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Coffs Harbour Jetty Foreshore Precinct

Noise and Vibration Impact Assessment

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Project ID	20220977.2
Document Title	Noise and Vibration Impact Assessment
Attention To	Property NSW

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	29/03/2023	20220977.2/2903A/R0/RG	RG	TA	
1	5/06/2023	20220977.2/0506A/R1/RG	RG		GC
2	5/10/2023	20220977.2/0510A/R2/RG	RG		
3	1/03/2024	20220977.2/0103A/R3/GC	GC		GC
4	14/03/2024	20220977.2/1403A/R4/GC	GC		GC
5	7/06/2024	20220977.2/0706A/R5/GC	ANP		SN
6	16/08/2024	20220977.2/1608A/R6/GC	ANP		AZ
7	3/09/2024	20220977.2/0309A/R7/GC	ANP		SN
8	21/02/2025	20220977.2/2102A/R8/GC	SW		AZ
9	27/02/2025	20220977.2/2702A/R9/GC	SW		AZ

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1 EXECUTIVE SUMMARY

This report has been prepared to assess potential noise impacts associated with the proposed Coffs Harbour Jetty Foreshore Precinct and will address the requirements of the 'State Environmental Planning Policy (Transport and Infrastructure) 2021', The NSW Department of Planning Document – 'Development Near Rail Corridors and Busy Roads' ("DNRCBR") 2008, NSW EPA – 'Noise Policy for Industry' ("NPfI"), October 2017, NSW EPA – 'Road Noise Policy" ("RNP") March 2011, and Australian Standard 2021-2015 'Aircraft Noise Intrusion – Building Siting and Construction" for the State Assessed Planning Proposal to at Coffs Harbour Jetty Foreshore Precinct to facilitate future development. Development will include short and long term accommodation, retail, commercial and community uses.

This assessment presents the results of site investigation and noise and vibration monitoring of environmental noise and vibration sources, assessment of potential traffic, aircraft and rail noise impacts and identification of indicative design considerations to effectively manage these impacts. This assessment also provides the existing rated background noise levels in order establish the required noise emission and noise amenity requirements from future use of the site affecting existing surrounding receivers.

This assessment demonstrates the State Assessed Planning Proposal for Coffs Harbour Jetty Foreshore Precinct satisfies the requirements of the 'State Environmental Planning Policy (Transport and Infrastructure) 2021', The NSW Department of Planning Document – 'Development Near Rail Corridors and Busy Roads' ("DNRCBR") 2008, NSW EPA – 'Noise Policy for Industry' ("NPfI"), October 2017, NSW EPA – 'Road Noise Policy" ("RNP") March 2011, and Australian Standard 2021-2015 'Aircraft Noise Intrusion – Building Siting and Construction" and therefore the proposal is readily able to achieve acceptable levels of noise and vibration through appropriate design measures and considerations.

2 INTRODUCTION

Property and Development NSW (PDNSW) is continuing to lead the revitalisation of the Coffs Harbour Jetty Foreshore Precinct (the Precinct) on behalf of the NSW Government. Acoustic Logic has been engaged by PDNSW to prepare a Noise and Vibration Impact Assessment that assesses potential noise and vibration impacts associated with the proposed Coffs Harbour Jetty Foreshore Precinct.

This Noise and Vibration Impact Assessment supports a Planning Justification Report that outlines proposed amendments to the Coffs Harbour Local Environmental Plan (CHLEP) 2013 and will be submitted to the Department of Planning, Housing and Infrastructure (DPHI) as part of a State Assessed Planning Proposal (planning proposal).

As Coffs Harbour continues to grow as a Regional City, the NSW Government and Coffs Harbour City Council have, through various strategic planning exercises, identified four key strategic priorities to reimagine its direction and respond to current and future challenges and opportunities:

- Deliver a regional economy (CHCC LSPS, 2020; CH Economic Development Strategy, 2017) that is diverse, sophisticated and able to retain businesses and skills
- Evolve the tourism offering CHCC LSPS, 2020) with improved attractions, activities and accommodation
- Provide more housing (CHCC LSPS, 2020) in accessible locations, including affordable housing
- Provide better connections between places with more sustainable movement choices (CHRCAP, 2021; CHCC, 2020)

As a large, strategically located and wholly government owned site, the Precinct represents a significant opportunity to deliver on each of these key regional priorities. In this planning proposal, PDNSW seeks to celebrate the unique location, history and culture of the Jetty Foreshore to deliver outcomes for the benefit of the Coffs Harbour community. The revitalisation will be staged and funded, over time, to deliver the shared community vision.

This report has been prepared to assess potential noise impacts associated with the proposed Coffs Harbour Jetty Foreshore Precinct. The Jetty Foreshore Precinct proposal encompasses a collection of developments positioned alongside the NSW NorthWest rail line. In line with the established developments situated westward along the rail line and numerous successful projects throughout New South Wales adjacent to rail corridors, the precinct anticipates acceptable levels of noise and vibration through careful design considerations. Nonetheless, potential noise and vibration impacts have been addressed in this report and indicative mitigation strategies have been evaluated.

As part of this assessment, the following has been undertaken:

- Site investigation and monitoring
- Quantification of existing background and ambient noise levels including traffic and rail noise sources.
- Assessment of potential traffic and rail noise impacts and identification of indicative design considerations to effectively manage these impacts.
- Assessment of potential aircraft noise impacts from Coffs Harbour Airport on the site
- Assessment of potential vibration and structure borne noise impacts
- Project operational noise emission criteria

The subject site and local context are indicated in Figure 7.

2.1 OUR SHARED COMMUNITY VISION

Coffs' family playground, a precinct of parks and places, that connects community with Country. The community is and always has been at the heart of creating a thriving regional economy and destination for Coffs Harbour. Shaped with the community, our vision is to ensure The Jetty Foreshore will become a world-class oceanfront precinct through the principles shown in **Figure 1.**

Figure 1: Vision for the Coffs Harbour Jetty Foreshore

2.2 THE PRECINCT

The Precinct, wholly owned by the NSW Government, is strategically significant to the State and to the Coffs Harbour region. The Precinct is located on the traditional lands of the Gumbaynggirr people, in saltwater freshwater Country. It encompasses approximately 62 hectares of foreshore land, 5km east of the Coffs Harbour CBD, located on the Coffs Harbour coast with direct access to the Pacific Ocean. Access is provided on Marina Drive in the north, and Camperdown Street in the south, with Jordan Esplanade bisecting the site north to south. A Precinct map showing existing conditions is provided at **Figure 2**.

The west boundary is generally defined by the railway line and Coffs Harbour Railway Station. To the north the Precinct borders a culturally significant site known as "Happy Valley", which has been returned as freehold land to the Coffs Harbour and District Local Aboriginal Land Council (LALC). Gallows and Boambee Beaches are located to the south of the Precinct, where Littoral Rainforest occurs. Coffs Harbour itself, the Pacific Ocean, Muttonbird Island and South Coffs Island (Corambirra Point) form the eastern boundary.

The Precinct is a popular destination for both locals and tourists offering a variety of attractions and amenities. These include Jetty Beach and extensive parklands with biodiversity value, as well as items of heritage significance such as the Coffs Harbour Jetty and Ferguson's Cottage, owned by the Coffs Harbour LALC. Further, the Coffs Harbour Fisherman's Co-op, the Coffs Harbour Yacht Club, weekly Sunday markets, and community hub building (recently delivered by PDNSW) are located within the Precinct. Various public works including breakwater and boat ramp upgrades have been undertaken over recent years to support the marina function.

There are redeveloped and well-maintained parts in the area however, much can be done to enhance the Coffs Harbour Jetty Foreshore Precinct. A large portion of the Precinct is currently gravelled, and a large area of residual railway land is fenced off and inaccessible to the public, as shown in **Figure 3**. While gravelled areas provide informal overflow parking, they do not reflect the potential of this foreshore.

Figure 2: Coffs Harbour Jetty Foreshore Precinct

Figure 3: Existing state of the Precinct rail lands and gravelled areas

2.3 THE ILLUSTRATIVE MASTERPLAN

The planning proposal is supported by an Illustrative Masterplan (**Figure 4**) that presents a potential development outcome that could be realised at the Coffs Harbour Jetty Foreshore Precinct – it is not prescriptive nor is it determined. The Illustrative Masterplan builds on the shared vision created via extensive community and stakeholder consultation and provides further detail in relation to land use and development outcomes sought for the Precinct.

The Place Principles shown in **Figure 5**, agreed with the community, guided the formation of the Illustrative Masterplan.

The Illustrative Masterplan is broadly organised across six sub-precincts that will each have a distinct character and function. These are identified as:

1. Foreshore Parklands – with improved amenities, proposed new board walk and nature-based playground.

2. The Marina – An active marina revitalised to accommodate local marine based businesses that reflect their regional importance.

3. North Park – Functional open space with recreational courts and formalised parking.

4. Jetty Hub – A hub of residential and tourist accommodation supporting activation, tourism and regional attraction located adjacent to the current Jetty Walkway, with massing capped at 6 storeys stepping down in scale when closer to public areas.

5. Activity Hub and Village Green – An active village green that delivers increased public open space connected to the existing foreshore parklands and may include family-friendly food and beverage, community uses and club houses or facilities to support events. A local business activity zone connected to the rail station.

6. Corambirra Point – A new regional tourist destination on the site of the former Deep Sea Fishing Club site including publicly accessible cafes and restaurants, a function space, activity centre and tourist accommodation.

A precinct map showing the Illustrative Masterplan and the six distinct zones is provided at **Figure 6**.

Figure 4: Illustrative Masterplan

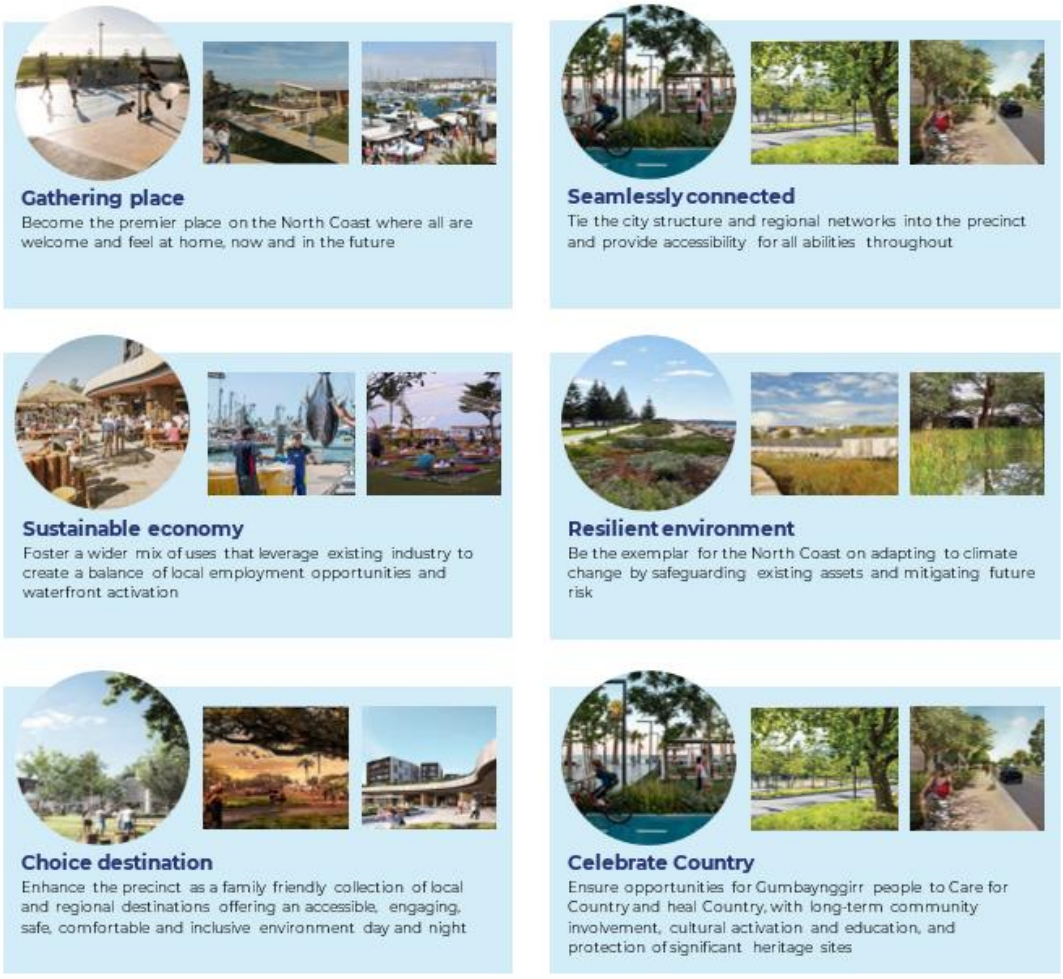


Figure 5: Community led place principles

Figure 6: Sub-precinct map

2.4 THE PLANNING PROPOSAL

The master planning of large-scale precincts follows a highly consultative and stepped approach. The current step, which paves the way for the revitalisation of the Coffs Harbour Jetty Foreshore Precinct, is the application for a State Assessed Planning Proposal, which is a legislated process.

PDNSW is lodging a planning proposal with the Department of Planning, Housing and Infrastructure that seeks approval for:

- Changes to permissible land uses
- Changes to permissible maximum building heights
- Planning controls for future State Significant Development Applications including design guidelines and design excellence processes

This Noise and Vibration Impact Assessment supports this planning proposal.

3 REFERENCED DOCUMENTS

3.1 BACKGROUND INFORMATION USED

The assessment is based on the following drawings, reports and other information:

- Coffs Harbour Foreshore - Typical Layout Plan prepared by SJB

3.2 PLANNING GUIDELINES

The following planning instruments and guidelines have been used in the assessment:

- 'State Environmental Planning Policy (Transport and Infrastructure) 2021'.
- NSW Department of Planning Document – 'Development Near Rail Corridors and Busy Roads' ("DNRCBR") 2008
- NSW EPA – 'Noise Policy for Industry' ("NPfI") October 2017
- NSW EPA – 'Road Noise Policy" ("RNP") March 2011
- Coffs Harbour Development Control Plan 2015 ("DCP")
- Coffs Harbour Local Environmental Plan 2013 ("LEP")
- Australian Standard 2021-2015 'Aircraft Noise Intrusion – Building Siting and Construction"

4 NEAREST NOISE AND VIBRATION IMPACTEDRECEIVERS

The following table lists the nearest sensitive receivers surrounding the site. An aerial photo of the site indicating nearby noise sensitive receivers and measurement locations is presented in .

Table 1 – Surrounding Receivers

Receiver (Refer Figure 1)	Land Use	Comment
R1	Residential	Multi-level residential along Orlando Street
R2	Residential	Multi-level residential along Camperdown Street and Angus McLeod Place
C3	Mixed-Use	Commercial and shop top housing along Harbour Drive
Coffs Harbour Station and Northwest NSW Rail Line	Railway Services	Coffs Harbour Train Station and NSW Trains Railway Line located along the western boundary of the site

4.1 ENVIRONMENTAL NOISE AND VIBRATION SOURCES

The following environmental noise sources have been identified and assessed in this report:

- Railway noise and vibration from the NSW North West Rail Line.
- Traffic noise from Marina Drive and Jordan Esplanade.
- Aircraft noise from Coffs Harbour Airport

The primary noise source impacting on the development is the NSW Northwest rail line to the east. As mentioned, the presence of existing complying development situated west of the rail line at a similar proximity serves as a testament to the feasibility of achieving a satisfactory acoustic for future residents and occupants.

Figure 7 – Site Plan Showing Monitoring Locations and Surrounding Land Uses/Receivers

- Unattended Noise Monitoring Location	- Residential
- Attended Vibration Monitoring Location	- Mixed-Use
- Attended Noise Monitoring Location	- Train Station

5 AMBIENT NOISE MONITORING

Monitoring has been undertaken to obtain existing background noise levels on site and traffic/rail noise levels affecting the site.

Figure 7 above shows the monitoring locations used.

5.1 NOISE DESCRIPTORS

Ambient noise constantly varies in level from moment to moment, so it is not possible to accurately determine prevailing noise conditions by measuring a single, instantaneous noise level.

To quantify ambient noise, a 15 minute measurement interval is typically utilised. Noise levels are monitored continuously during this period, and then statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters obtained from the data are:

L_{eq} - represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of noise impact as it closely corresponds with how humans perceive the loudness of time-varying noise sources (such as traffic noise).

L_{90} – This is commonly used as a measure of the background noise level as it represents the noise level heard in the typical, quiet periods during the measurement interval. The L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise 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.

L_{10} is used in some guidelines to measure noise produced by an intrusive noise source since it represents the average of the loudest noise levels produced at the source. Typically, this is used to assess noise from licenced venues.

L_{max} is the highest noise level produced during a noise event, and is typically used to assess sleep arousal impacts from short term noise events during the night. It is also used to assess internal noise levels resulting from aircraft and railway ground vibration induced noise.

L_1 is sometimes used in place of L_{max} to represent a typical noise level from a number of high level, short term noise events.

5.2 UNATTENDED LONG TERM NOISE MONITORING

5.2.1 Equipment Used

Unattended noise monitoring was conducted using three Rion NL-42 (Type 2) noise monitors.

The monitoring was continuous, with statistical noise levels recorded at 15-minute intervals throughout the monitoring period. Measurements were taken on "A" frequency weighting and fast time response.

All monitoring equipment used retains current calibration - either manufacturers' calibration or NATA certified calibration. The monitors were field calibrated at the beginning and the end of the measurement with no significant drift in calibration noted.

5.2.2 Locations Monitored

Three noise monitors were located across the site to measure existing rail, traffic, and background noise levels. Refer to Figure 7 for unattended noise monitor locations.

5.2.3 Calculated Noise Levels

Assessment, ambient and rating background levels have been determined from the long term, unattended noise monitoring data based on the methodology in the Noise Policy for Industry Fact Sheet B. Appendix 1 contains the data collected, and the periods identified as being affected by adverse weather conditions or extraneous noise (as defined by INP Fact Sheet B).

Weather data was obtained from records provided by the Bureau of Meteorology for the weather station located at Coffs Harbour.

The NPfI day, evening and night periods are:

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

Representative traffic noise levels have been calculated using the guidelines in the EPA Road Noise Policy.

5.2.3.1 Background Noise Levels

The following tables summarise the assessment background noise levels (ABL) for each location. Where no ABL is indicated, that period was affected by adverse weather or other extraneous noise and excluded from the ABL calculation.

Table 2 – NPfI Assessment Background Noise Levels

Location	Date	ABL		
		Day	Evening	Night
1	22/08/2022	-	48	42
	23/08/2022	49	46	41
	24/08/2022	-	48	47
	25/08/2022	46	43	41
	26/08/2022	48	46	44
	27/08/2022	48	44	-
	28/08/2022	47	41	-
	29/08/2022	46	47	44
	30/08/2022	48	45	37
	31/08/2022	48	42	40
	01/09/2022	46	41	42
	02/09/2022	47	-	-
	03/09/2022	-	-	-
	04/09/2022	-	-	-
	RBL	**47**	**45**	**42**
2	22/08/2022	-	47	42
	23/08/2022	47	46	41
	24/08/2022	-	48	47
	25/08/2022	46	44	42
	26/08/2022	47	45	43
	27/08/2022	46	43	-
	28/08/2022	46	44	-
	29/08/2022	45	45	41
	30/08/2022	45	42	36
	31/08/2022	45	42	40
	01/09/2022	44	41	42
	02/09/2022	46	-	-
	03/09/2022	-	-	-
	04/09/2022	-	49	48
	05/09/2022	49	48	48
	06/09/2022	49	45	-
	RBL	**47**	**45**	**42**

3	22/08/2022	0	45	41
	23/08/2022	46	45	41
	24/08/2022	0	48	48
	25/08/2022	45	44	43
	26/08/2022	46	46	45
	27/08/2022	47	43	0
	28/08/2022	45	44	0
	29/08/2022	44	42	39
	30/08/2022	45	40	35
	31/08/2022	44	43	42
	01/09/2022	44	40	40
	02/09/2022	44	0	0
	03/09/2022	0	0	0
	04/09/2022	0	50	49
	05/09/2022	50	48	49
	06/09/2022	48	46	47
	RBL	**45**	**44**	**43**

The following table summarises the rating background noise levels determined for the day, evening and night periods as defined in the NPfI.

Table 3 – NPfI Rating Background Noise Levels

Location	**Assessment Background Noise Level (dB(A) L_{90})***		
	Day	Evening	Night
1	47	45	42
2	46	45	42
3	45	44	43

5.3 ATTENDED SHORT TERM NOISE MONITORING

5.3.1 Equipment Used

Attended noise monitoring was conducted using a Norsonic N-140 Type 1 sound level meter.

All monitoring equipment used retains current calibration - either manufacturers' calibration or NATA certified calibration. The monitors were field calibrated at the beginning and the end of the measurement with no significant drift in calibration noted.

5.3.2 Locations Monitored

The monitoring locations are indicated in Figure 7.

5.4 RESULTANT MEASURED NOISE LEVELS

The following table presents the resultant noise levels at the proposed boundary of the development. The data for the day and night periods as defined in the SEPP and Development Near Rail Corridors and Busy Roads have been processed using the guidelines in the EPA Road Noise Policy to determine the ambient noise levels at the monitoring locations. The noise levels are based on the unattended and attended traffic/rail noise measurement results, the measured day/night noise level difference and are adjusted for distance attenuation to the location specified.

Table 4 – SEPP/DNRCBR Ambient Noise

Source / Location	Traffic and Rail Noise Level (dB(A) $L_{eq,period}$)*	
	Day (7am to 10pm)	Night (10pm to 7am)
Rail / @5m	65	71
Marina Drive / @5m	65	59
Jordan Esplanade / @5m	62	56

5.5 PREDICTED AIRCRAFT NOISE LEVELS

In accordance with Australian Standard 2021:2015 *Acoustics - Aircraft noise intrusion - Building siting and construction* is a two-stage approach.

Firstly, a site evaluation is carried out to determine whether the overall aircraft noise exposure of the site is compatible with the proposed use.

Where it is established the site has a level of aircraft noise exposure, the second stage determines the building envelope requirements to attenuate aircraft noise within buildings to a level compliant with the recommended internal noise levels set out within the Standard.

The ANEF is a calculated number based on the anticipated mix of aircraft types and number of movements.

Using the Standard, a site can be classed as either:

- Acceptable – Development can occur with no specific measures needed to control aircraft noise.
- Conditionally Acceptable - Development can occur, however it is normally required to upgrade the building façade to control internal noise levels within buildings.
- Unacceptable – Development not normally considered.

It is to be noted that as of the date of this assessment, there is no relevant Australian Noise Exposure Forecast (ANEF) applied to aircraft activities departing and arriving from Coffs Harbour Aircraft.

Appendix E of AS2021-2015 allows for a Method for *Determining Building Site Acceptability for Light General Aviation Aerodromes Without ANEF Charts*.

For airports such as Coffs Harbour Airport where usage is defined to a small number of aircraft movements *the production of an ANEF chart may not be justified and is unlikely to occur.*

For the purposes of this assessment, determination of aircraft noise levels to which the building site will be exposed will be based on the noise levels of the type of the aircraft as well as the number of daily aircraft movements from the current timetable of aircraft usage at Coffs Harbour Airport. The current movements of aircraft at Coffs Harbour. Table E1 from AS2021 presented below provides acceptable noise levels at building sites.

TABLE E1

BUILDING SITE ACCEPTABILITY BASED ON AIRCRAFT NOISE LEVELS*

Number of flights per day	Aircraft noise level expected at building site, dB(A)		
	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park, school, university, hospital, nursing home			
>30	<70	70–75	>75
15–30	<80	80–85	>85
<15	<90	90–95	>95
Hotel, motel, hostel, public building			
>30	<75	75–80	>80
15–30	<85	85–90	>90
<15	<95	95–100	>100
Commercial building			
>30	<80	80–85	>85
15–30	<90	90–95	<95
<15	<100	100–105	>105

Typical number flights per day for Coffs Harbour Airport ranges from 10-15 flights per day of light general aviation. It is noted that there are no flights during nighttime hours being between 10pm and 7am daily.

Based on the distance from the site to the runways, the flight path, and the site elevation, AS2021 predicts that the loudest typical aircraft movement will be from a SAAB 340B aircraft departing from the Main Runway. The noise level at the site as indicated by the standard is 72dB(A). This noise level is significantly below the <90 dB(A) required for aircraft movements <15 aircraft movements per day required and deems the site to be Acceptable. Therefore, this noise level can be used to predict the resultant internal noise levels.

It is noted there will be instances where the noise level at the site from aircraft will be louder than those discussed above. These would typically be from occasional flights of the C-130Hercules RAAF aircraft; however, these have a much lower frequency of flights per day (sometimes even whole weeks without a single flight), equating to a small percentage of flights. This is not considered to be the typical flight/noise level which would be experienced at the property.

Notwithstanding this, the Standard also indicates that departures from these recommendations may be permitted where there are existing built up areas, as is the case with the Coffs Harbour Jett Foreshore Precinct site, which is existing residential development to the west.

