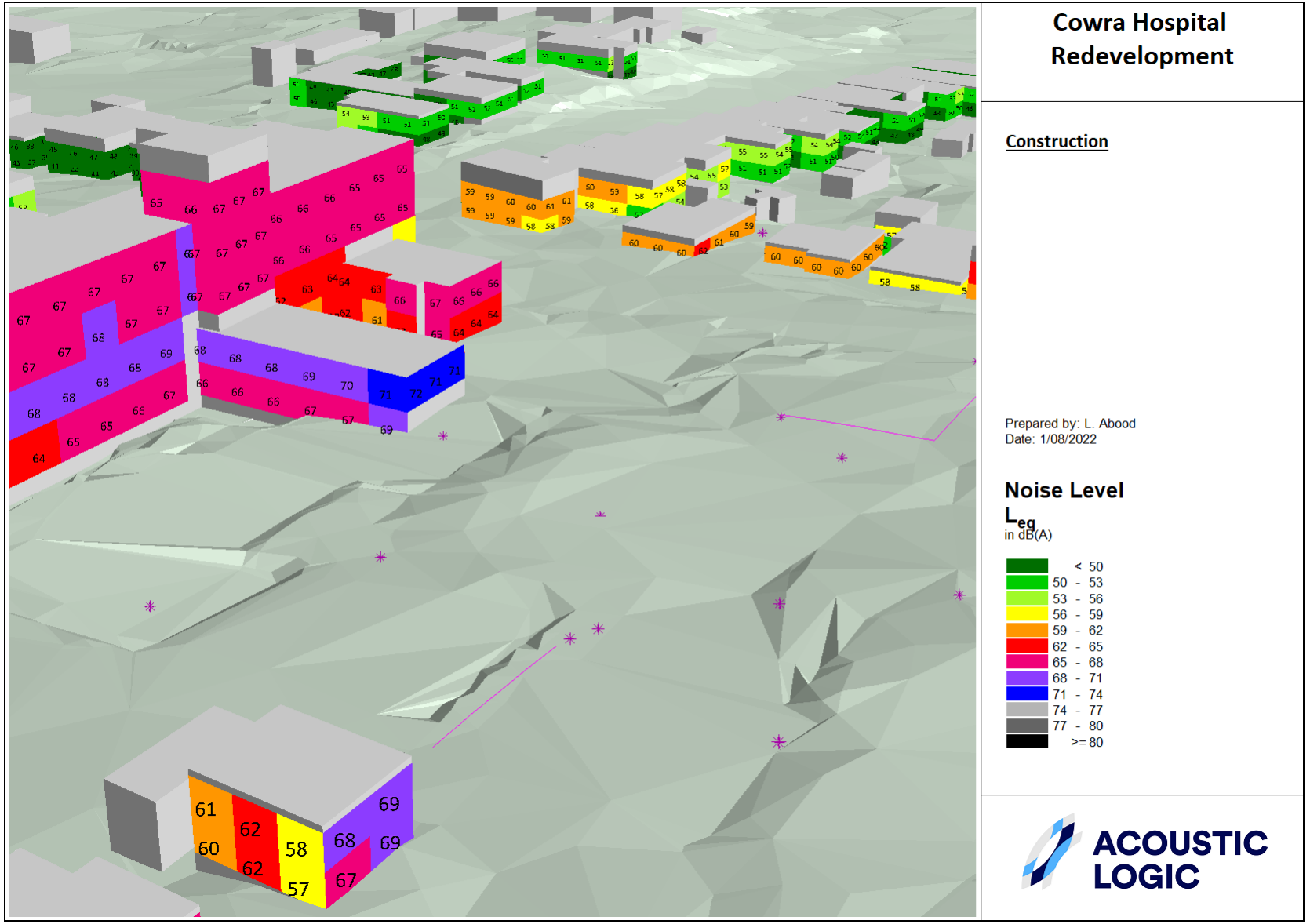


Figure 10: Construction – R1 and H1

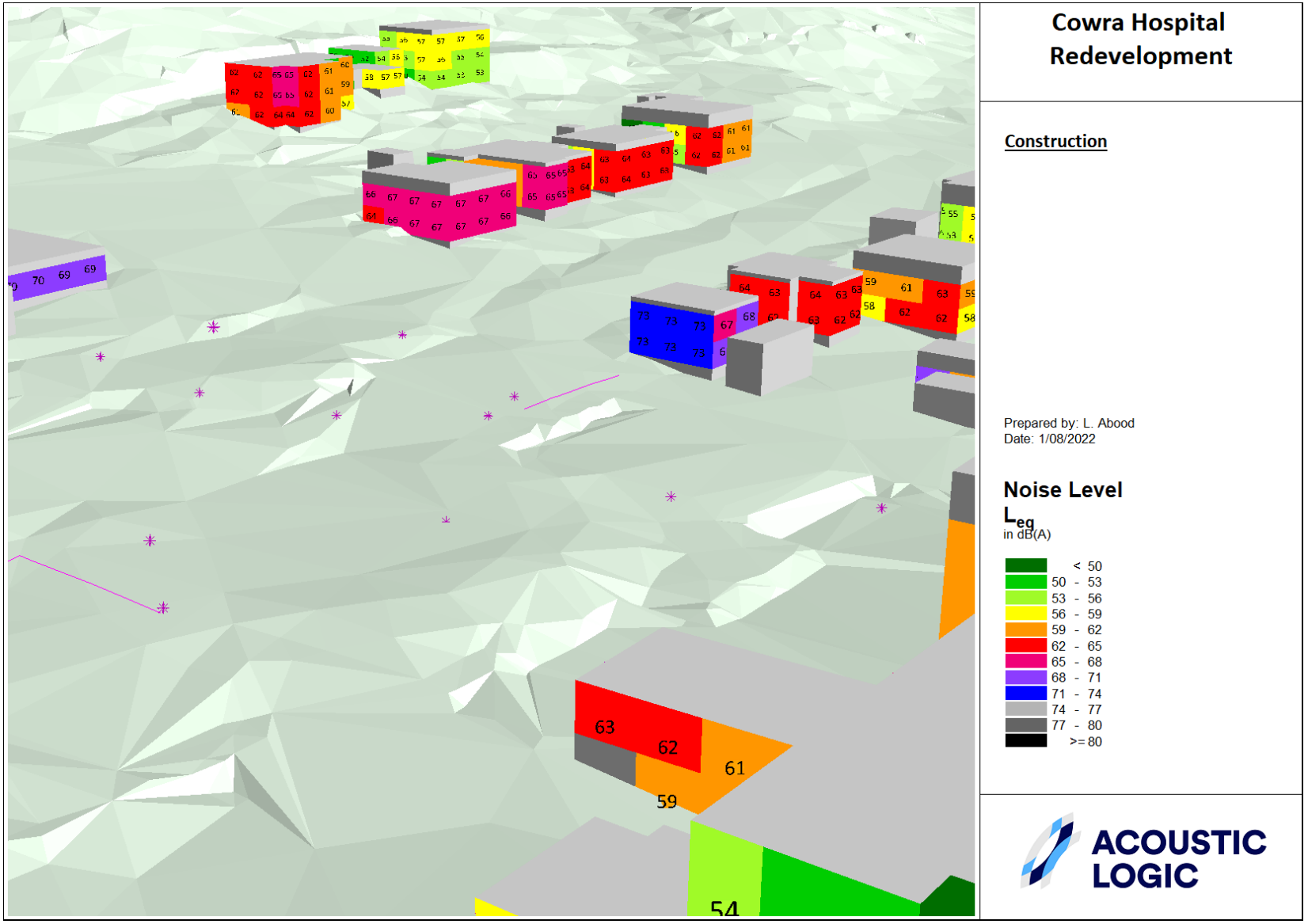


Figure 11: Construction – R2, R3 and C1

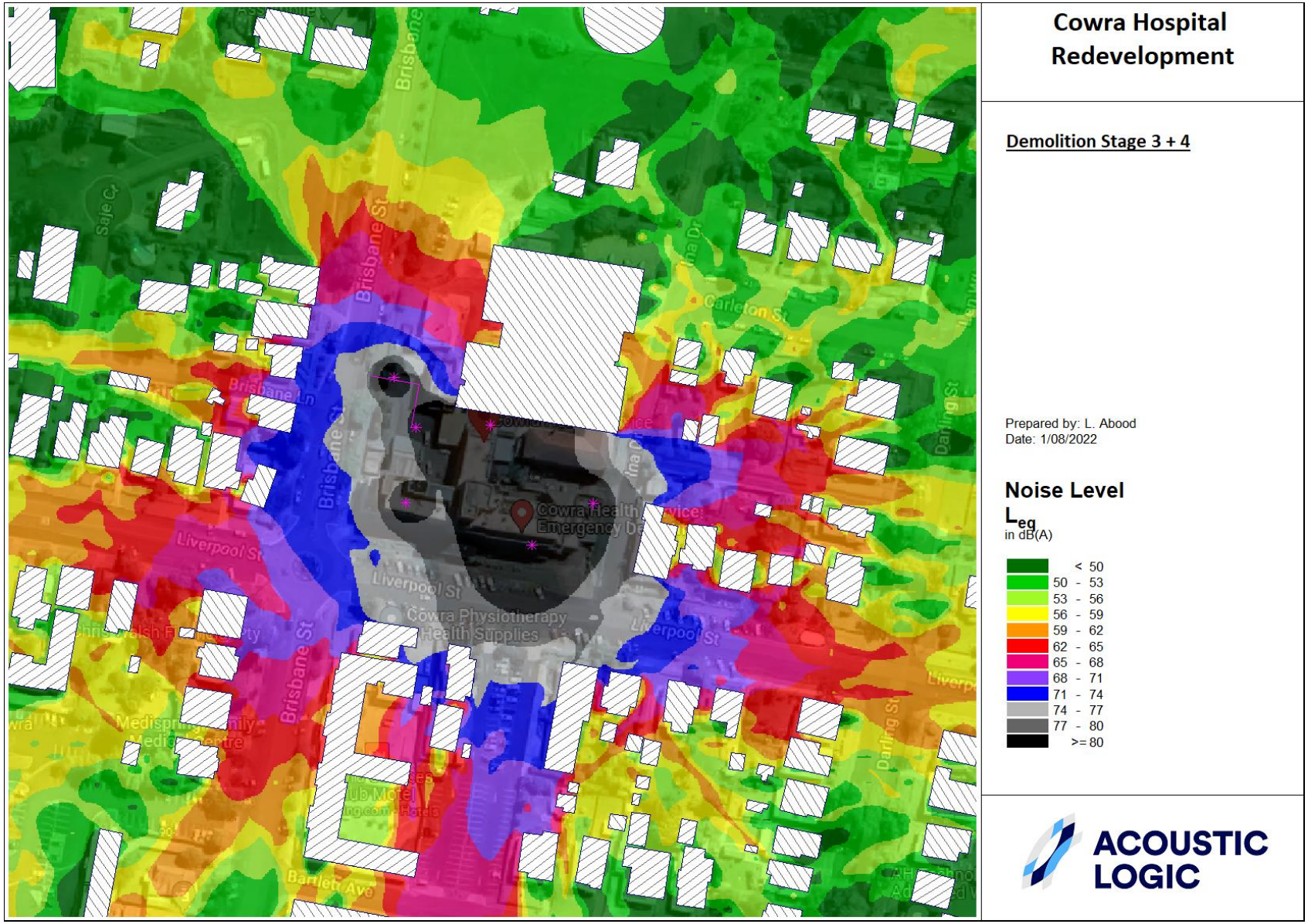


Figure 12: Demolition Stage 3 & 4

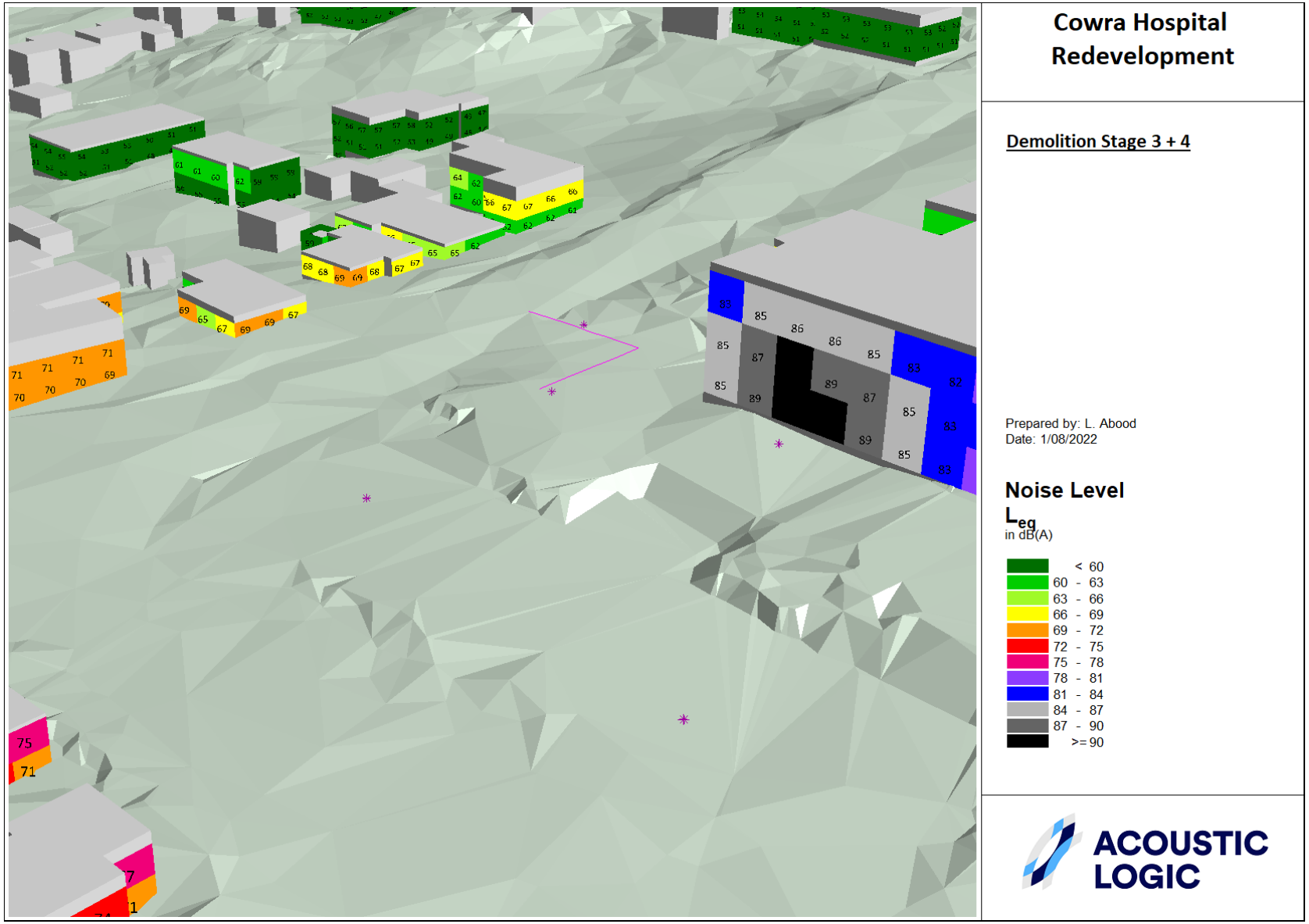


Figure 13: Demolition Stage 3 & 4 – R1 and H1

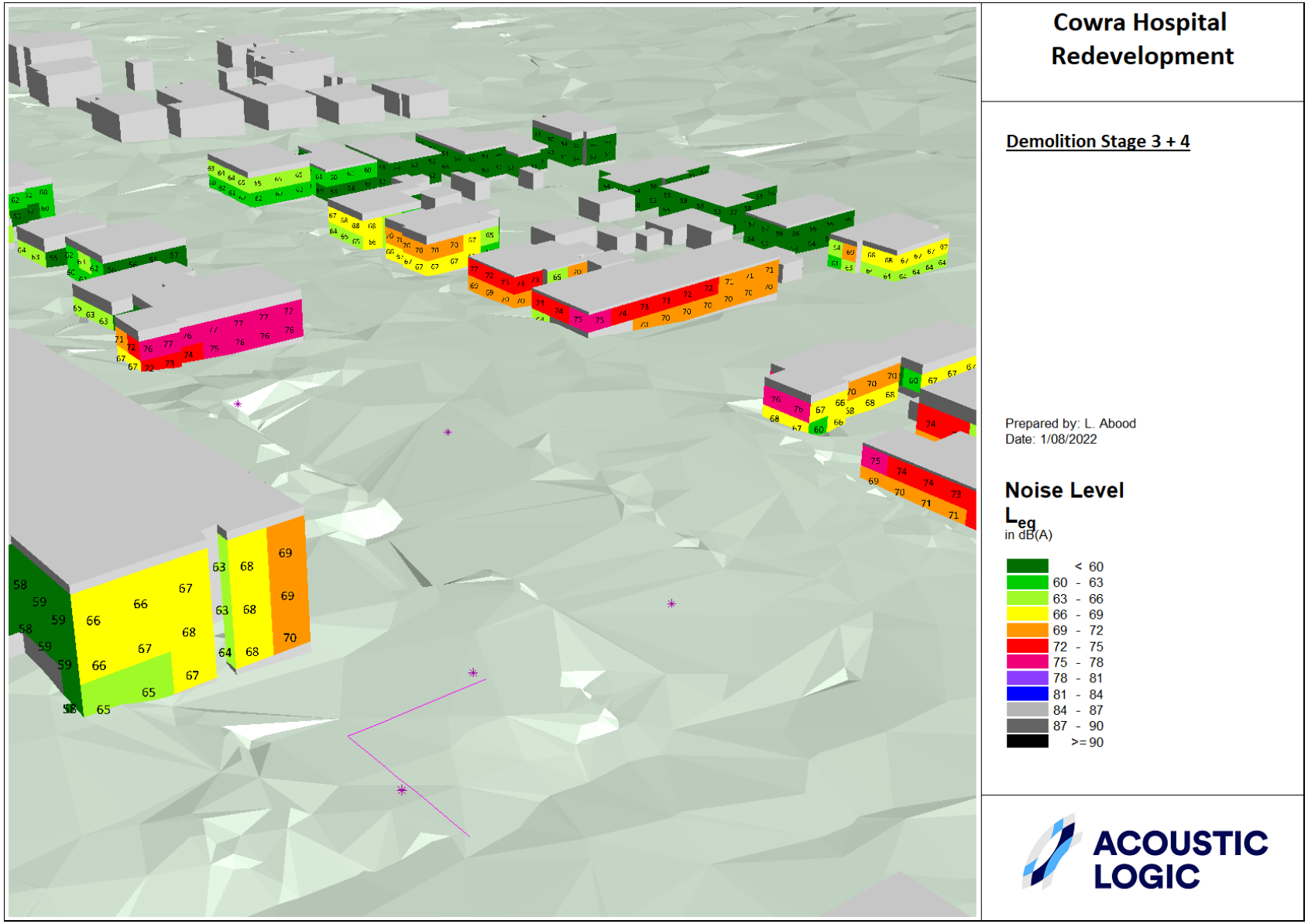


Figure 14: Demolition Stage 3 & 4– R2 and C2

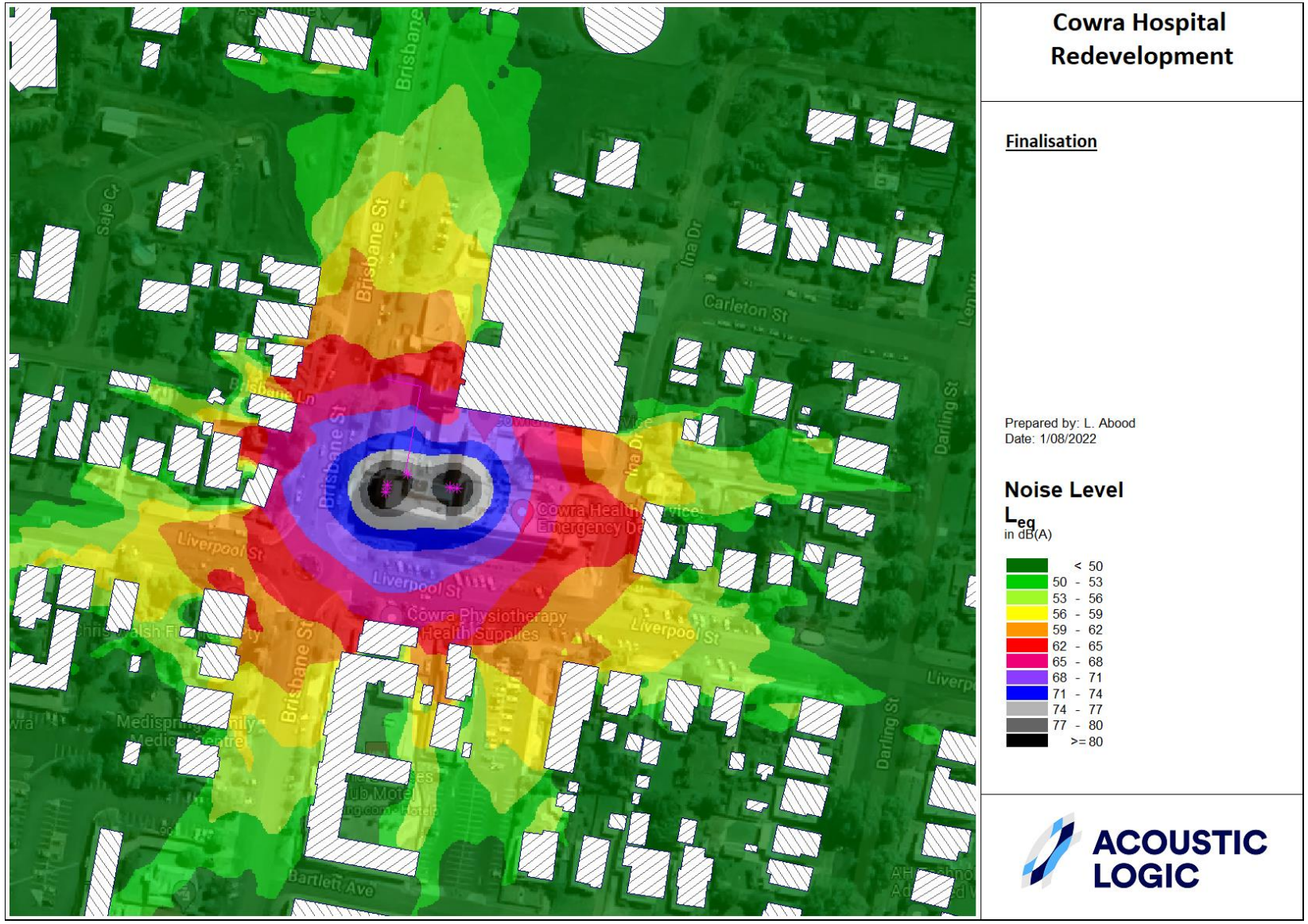


Figure 15: Finalisation

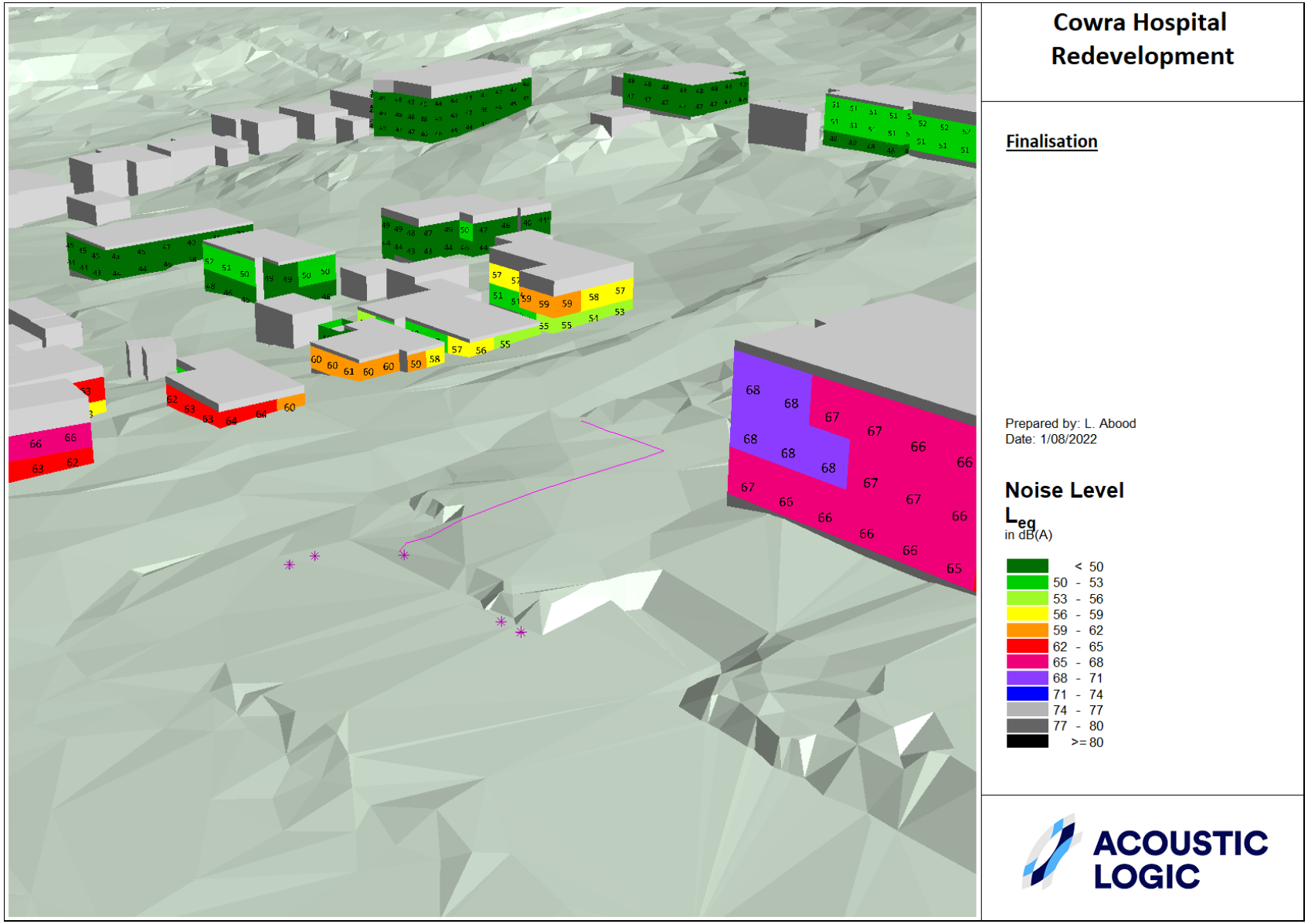


Figure 16: Finalisation – R1 and H1

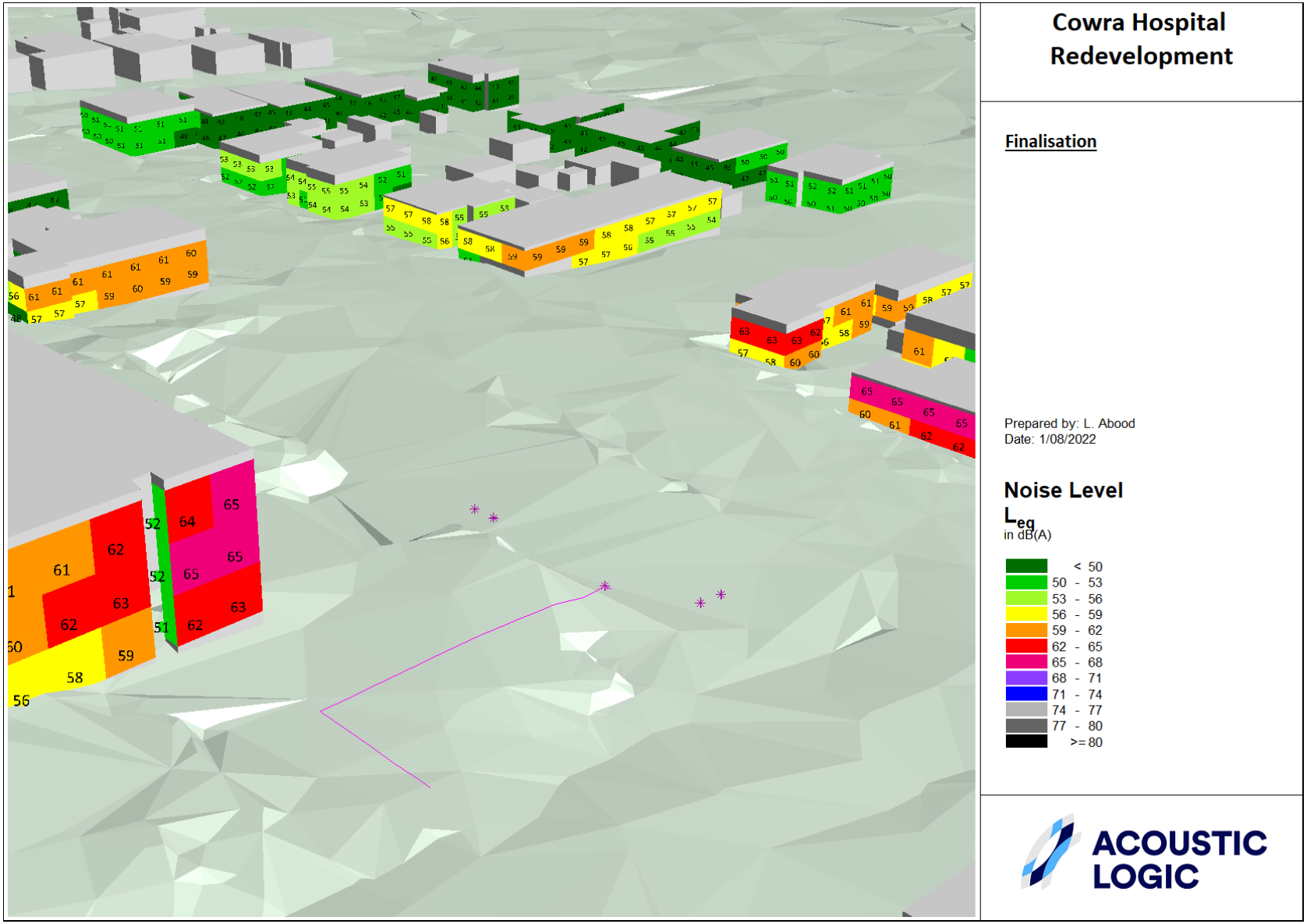


Figure 17: Finalisation – R2 and C2

8.3 PREDICTED NOISE LEVELS AT SENSITIVE RECEIVERS

The predicted external noise levels at nearest sensitive receivers are presented in the Table's 7 and 8 below.

Table 7 –Predicted External Noise Levels at Nearest Sensitive Receivers – External

Receiver	Demolition Stage 1 Predicted External Noise Level dB(A) $L_{eq(15min)}$	Demolition Stage 2 Predicted External Noise Level dB(A) $L_{eq(15min)}$	Construction Predicted External Noise Level dB(A) $L_{eq(15min)}$	Demolition Stage 3 & 4 Predicted External Noise Level dB(A) $L_{eq(15min)}$	Finalisation Predicted External Noise Level dB(A) $L_{eq(15min)}$	Affected Noise Level / Highly Affected Noise Level dB(A) $L_{eq(15min)}$	Recommendations
R1	46-70	48-72	38-64	44-72	37-66	48/75	Potential to exceed Affected Noise Management Level, below Highly Affected Noise Management Level
R2	50-82	43-73	40-66	51-77	40-66		Potential to exceed Highly Affected Noise Management Level, see Section 9 for recommendations
R3	49-78	48-77	42-73	41-77	33-54	70/n.a.	
C1	54-73	52-73	48-70	43-50	33-38		Potential to exceed Affected Noise Management Level, see Section 9 for recommendations
C2	48-69	40-63	<35-56	44-77	34-65		

Table 8 –Maximum Predicted Internal Noise Levels at H1

Receiver	Room Usage	Demolition Stage 1 Predicted Internal Noise Level dB(A) $L_{eq(15min)}$	Demolition Stage 2 Predicted Internal Noise Level dB(A) $L_{eq(15min)}$	Construction Predicted Internal Noise Level dB(A) $L_{eq(15min)}$	Demolition Stage 3 Predicted Internal Noise Level dB(A) $L_{eq(15min)}$	Finalisation Predicted Internal Noise Level dB(A) $L_{eq(15min)}$	Affected Noise Level dB(A) $L_{eq(15min)}$	Recommendations
H1	General Wards	39	37	31	60	37	45	Potential to exceed Affected Noise Management Level during Demolition Stage 3 and 4, See Section 9 for recommendations
	Operating Theatres	<30	<30	<30	32	<30	48	Below Noise Affected Level
	Dental Clinic	<30	49	31	32	<30	51	
	X-Ray Room	<30	<30	<30	32	<30	65	
	Pathology Laboratory	44	42	35	37	<30	46	
	Labour Ward	39	52	36	33	<30	52	

9 AMELIORATIVE MEASURES

The following recommendations are made to mitigate the impacts.

9.1 SITE SPECIFIC RECOMMENDATIONS

- Notification - Prior to commencement of each month, neighbouring receivers should be notified of the anticipated works for that month and the potential noise and vibration generation from the anticipated construction activity.
- Demolition, Excavation and Piling:
    - It is recommended to use CFA/Drill piling.
    - Wherever feasible, hydraulic hammering should be minimised in favour for the use of excavators with a bucket.
- High Noise Generating Works:
    - Where high noise generating works are proposed to be undertaken, respite hours should be implemented to reduce the impact on surrounding receivers. Limit the use of any required piling, hydraulic hammers and grinding activities to between 8:00am – 12:00pm and 1:00pm - 5:00pm Monday to Friday and between 9:00am - 1:00pm on Saturdays. This equates to a maximum of four-hour blocks of high generating noise activity, separated by a minimum 1 hour respite period.
- Vehicle Noise - Trucks to turn off their engines during idling to reduce impacts on nearby receivers (unless truck ignition needs to remain on during concrete pumping). Minimise truck reversing. Plant and equipment should be off when not in use.
- Deliveries should use straps in place of chains for handling materials wherever possible. Deliveries should be scheduled during less sensitive time periods (After 9am) wherever practical.
- When selecting construction equipment to be used on the project, the noise levels of plant and equipment should be considered, whereby equipment selected has an equivalent or lower sound power level than the predictive sound power levels of equipment maintained within this report.