An appropriate approach for the Coffs Harbour Jett Foreshore Precinct site would be to design the residential building envelopes so that the internal noise recommendations in AS2021:2015 are achieved. All portions of the site can be designed to comply with the internal noise levels stipulated within Table 3.3 of AS2021:2015. Thus, the occupants of the future dwellings would experience the same internal noise levels regardless of their location within site. The future Coffs Harbour Jett Foreshore Precinct occupants would have a greater level of acoustic amenity than those located within the existing dwellings surrounding the site, that may not have the benefit of high performing façades.

While acceptable noise levels within future dwellings can be achieved through appropriate building design, the need for adequate ventilation and external recreation space should also be addressed.

To exclude aircraft noise, windows would need to be closed and an alternative ventilation or air conditioning system incorporated so that the dwellings are ventilated even when external windows need to be closed to minimise aircraft noise. It is noted that windows can still be made openable, so that occupants can take advantage of the significant periods when aircraft flyovers are not occurring (or are of lower frequency) as a result of the aircraft not being operational during nighttime periods.

Assuming typical bedroom and living room size, medium weight single glazing (6mm toughened/6.38mm laminated) with full perimeter acoustic seals would result in AS2021:2015 compliant internal noise levels. This will need to be assessed during future DA stages of the project once final glazing size and orientation is established.

For external walls of masonry construction, no acoustic upgrade is required for AS2021:2015 compliance. For lightweight cladding façades, such as Barestone or fibrous cement sheet, an insulated cavity stud with layers of upgraded plasterboard would be required. This will need to be assessed during future DA stages of the project.

Any concrete slab roofs of the buildings do not require any acoustic upgrade for AS2021:2015 compliance.

6 EXTERNAL NOISE INTRUSION

This section of the report details the acoustic assessment of traffic and train noise intrusion to the proposed development.

The environmental noise assessment has been conducted in accordance with the following documents:

- Coffs Harbour Development Control Plan (DCP) 2015;
- 'State Environmental Planning Policy (Transport and Infrastructure) 2021'.
- NSW Development of Planning's *"Development Near Rail Corridors & Busy Roads (Interim Guideline)"*
- NSW EPA – 'Road Noise Policy" ("RNP") March 2011
- Australian Standard 2021-2015 'Aircraft Noise Intrusion – Building Siting and Construction"

6.1 INTERNAL NOISE CRITERIA

6.1.1 Coffs Harbour Development Control Plan (DCP) 2015

The relevant acoustic requirements from the Coffs Harbour DCP have been summarised below.

C1 SUBDIVISION OF LAND

C1.16 AMENITY REQUIREMENTS

Objectives

- *To ensure that the impact of road/rail noise or vibration is considered in the assessment of development proposals near the Pacific Highway and/or rail corridors.*

Requirements

(1) Development applications comprising the subdivision of land in or adjacent to the Pacific Highway and/or in or adjacent to a rail corridor are to be accompanied by sufficient information to demonstrate that resulting lots proposed for future residental uses an equitably satisfy the following criteria:

(a) In any bedroom in the building – 35 dB(A) at any time between 10:00pm and 7:00am; and

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.

D1 COMMERCIAL DEVELOPMENT & D3 RESIDENTIAL DEVELOPMENT

D1.20 & D3.26 AMENITY REQUIREMENTS

Objectives

- *To ensure that the impact of road/rail noise or vibration is considered in the assessment of development proposals near the Pacific Highway and/or rail corridors.*

Requirements

(1) Development applications comprising development to which Clause 87 or Clause 102 of State Environmental Planning Policy (Infrastructure) 2007 applies are to be accompanied by sufficient information demonstrating that the relevant provisions of the policy and the guideline can be satisfied.

Notes

- *Development consent cannot be granted to development for the purposes of a building for residential use on land in or adjacent to the Pacific Highway or on land in or adjacent to a rail corridor unless it can be demonstrated that noise levels as prescribed by Clause 87(3) and/or Clause 102(3) of State Environmental Planning Policy (Infrastructure) 2007 are not exceeded.*
- *An acoustic report may be required to be undertaken by an appropriately qualified person to demonstrate that the requirements specified in the above policy and the following guidelines can be reasonably met:*
    - *Development Near Rail Corridors and Busy Roads - Interim Guideline; and*
    - *Any other associated guidelines issued by the Director-General for the purposes of State Environmental Planning Policy (Infrastructure) 2007.*
- *Noise levels at the boundary of the site subject to the development are to accord with the requirements of the Protection of the Environment Operations Act 1997.*
- *Acoustic and amenity requirements may be specified within an environmental planning instrument for certain types of residential accommodation. In this regard, provisions of an environmental planning instrument prevail.*

6.1.2 NSW Department of Planning - State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021

Certain developments adjacent to major roadways must have regard to TI SEPP Clause 2.100, which is repeated below:

Section 2.100 Impact of Rail Noise or Vibration on Non-Rail Development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration—

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this section and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10.00 pm and 7.00 am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom, or hallway)—40 dB(A) at any time.

6.1.3 NSW Department of Planning's 'Development Near Rail Corridors and Busy Roads (Interim Guideline)'

Section 3.5 of the NSW Department of Planning's 'Development Near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail.

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
  - *in any bedroom in the building: 35dB(A) at any time 10pm-7am*
  - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

6.1.4 Summary of Internal Noise Criteria

Internal noise criteria for each space are summarised below.

Table 5 – Summary of Project Noise Intrusion Criteria

Location	Criteria	
	Traffic and Train Noise Intrusion	**Aircraft Noise Intrusion**
	SEPP (Infrastructure and Transport) 2021 & AS2107:2016	**AS2021:2015**
Bedroom	35 dB(A) $L_{eq(9\ hour)}$	50 dB(A)
Living Spaces	35 dB(A) $L_{eq(15\ hour)}$	55 dB(A)
Bathrooms	N/A	60 dB(A)

6.1.5 Sleep Disturbance Considerations - NSW EPA – 'Road Noise Policy" ("RNP") March 2011

In addition to complying with the SEPP day and night time period L_{Aeq} noise levels, consideration may be given to short term noise events that have the ability to cause annoyance or sleep disturbance. An assessment of sleep disturbance is not mandatory in the SEPP controls, however, given that there are typically 4-5 late night freight train movements, an assessment of sleep disturbance will also be presented.

The rail line neighbouring the project site carries low volumes of passenger and freight trains. The passing trains are required to sound a horn to signal their approach to the Marina Drive level crossing. The sounding of these horns result in L_{max} noise levels much higher than the day and night time L_{Aeq} equivalent noise levels. As such, train horn L_{max} noise levels have been assessed against the sleep disturbance criteria.

The 2011 Road Noise Policy has been utilised as a guide for evaluating potential sleep disturbance and annoyance impacts on residents near the rail line. Potential sleep disturbance impacts to residents as a result of late night train movements will be assessed using the methodology set out in section 5.4 of the NSW EPA Road Noise Policy. The policy states the following regarding sleep disturbance:

From the research on sleep disturbance to date it can be concluded that:

- *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

For the purpose of this assessment, acoustic controls will be determined such that there will be less than one sleep disturbance per night as a result of external noise intrusion. In our opinion, a maximum of one awakening per night is considered acceptable, as, on average, a sleeper will have one awakening during the night as result of some disturbance other than external noise. As such, the target internal noise level will be set at 55dB(A)L_{max}.

Table 6 – Sleep Disturbance Controls

Building Type	Space	Objective dB(A)L_{max}
Residential	Bedrooms	<55

6.2 EXTERNAL NOISE INTRUSION ASSESSMENT

6.2.1 Summary of Assessment Noise Levels

Rail noise levels have been measured using unattended noise monitors as outlined in section 5.2.

The summarised rail noise levels used in this assessment are outlined in the table below. Values for both the SEPP and sleep disturbance assessments have been included.

Table 7 – Assessment Rail Noise Levels

Source / Location	Period / Descriptor	Rail Noise Level
North West Rail Line / @5m	Daytime dB(A) $L_{eq,15\ hour}$ (7am to 10pm)	65
	Night time dB(A) $L_{eq,9\ hour}$ (10pm to 7am)	71
Train Horn / @5m	(Anytime) dB(A) L_{max}	108
Marina Drive / @5m	Daytime dB(A) $L_{eq,15\ hour}$ (7am to 10pm)	65
	Night time dB(A) $L_{eq,9\ hour}$ (10pm to 7am)	59
Jordan Esplanade / @5m	Daytime dB(A) $L_{eq,15\ hour}$ (7am to 10pm)	62
	Night time dB(A) $L_{eq,9\ hour}$ (10pm to 7am)	56

6.2.1.1 SoundPLAN Noise Model

SoundPLAN™ is a software program for acoustic simulation and noise mapping. It uses advanced algorithms and models to provide highly accurate simulations of sound propagation in various environments. SoundPLAN™ is used commonly in the field for a wide range of applications, including noise mapping, noise impact assessments, and noise reduction design.

Rail noise propagation across the site has been predicted 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. The SoundPLAN software considers several elements when calculating noise emissions, including distance attenuation, barrier effects, air/ground absorption, time corrections etc.

The source noise levels used in the model have been calibrated using the measured noise levels stipulated in section 5.2.

Digital Ground Elevation data are sourced from the Intergovernmental Committee on Surveying and Mapping (ICSM) - Elvis - Elevation and Depth - Foundation Spatial Data website. Receiver building spatial data (heights and elevations) are sourced from Geoscape Australia.

Noise enhancing meteorological conditions 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 conditions are always in effect).

Appendix A presents SoundPlan outputs for the rail noise modelling for both daytime and night-time façade and grid noise levels

6.2.2 Evaluation of Noise Intrusion

External noise intrusion to residential areas have been assessed in this section with reference to the internal noise criteria established in section 6.1 and the assessment noise levels in section 6.2.1.

Internal noise levels will primarily be a result of noise transfer through windows, doors, and roof, as these are expected to be relatively light building elements which offer less resistance to the transmission of sound. Calculations were performed taking into account the orientation of windows, barrier effects (1.8m noise barrier and neighbouring buildings), the total area of glazing, façade transmission loss and the likely room sound absorption characteristics. In this way, the likely internal noise level can be predicted.

Given there are currently no architectural drawings identifying the proposed layouts of each dwelling, the following assumptions have been made:

- Living Rooms 6m x 4m x 2.7m with a glazing area of approx. $10m^2$.
- Bedrooms 4m x 3m x 2.7m with a glazing area of approx. $4m^2$.

Further, treatments are presented to comply with the two sets of acoustic objectives provided in sections 6.1:

- **SEPP Infrastructure criteria:** These are mandatory criteria, and deal with *average* noise levels.
- **AS2021-2015:** Site evaluation has been carried out to determine whether the overall aircraft noise exposure of the site is compatible with the proposed use. See Section 4.5.
- **Sleep disturbance guidelines**: Although the sleep disturbance guidelines are not mandatory, given there are typically 4-5 late night freight rail movements, an assessment only of average noise levels (as required by SEPP) may allow for short duration, high noise level events to result in sleep disturbance. The RNP Sleep Disturbance assessment results in increased mitigation measures when compared to the SEPP assessment, and thus, compliance with the Sleep Disturbance objectives results in compliance with SEPP criteria.

The recommendations in this section are indicative only. Any individual building will require a specific acoustic assessment to ensure the internal noise criteria can be achieved. The constructions contained in this report are indicative and for the purpose of seeking planning authority approval only.

6.2.2.1 SEPP Noise Intrusion Assessment

The following table presents the indicative minimum glazing thicknesses required to mitigate external noise sources and comply with the SEPP internal noise level criteria outlined in section 6.1.4.

Table 8 – SEPP/AS2021 Minimum Complying Glazing Thickness

Façade/s	Room/s	Glazing Requirements	Acoustic Seals
Facing Rail Line (West) Facing Marina Drive	Sleeping and Living Areas	Heavy Weight Single Glazing	Yes
North / South		Medium Weight Single Glazing	Yes
East		Medium Weight Single Glazing	Yes
All	Bathrooms	Lightweight Weight Single Glazing	Yes

6.2.2.2 Sleep Disturbance Noise Intrusion Assessment

The following table presents the indicative minimum glazing thicknesses required to comply with the sleep disturbance internal noise level outlined in section 6.1.5 (and resultantly, the SEPP criteria in section 6.1.4).

Table 9 – Sleep Disturbance Minimum Glazing Thickness

Façade/s	Room	Glazing Requirements	Acoustic Seals
Facing Rail Line (West) Facing Marina Drive	Sleeping Areas	Large Air Gap Double Glazing	Yes
North / South		Heavy Weight Single Glazing	Yes
East		Light Weight Single Glazing	Yes

In addition to meeting the minimum glazing requirements above, the design of the window mullions, perimeter seals and the installation of windows/doors in the building openings shall not reduce the R_w rating of the glazing assembly below the values nominated in the table below. It is recommended to fit with

Acoustic Seals. Final recommendations to be determined at DA Stage once final locations and window orientations are determined.

Expected R_w values for glazing recommendations are provided below.

Table 10 – Minimum R_w Rating of Glazing

Glazing Assembly	R_w Rating	Acoustic Seals
Lightweight Single Glazing	27-32	Yes
Medium Weight Single Glazing	33-36	Yes
Heavy Weight Single Glazing	37-40	Yes
Large Air Gap Double Glazing*	>40	Yes

Aluminium framed/sliding glass doors and windows will be satisfactory provided that they meet the following requirements. All external windows and doors listed are recommended to be fitted with Q-lon type acoustic seals (**Mohair or brush seals are not considered acoustic seals**). Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

6.2.2.3 Complying External Entry Door Construction

Non-glazed entry doors facing the rail line shall be of a minimum 40mm solid core timber construct with perimeter acoustic seals. Seals will have to be equivalent to Raven RP 10 to the top and sides and Raven RP38 to the underside of the door. All other external doors can be standard solid core doors (minimum 35m thick) with all gaps minimised.

Any glass door or glazed panel set into solid doors should be constructed using the glazing thickness outlined in the above section. Full perimeter door seals are required.

6.2.2.4 Complying External Wall Construction

If external walls are proposed to be of a concrete or masonry construction, further acoustic treatment will not be required. Any light-weight construction (e.g. sheet metal cladding, etc.) will need to be reviewed and assessed at a later stage to ensure acoustic requirements outlined in this report are achieved.

6.2.2.5 Complying Roof/Ceiling Construction

Any light-weight roof construction will need to be reviewed and assessed at a later stage once the building shell materials are finalised to ensure acoustic requirements outlined in this report are achieved.

6.2.3 Comparison of Predicted Internal Noise Levels

For comparative purposes, the predicted maximum internal noise levels from rail pass-bys in bedrooms at different facades with different noise mitigation strategies applied have been summarised in the following table. Note that the levels indicated are for the worst affected points on each facade. Noise levels are expected to vary for different rooms on the same façade.

Table 11 - Comparison of Predicted Internal Noise Levels

Façade	Predicted Maximum Internal Noise Level with SEPP Treatments	Predicted Maximum Internal Noise Level with Sleep Disturbance Treatments	Sleep Disturbance Objectives
West	60	50	<55
North / South	60	50	<55
East	45	45	<55

6.2.4 Ventilation Requirements

The NSW Department of Planning's *Development near Rail Corridors and Busy Roads – Interim Guideline* states:

> *"If internal noise levels with windows or doors open exceed the criteria by more than 10dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia."*

With windows open, the allowable internal noise goal is permitted to be 10dB(A) higher than when the windows are closed (i.e., – allowable level becomes 50 dB(A) in living rooms and 45 dB(A) in bedrooms at night).

With respect to the above we note:

- All bedrooms and living rooms facing the rail line will require alternative ventilation.
- All bedrooms located on the northern and southern facades of buildings along the rail line will require alternative ventilation.

6.3 ADDITIONAL ACOUSTIC DESIGN CONSIDERATIONS

There are a variety of additional strategies for reducing internal noise levels experienced on the facades of a development, particularly those facing busy rail lines and other noise sources. An integrated approach should be taken in the design phase to optimise acoustic conditions where feasible.

6.3.1 Building Location and Layout

The first option for noise mitigation that should be considered is the location of the development in relation to the noise source. Increasing the distance between the source and receiver where possible may include:

- Locating apartments further away from the source (sometimes closer to quieter roads that bound the site).
- Locating noise sensitive spaces, such as bedrooms and living areas, furthest away from the source and locating less sensitive spaces, such as kitchens, bathrooms and corridors, closer to the source.
- Facing windows/doors away from the source.

6.3.2 Building Barriers

Another design method which can be used in some developments involves arranging a commercial podium or other non-sensitive use buildings on lower levels closer to the rail line whilst providing shielding for residential spaces behind. The building could run parallel to the rail and interrupt the line of sight of apartments to the rail line. Similarly, where apartments are located on top of the commercial area or a podium, the residential building can be set back away from the rail to provide increased distance and noise shielding.

6.3.3 Balconies

Balconies can also be considered and provide an opportunity to minimise noise levels at the façade or window/door openings It should be noted however, that a standard balcony may act to reflect noise into the apartment opening.

The design of balconies to reduce noise intrusion can include the following measures:

- Provision of solid balustrades to provide screening from the source of road/rail noise.
- In order to minimise reflected noise from soffits, an absorptive lining would be required. An absorptive lining to wall surfaces could also further attenuate noise levels.
- Provision of angled blades/baffles could be used in front of balconies or ventilation openings to provide noise screening from the external source. Care would need to be taken in the design to avoid adjacent blades reflecting noise into the ventilation openings, which may be partially mitigated through the use of absorptive linings applied to blade faces.
- Use of a 'winter garden' enclosed balcony with acoustic louvres could also be considered.

7 RAILWAY VIBRATION ASSESSMENT

Trains induce ground borne vibration that is transmitted through the subsoil. These vibrations can be perceptible close to railways, as tactile vibrations and as structure borne noise.

7.1 PROJECT VIBRATION OBJECTIVES

7.1.1 Tactile Vibration

Human comfort is normally assessed with reference to the British Standard BS 7385 Part 2 1993 or Australian Standard AS 2670.2 1990.

British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)" is recommended by the RIC's and SRA's Interim Guidelines for Councils "Consideration of rail noise and vibration in the planning process" as this standard includes guidance for the assessment of human response to building vibration including intermittent vibrations such as that caused by trains.

Human response to vibration has been shown to be biased at particular frequencies, which are related to the orientation of the person. Australian Standard 2670 "Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80Hz)" provides curves of equal annoyance for various orientations. These curves are applied as correction filters such that an overall weighted acceleration level is obtained. As the orientation of the resident is unknown or varying, the weighting filter used is based on the combined base curve as given in ISO 2631 & Australian Standard AS 2670.2 1990 which represents the worst case of the X, Y and Z axes. Filtered measurements are made in all three co-ordinate axes and the highest value axis used. The standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (6am-10pm) and "Night time" (10pm-6am).

The NSW EPA document "*Assessing Vibration: A Technical Guideline*" draws on both the British Standard BS 6472:1992 Part 2 as well as Australian Standard AS2670.2-1990. The guideline provides acceptable values for three different types of vibration. Within the guideline, vibration is classed as either continuous, impulsive, or intermittent. The vibration source impacting on this site is from railway trains which is classified as an intermittent source.

The summarised criteria for intermittent vibration is presented below.

Table 12 - EPA Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical areas	0.10	0.20	0.10	0.20
Residences	**0.20**	0.40	**0.13**	0.26
Offices, schools, educational institutional and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

[1] Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.

7.1.2 Structure Borne Noise

Typically, the structure borne noise component of train noise when a site lies adjacent to an above ground rail is masked by the airborne noise component of the train pass by. However, we note that the Department of Planning document '*Development Near Rail Corridors and Busy Road – Interim Guideline*' (the Interim Guidelines) state in Section 3.6.2:

"In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground-borne LAmax noise limit of 40dBA (daytime) or 35dBA (night-time)".

7.2 RAIL VIBRATION LEVELS

7.2.1 Equipment Used

Vibration measurements were conducted on site using a Svan 958 Vibration Analyser fitted with a Dytran triaxial accelerometer.

7.2.2 Locations Monitored

Attended train vibration measurements were conducted on site on the 22 of August 2022 between 8:30-9:00pm and on the 7th of September 2022 between 1:00-1:30am and 10:30-11:00am. Vibration measurements were conducted approximately 15m from the rail line at the location marked up in Figure 7.

7.2.3 Tactile Vibration Dose Values

The measured vibration levels, duration of train pass by and the number of rail movements per hour were used to determine the overall vibration dose (VDV) at the proposed development for both daytime and night-time periods. The results have been compared against the most sensitive typical building type expected in this area, being residential, and presented in the table below.

Table 13 - Vibration Dose Values

Time Period	Calculated VDV $m/s^{1.75}$	Residential Criteria VDV $m/s^{1.75}$	Note
Day (7am – 10pm)	0.03	<0.2	Complies
Night (10pm -7am)	0.03	<0.13	Complies

In the event the future train use increases, say by 10%, predicted eVDV will not increase significantly (no more than approximately 0.007 more than the levels predicted in the Table above) and will not impact recommended vibration isolation treatments.

The calculated levels comply with the tactile vibration requirements listed in Table 13.

7.2.4 Predicted Structure Borne Noise Levels

Internal L_{Amax} noise levels were predicted using a semi empirical model developed by this office. The predicted internal noise level is calculated from the ground vibration levels, typical building transmission losses, and typical habitable room characteristics.

Table 14 – Predicted Structure Borne Noise Levels

Predicted dB(A) L_{Max}	Building Type	Criteria dB(A) L_{Max}	Note
45-48 dB(A)L_{max}	Residential	≤ 40 dB(A) Day	Refer to discussion below.
		≤ 35 dB(A) Night	

Note: The structure borne noise levels presented above represent the ground floor. The noise level on upper floors of the development will progressively reduce.

7.2.4.1 Structure Borne Noise - Discussion

Based on the above preliminary assessment, there is a potential that structure borne noise transmission from the rail line will exceed the levels detailed in the *Development near rail corridors and busy roads – Interim guideline*. However, there are additional factors which we must consider that are likely to mitigate the degree of structure borne noise impacts.

Where airborne noise from train pass-bys impacts the facades of residents, there is the likelihood of a 'masking' effect, where the airborne noise will be of a higher level than the structure borne noise generated, and as such any structure borne $L_{max, slow}$ level is likely to be inaudible. To elaborate, facades facing the rail line are to be designed to meet the SEPP airborne noise intrusion criteria (40/35dB(A)$L_{eq(period)}$. This can be described as the 'average' noise level across the specific period (daytime or night time). Despite meeting these criteria when average over a period, rail pass-bys are predicted to generate short term maximum internal noise levels of $\geq$50dB(A). In this case, the short-term airborne noise level will exceed the structure borne noise level. This results in a masking effect, where structure borne noise is inaudible and thus will have negligible impacts on any residents.

In this case, it would be facades which are not exposed to the same level of airborne noise (generally those at the rear of the development) which would become the critical location as there will be no or a reduced, masking effect. The presented structure borne noise level in Table 14 is based on measurements near the proposed boundary of the new developments. We note that level of vibration, and thus structure borne noise, is likely to reduce as the distance from the rail line is increased and vibration levels may vary at locations further south or north along the line.

Additionally, the level of structure borne noise decreases with increasing storeys above ground level. For example, in cases where mixed-use residential developments contain commercial or other uses on the first one or two storeys, the structure borne noise level at the first residential storey will likely decrease by up to 3-6dB. Further reductions will be present for each additional storey above ground.

In order to determine precise vibration levels at residential spaces which will not experience a masking effect, a full review of the potential vibration impacts from the rail line should be undertaken at a stage when building orientations, façade constructions, room types and layouts are finalised. This allows for the accurate determination of structure borne noise impacts and the need and extent for any vibration isolation treatments. Any structure borne noise impacts, if identified in a detailed review, will be able to be managed effectively with appropriate treatments and design strategies.

8 NOISE EMISSION ASSESSMENT

8.1.1 Assessment Guidelines

8.1.1.1 Council Guideline – Coffs Harbour Development Control Plan (DCP) 2015

The relevant DCP notes the following in regard to noise emissions from developments:

> *Noise levels at the boundary of the site subject to the development are to accord with the requirements of the Protection of the Environment Operations Act 1997 and the NSW Industrial Noise Policy published by the Environment Protection Authority.*

The Protection of the Environment Operations Act 1997 has been superseded by the above-mentioned Industrial Noise Policy. As such, noise emission criteria will be established using this policy.

8.1.2 Project Specific Criteria

Assessment criteria have been determined for each receiver and noise source using the above guidelines and the measured ambient noise levels. These are summarised below.

8.1.2.1 Noise Policy for Industry

The Noise Policy for Industry (NPfI) provides a methodology for assessing the need for noise mitigation:

- Determine project specific "trigger" levels.
- Predict noise emissions to surrounding properties, and assess against the trigger levels.
- Noise mitigation should be assessed when the predicted noise emissions exceed the trigger levels.

In this assessment, the trigger levels determined using the NPfI will be adopted as assessment criteria for permanent plant and equipment.

Project specific noise "trigger" levels are determined based on the land use impacted, ambient noise environment and the time of day.

The EPA NPfI has three sets of criteria which are all required to be satisfied, namely "intrusiveness", "amenity" and "maximum noise levels". Intrusiveness and amenity are generally assessed at the most affected part of the property, or at the balcony or façade of an apartment or upper level of residence. Maximum noise levels are generally assessed outside bedroom windows.

The derivation of the project specific trigger levels is discussed below.

Intrusiveness Criteria

The guideline is intended to limit the audibility of noise emissions at residential receivers only. Noise emissions measured using the L_{eq} descriptor should 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 (in accordance with Fact Sheet C of the Policy).

Intrusiveness criteria have been determined using the background noise levels in Section 5.2 and are summarised in the following table.

Table 15 - Intrusiveness Criteria

Location	Period/Time	EPA NPfI Intrusiveness Noise Emission Trigger Level dB(A) $L_{eq(15min)}$
Nearby Residences	Day (7am-6pm)	52
	Evening (6pm-10pm)	50
	Night (10pm-7am)	47

Amenity Criteria

The guideline is intended to limit the absolute noise level from all "industrial" noise sources so that it is consistent with the general environment.

Table 2.2 of the NPfI sets out acceptable noise levels for various land uses.

There are 3 categories for residential receivers - rural, suburban, urban. This subject site is most appropriately categorised as sub-urban.

Categories for non-residential uses are also indicated in the table.

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

Amenity $L_{Aeq,15min}$ *= Recommended Amenity Noise Level – 5 dB(A) + 3 dB(A)*

The applicable amenity goals are provided in the following table.

Table 16 - Amenity Noise Levels

Type of Receiver	Time of day	EPA NPfI Recommended Noise Level dB(A)$L_{eq(period)}$	EPA NPfI Project Amenity Noise Level dB(A)$L_{eq(15\ minute)}$
Residential – Suburban	Day (7am-6pm)	55	53
	Evening (6pm-10pm)	45	43
	Night (10pm-7am)	40	38
Commercial	When in Use	63	-

Maximum Noise Level Assessment

The procedure nominated in Section 2.5 of NPfI has been used to assess residential sleep disturbance impacts from maximum (i.e. short term) noise events. This is summarised below.

Where night time noise emissions outside a residential building exceed:

- $L_{eq(15min)}$ 40 dB(A) or the prevailing RBL (L_{90}) plus 5 dB, whichever is the greater, and/or
- L_{max} 52 dB(A) or the prevailing RBL (L_{90}) plus 15 dB, whichever is the greater

a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.

Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development
- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

The project specific maximum noise event trigger levels are summarised in the following table.

Table 17 – Maximum Noise Event Trigger Levels (Night Time)

Location	$L_{eq,15min}$ (dB(A))	L_{AFmax} (dB(A))
Residence	47	57 dB(A)

Summarised NPfI Noise Emission Criteria

The applicable assessment criteria and trigger levels are summarised in the following table. It is noted that all criteria should be satisfied.

Table 18 - Noise Emissions Criteria (NPI)

Location	Time Period	Project Amenity Criteria dB(A) $L_{eq,15min}$	Intrusiveness Criteria dB(A) $L_{eq,15min}$	Maximum Noise Trigger Levels dB(A) $L_{eq,15min}$ / L_{max}
Residence	Day	53	52	-
	Evening	43	50	-
	Night	38	47	47/57
Commercial	Day	63	-	-
	Evening	63	-	-
	Night	Not applicable	-	-

9 SUMMARY OF NOISE AND VIBRATION IMPACTS

In summary:

- Noise and vibration impact from rail corridors have been assessed in accordance with SEPP 2021 and NSW Development of Planning's *"Development Near Rail Corridors & Busy Roads (Interim Guideline)"*

- It would be appropriate that the Coffs Harbour Jetty Foreshore Precinct is readily able to achieve acceptable levels of noise and vibration through appropriate design measures and considerations.

- Similar projects where residential projects have been built in close proximity to rail corridors include 987-1015 Pacific Highway, Roseville and 80 Rider Boulevarde, Rhodes. In both projects' acceptable levels from noise and vibration impacts through appropriate design measures and considerations were achievable.

- Considerations during development application stages will include vibration impacts to future developments as well as internal noise levels from ground borne noise impacts to sleeping spaces during nighttime hours. In particular to the sleeping spaces facing away from the rail corridor where they not receiving noise masking benefits from airborne rail noise that the sleeping spaces with a full or partial view of the rail corridor are receiving. Recommend that vibration impacts and ground borne noise impacts to sleeping spaces can be assessed in detail during DA stage once final building locations and layouts are provided.

- In regard to aircraft noise, and in the absence of an ANEF, when determining building site acceptability for light general aviation for residential development on the proposed Coffs Harbour Jetty Foreshore Precinct the AS 2021:2015 envisages that in practice, the land use is deemed acceptable to proceed based on the current average number of flights per day of site and aircraft type being used.

- It would be appropriate to permit residential development on the basis that the buildings would be constructed to meet the internal noise level recommendations contained in AS2021:2015

- With the adoption of the building shell recommendations of this letter, the recommended internal noise goals of AS2021:2015 will be satisfied within the Coffs Harbour Jetty Foreshore Precinct development.

- Rated background noise levels have been provided based on long term monitoring and suitable intrusiveness noise levels to receivers as well as appropriate amenity noise levels have been provided to comply with the requirements of the EPA Noise Policy for Industry 2017.

10 CONCLUSION

This report summarises the results of a preliminary noise and vibration impact assessment for the proposed Coffs harbour Jetty Foreshore Precinct development. Site monitoring and investigation works have been carried out to establish existing noise and vibration impacts on future land uses within the masterplan.

Internal noise level criteria have been established for the residential aspects of the development in section 6.1. Noise impacts from the rail line have been assessed against these criteria and indicative recommendations have been provided for compliance with both the SEPP criteria and the RNP sleep disturbance guidelines.

In addition, rail vibration impacts have also been assessed. A detailed review of potential rail vibration and noise impacts on each individual development within the masterplan should be carried out at a later stage as developments seek individual approval and/or construction certification.

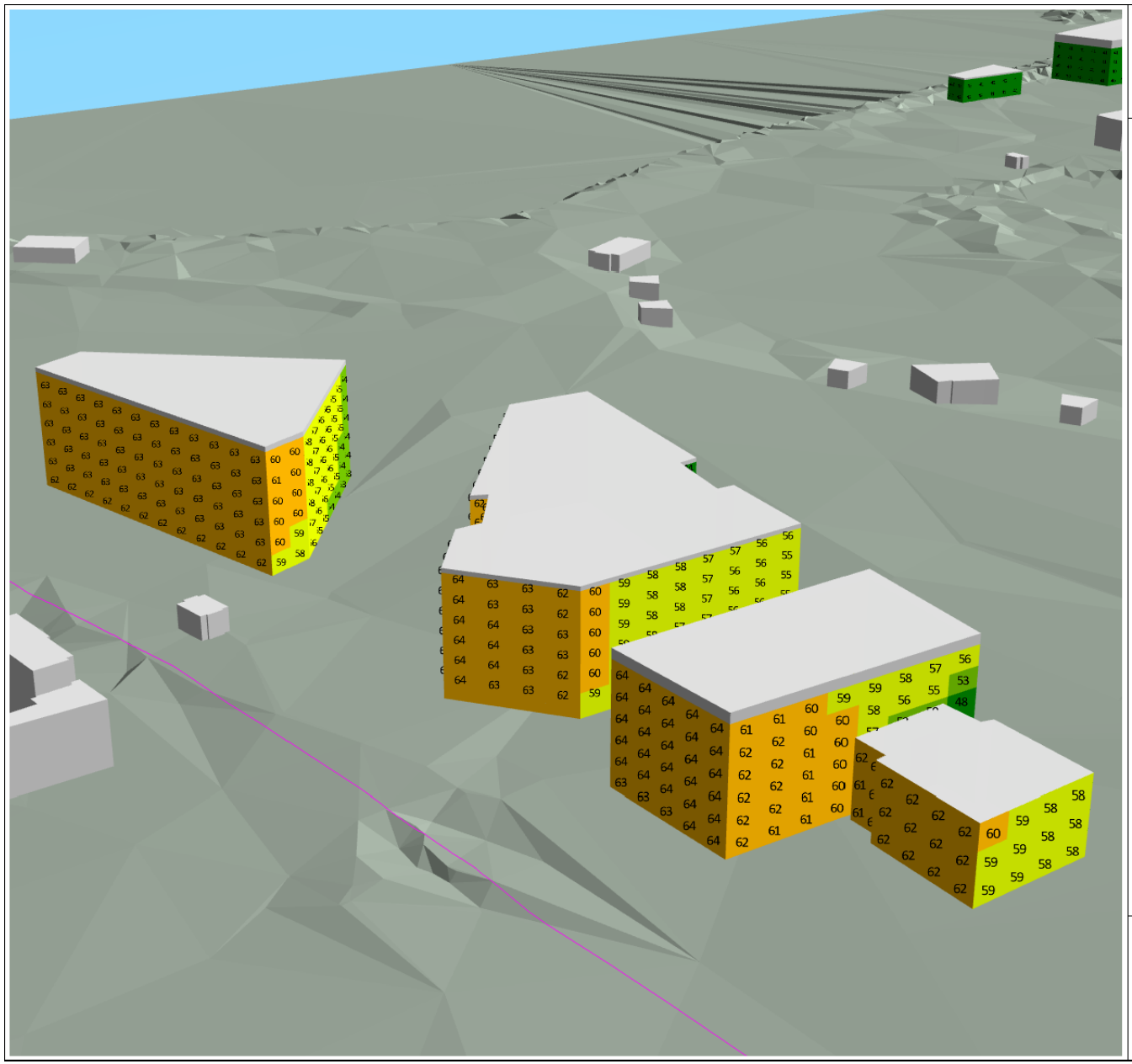
In light of the assessments presented in this report and consistent with developments surrounding the North-West rail line in Coffs Harbour, The Coffs Harbour Jetty Foreshore Precinct is readily able to achieve acceptable levels of noise and vibration through appropriate design measures and considerations.

Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Glen Campbell

APPENDIX A – SOUNDPLAN RESULTS



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

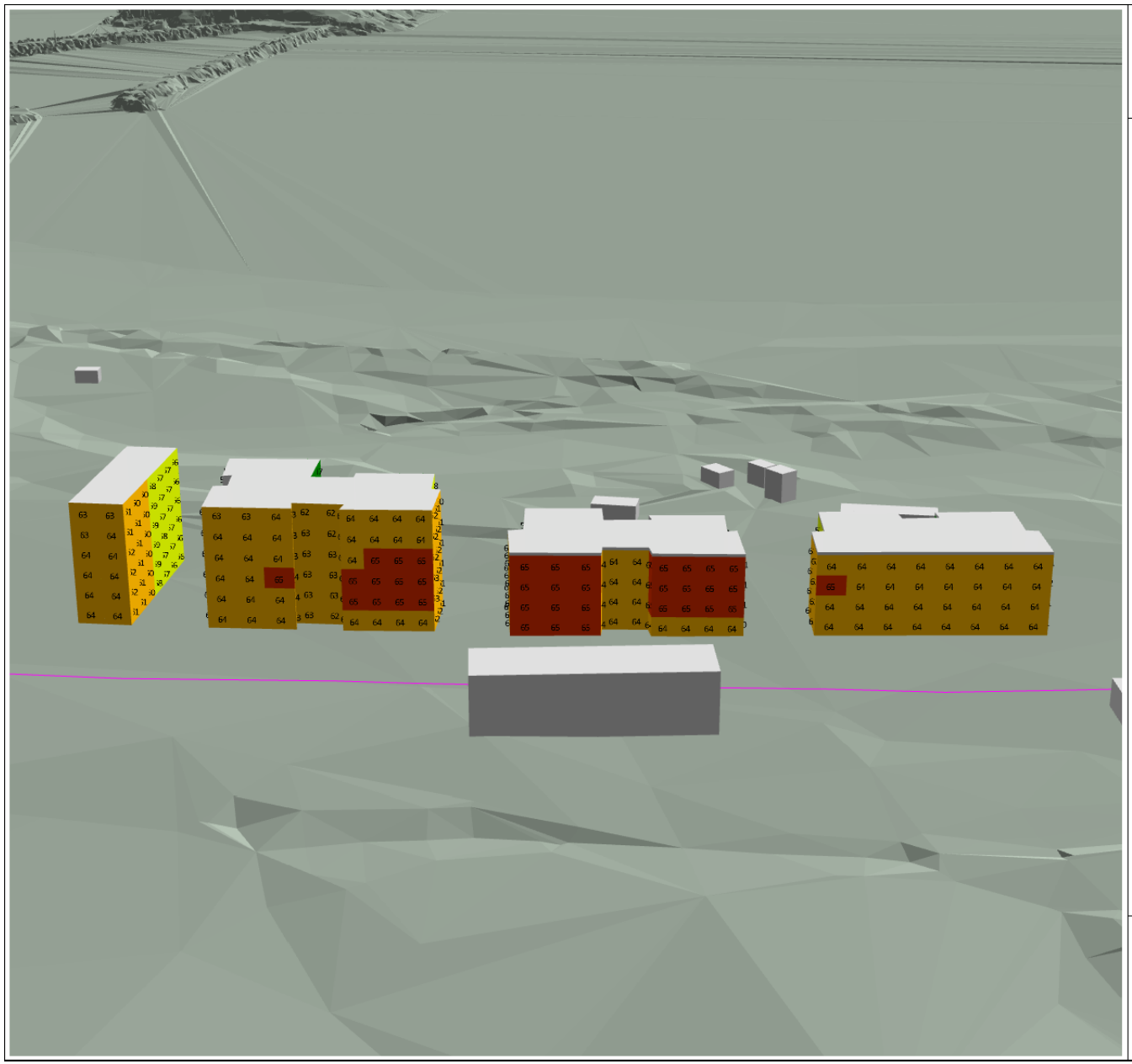
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

< 50
50 - 55
55 - 60
60 - 65
65 - 70
>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

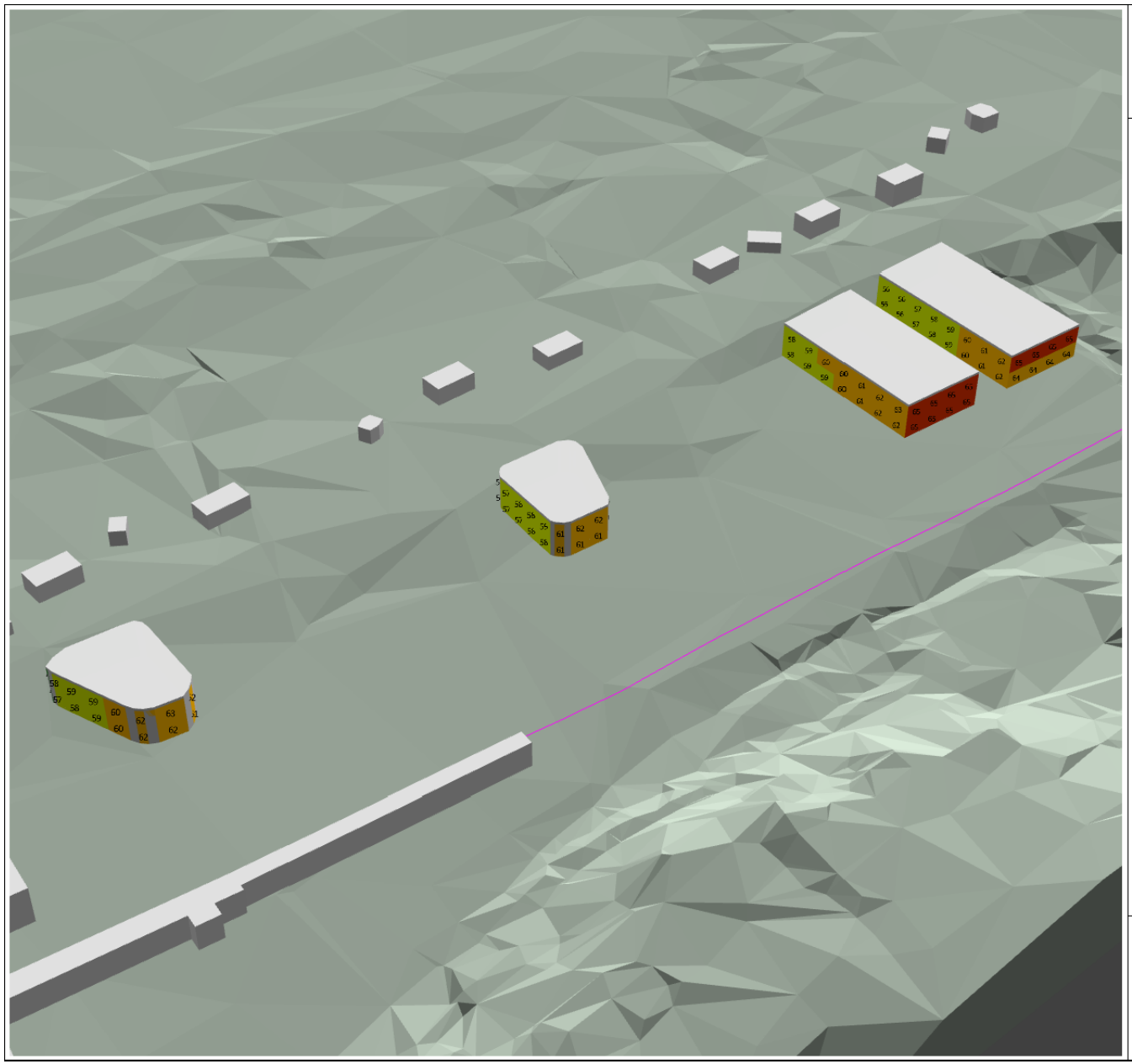
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

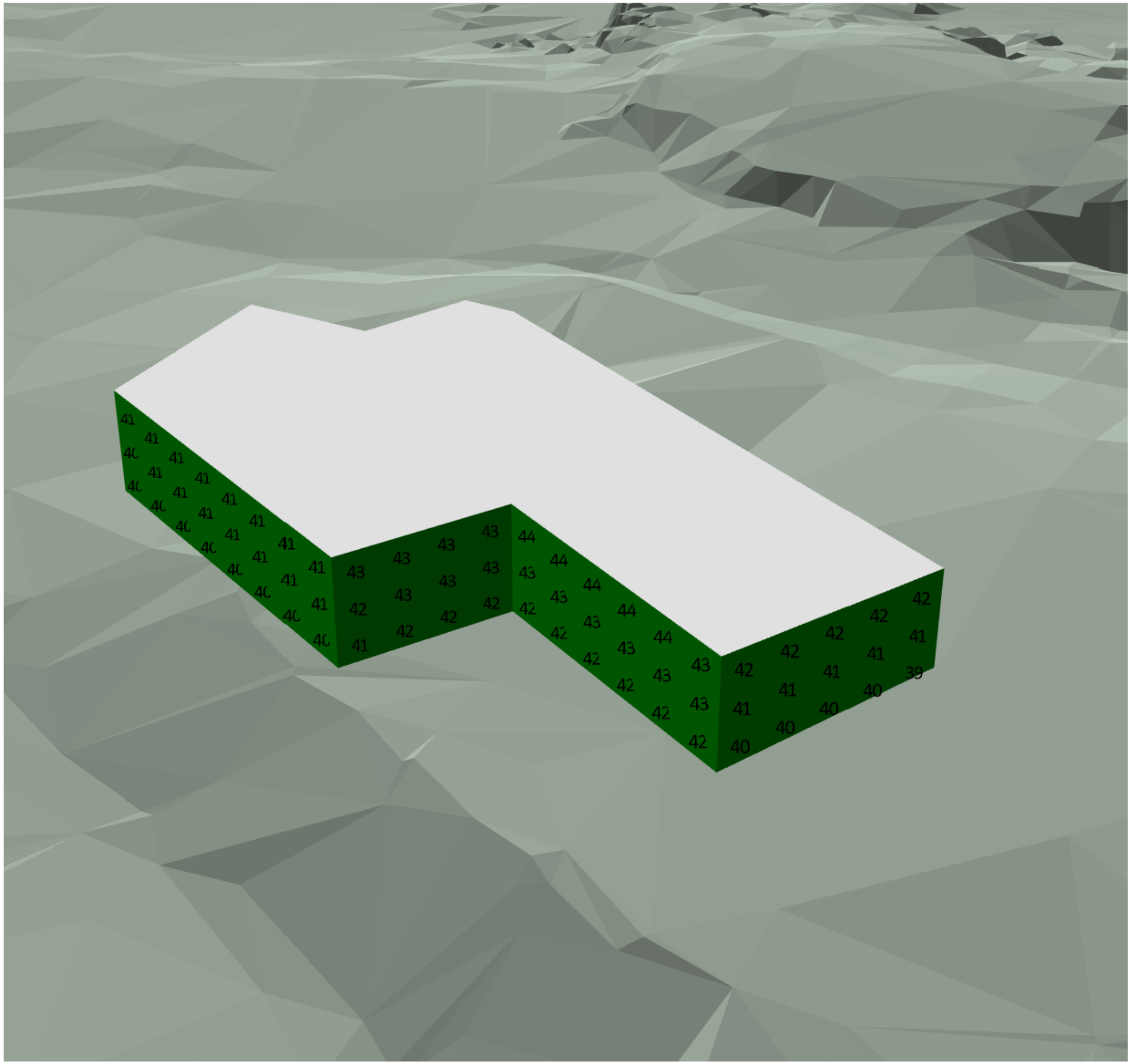
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

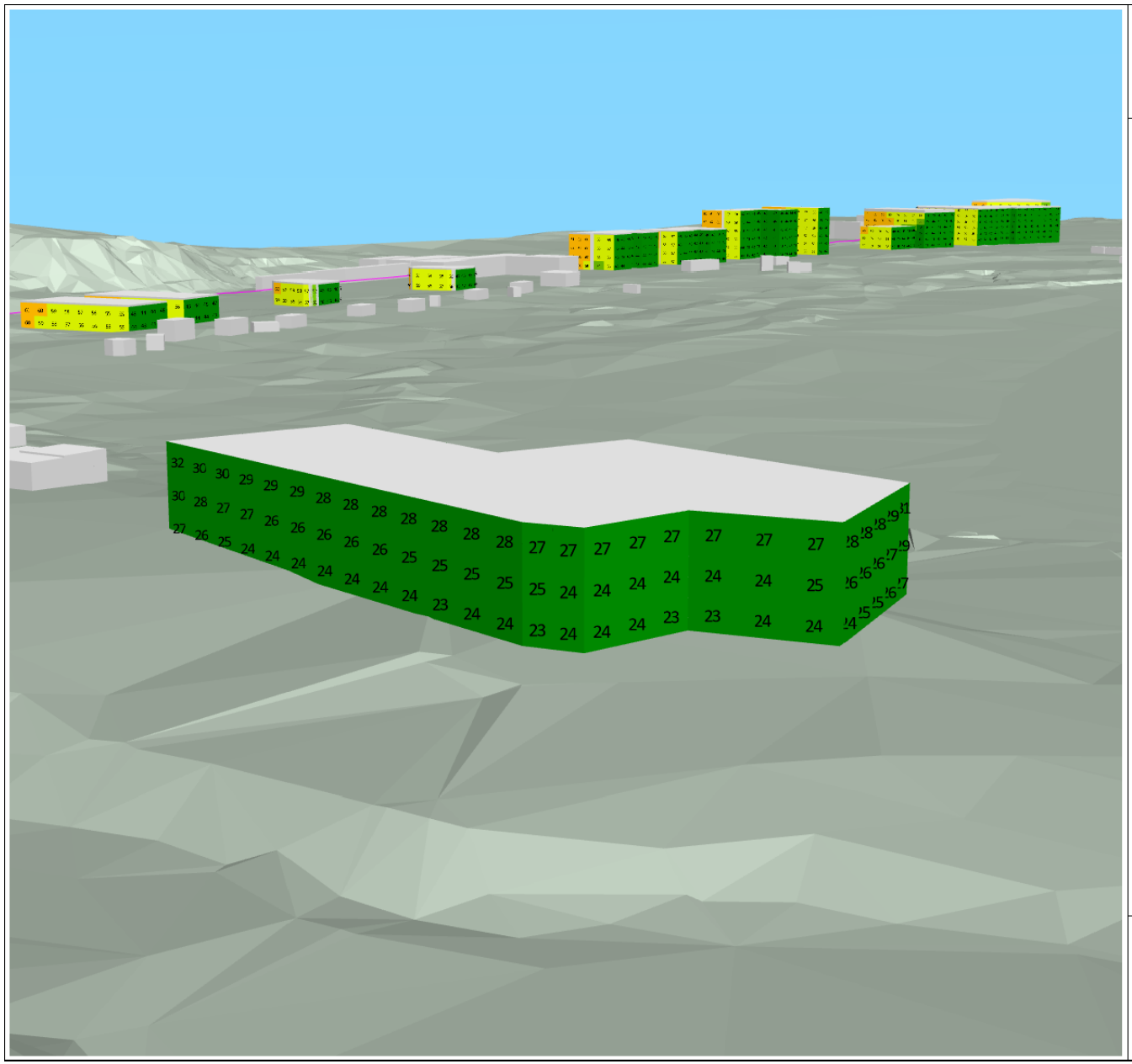
Night-time Rail Noise Prediction

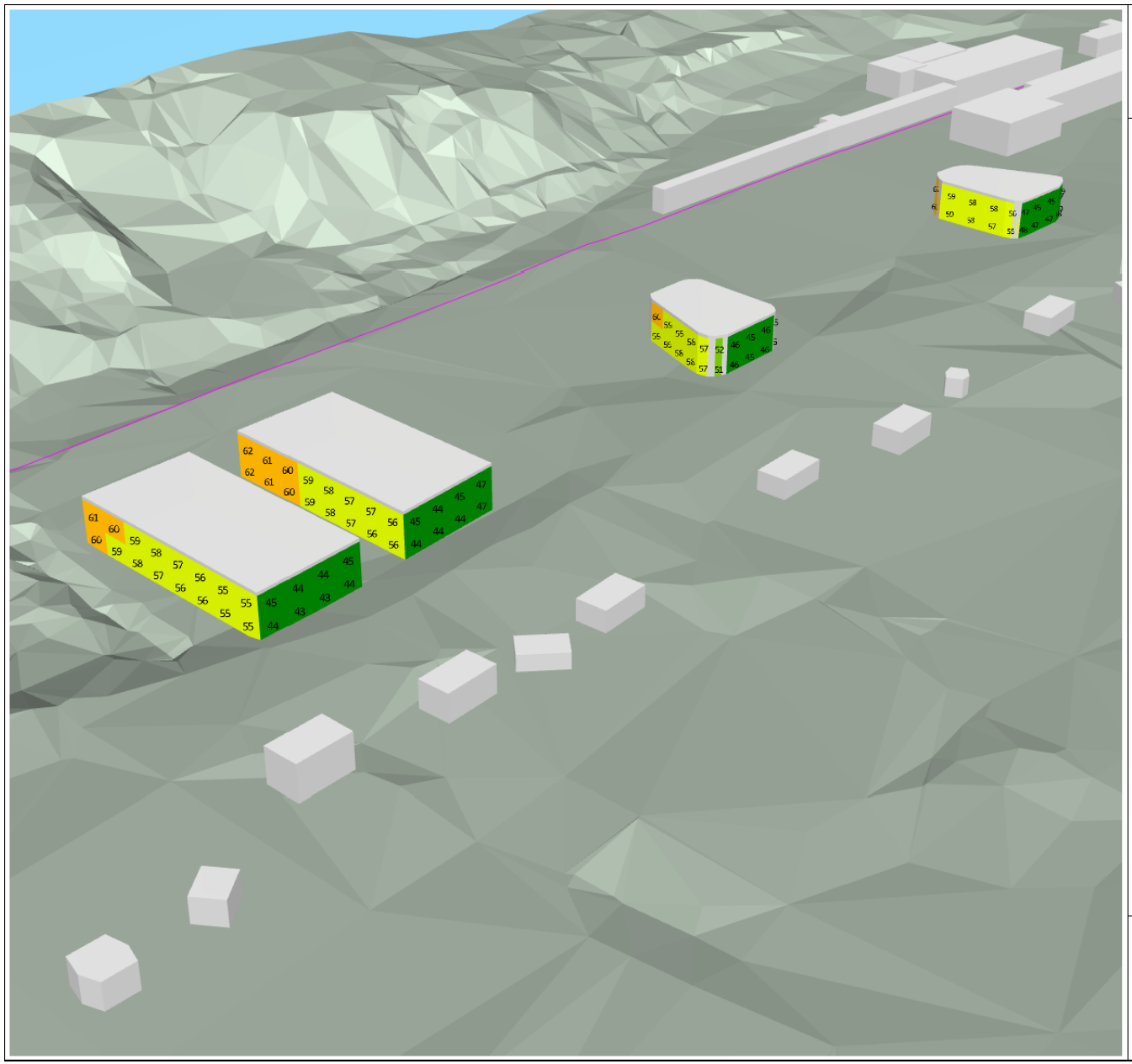
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