- A conscientious effort should be made to avoid works near the nearest sensitive receivers, particularly the existing/new hospital, wherever feasible. Compounding various high generating activities simultaneously near receivers should be avoided where possible.
- Unnecessary shouting should be avoided on site, and appropriate signage should be installed to remind workers of their responsibility to reduce noise impacts where feasible. Loud music from radios and stereos should not be permitted.
- Materials should be placed gently and not thrown to avoid making crashing noises.
- During fit-out in the construction stage and where practical and safe to do so, handheld construction equipment should be used within the building shell to minimise noise impacts on adjacent receivers.
- Non-tonal reversing beepers should be implemented on all construction equipment and mobile plant used regularly on site.
- Maximum delivery vehicle speed of 10km/h through service road.
- In the event of a complaint, noise management procedure identified in section 10 of this report are to be followed. Notwithstanding above, general management techniques and acoustic treatments are included below which may be implemented on a case-by-case basis to reduce noise emissions to surrounding receivers.

9.2 ASSESSMENT OF VIBRATION

9.2.1 Vibration Producing Activities

Proposed activities that have the potential to produce significant ground vibration include:

- Demolition.
- Excavation Work.
- Piling.

9.2.2 Safeguards to Protect Sensitive Structures

It is impossible to predict the vibrations induced by the excavation operations on site at potentially affected receivers. This is because vibration levels are principally proportional to the energy impact which is unknown, the nature of the terrain in the area (type of soil), drop weight, height etc.

9.2.3 Vibration Monitoring

AL recommends that vibration monitoring be conducted within the operational hospital (Existing or New for the relevant construction stage), during each demolition stage, as well as during any required excavation and piling. This recommendation is made to monitor vibration levels experienced by the vibration-sensitive equipment discussed within this report.

Number of vibration monitors to be confirmed concluding consultation with the existing hospital and the contractor.

AL also recommends that if complaints regarding vibration impacts from construction activity arise at nearby sensitive receivers, vibration monitoring be conducted to manage construction vibration levels at said receiver. Any vibration monitor is to have SMS notification capability to enable contractor to be immediately informed when 75% of the vibration criteria has been measured.

9.2.4 Downloading of Vibration Monitor Data

Downloading of the vibration monitor data will be conducted on a regular basis. In the event of exceedance of the vibration criteria, downloading of the vibration monitor data will be conducted more frequently. Results obtained from the vibration monitor will be presented in a graph format and will be forwarded to the client for review. It is proposed that reports are provided fortnightly with any exceedances in the vibration criteria reported as detailed in this report.

9.2.5 Presentation of Vibration Monitor Results

A fortnightly report will be submitted to the client via email summarising the vibration events. The vibration exceedance of criteria is recorded, and the report shall be submitted within 24 hours. Complete results of the continuous vibration logging will be presented in fortnight reports including graphs of the collected data.

9.2.5.1 Equipment

Vibration monitoring at receiver facades or site boundaries are to be conducted using Texcel ETM type monitors with externally mounted tri-axial geophones.

The monitors are to be set to send an SMS message when alert levels have been reached/exceeded at the location of the geophone.

9.2.5.2 Vibration Monitoring Alerts

The following personnel will receive alarms in the event that the nominated vibration trigger levels are exceeded at the site:

1. Acoustic consultant/advisor.
2. Project site foreman.
3. Project Manager.

9.3 GENERAL RECOMMENDATIONS

Other noise management practices which may be adopted are discussed below. In addition, notification, reporting and complaints handling procedures should be adopted as recommended in later sections of this report.

9.3.1 Acoustic Barrier

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant (tower cranes). Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10 or 15mm plywood would be acceptable for the barriers.

9.3.2 Silencing Devices

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

9.3.3 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

9.3.4 Treatment of Specific Equipment

In certain cases, it may be possible to specially treat a piece of equipment to reduce the sound levels emitted. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

9.3.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers.

Construction vehicles accessing the site should not queue in residential streets and should only use the designated construction vehicle routes. Loading of these vehicles should occur as far as possible from any sensitive receiver.

10 ASSESSMENT METHODOLOGY AND MITIGATION METHODS

The flow chart that follows illustrates the process to be followed to minimise the impact associated with these activities.

Noise sources with the potential to exceed the criteria set out in Section 7 have been identified and discussed in section 8.

11 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

11.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continuous communication is required between; all parties which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation process is to:

- Inform and educate the groups about the project and the noise controls being implemented.
- Increase understanding of all acoustic issues related to the project and options available.
- Identify group concerns generated by the project, so that they can be addressed.
- Ensure that concerned individuals or groups are aware of and have access to the Site Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular scheduled meetings may be required for a finite period, until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generate higher noise/vibration levels.

11.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise, vibration or dust occur, immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. In the case of exceedances of the vibration and dust limits, all work potentially producing vibration or dust shall cease until the exceedance is investigated. The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Required remedial action, if required.
- Validation of the remedial action.
- If necessary, setup vibration monitoring at the location representing the nearest affected vibration receiver, with alarm device which can inform the project manager on site if the vibration exceedance happened.
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of a complaint shall involve where applicable.

- noise measurements at the affected receiver.
- an investigation of the activities occurring at the time of the incident.
- inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

12 CONTINGENCY PLANS

Where non-compliances or noise complaints are raised the following methodology will be implemented.

1. Determine the offending plant/equipment/process
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc where practical.
4. Selecting alternative equipment/processes where practical
5. If necessary, setup noise and vibration monitoring devices at locations representing the nearest noise/vibration and dust affected receivers and provide data for each complain time period. Analysis is required to determine suitable mitigation measures.

Complaints associated with noise and vibration generated by site activities shall be recorded on a Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

13 CONCLUSION

This report presents a construction noise and vibration management plan for the associated construction activities proposed to be conducted for the proposed alterations and additions to Cowra Hospital, located at 64 Liverpool Street, Cowra.

Provided that the practices and recommendations in this report are implemented, the noise and vibration impacts during the excavation and construction stages will be minimised.

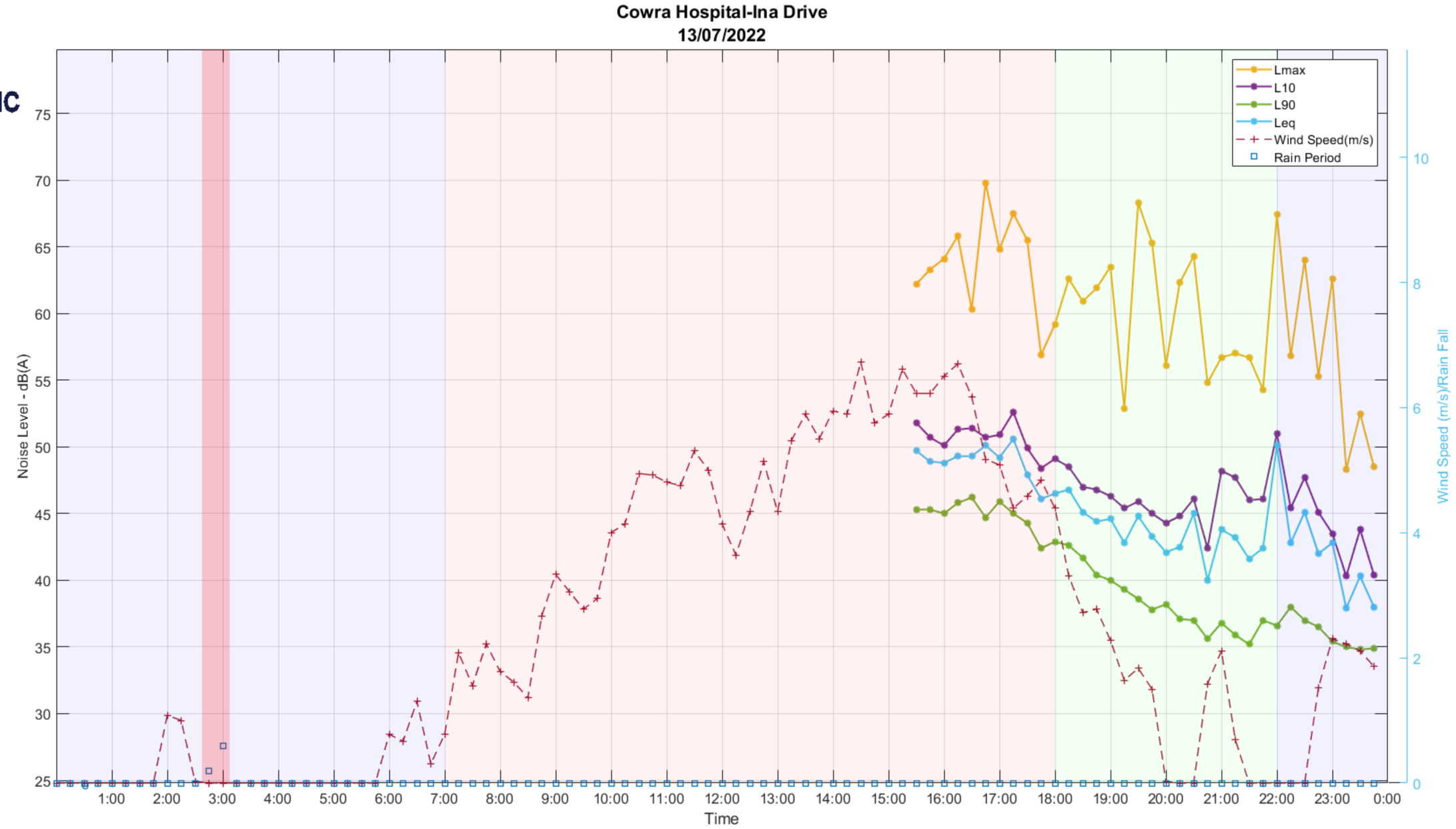
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Lachlan Abood

APPENDIX 1A – UNATTENDED NOISE MONITOR – 2 INA DRIVE, COWRA

ACOUSTIC LOGIC



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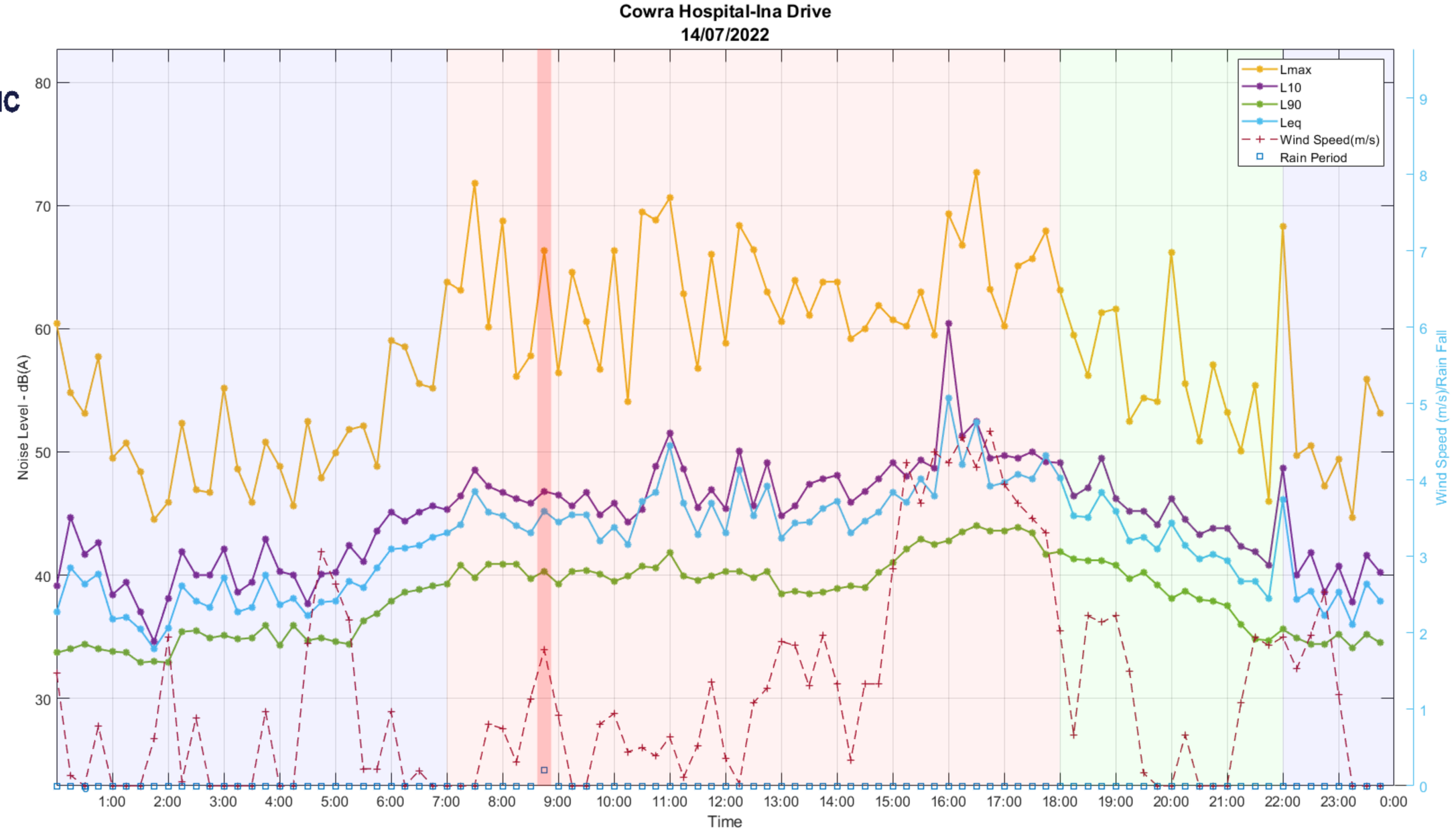

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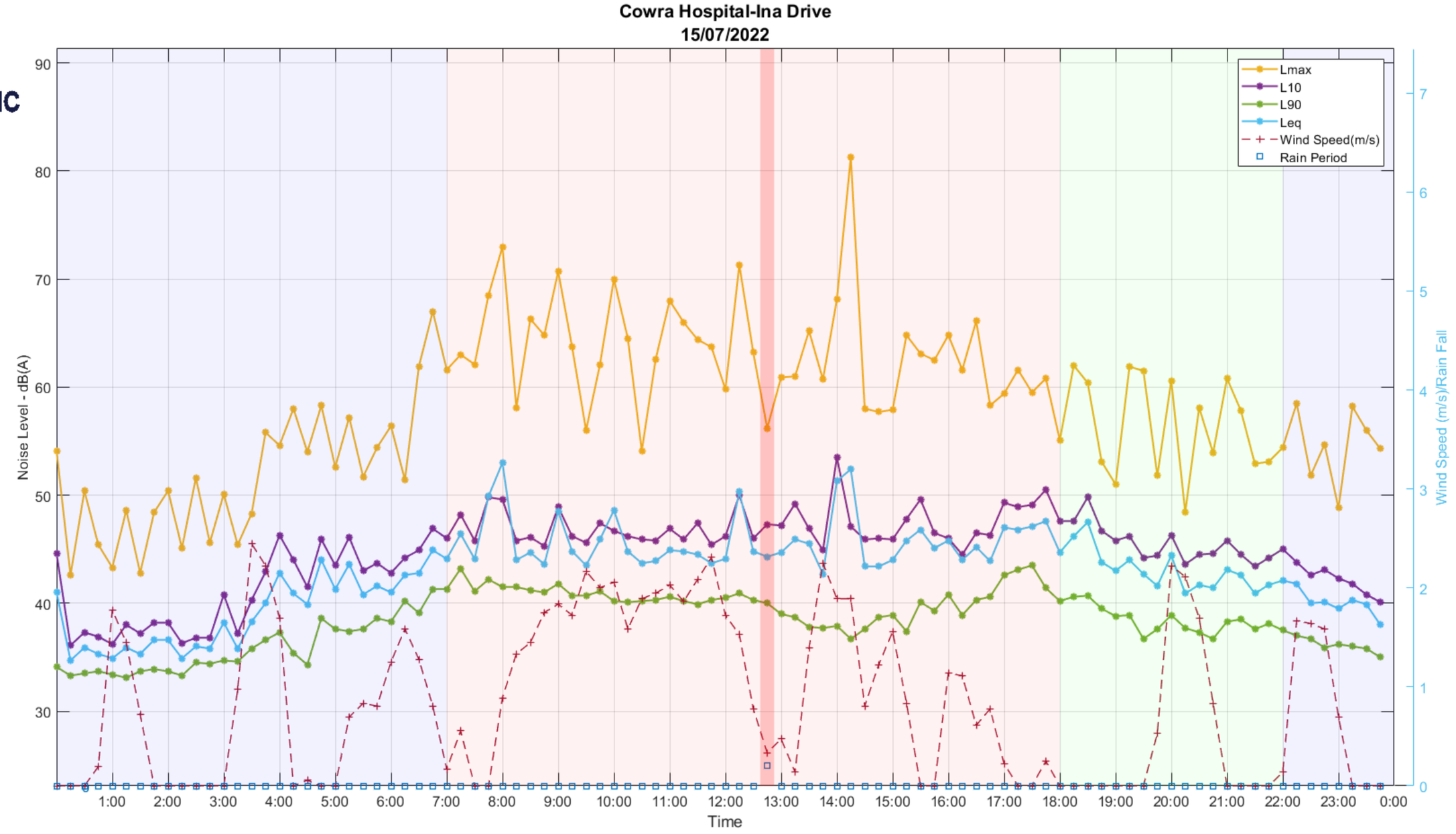

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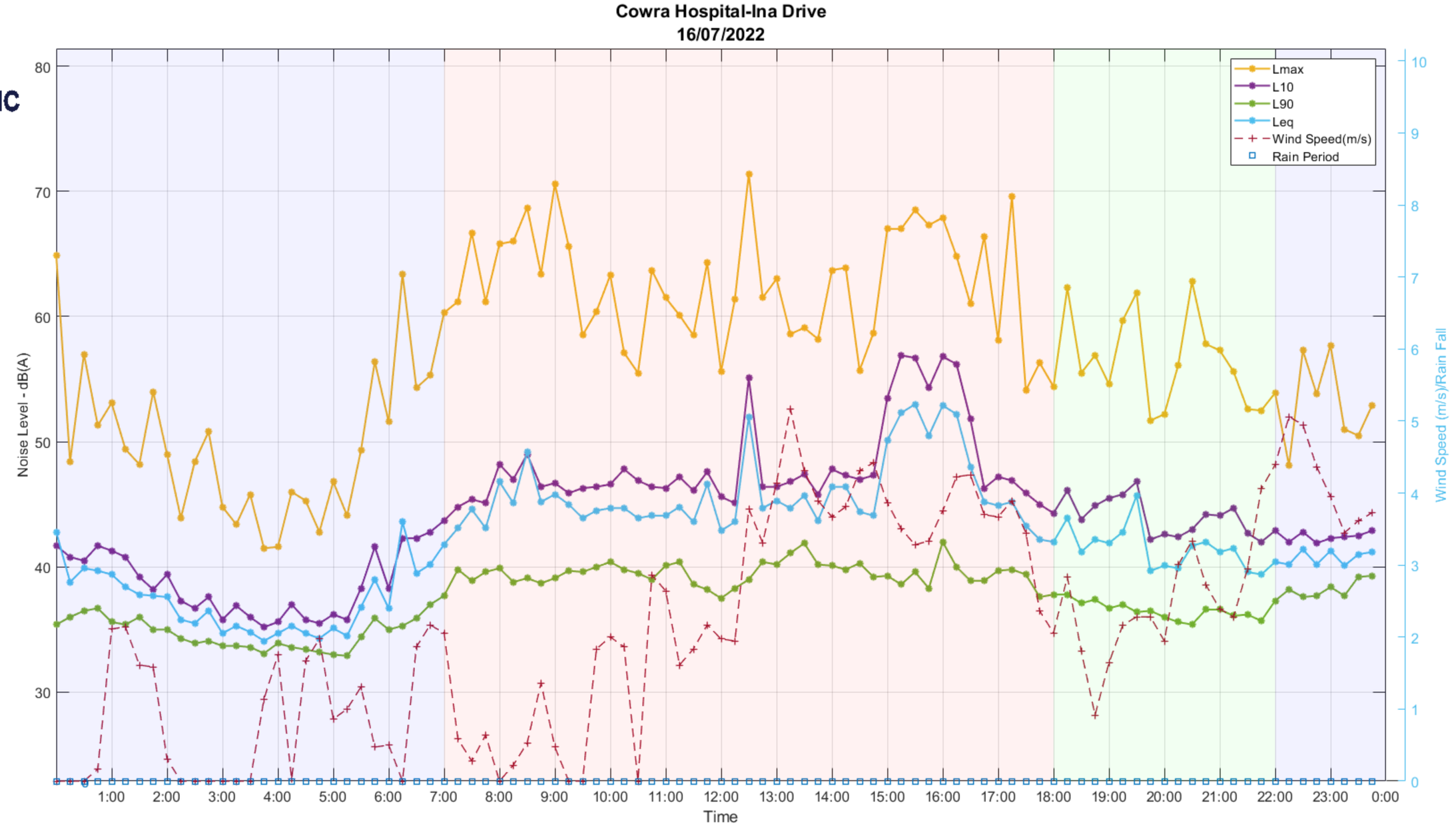