< 50
50 - 55
55 - 60
60 - 65
65 - 70
>= 70


32 30 30 29 29 29 28 28 28 28 28 28 27 27 27 27 27 27 27 27
30 28 27 27 26 26 26 26 26 25 25 25 25 25 24 24 24 24 24 24
27 26 25 24 24 24 24 24 23 24 24 23 24 24 24 23 23 24 24 25
Coffs Harbour Jetty
Foreshore Precinct
Night-time Rail Noise Prediction
71 dB(A)Leq(9hr)
Prepared by: A.Zappia
Date: 21/02/2025
Noise Level
Leq(9hr)
in dB(A)
< 50
50 - 55
55 - 60
60 - 65
65 - 70
>= 70
ACOUSTIC
LOGIC



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

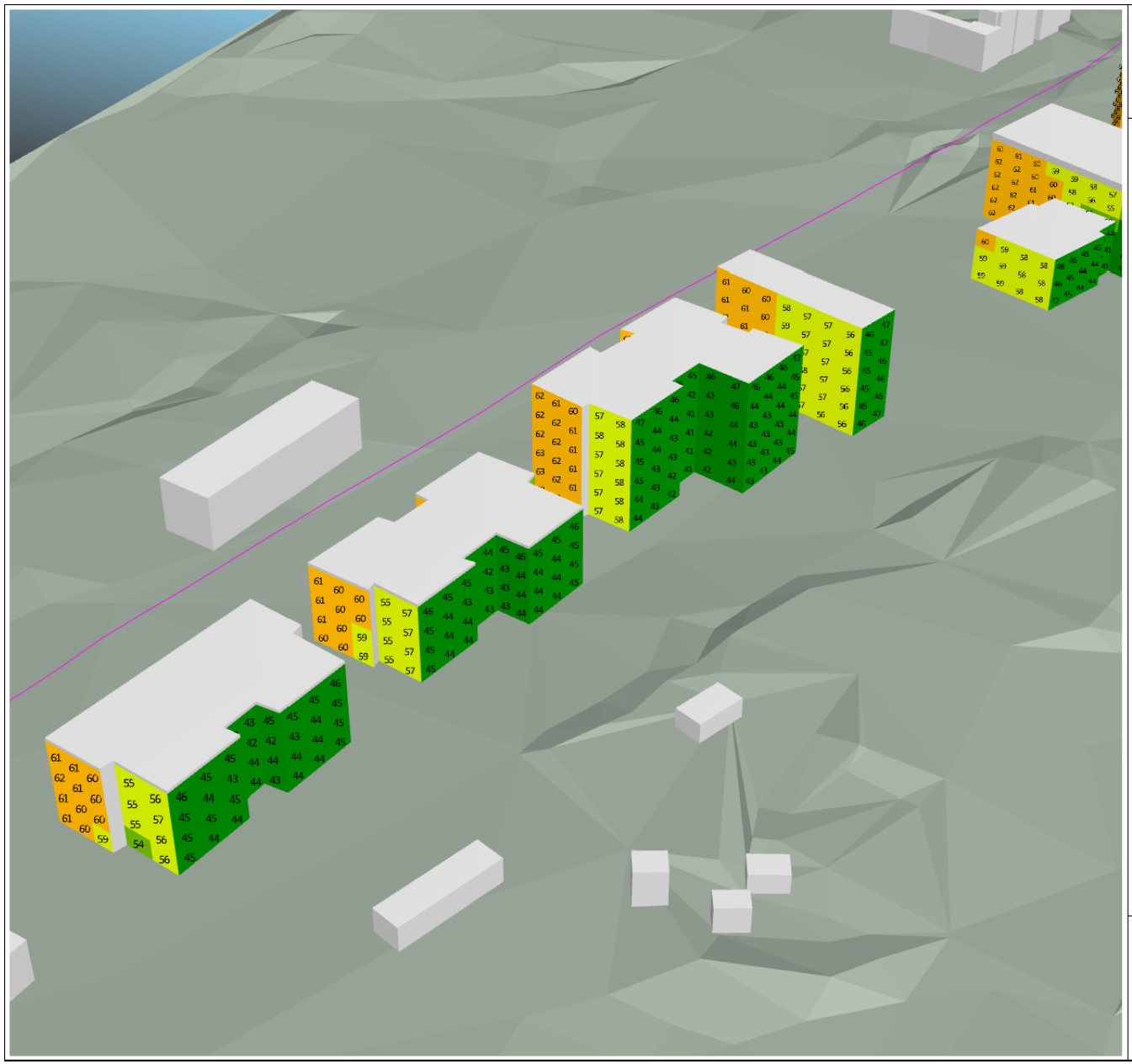
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

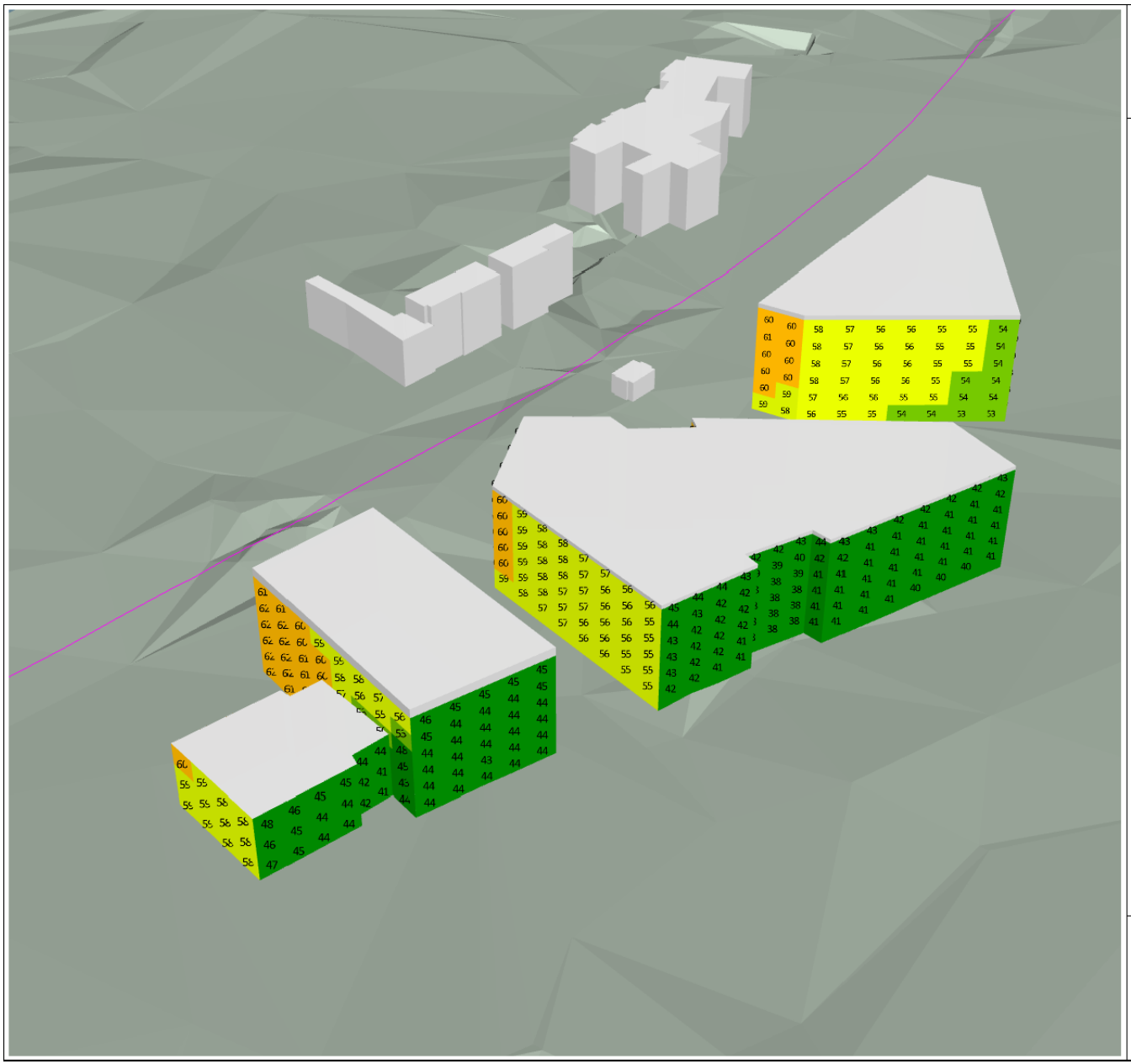
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

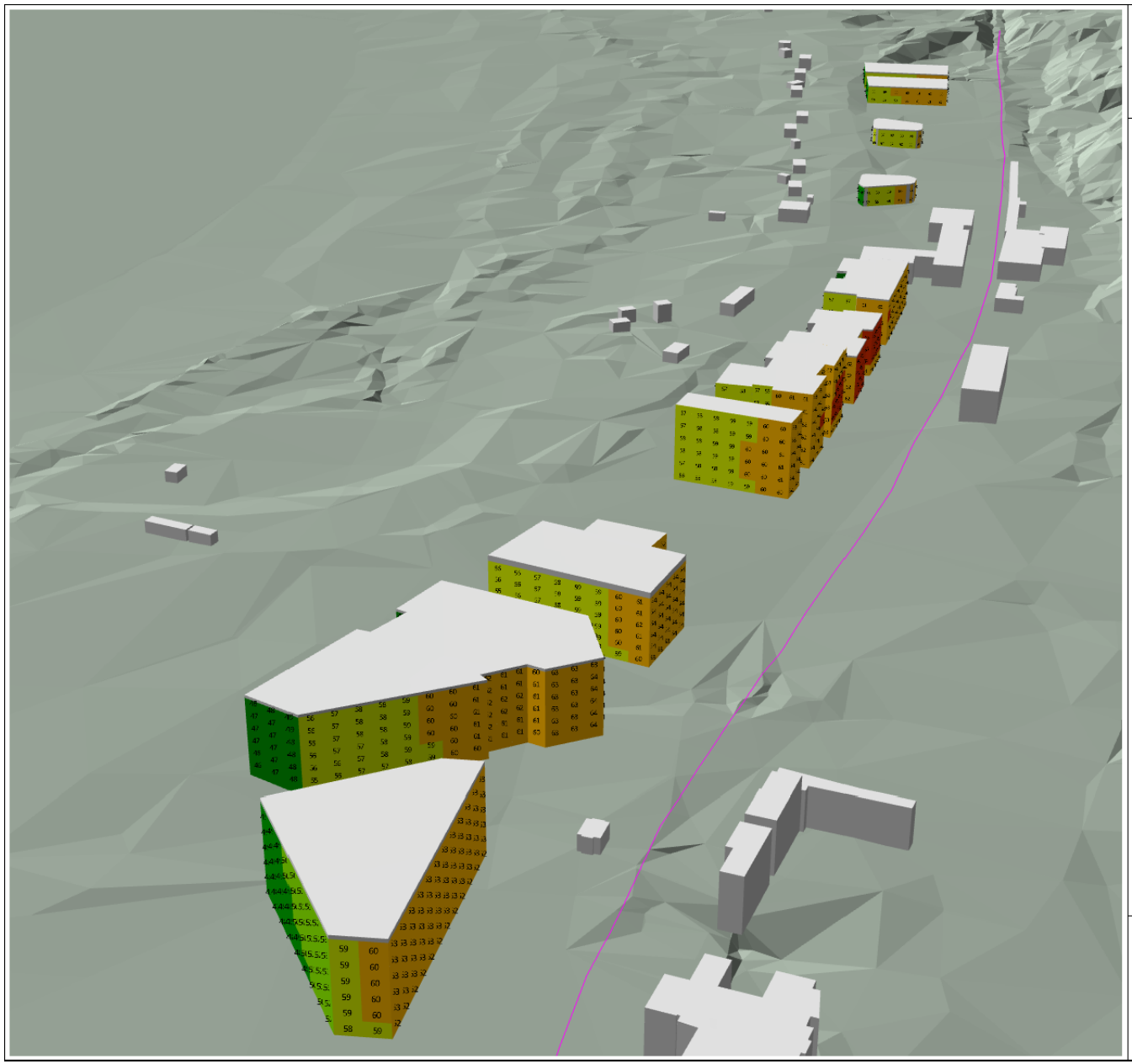
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Night-time Rail Noise Prediction

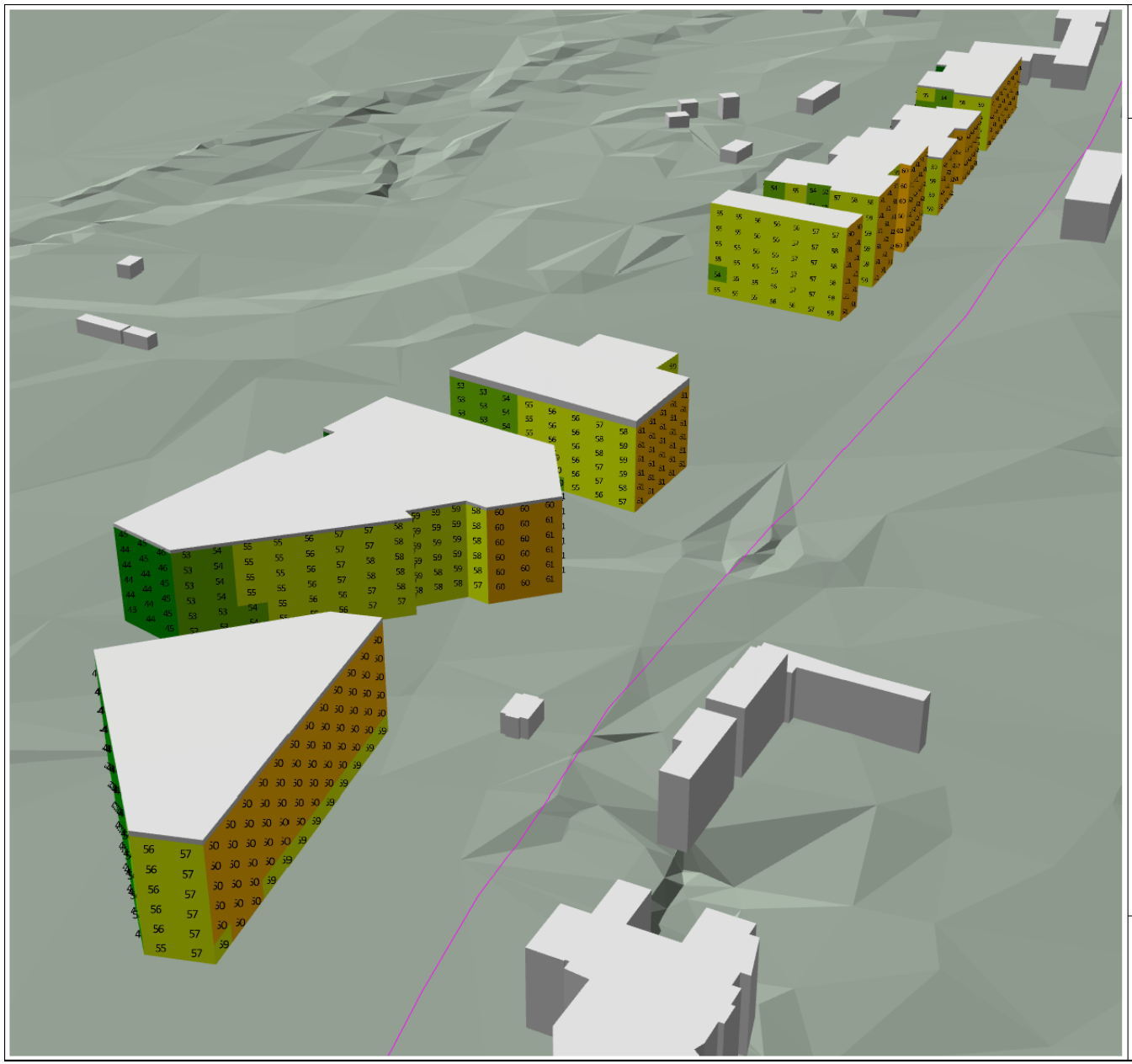
71 dB(A)Leq(9hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(9hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Daytime Rail Noise Prediction

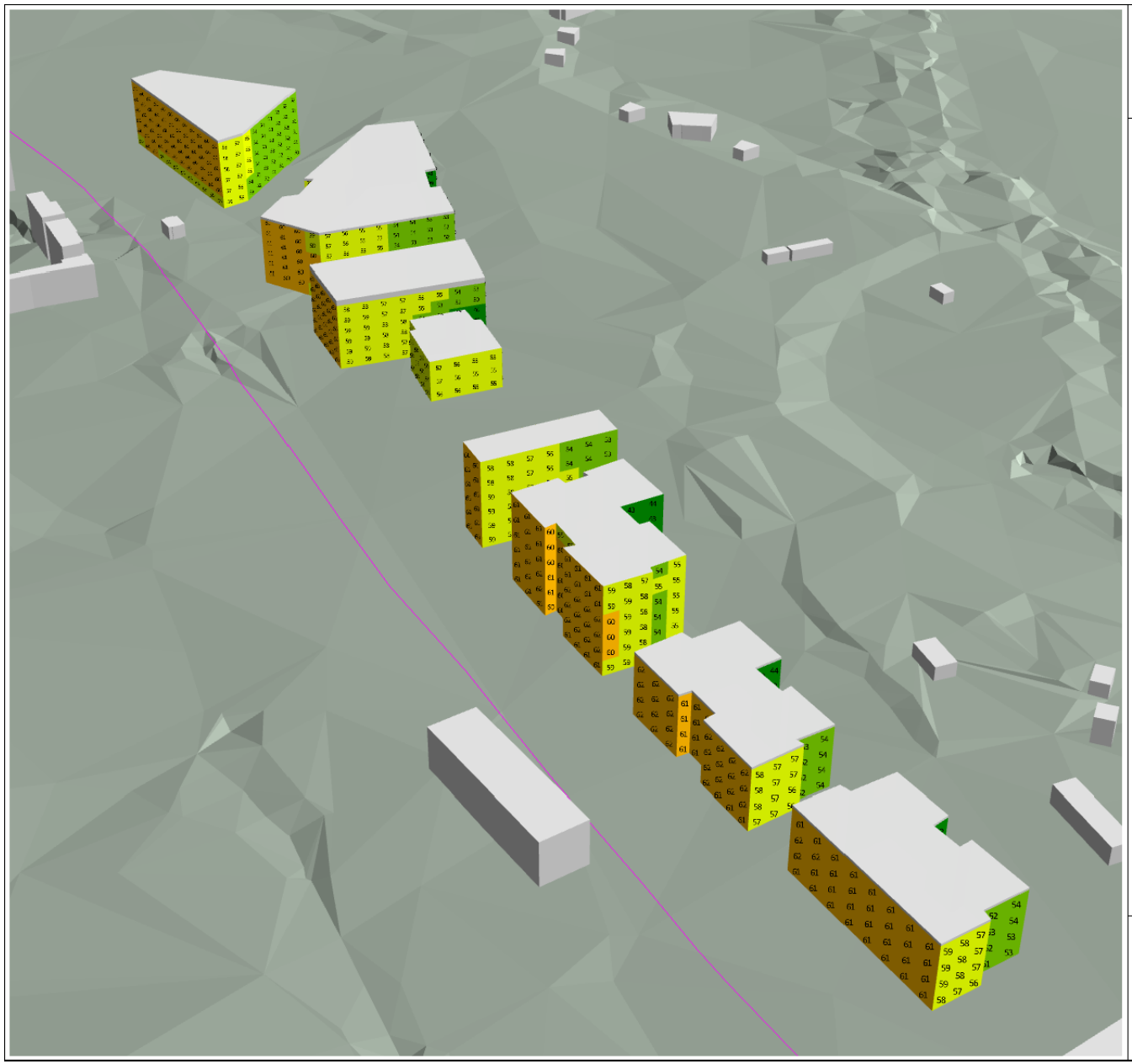
65 dB(A)Leq(15hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(15hr)}$
in dB(A)

< 50
50 - 55
55 - 60
60 - 65
65 - 70
>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Daytime Rail Noise Prediction