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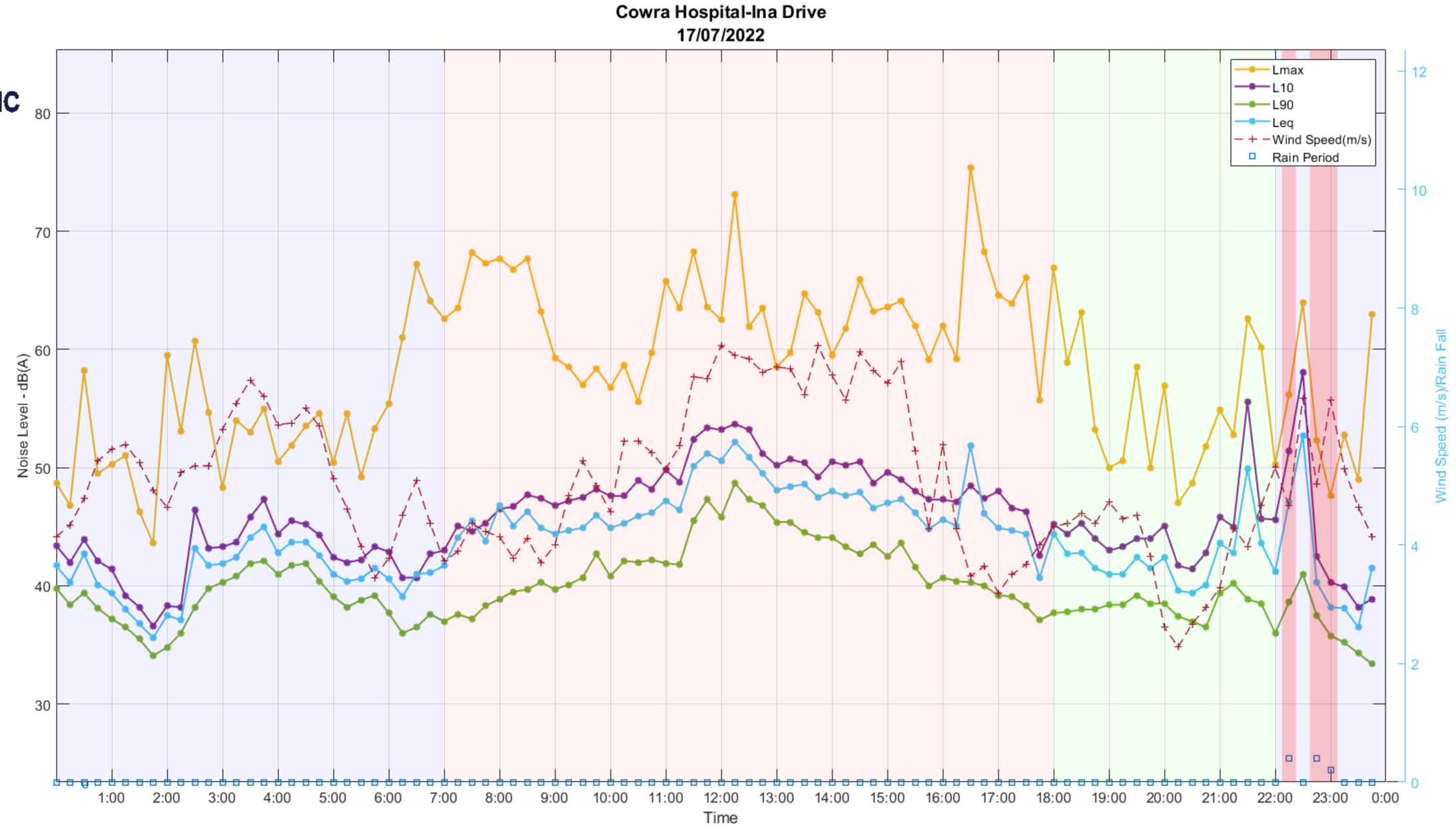

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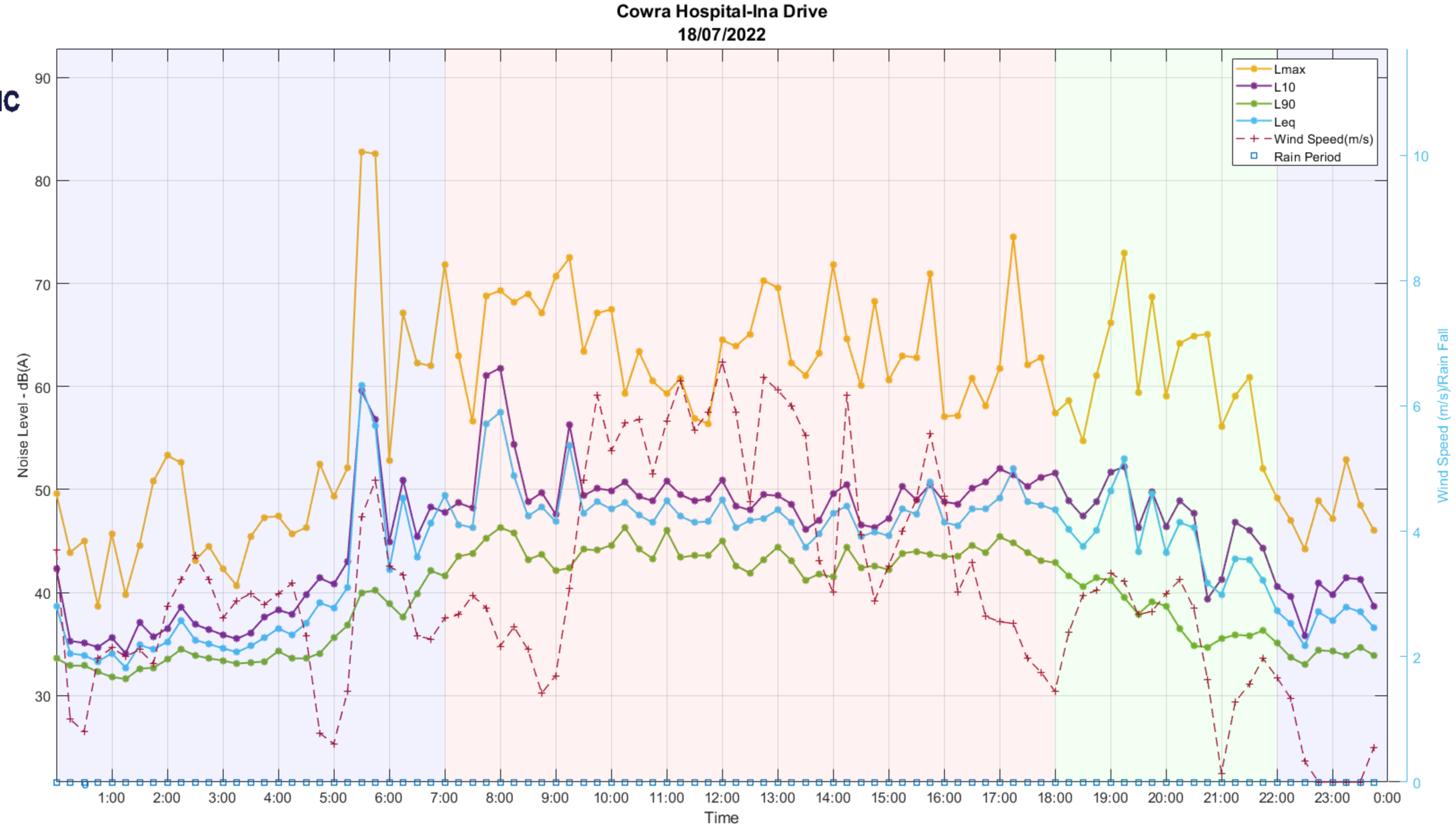

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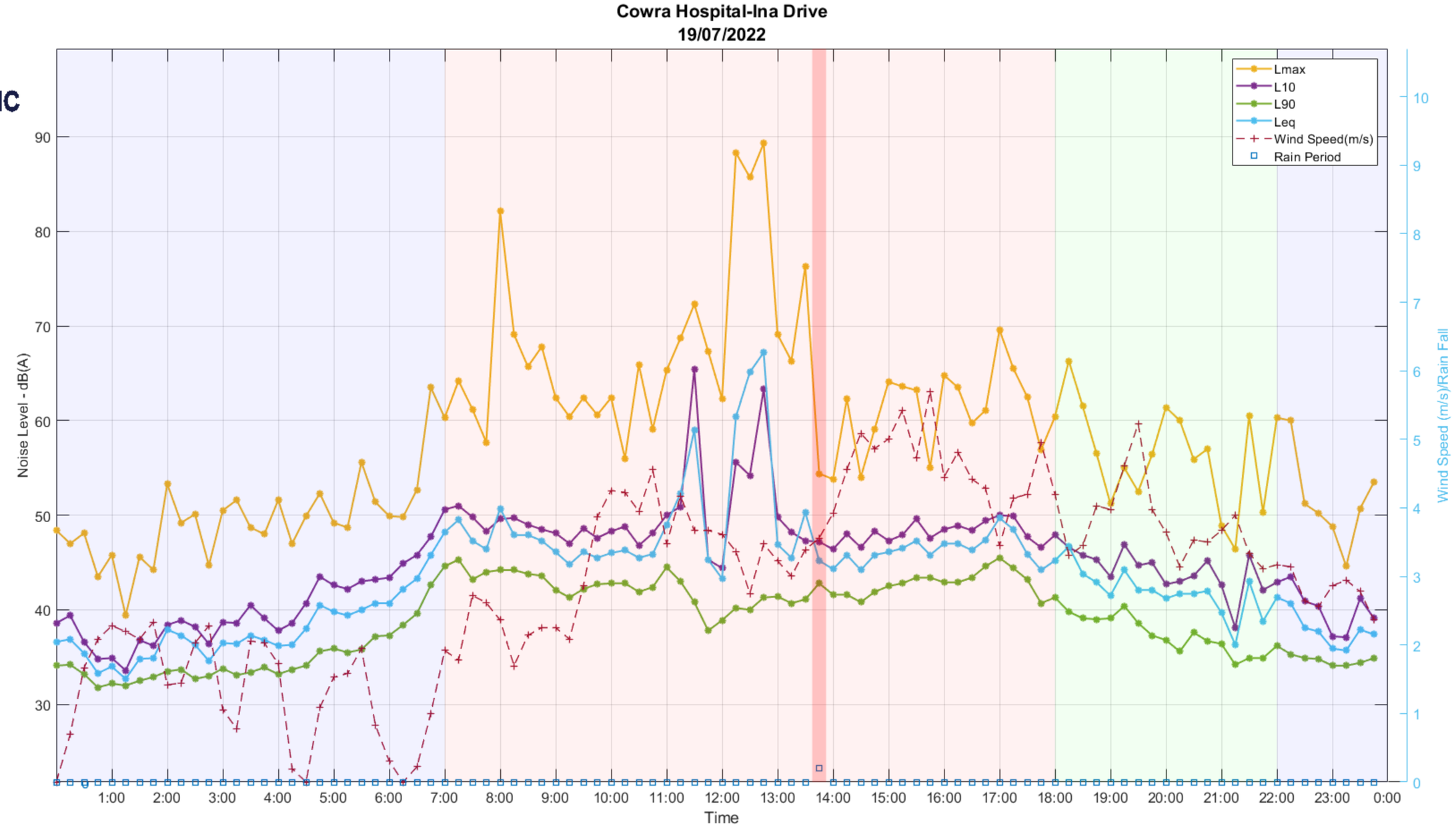

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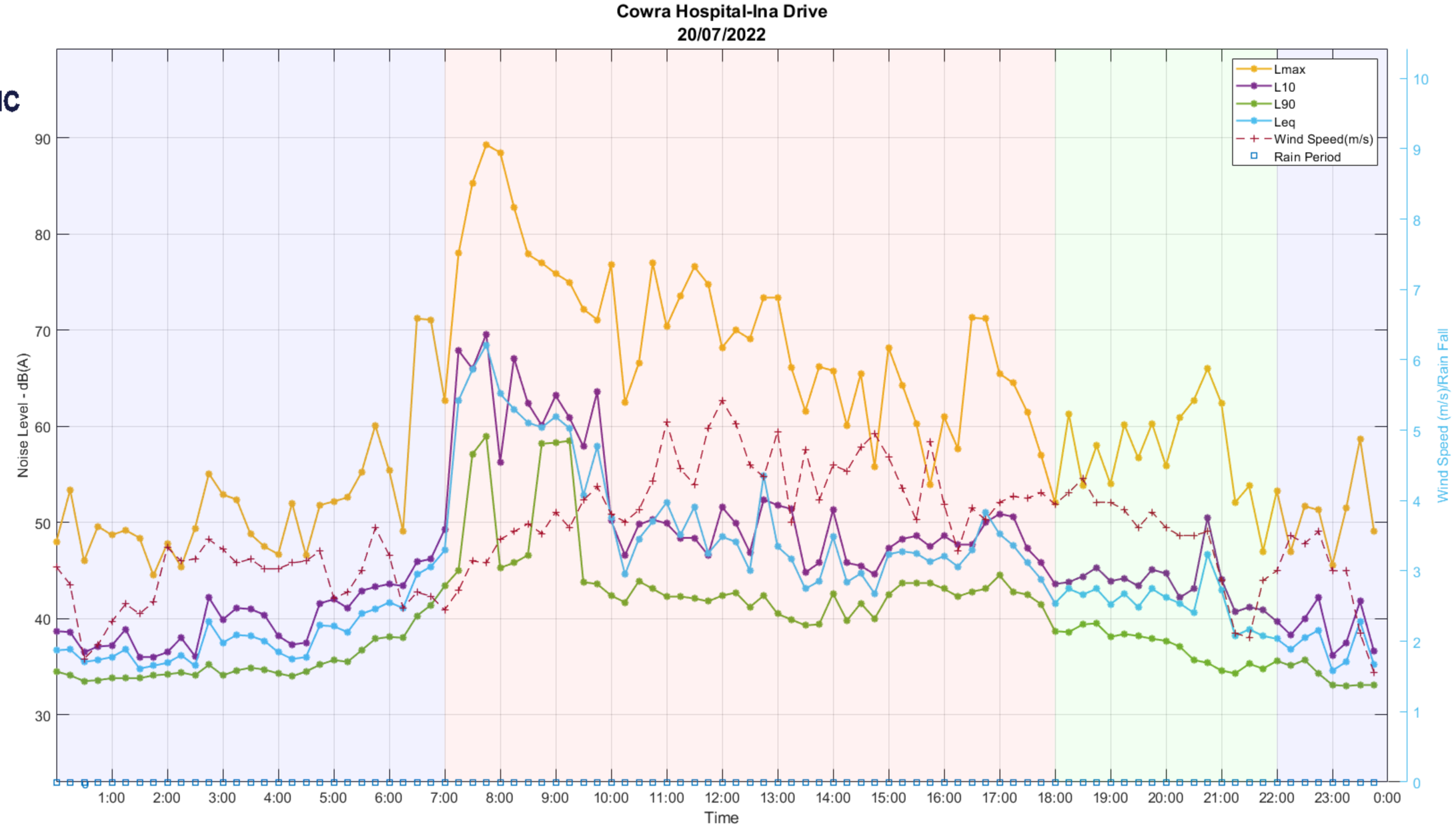

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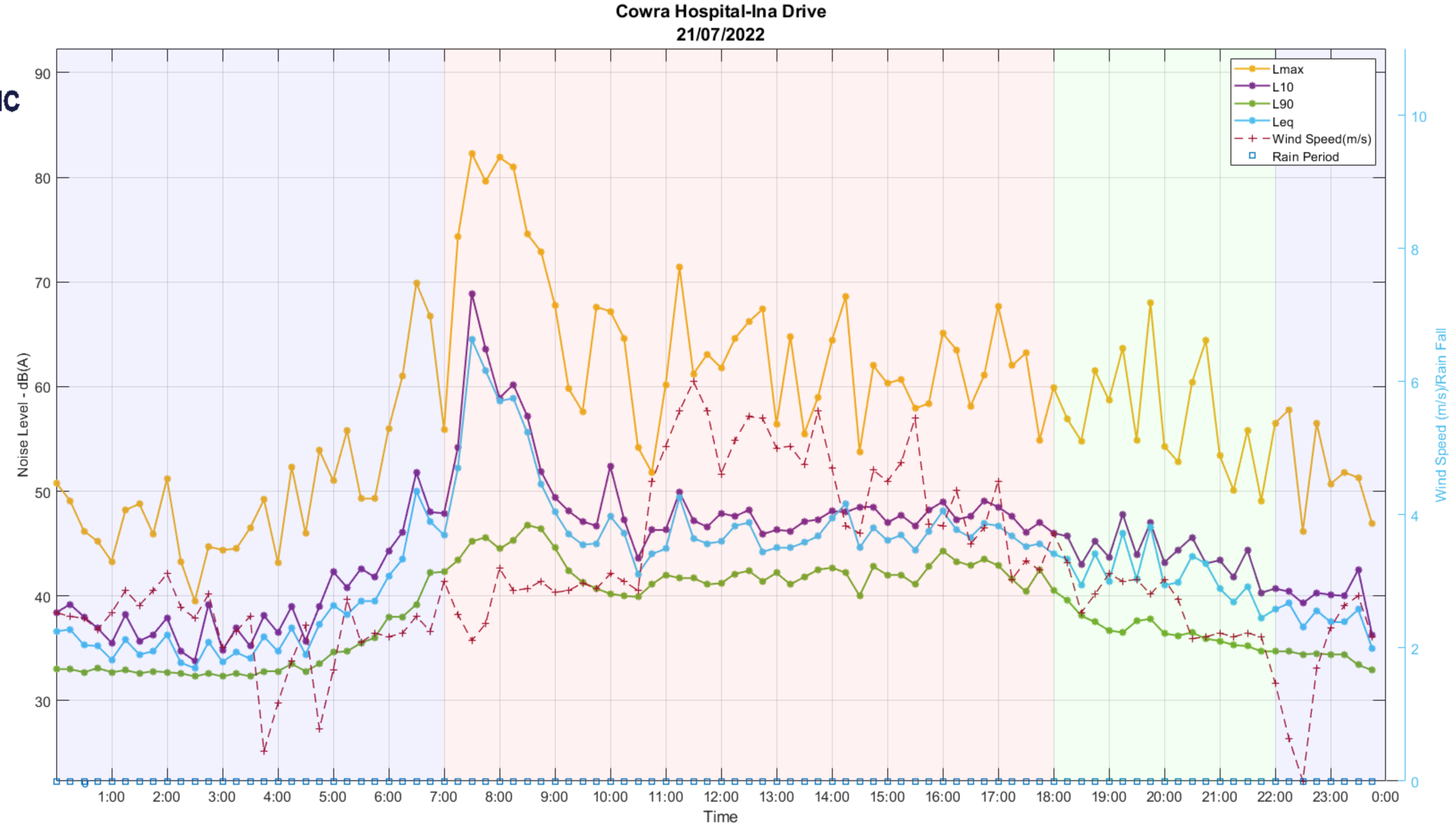

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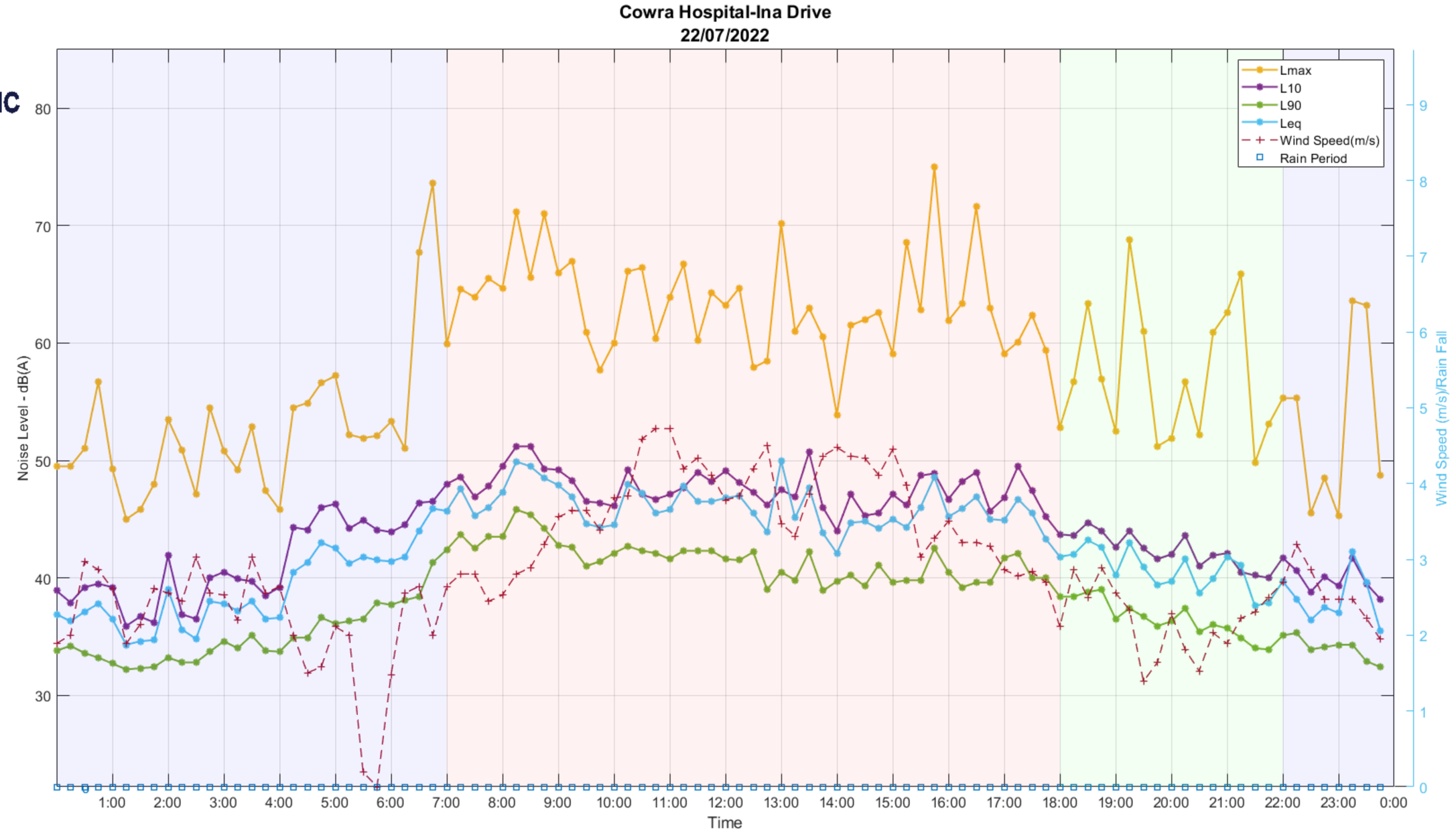

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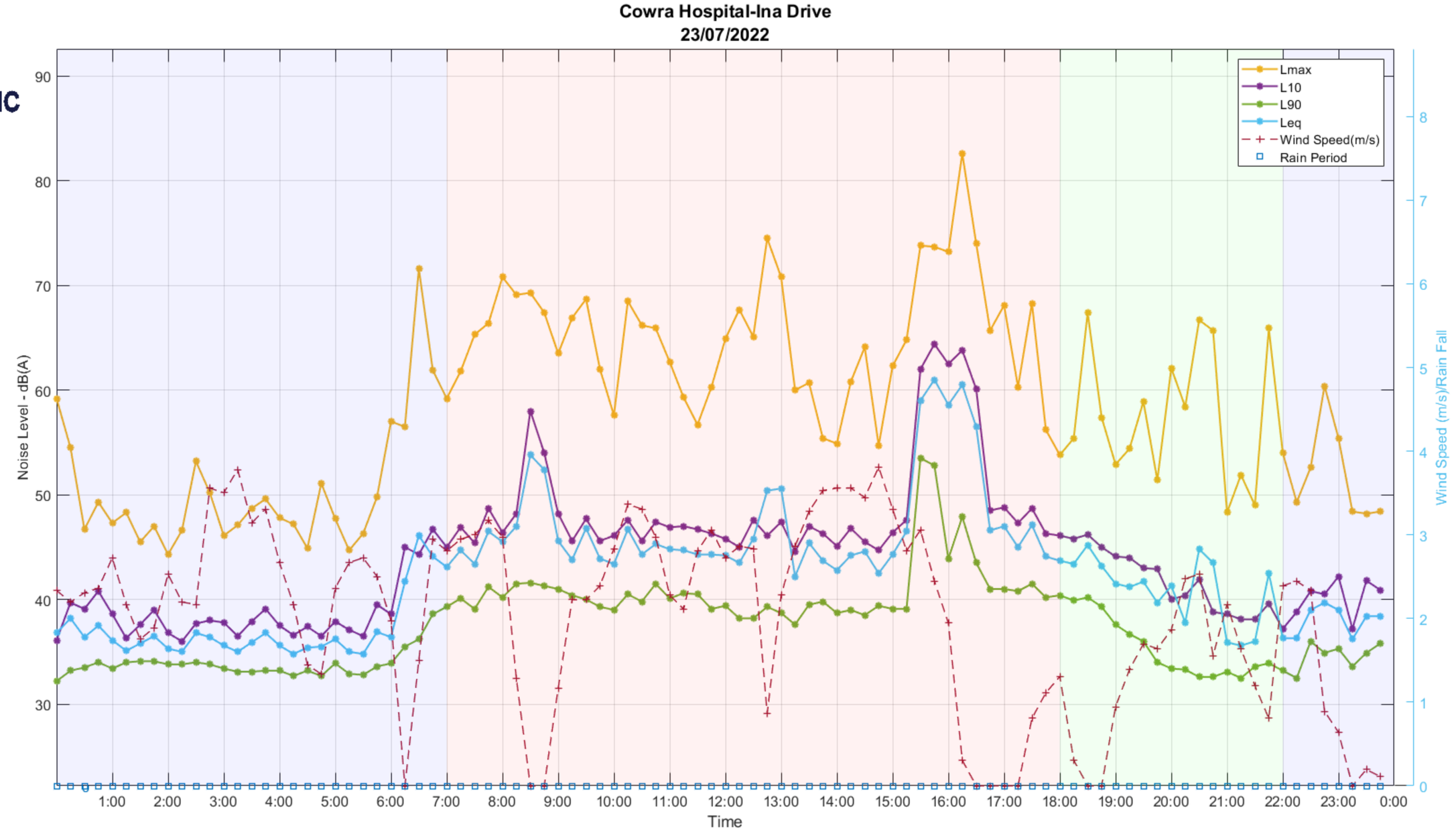

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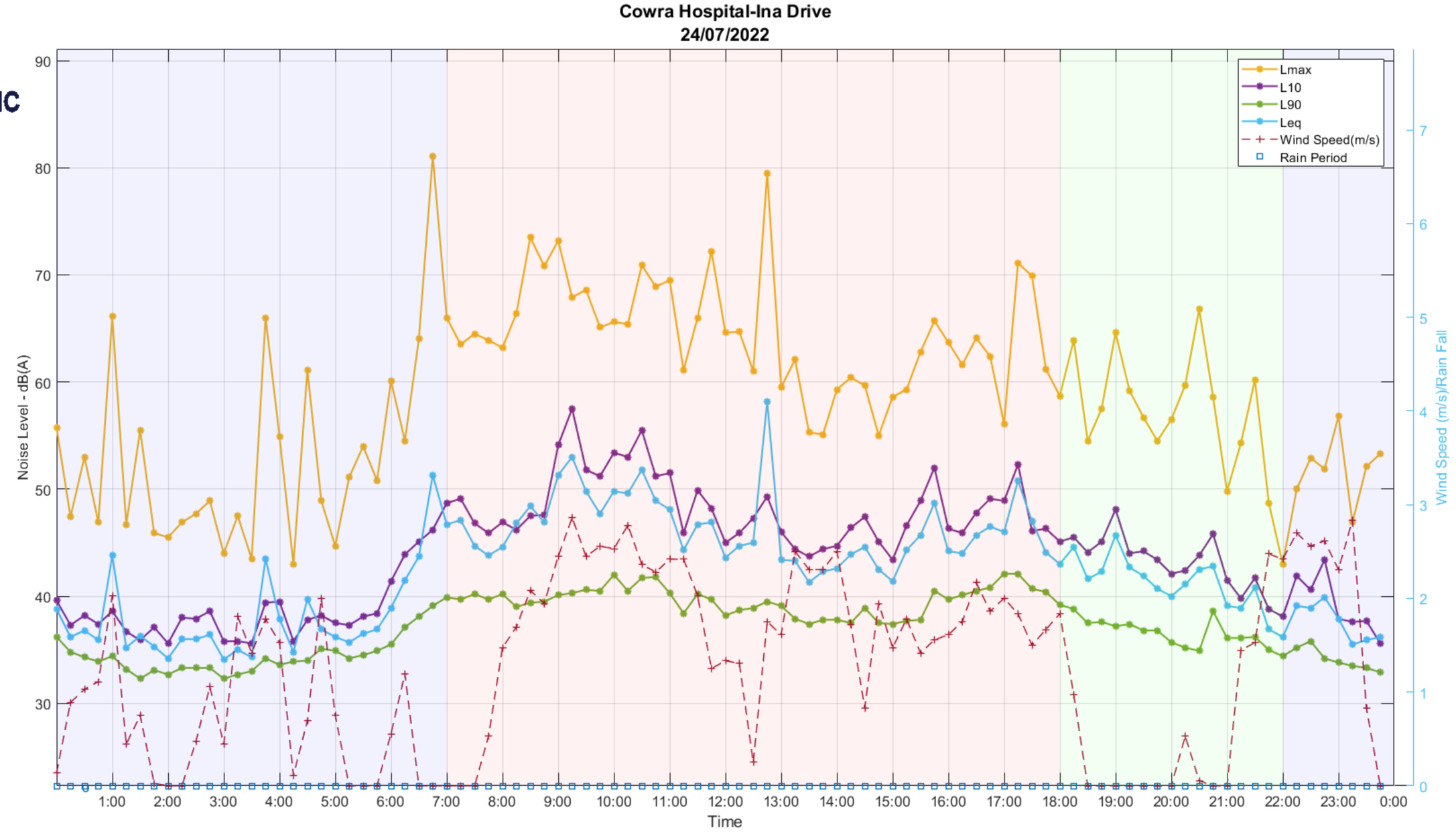

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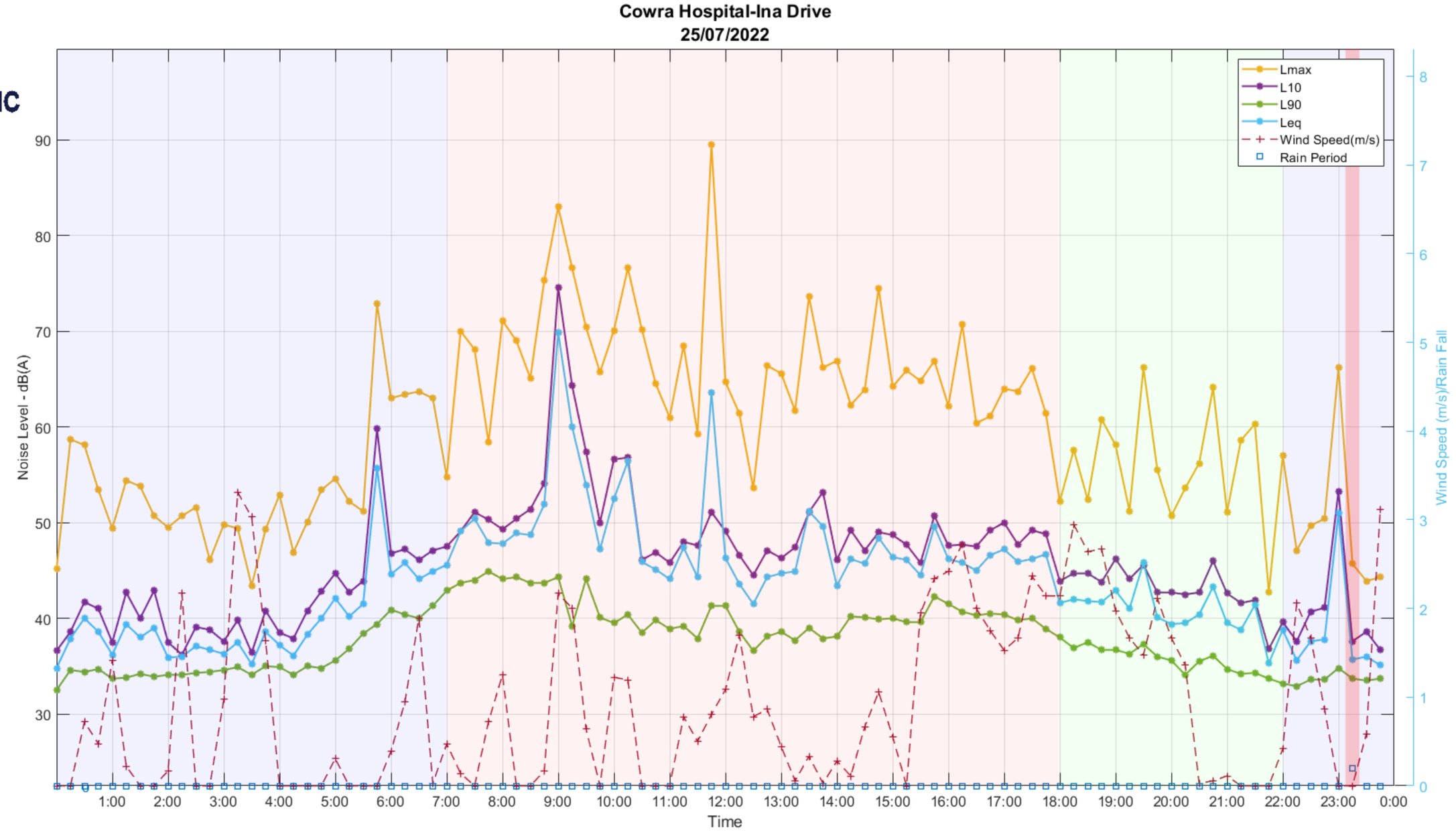

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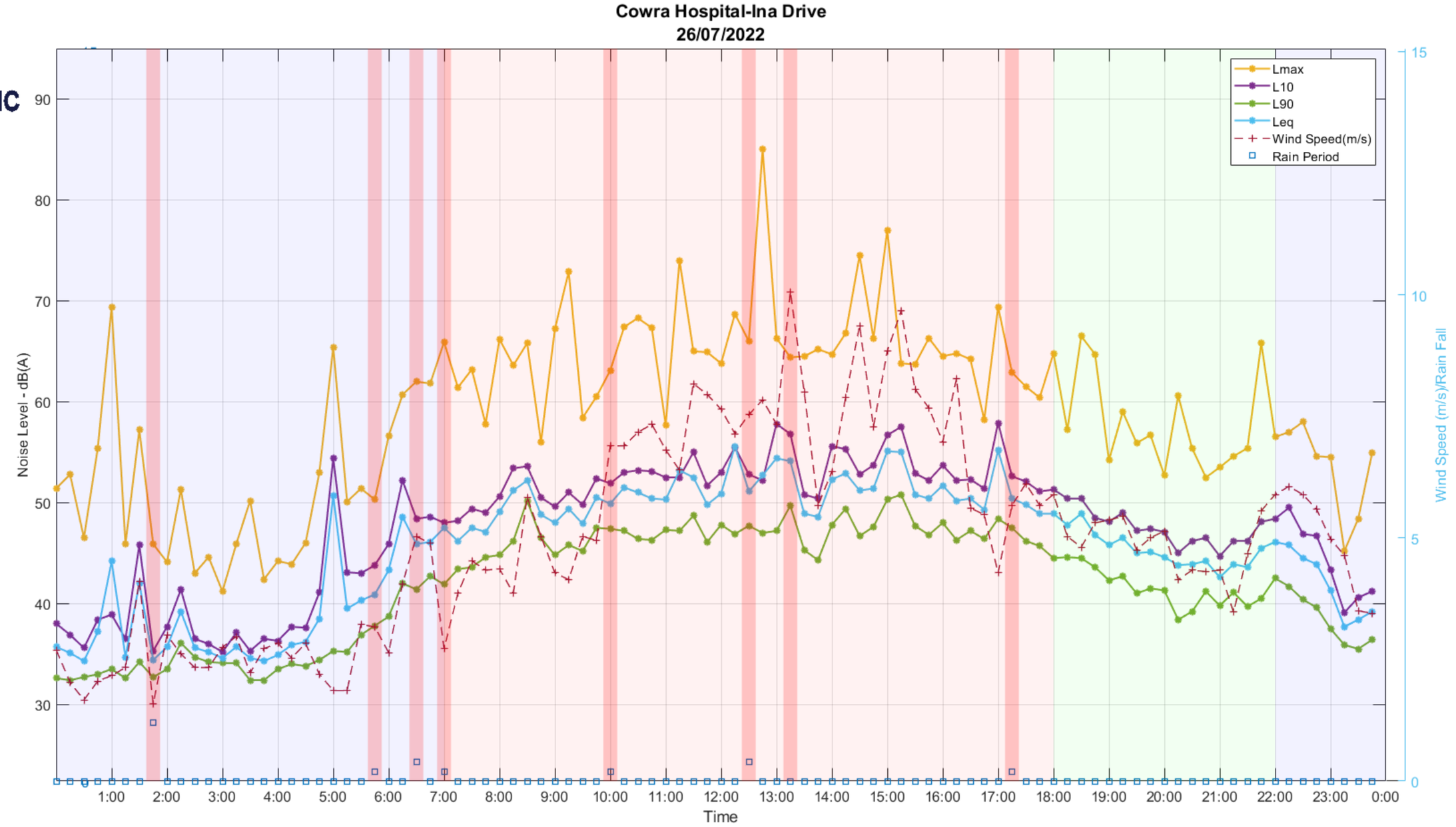