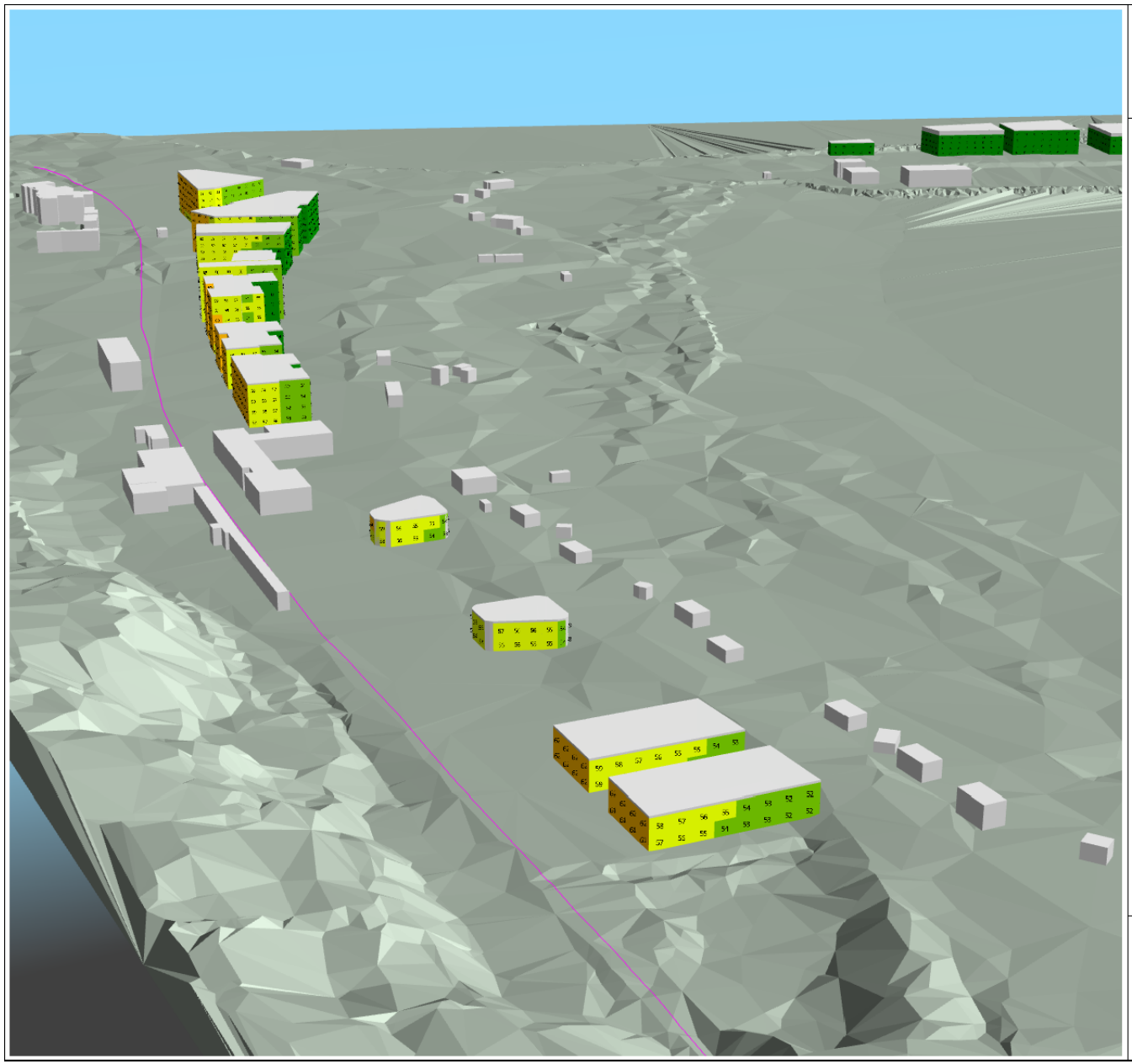
65 dB(A)Leq(15hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(15hr)}$
in dB(A)

< 50
50 - 55
55 - 60
60 - 65
65 - 70
>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Daytime Rail Noise Prediction

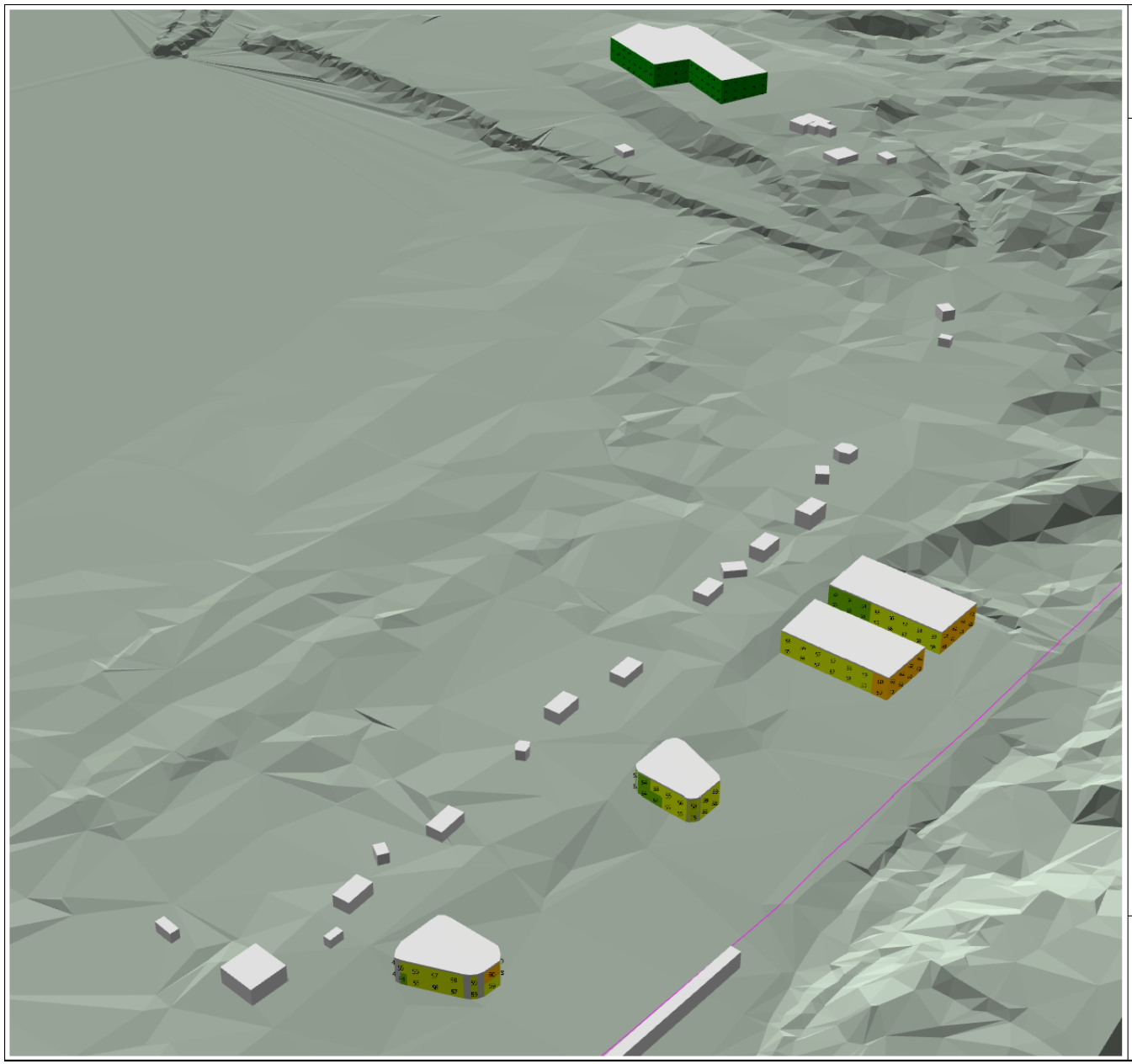
65 dB(A)Leq(15hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(15hr)}$
in dB(A)

< 50
50 - 55
55 - 60
60 - 65
65 - 70
>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Daytime Rail Noise Prediction

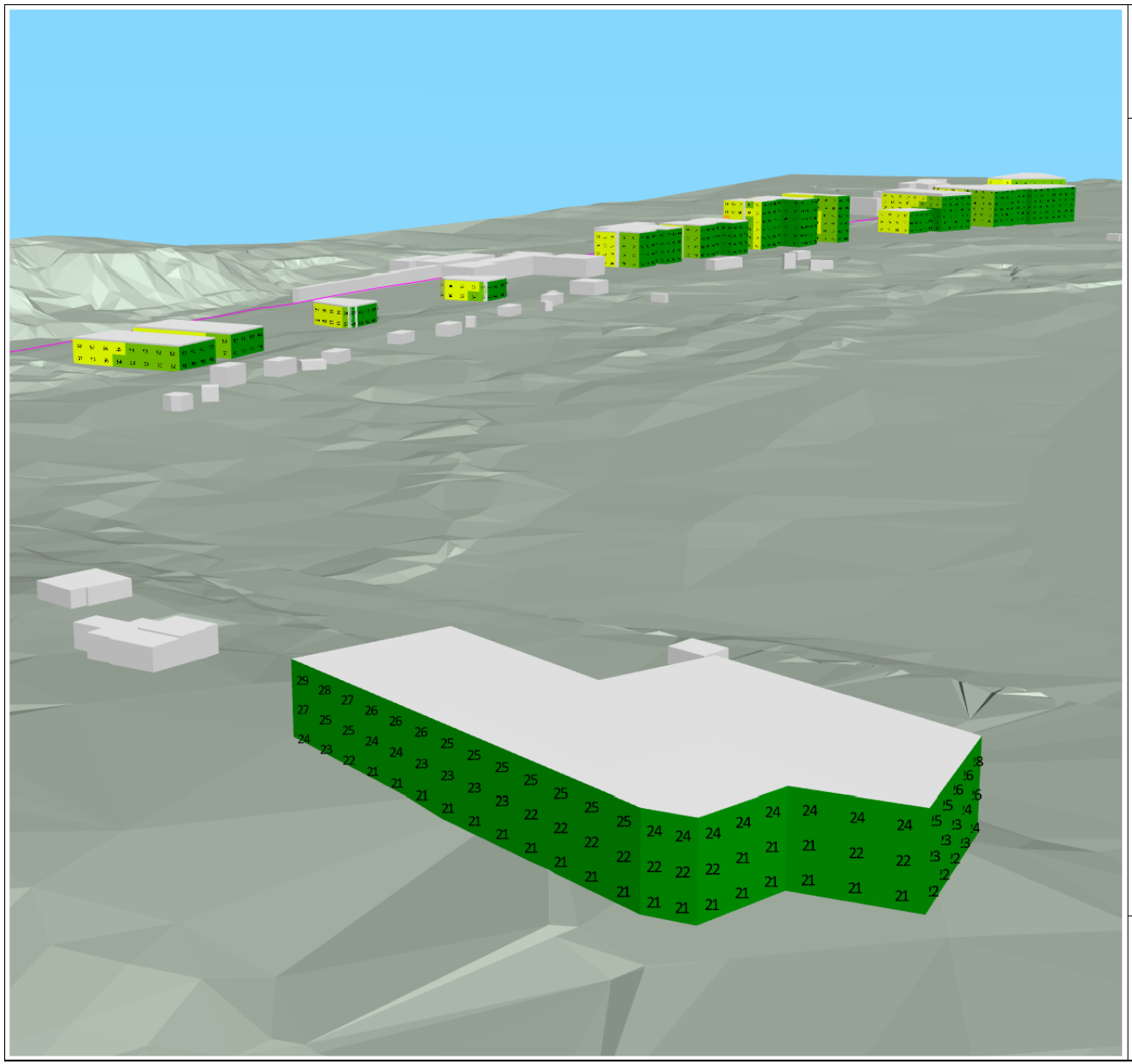
65 dB(A)Leq(15hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(15hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Daytime Rail Noise Prediction

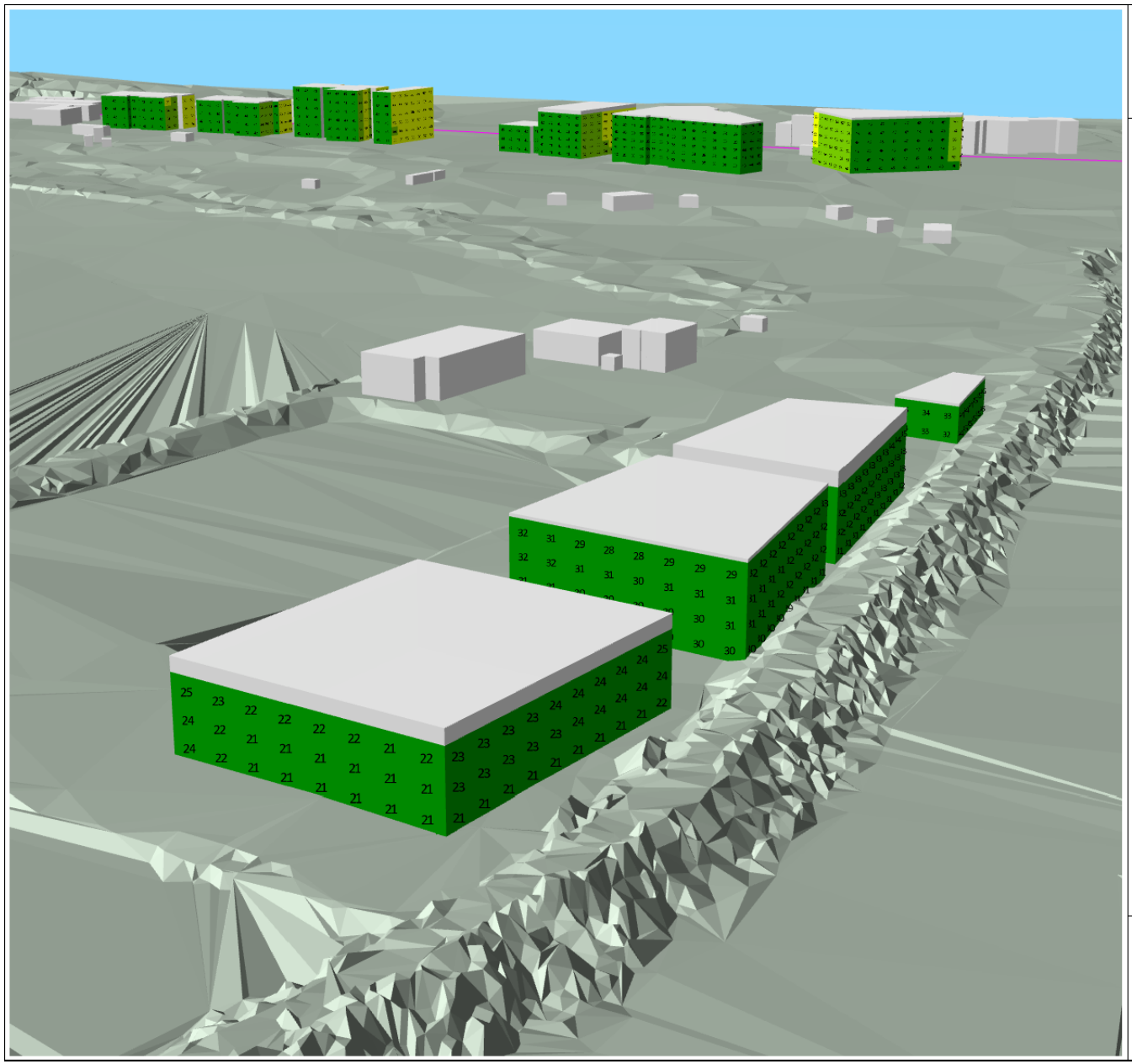
65 dB(A)Leq(15hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(15hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Daytime Rail Noise Prediction

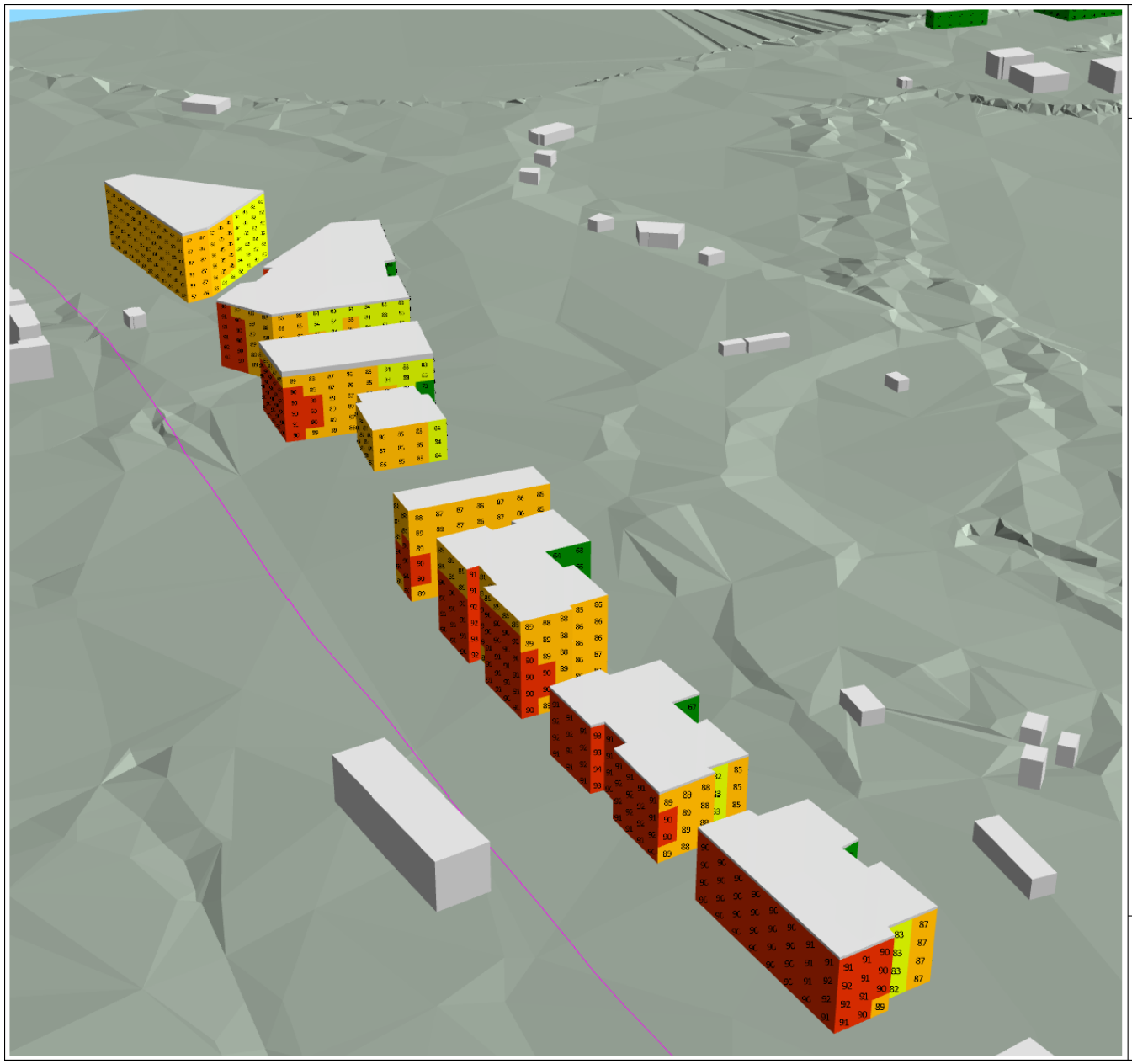
65 dB(A)Leq(15hr)

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
$L_{eq(15hr)}$
in dB(A)

	< 50
	50 - 55
	55 - 60
	60 - 65
	65 - 70
	>= 70

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

Peak Rail Noise Prediction

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
L_{max}
in dB(A)

<	75
75 -	80
80 -	85
85 -	90
90 -	95
95 -	100
>=	100

ACOUSTIC LOGIC

Coffs Harbour Jetty Foreshore Precinct

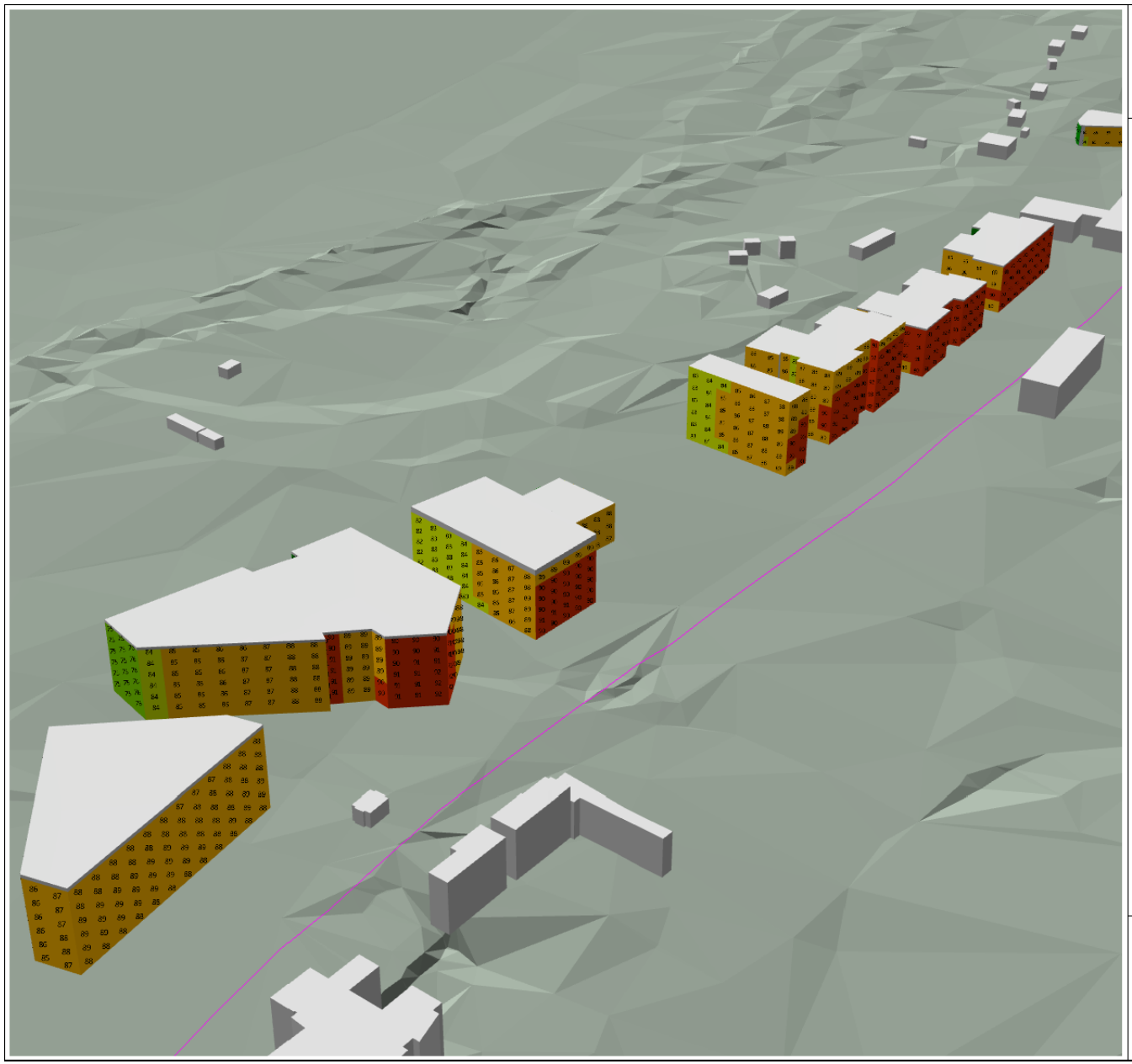
Peak Rail Noise Prediction

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
L_{max}
in dB(A)

<	75
75 -	80
80 -	85
85 -	90
90 -	95
95 -	100
>=	100

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

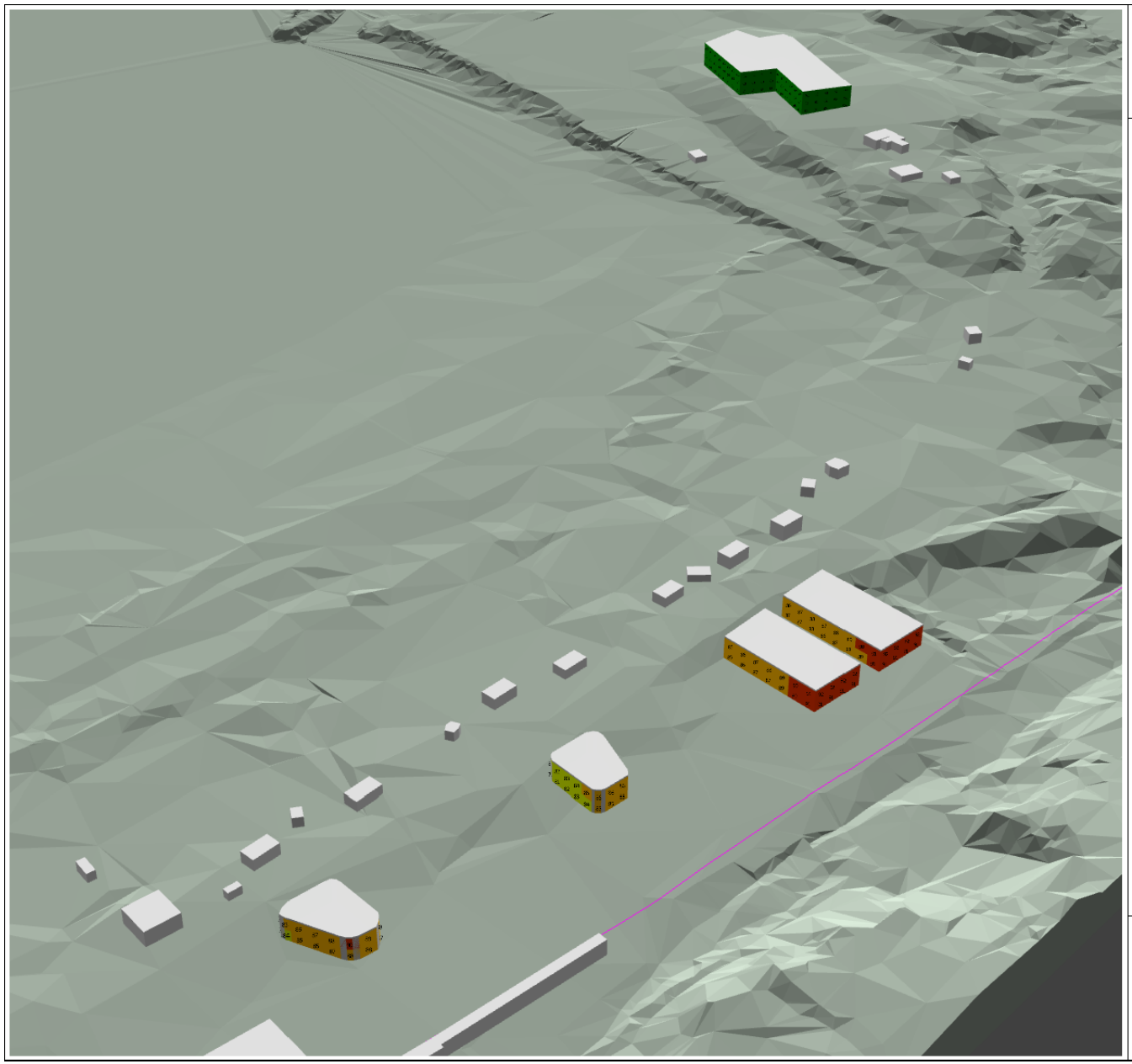
Peak Rail Noise Prediction

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
L_{max}
in dB(A)

<	75
75 -	80
80 -	85
85 -	90
90 -	95
95 -	100
>=	100

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

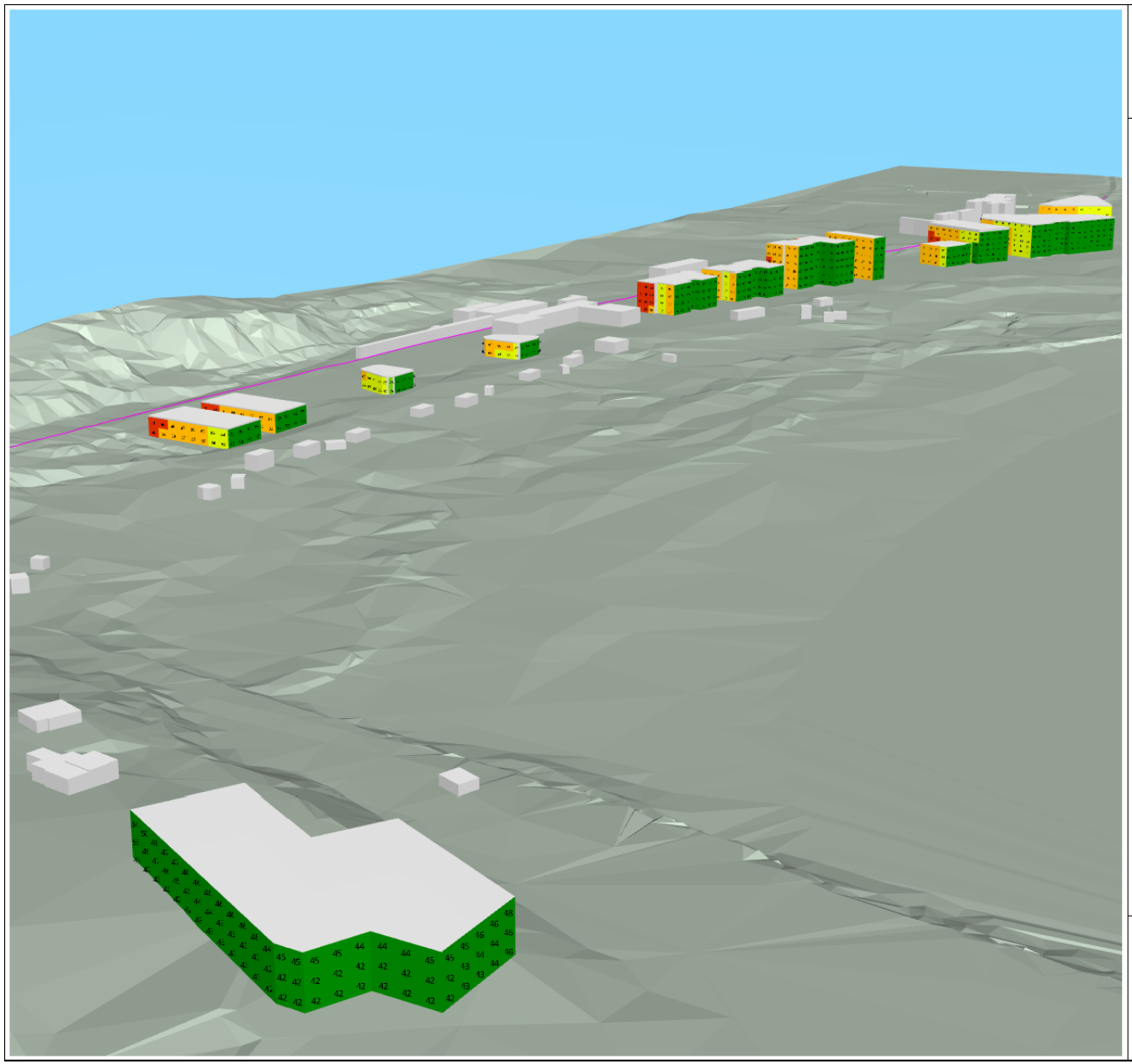
Peak Rail Noise Prediction

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
L_{max}
in dB(A)

<	75
75 -	80
80 -	85
85 -	90
90 -	95
95 -	100
>=	100

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

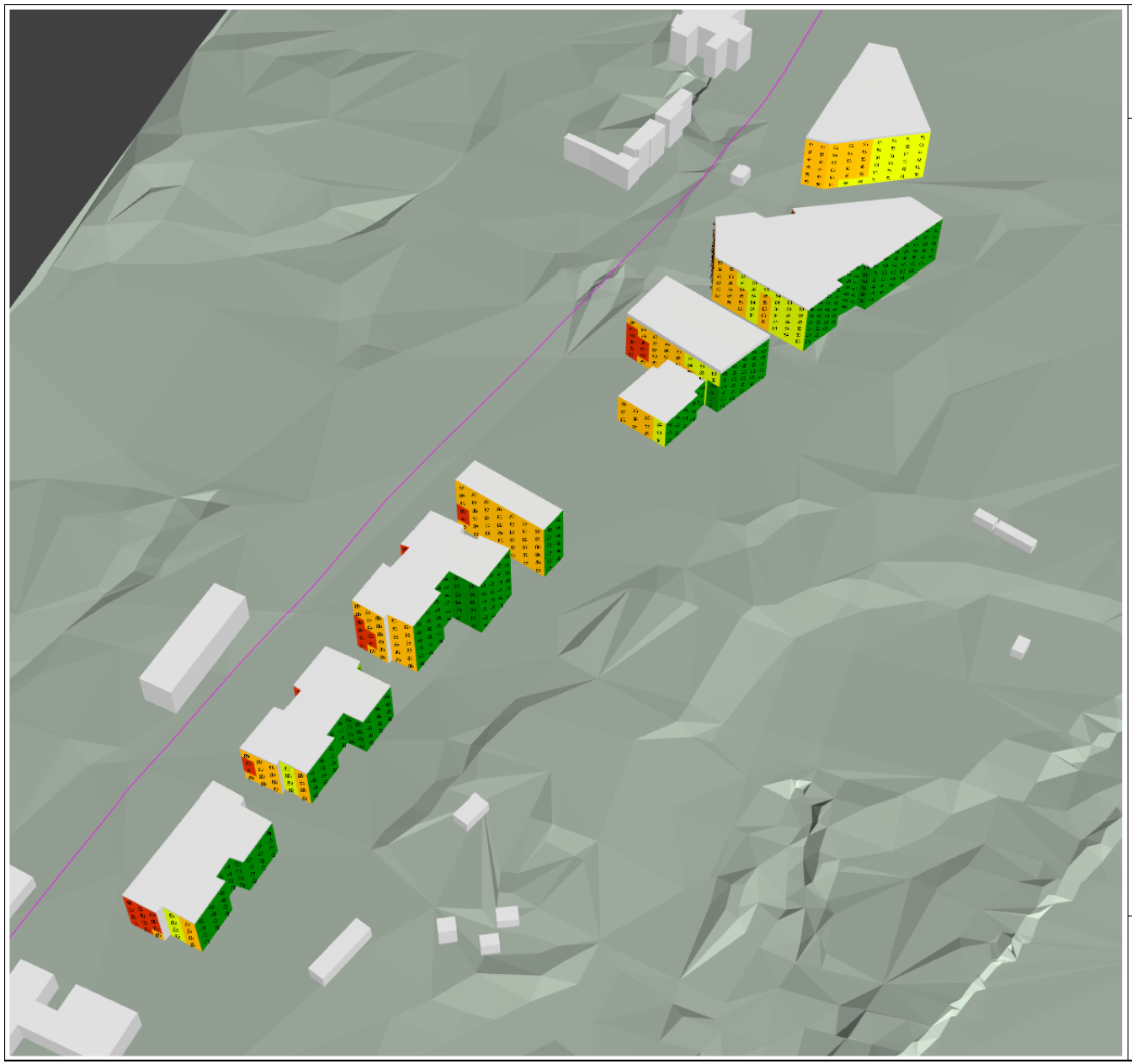
Peak Rail Noise Prediction

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
L_{max}
in dB(A)

	< 75
75	- 80
80	- 85
85	- 90
90	- 95
95	- 100
	>= 100

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

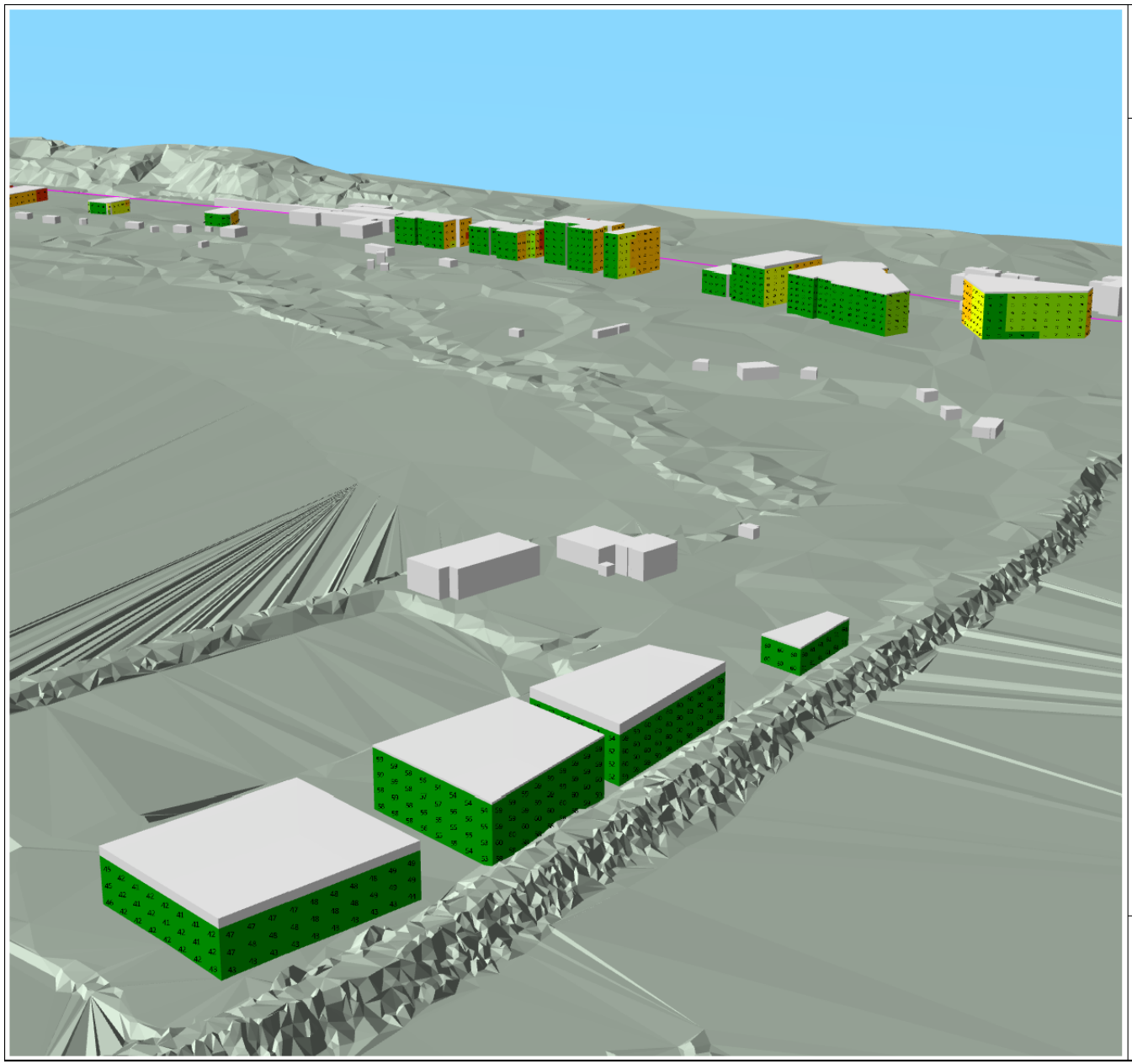
Peak Rail Noise Prediction

Prepared by: A.Zappia
Date: 21/02/2025

Noise Level
L_{max}
in dB(A)

<	75
75 -	80
80 -	85
85 -	90
90 -	95
95 -	100
>=	100

ACOUSTIC LOGIC



Coffs Harbour Jetty Foreshore Precinct

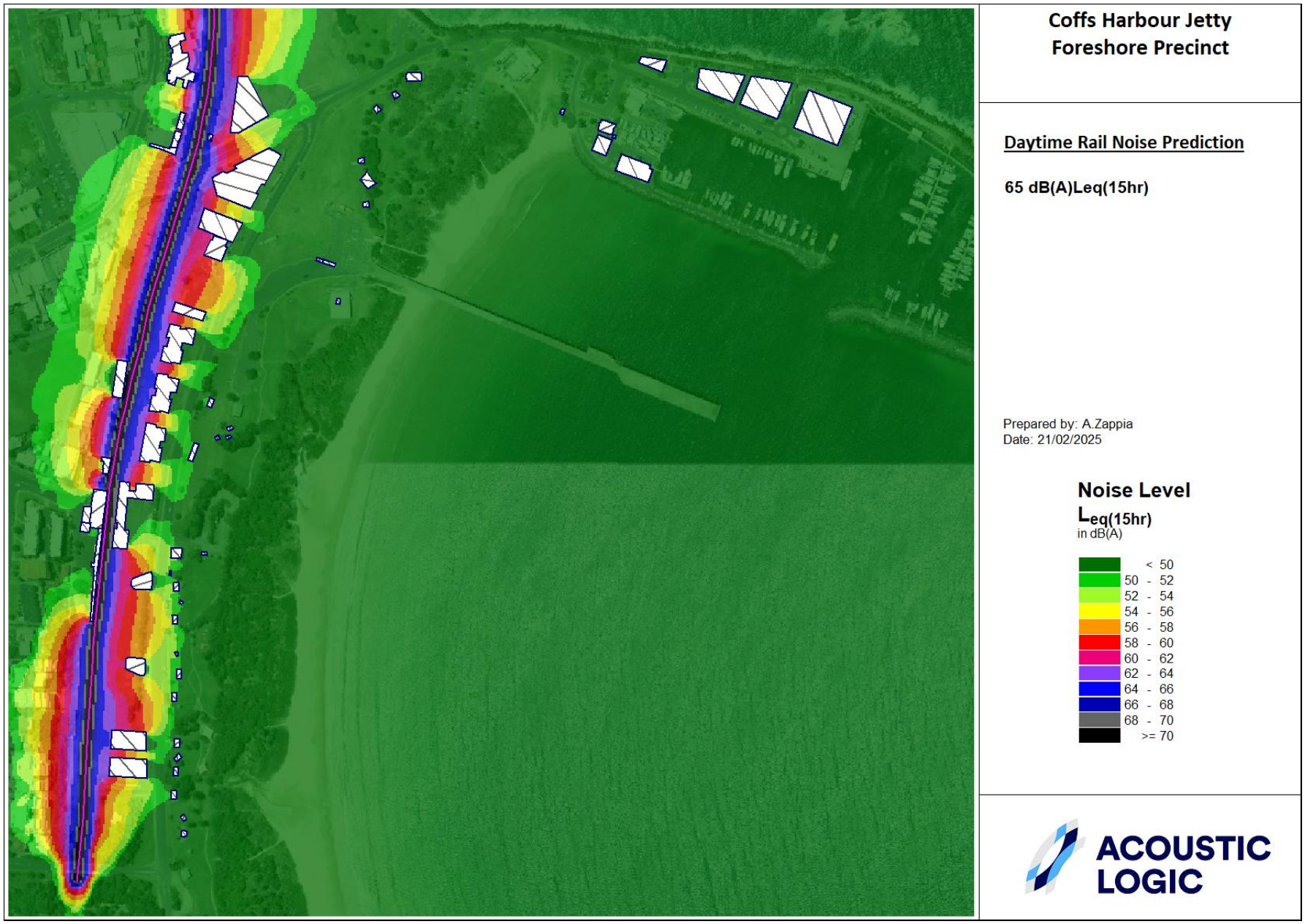
Peak Rail Noise Prediction

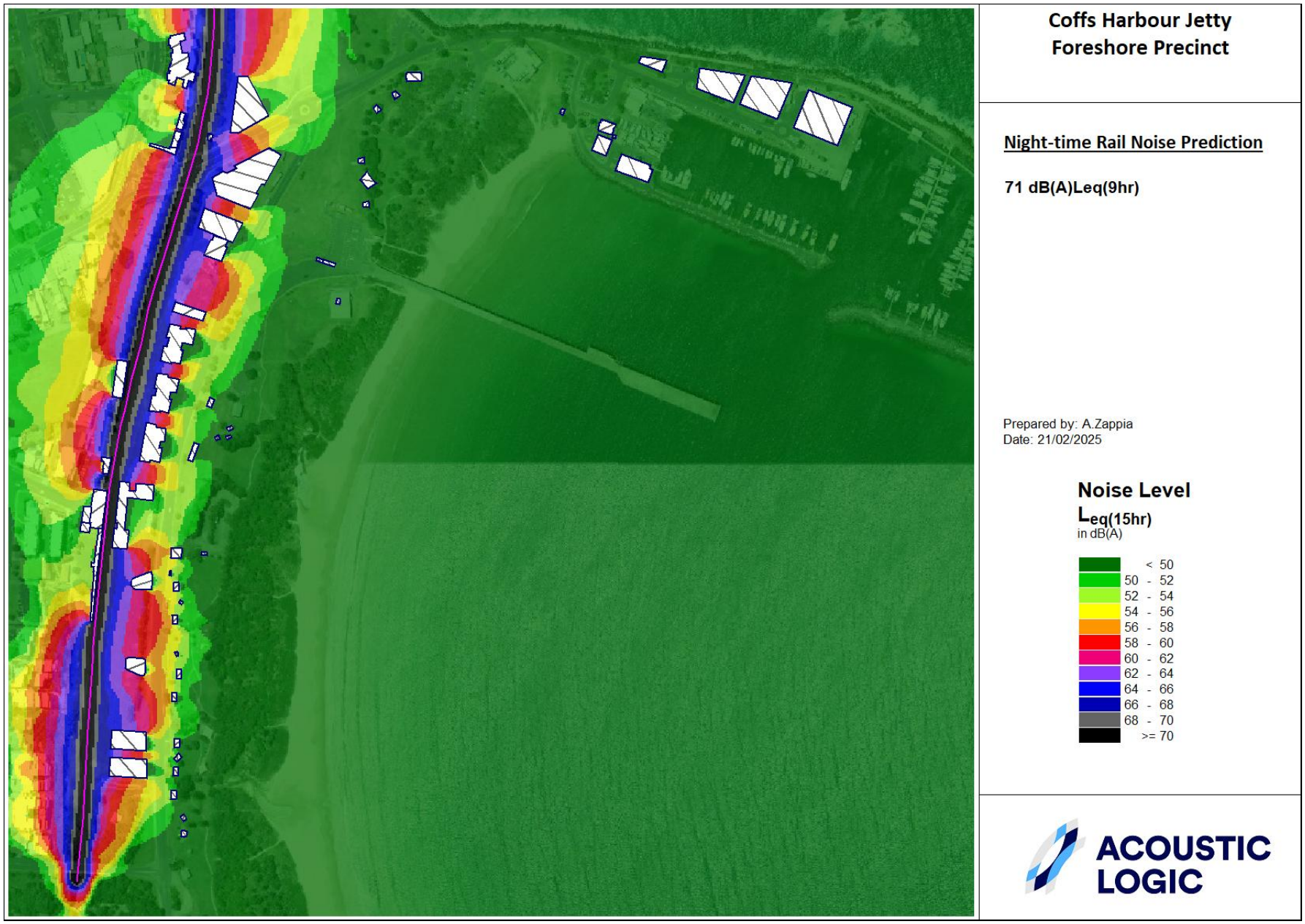
Prepared by: A.Zappia
Date: 21/02/2025

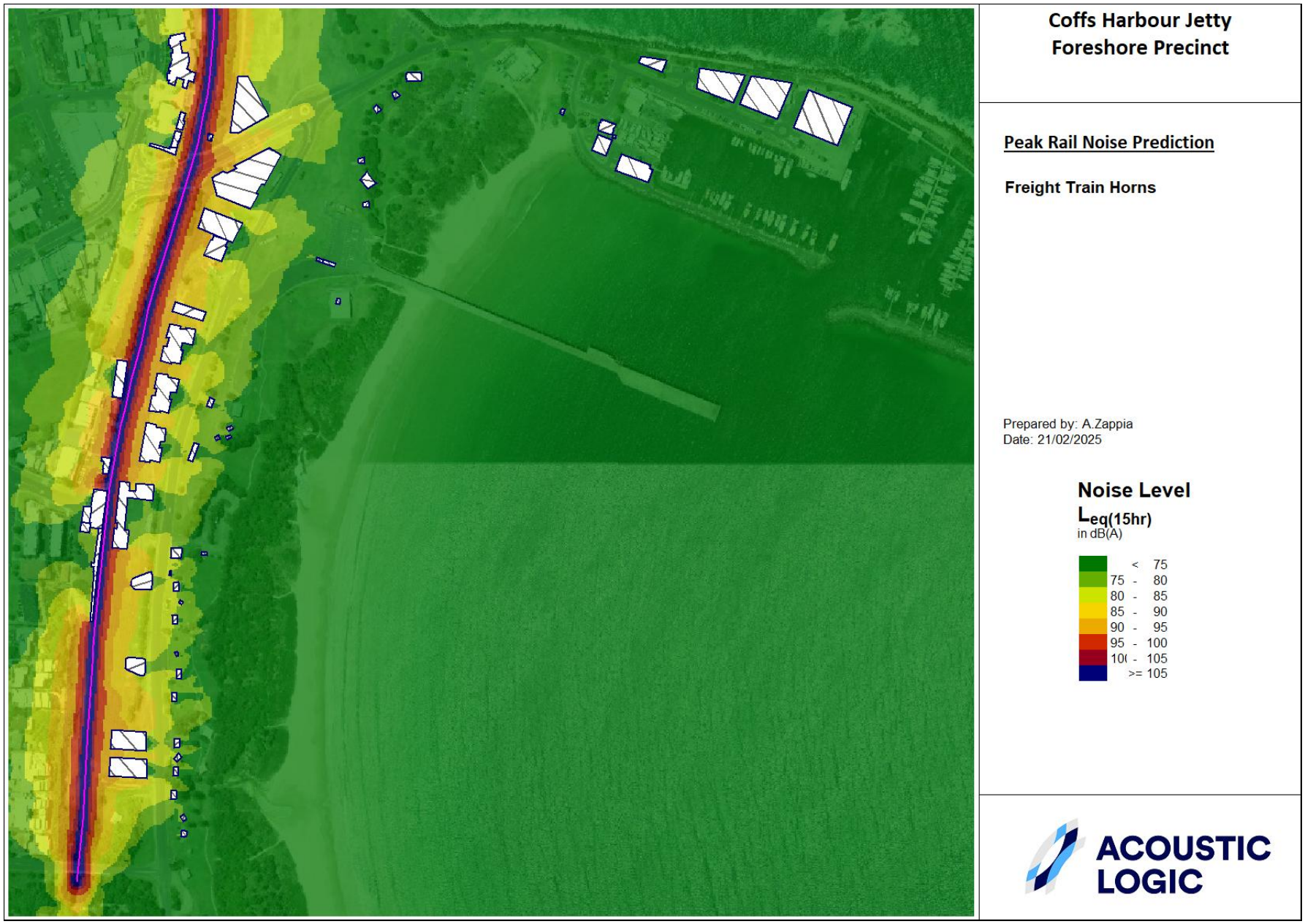
Noise Level
L_{max}
in dB(A)