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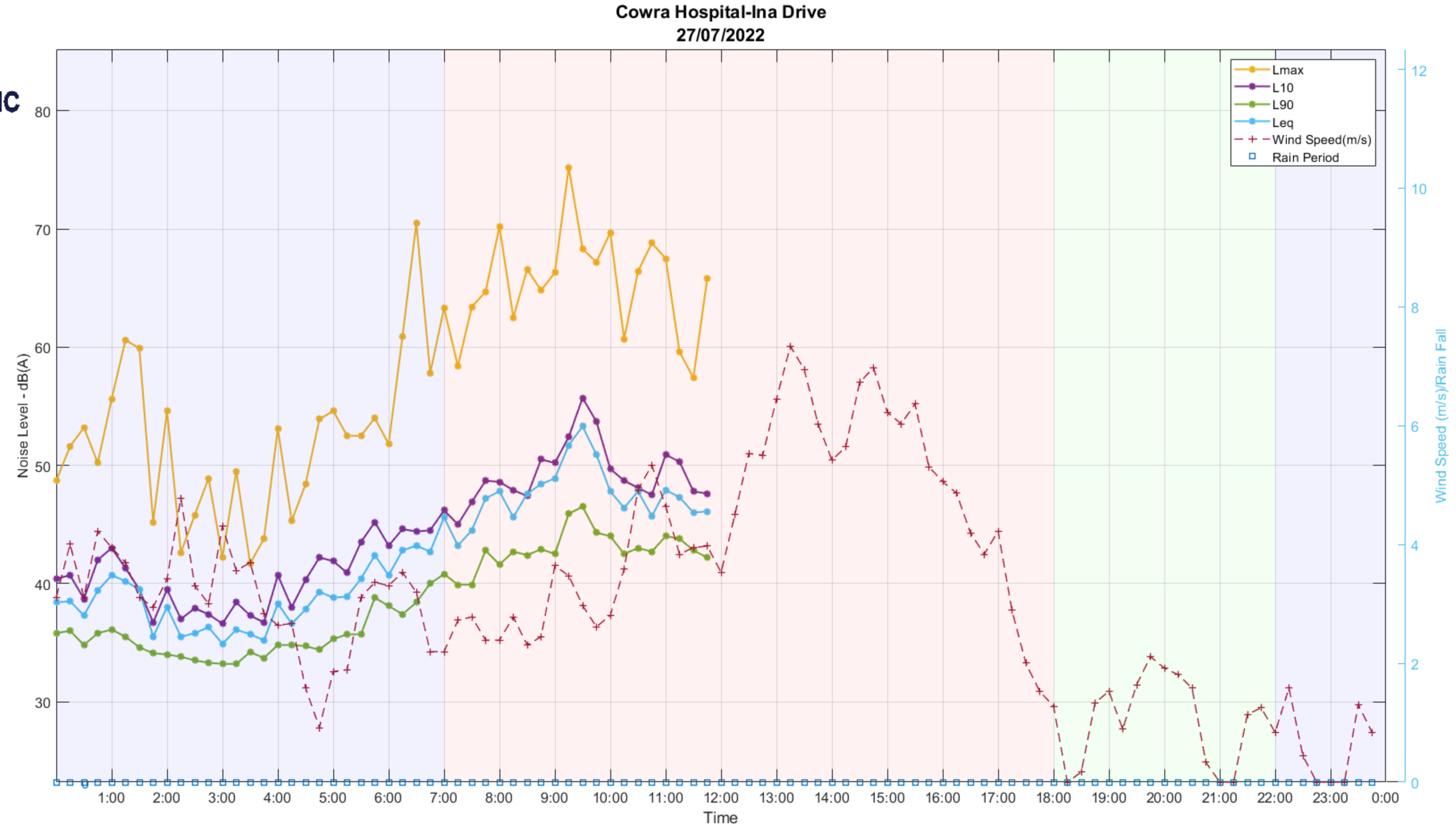
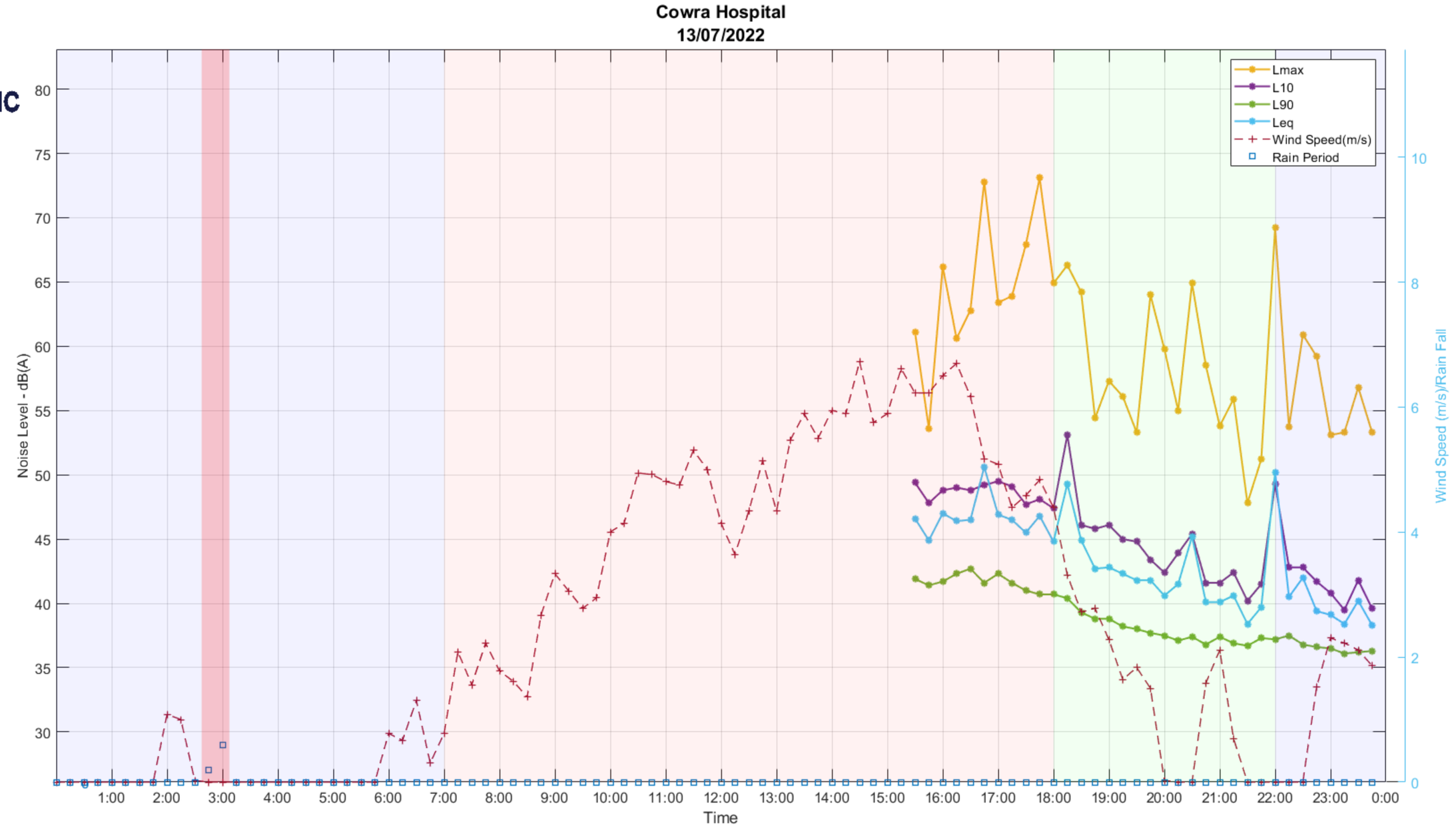


APPENDIX 1B – UNATTENDED NOISE MONITOR – 66 LIVERPOOL STREET, COWRA

ACOUSTIC LOGIC



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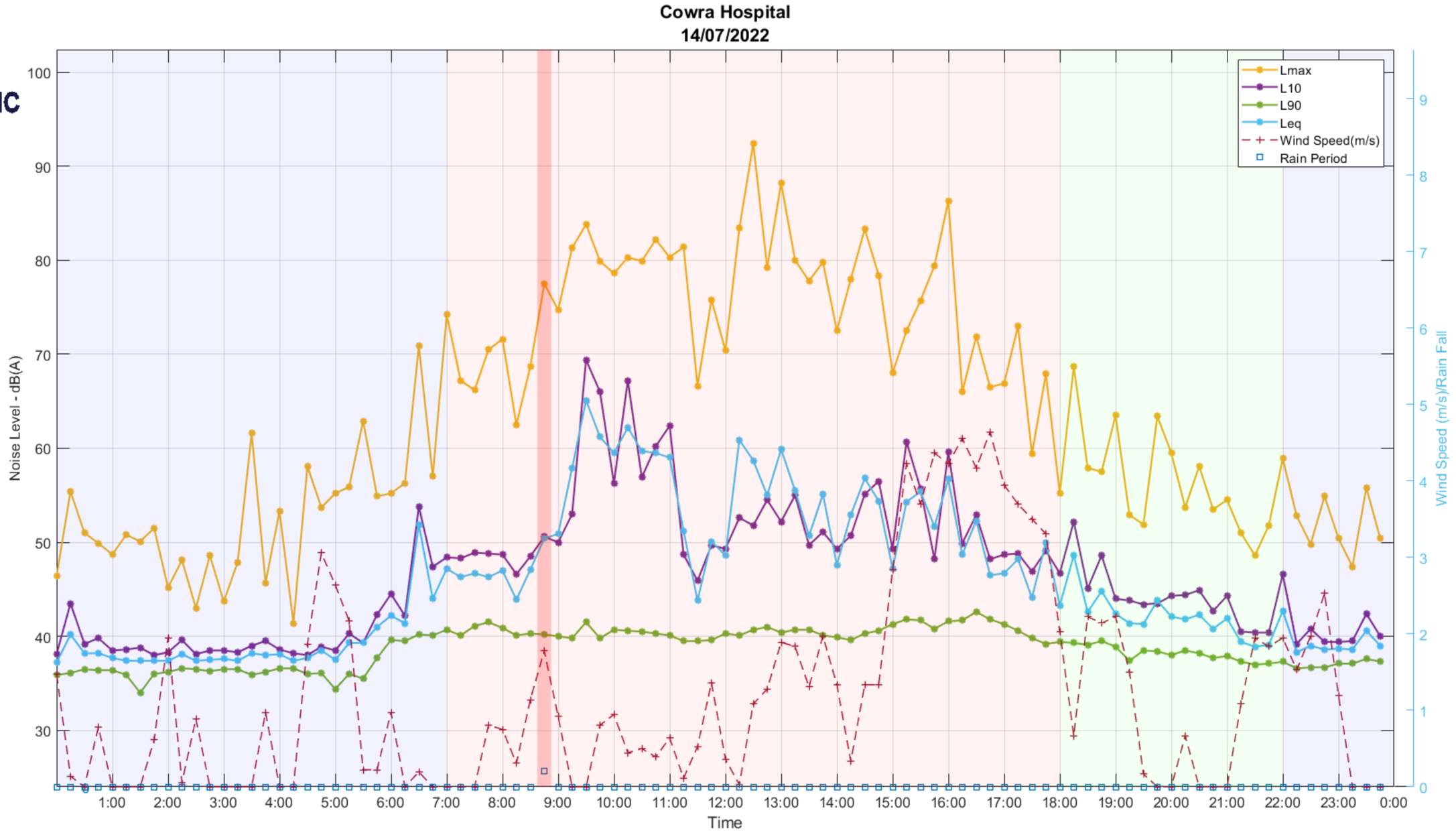

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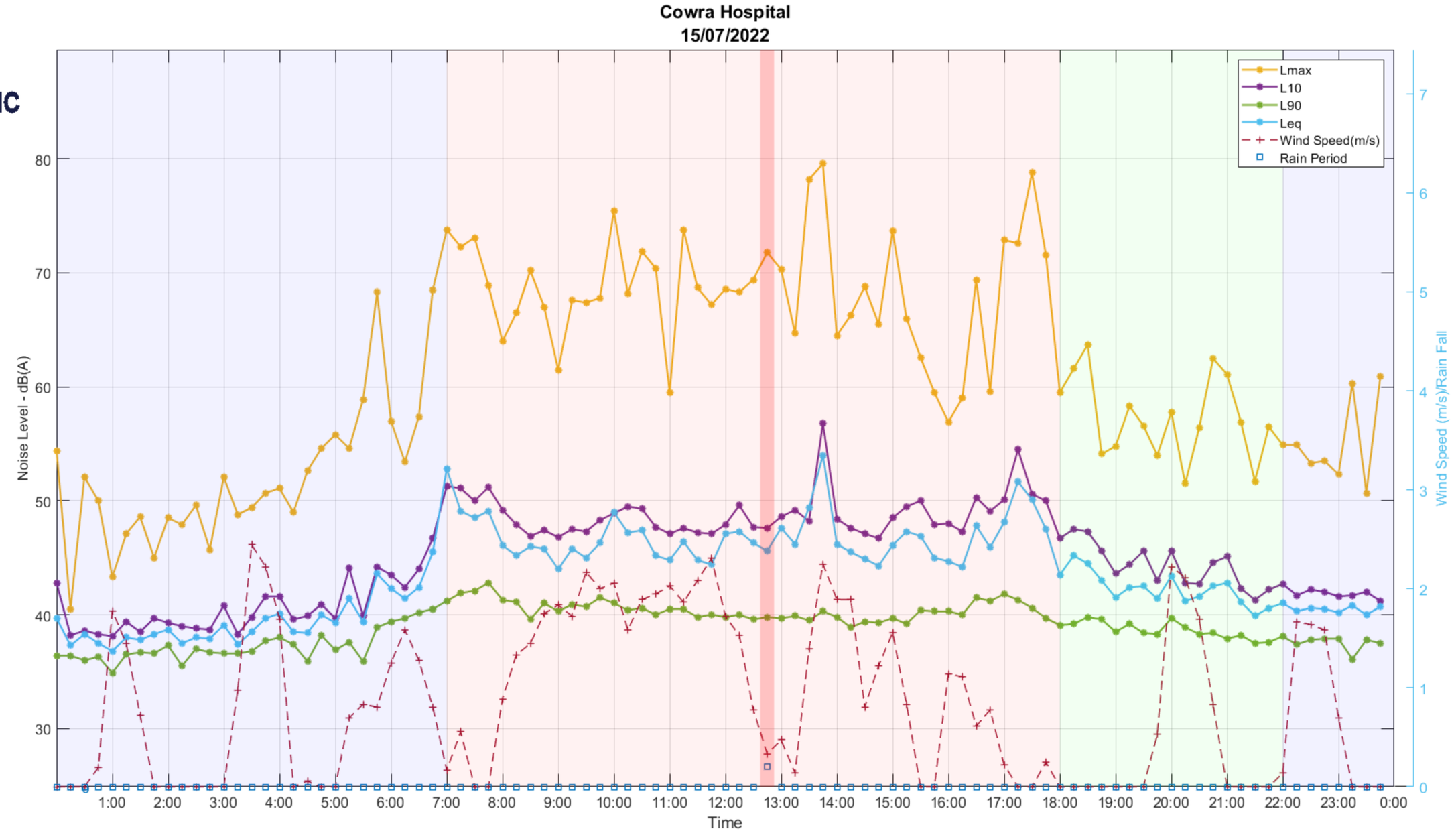

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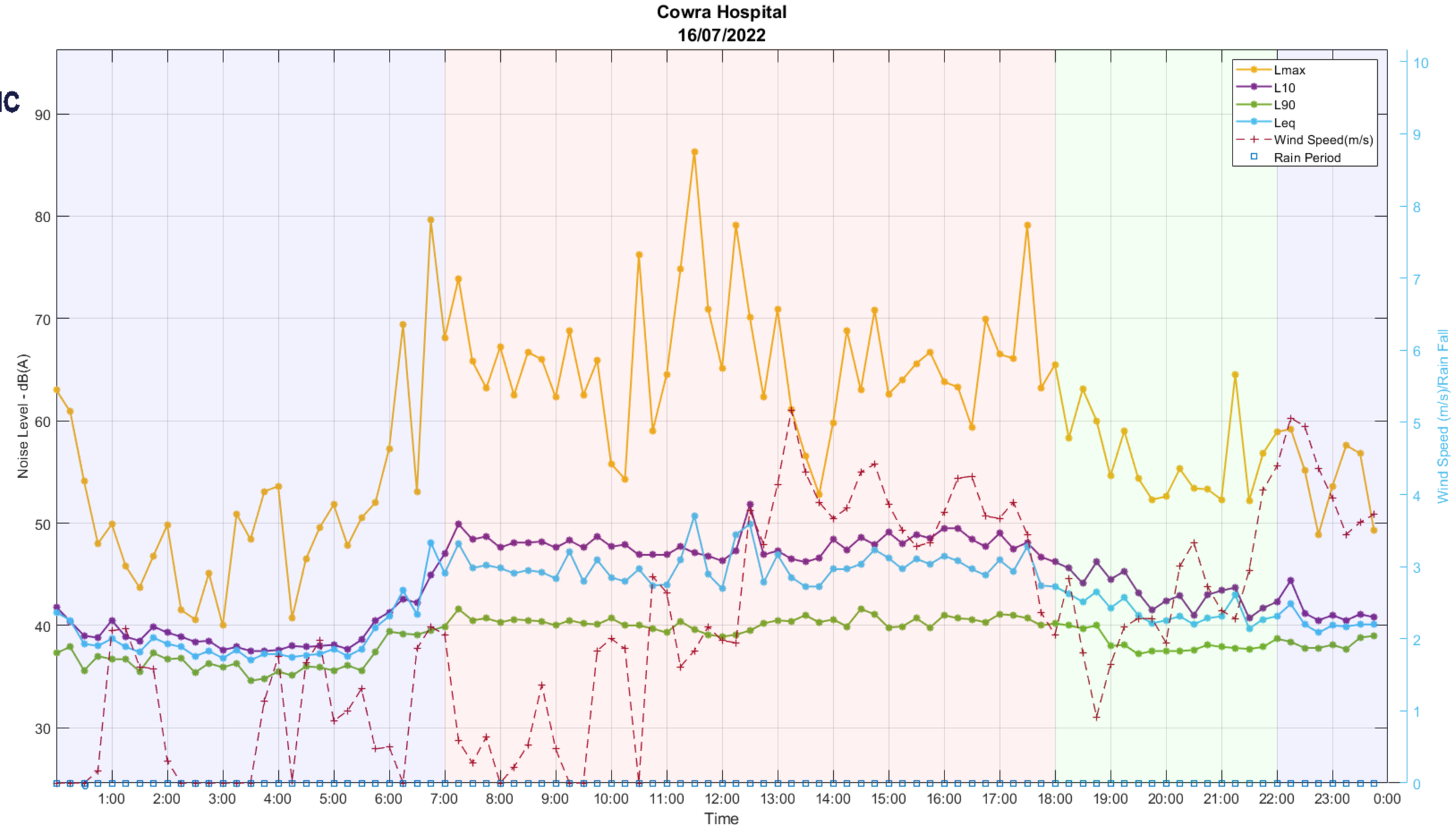
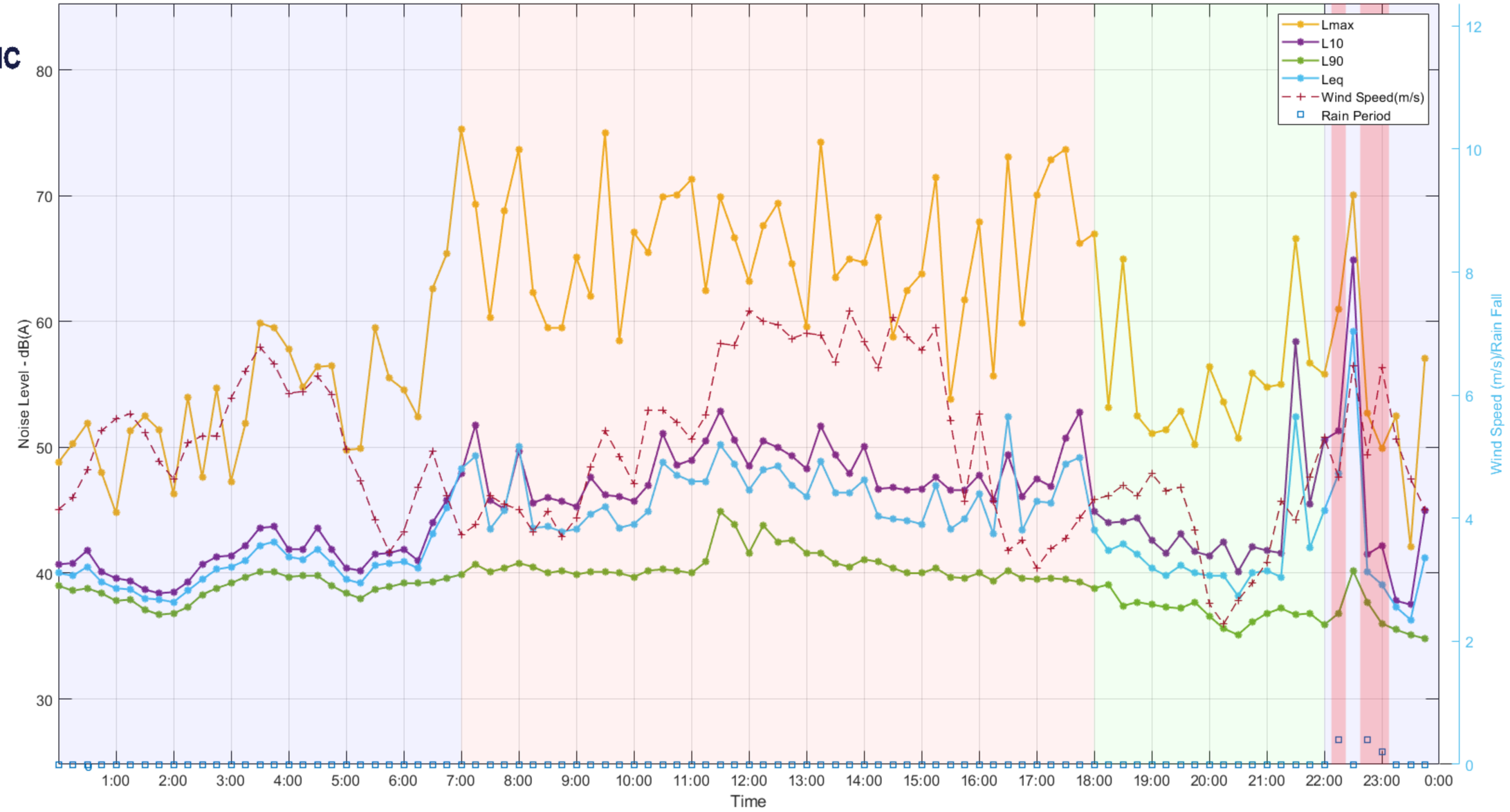