<	75
75 -	80
80 -	85
85 -	90
90 -	95
95 -	100
>=	100

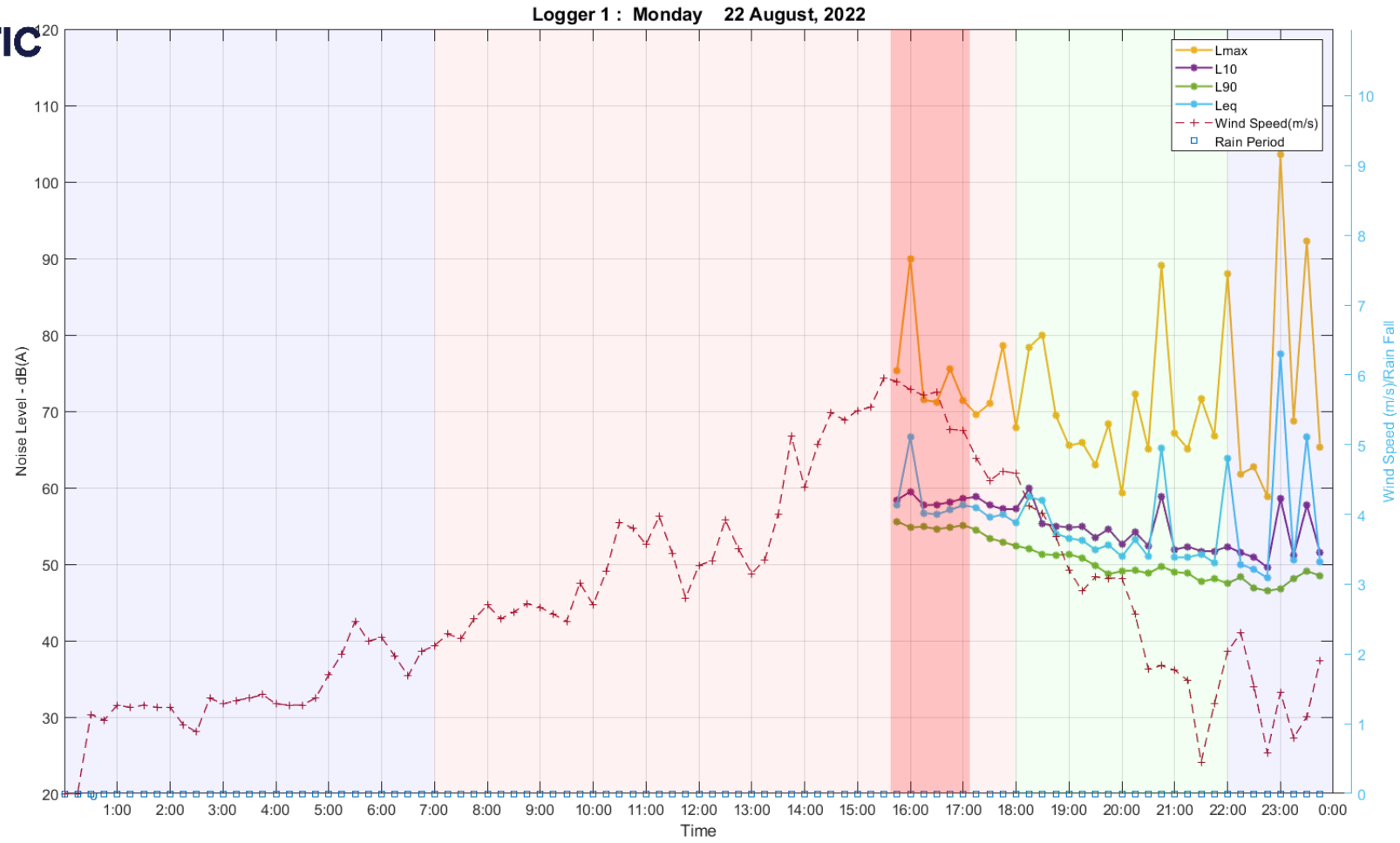
ACOUSTIC LOGIC

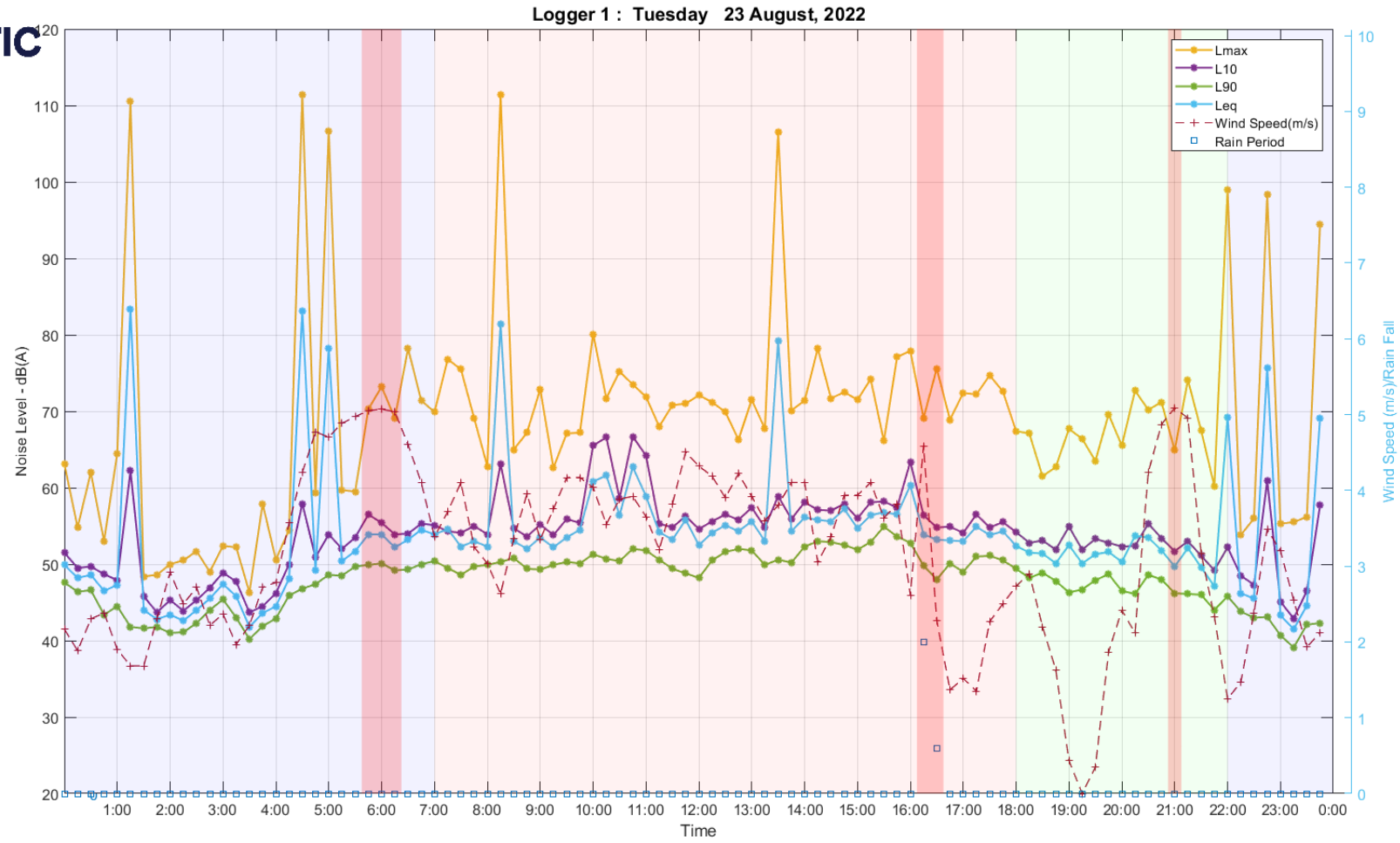

Coffs Harbour Jetty
Foreshore Precinct
Daytime Rail Noise Prediction
65 dB(A)Leq(15hr)
Prepared by: A.Zappia
Date: 21/02/2025
Noise Level
Leq(15hr)
in dB(A)
< 50
50 - 52
52 - 54
54 - 56
56 - 58
58 - 60
60 - 62
62 - 64
64 - 66
66 - 68
68 - 70
>= 70
ACOUSTIC
LOGIC

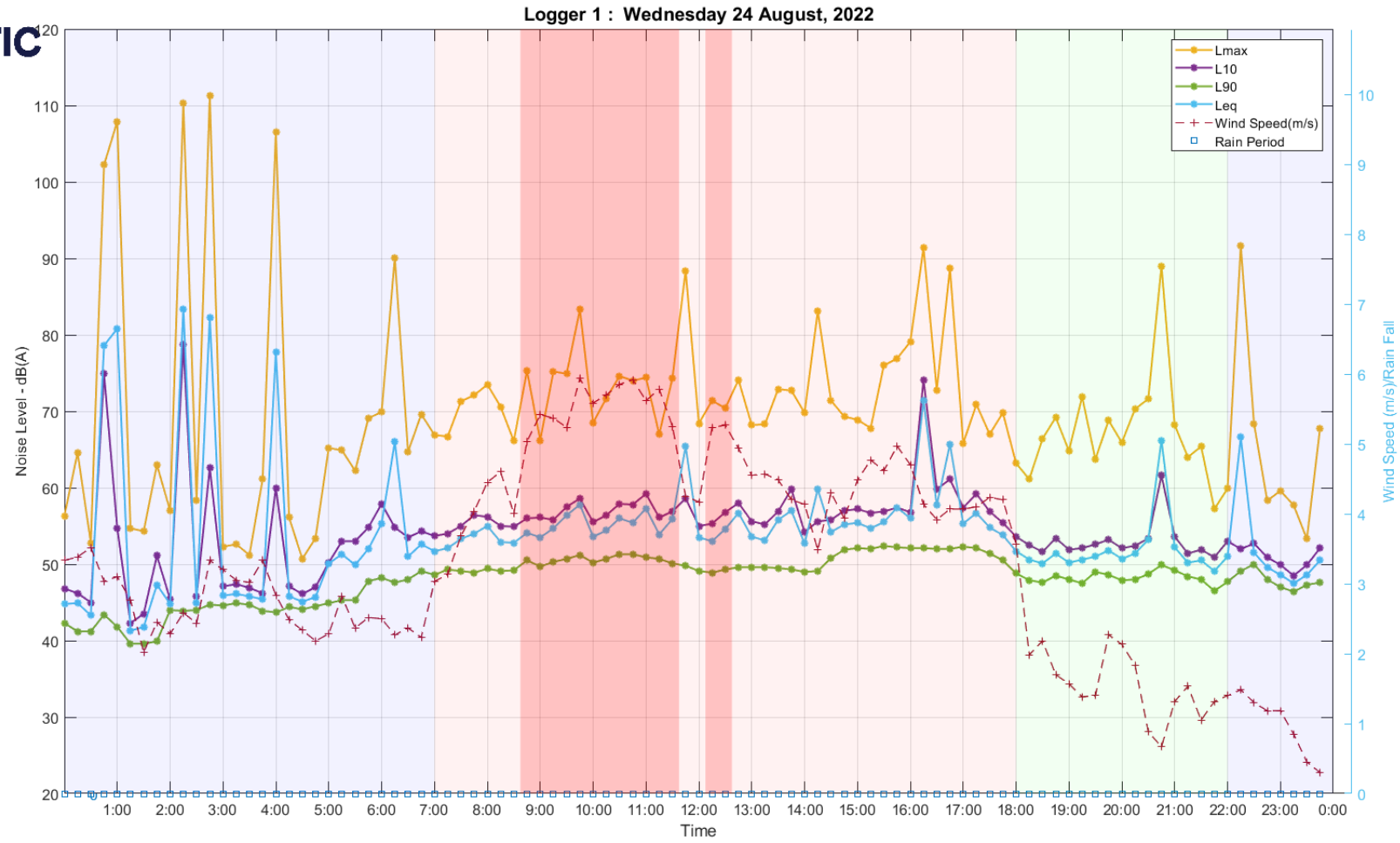

Coffs Harbour Jetty
Foreshore Precinct
Night-time Rail Noise Prediction
71 dB(A)Leq(9hr)
Prepared by: A.Zappia
Date: 21/02/2025
Noise Level
Leq(15hr)
in dB(A)
< 50
50 - 52
52 - 54
54 - 56
56 - 58
58 - 60
60 - 62
62 - 64
64 - 66
66 - 68
68 - 70
>= 70
ACOUSTIC
LOGIC

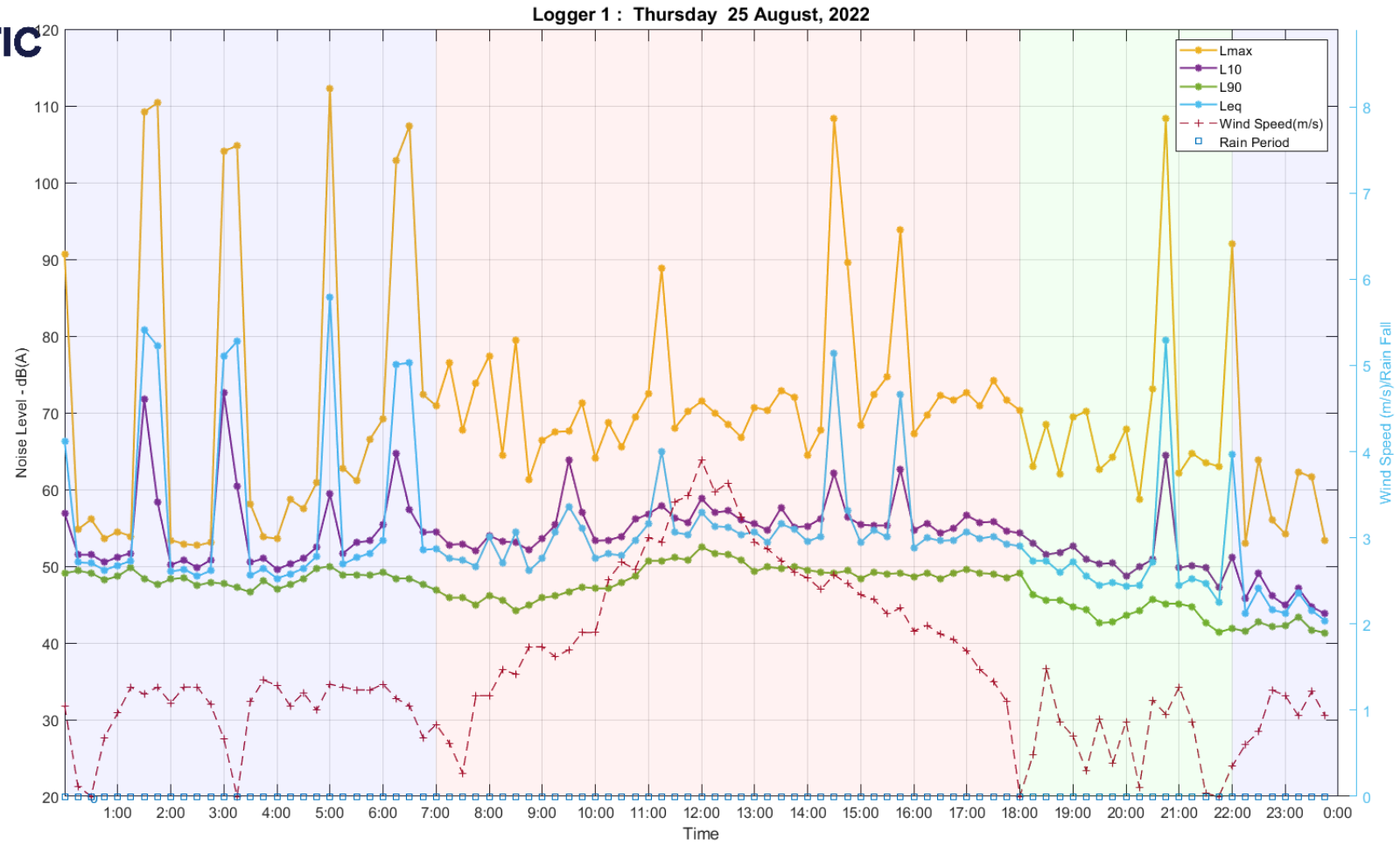

Coffs Harbour Jetty
Foreshore Precinct
Peak Rail Noise Prediction
Freight Train Horns
Prepared by: A.Zappia
Date: 21/02/2025
Noise Level
Leq(15hr)
in dB(A)
< 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
10(- 105
>= 105
ACOUSTIC
LOGIC

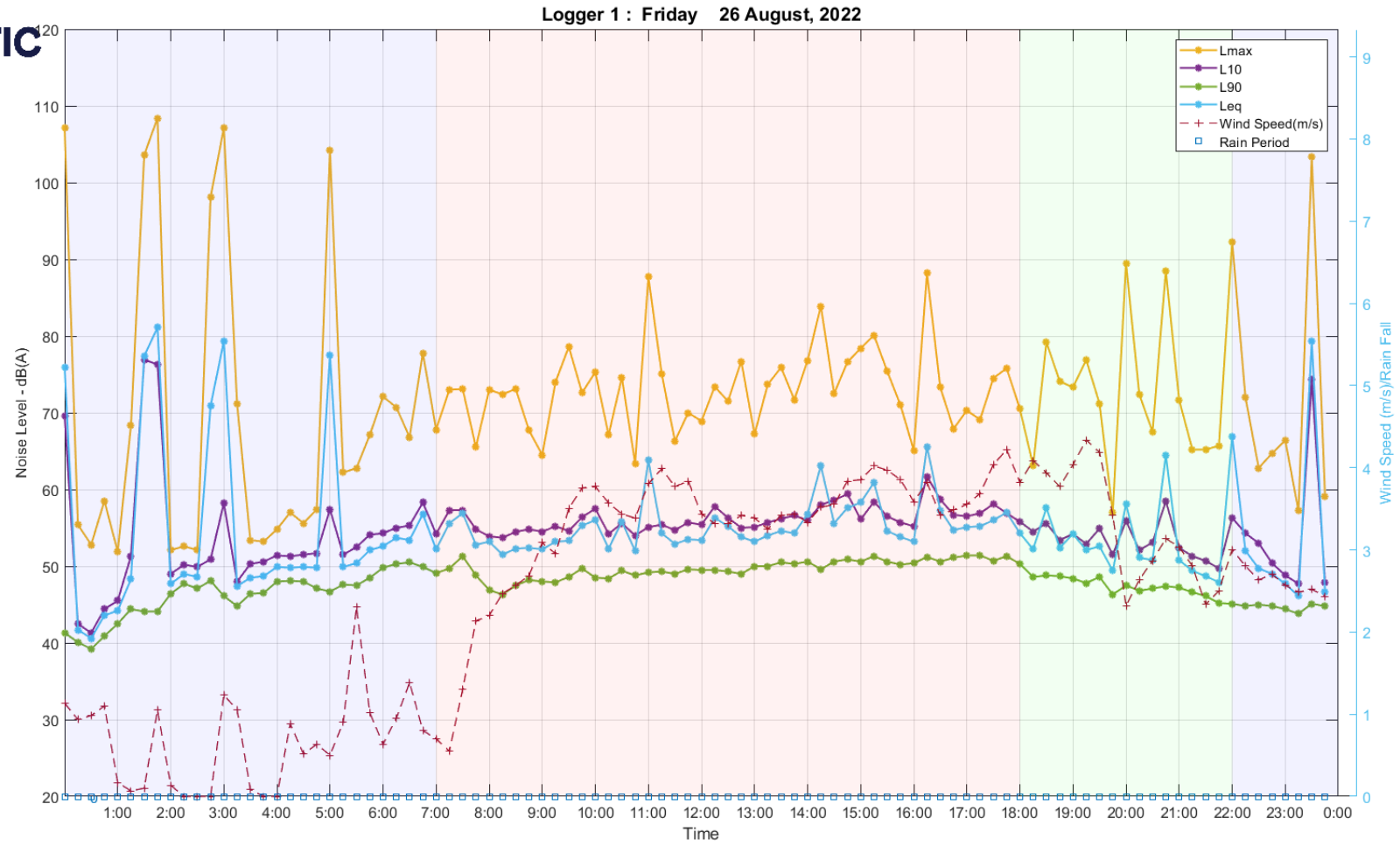
APPENDIX B – UNATTENDED NOISE MONITORING RESULTS

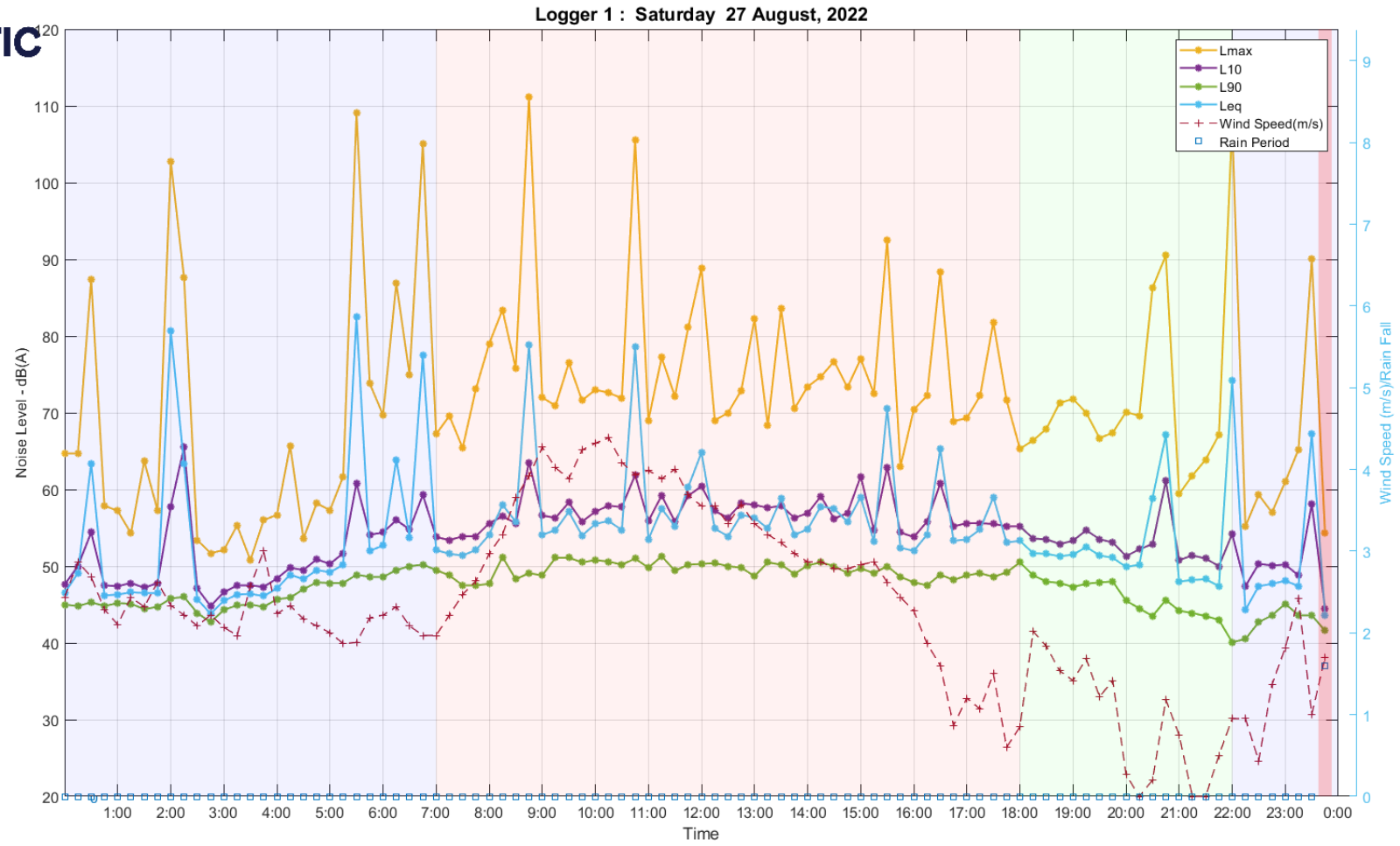

Logger 1 : Monday 22 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00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


Logger 1 : Tuesday 23 August, 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
50
40
30
20
10
9
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00


Logger 1 : Wednesday 24 August, 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
50
40
30
20
10
9
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00


Logger 1 : Thursday 25 August, 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
50
40
30
20
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00


Logger 1 : Friday 26 August, 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
50
40
30
20
9
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00