ACOUSTIC LOGIC

Cowra Hospital
17/07/2022



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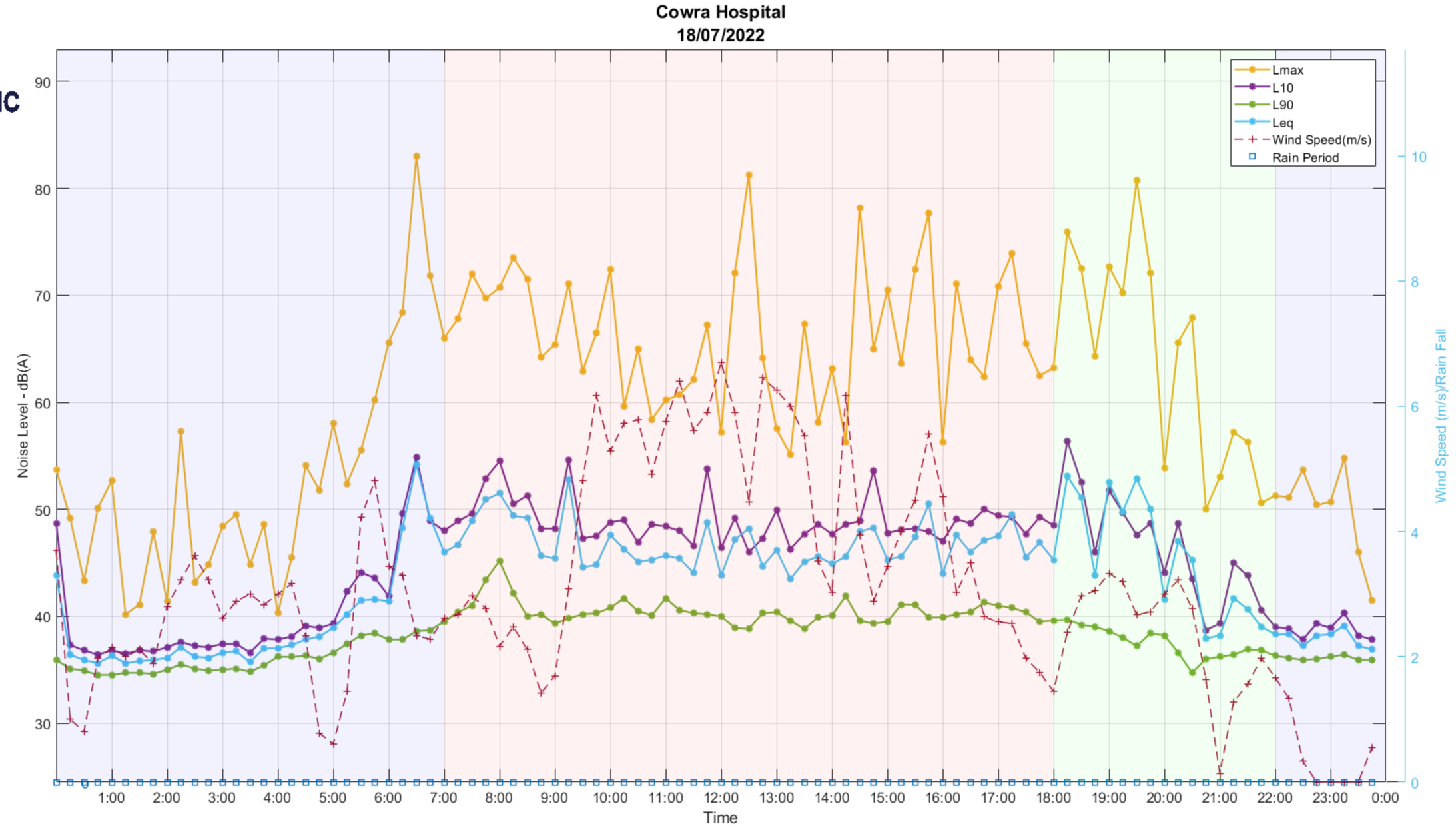
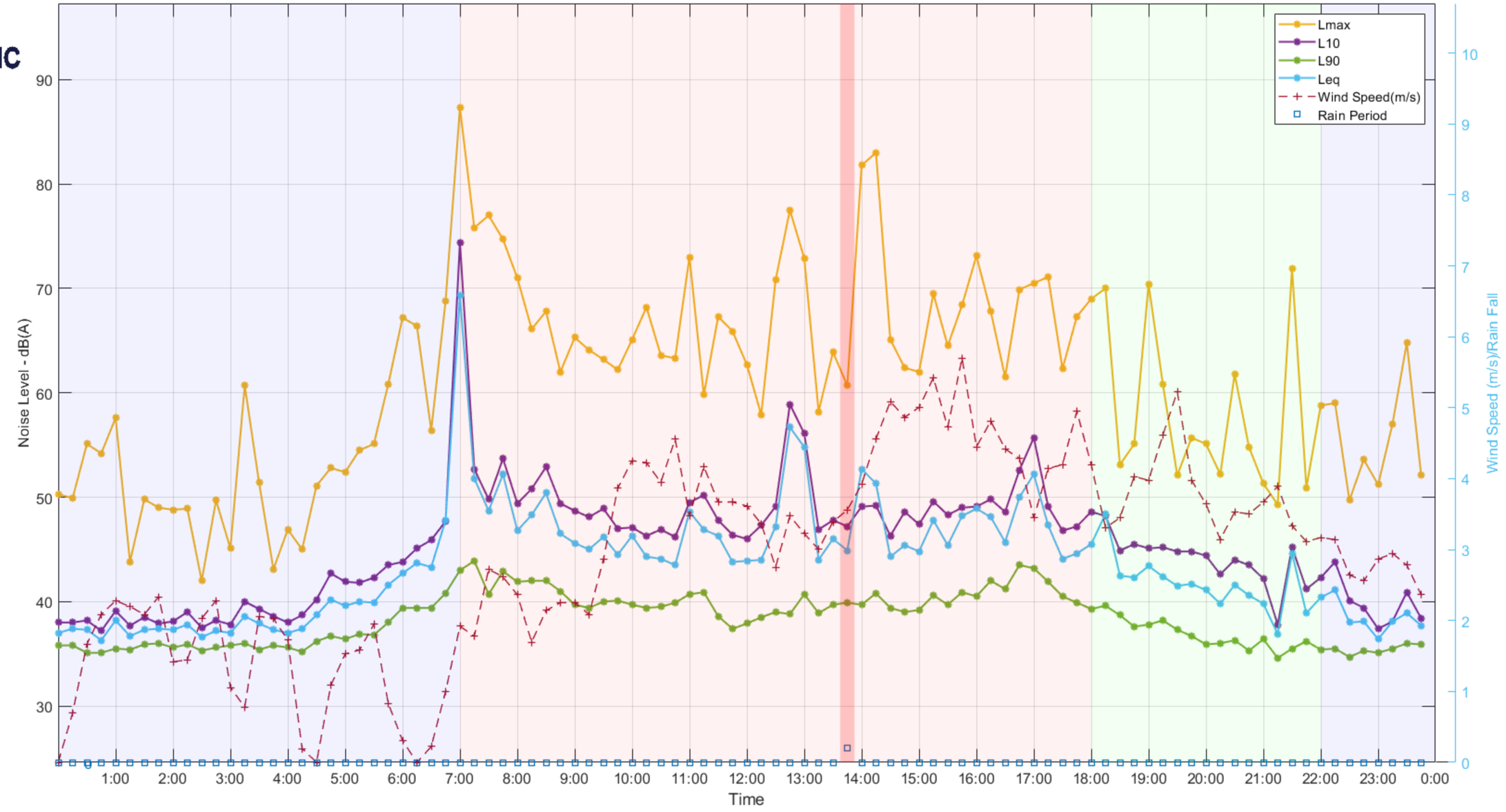
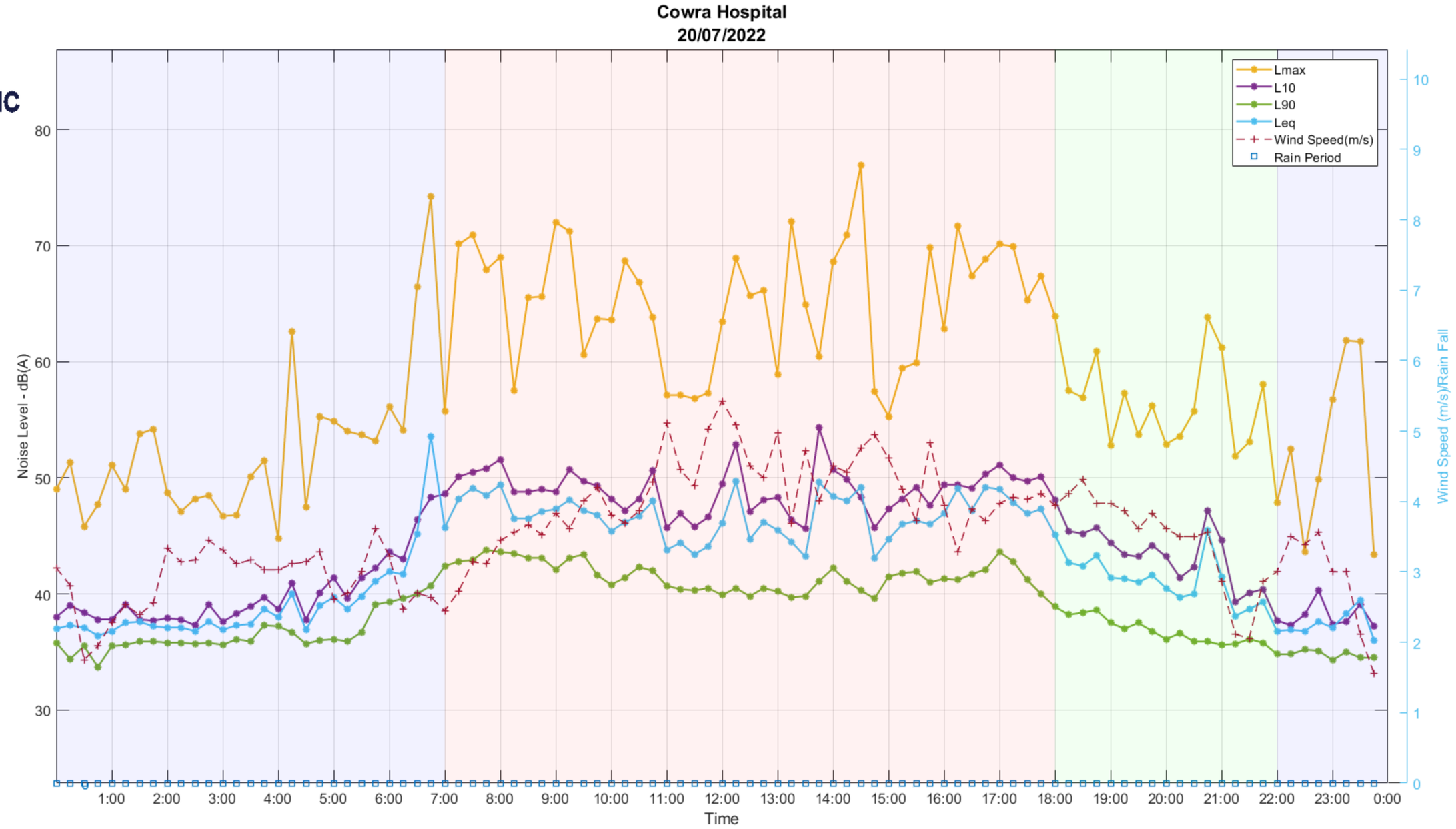


ACOUSTIC LOGIC

Cowra Hospital
19/07/2022



ACOUSTIC LOGIC



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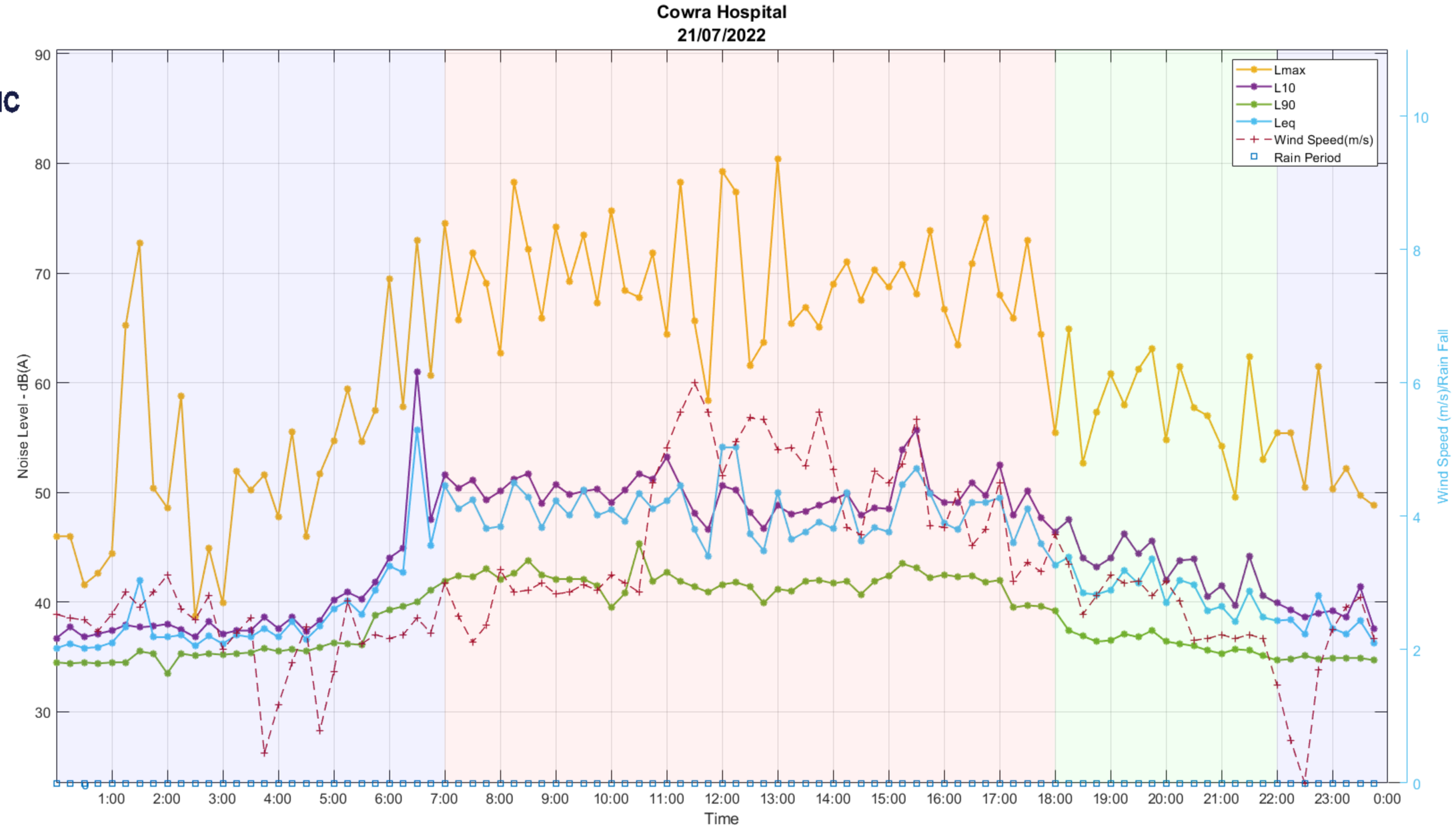

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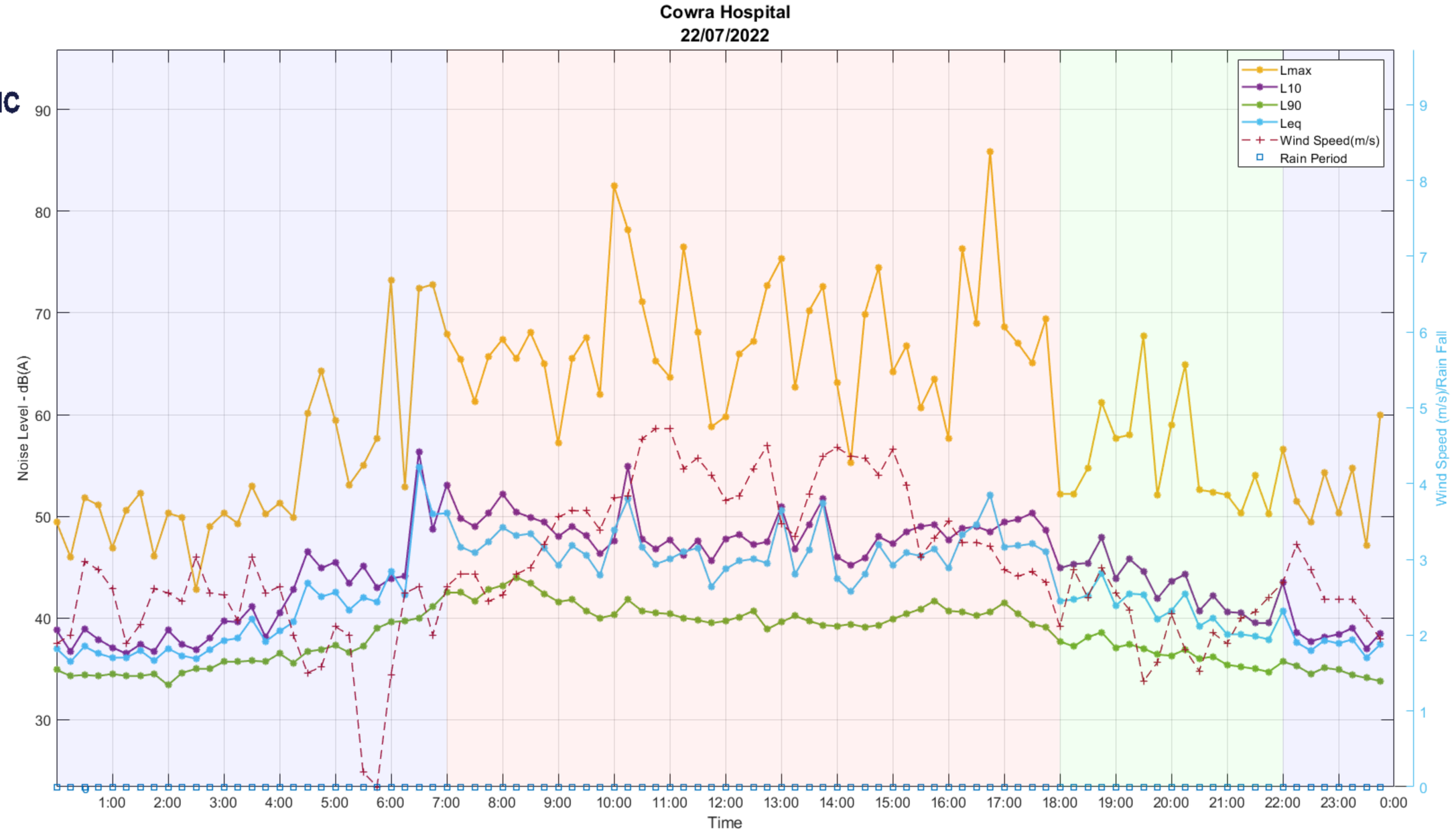

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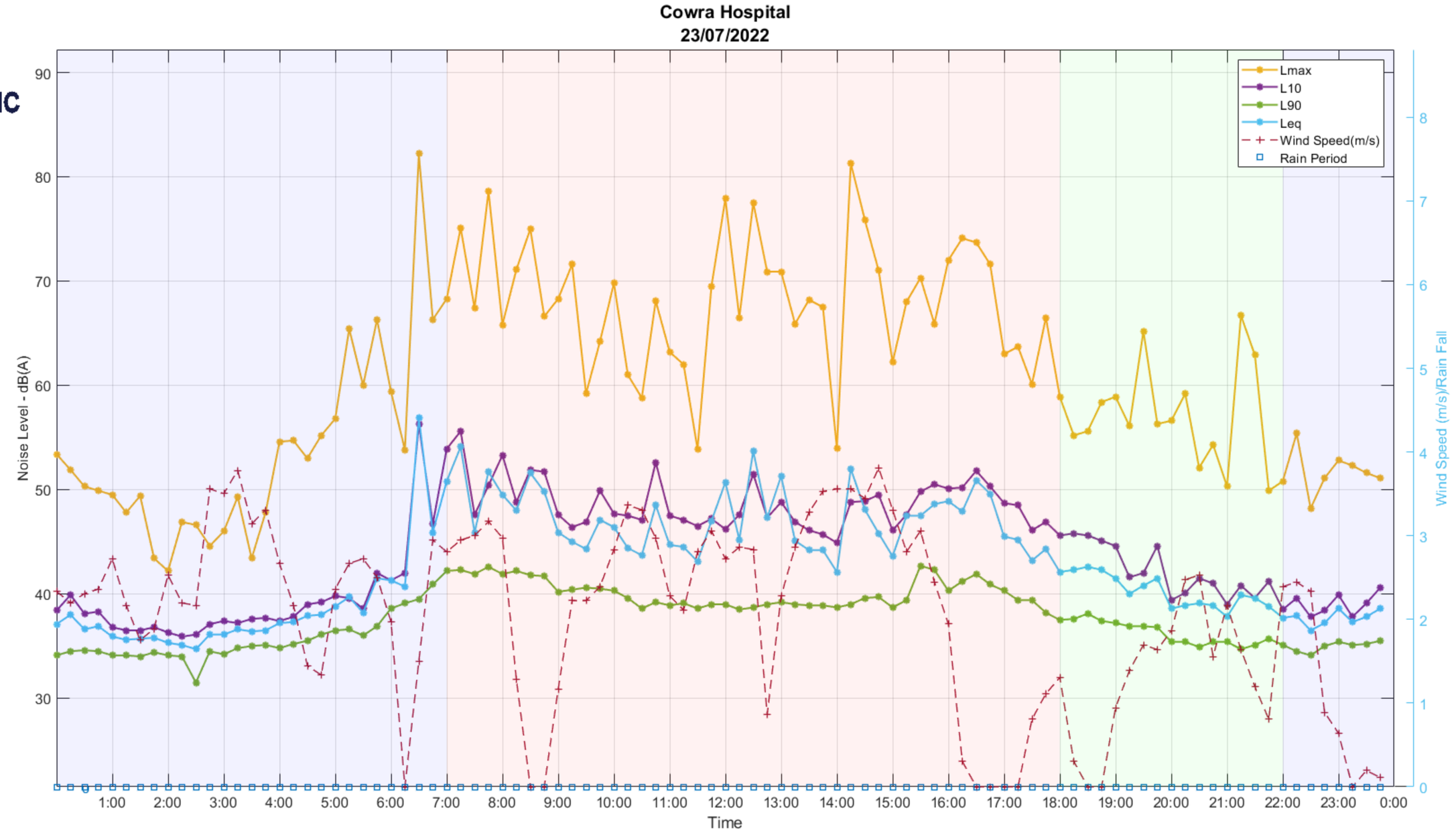

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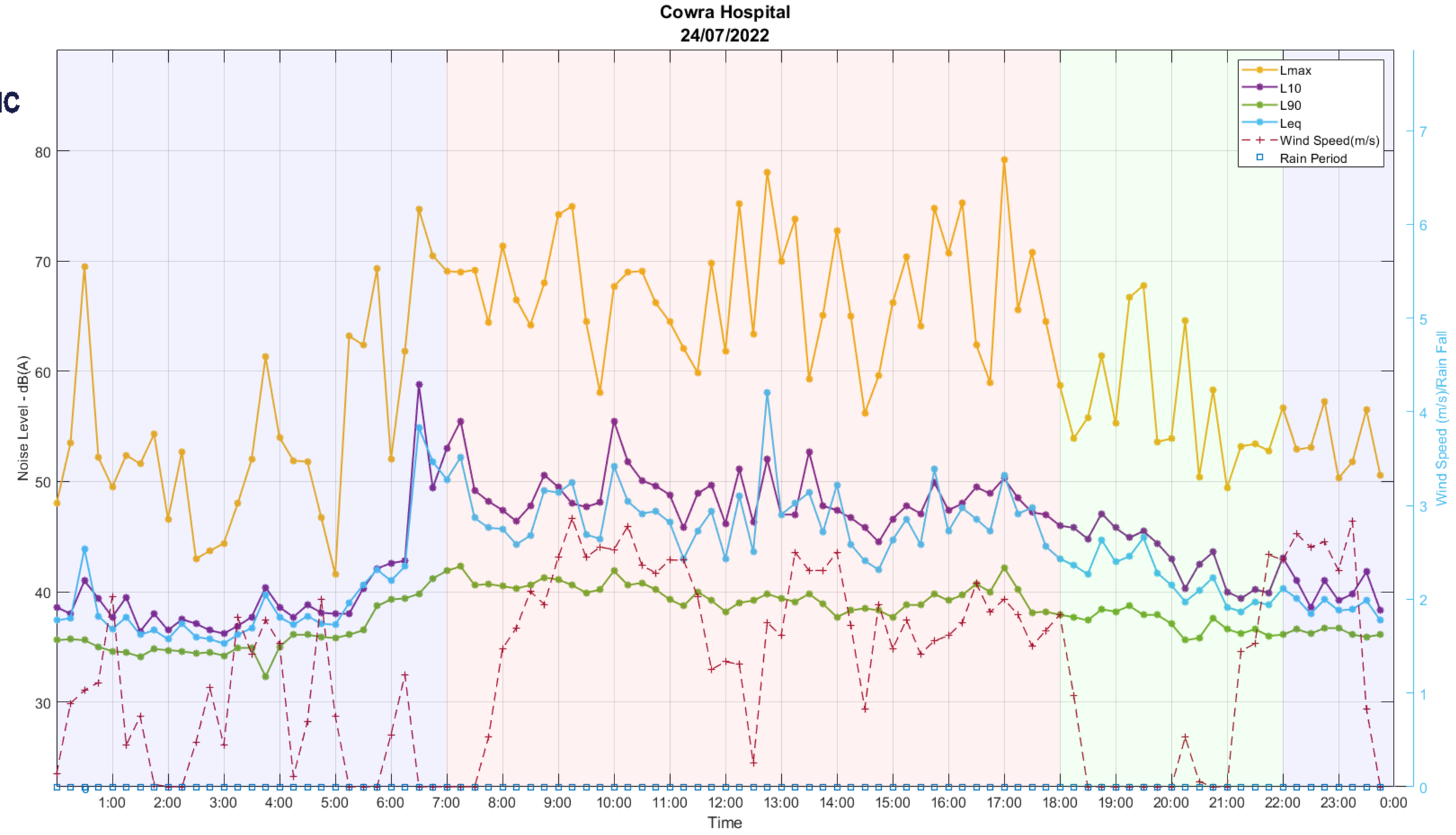

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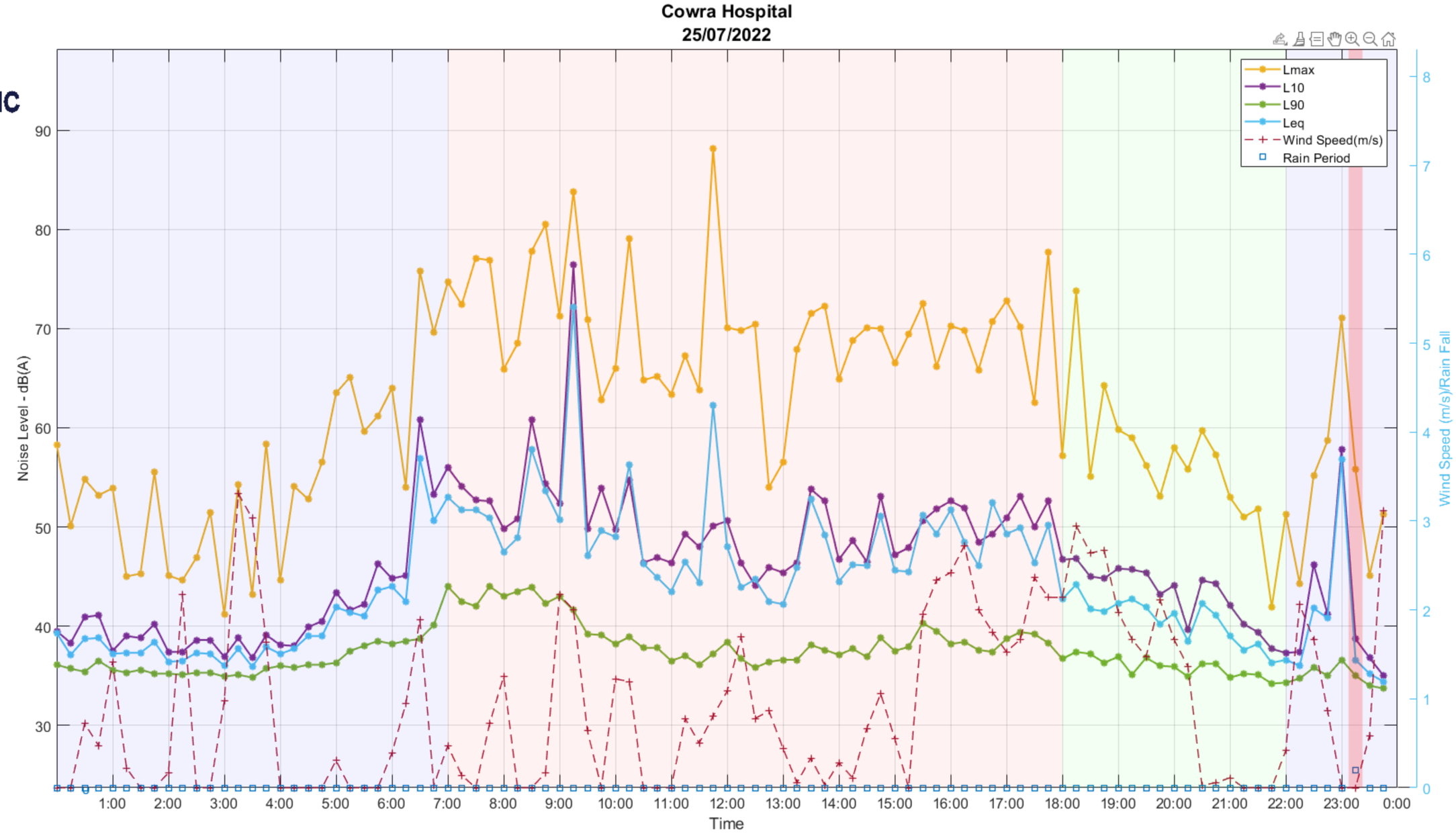

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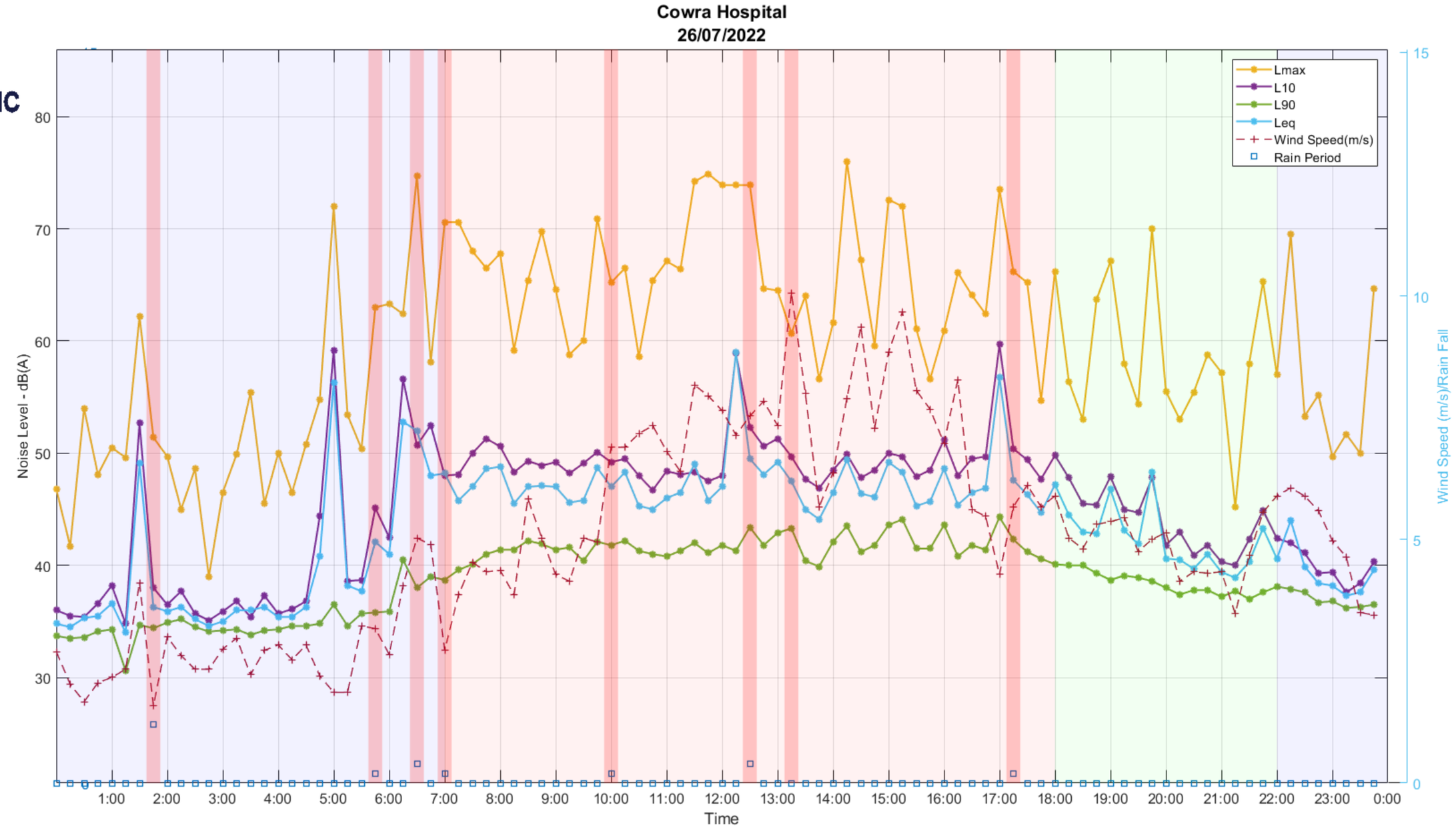

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