Logger 1 : Saturday 27 August, 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
50
40
30
20
9
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
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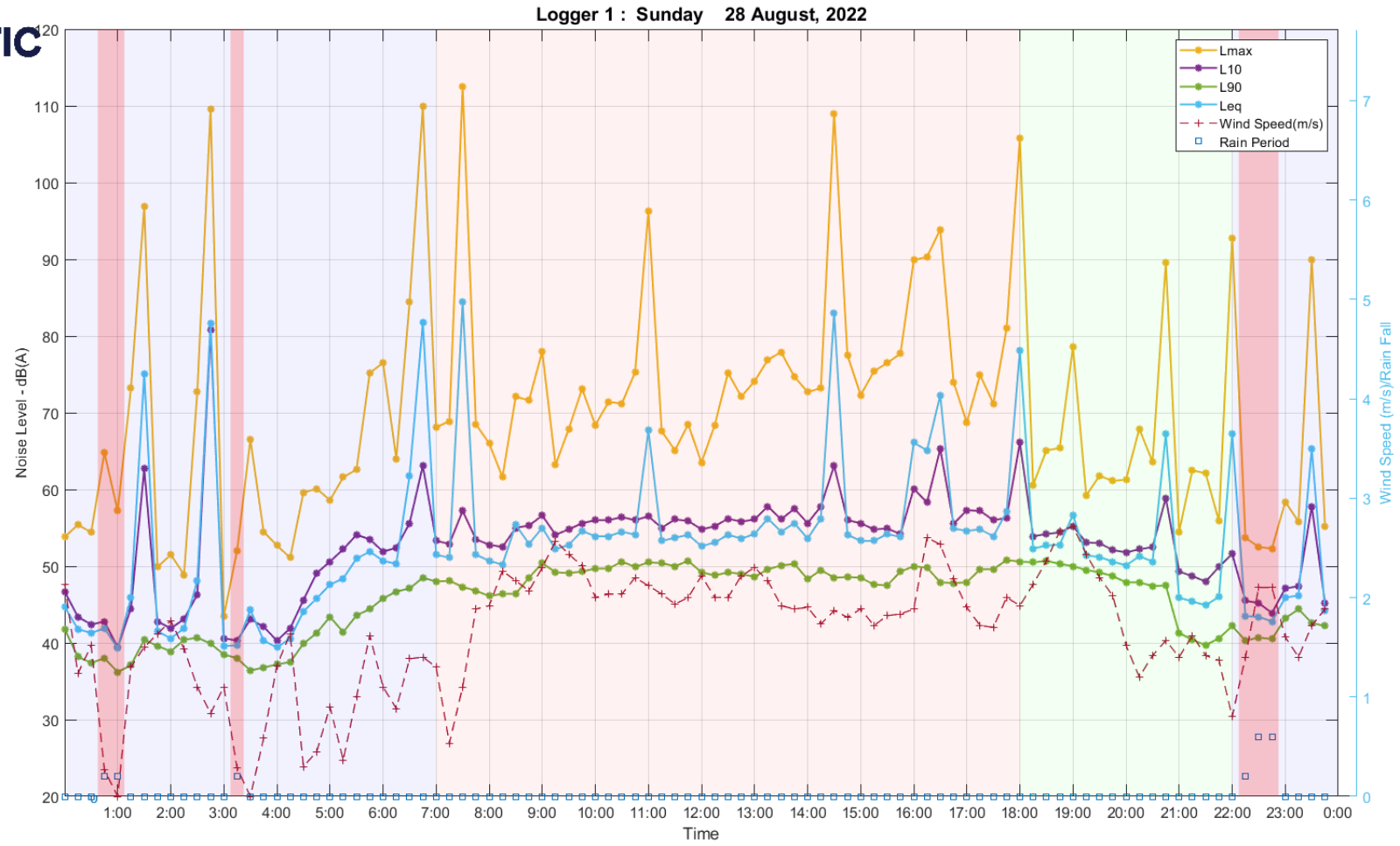
Logger 1 : Sunday 28 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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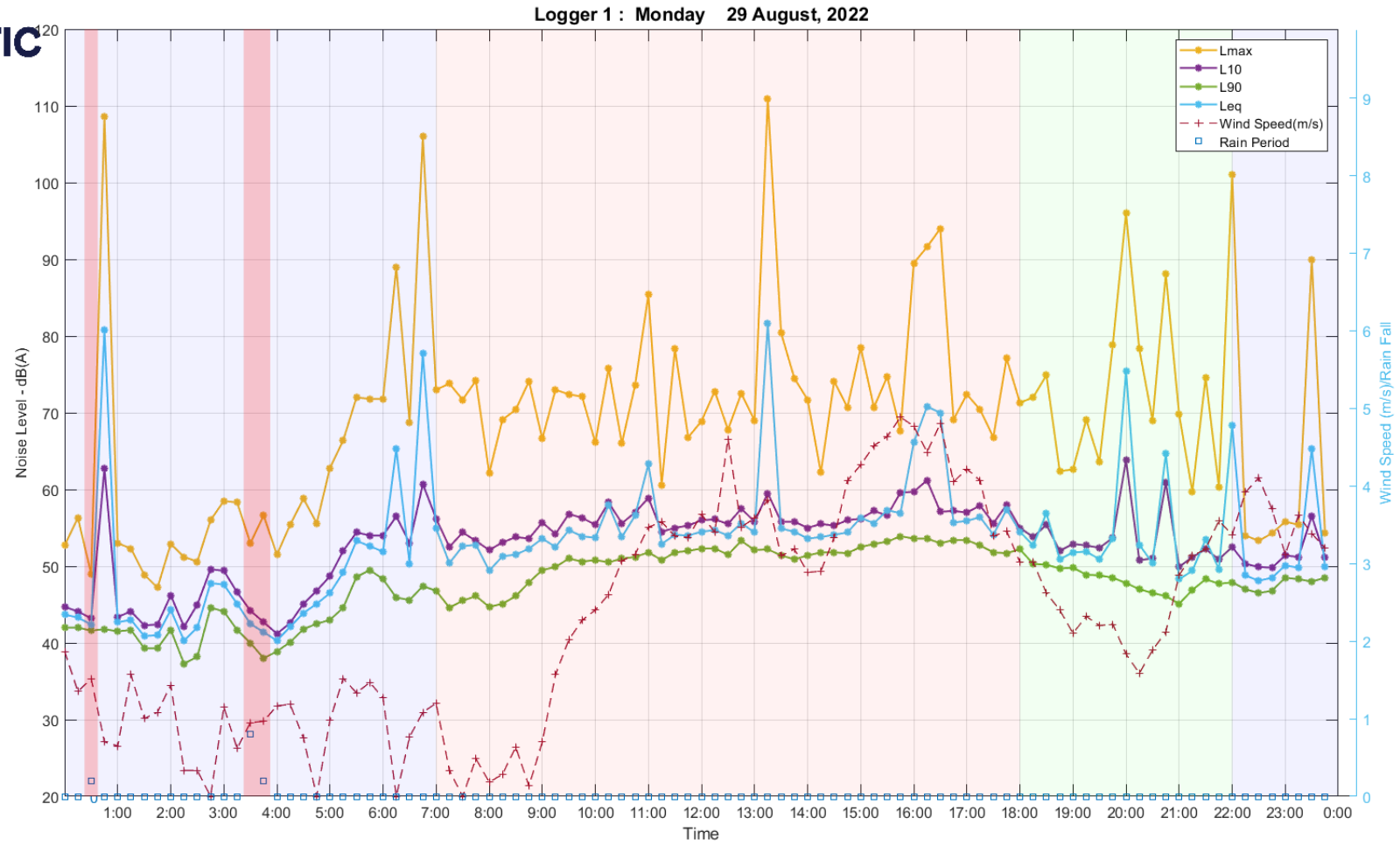
Logger 1 : Monday 29 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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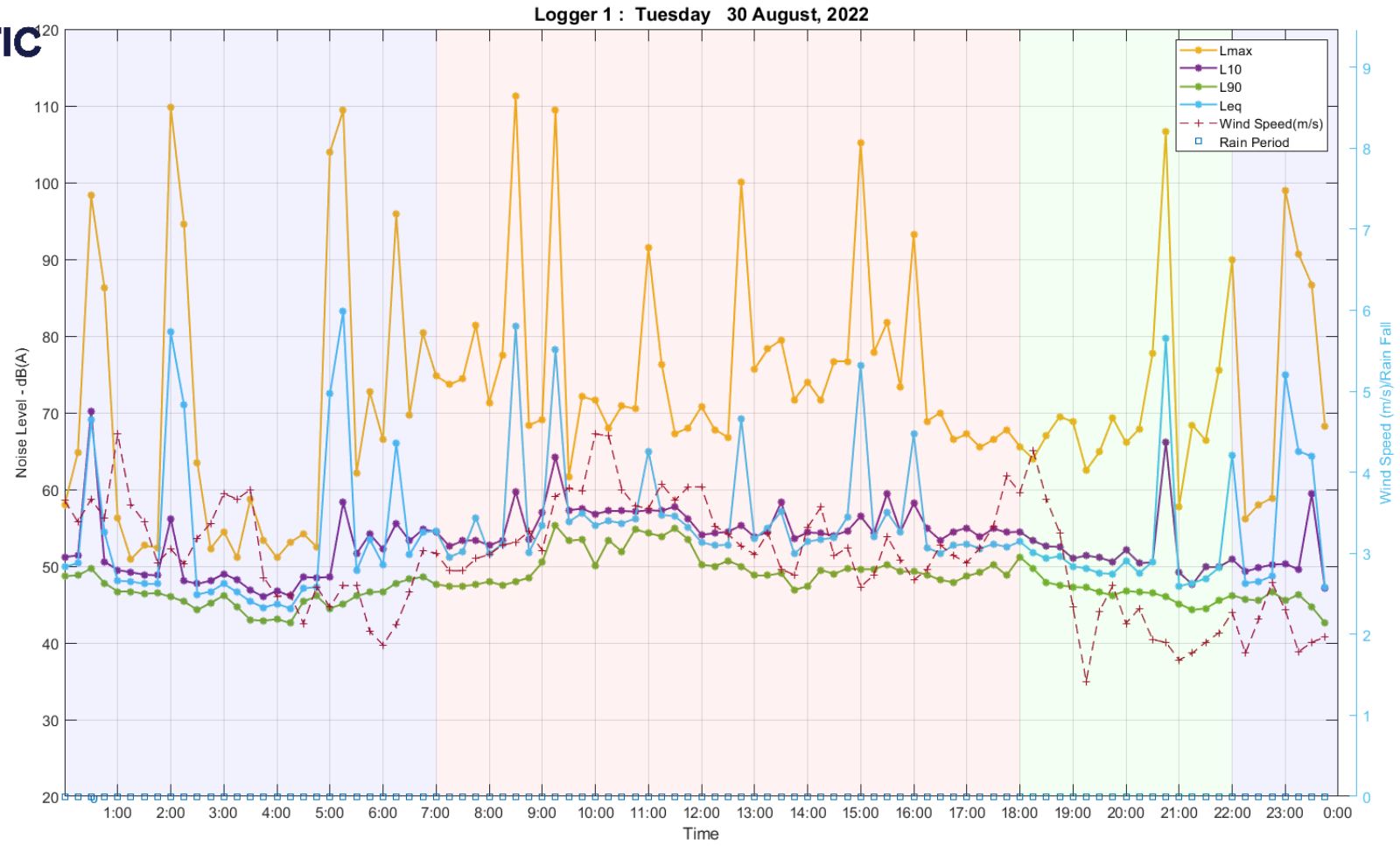
Logger 1 : Tuesday 30 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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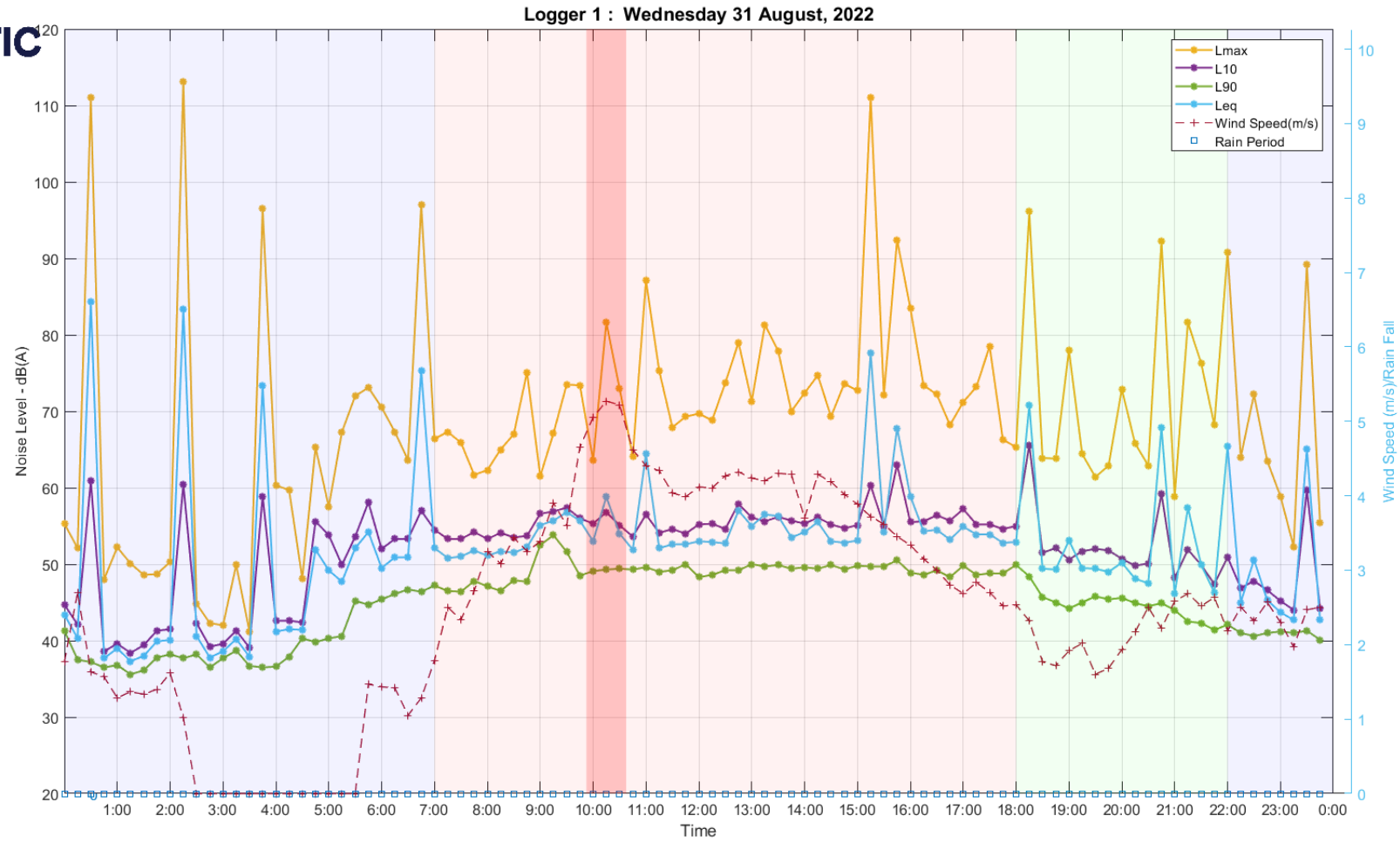
Logger 1 : Wednesday 31 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
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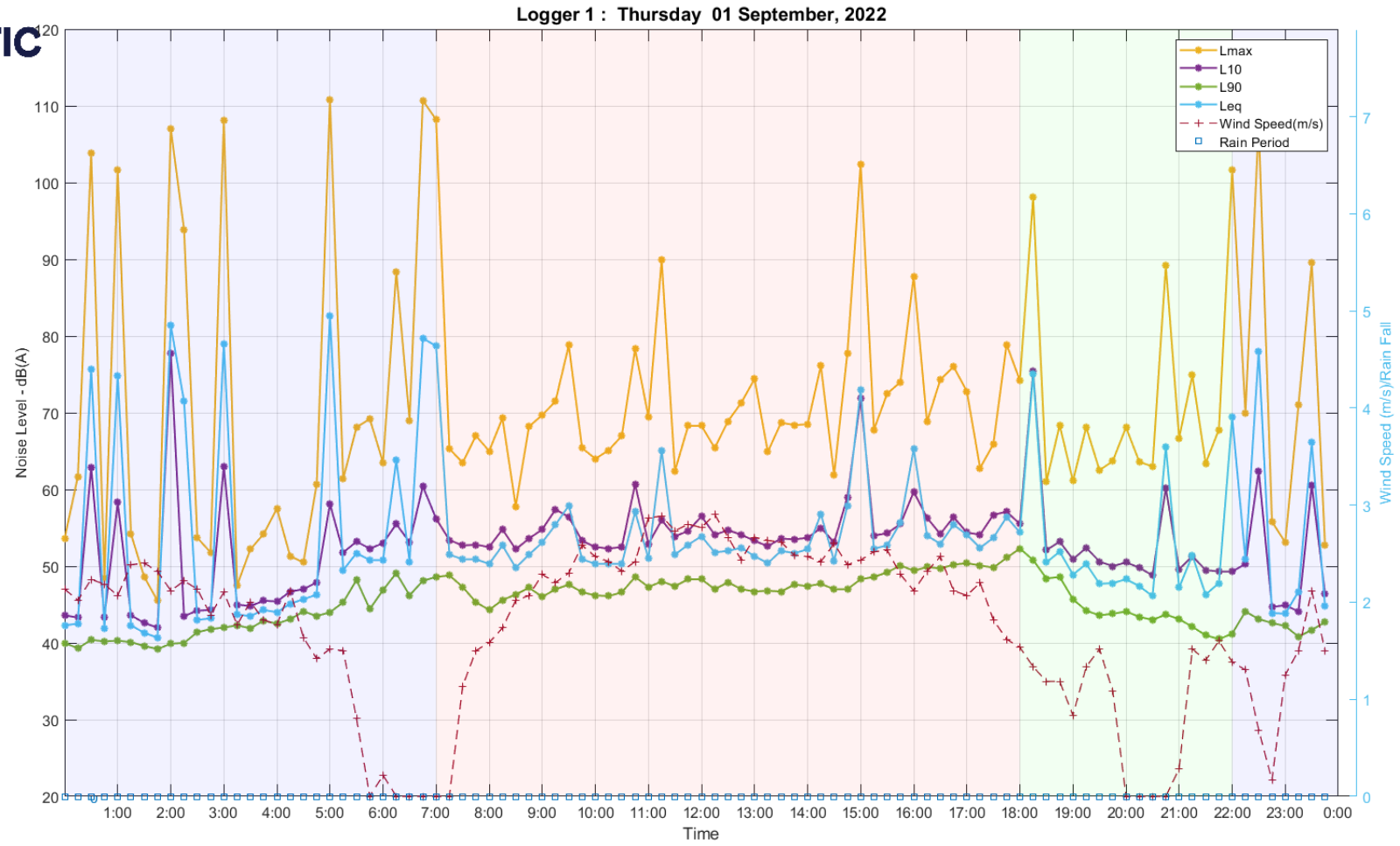
Logger 1 : Thursday 01 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
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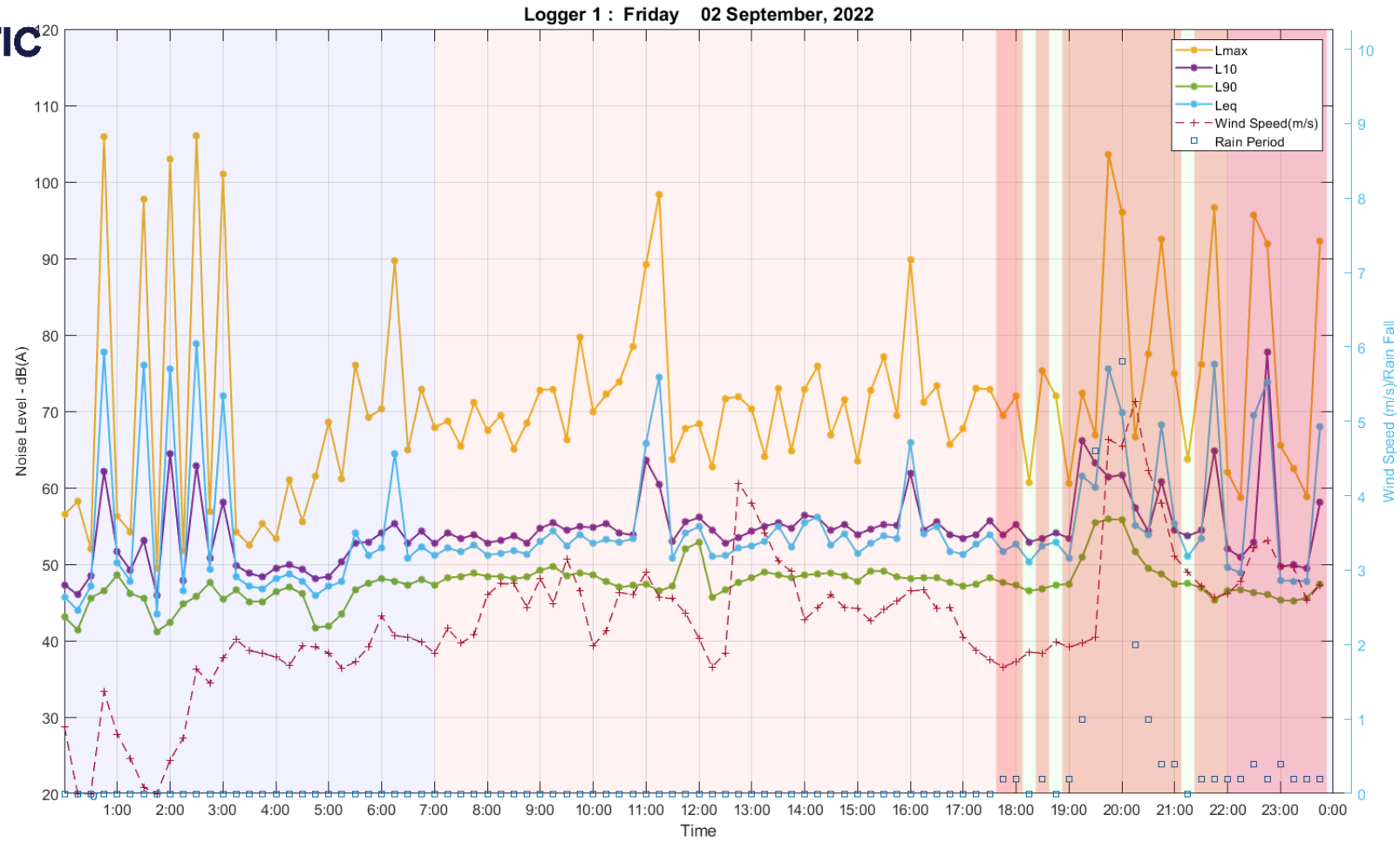
Logger 1 : Friday 02 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
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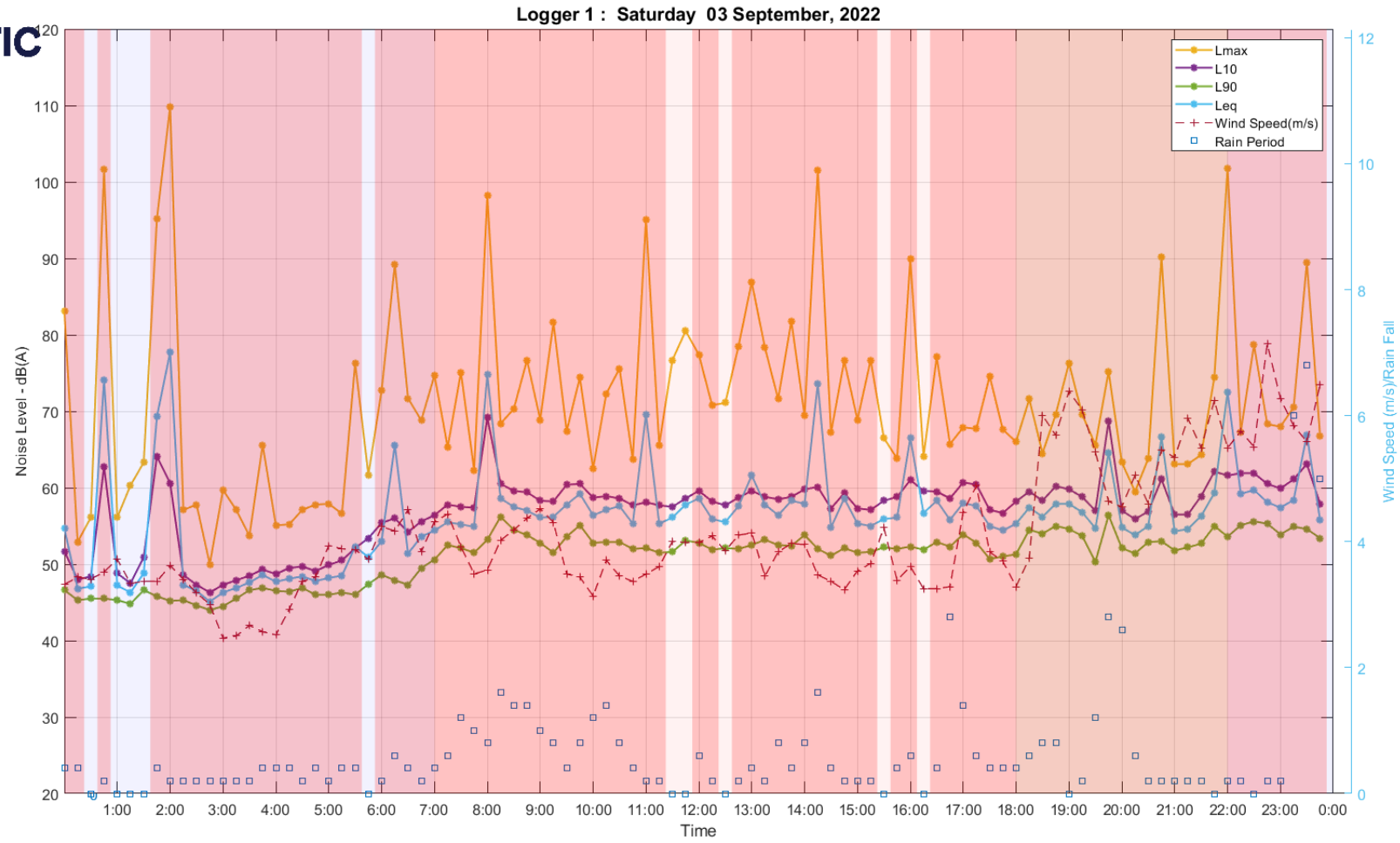
Logger 1 : Saturday 03 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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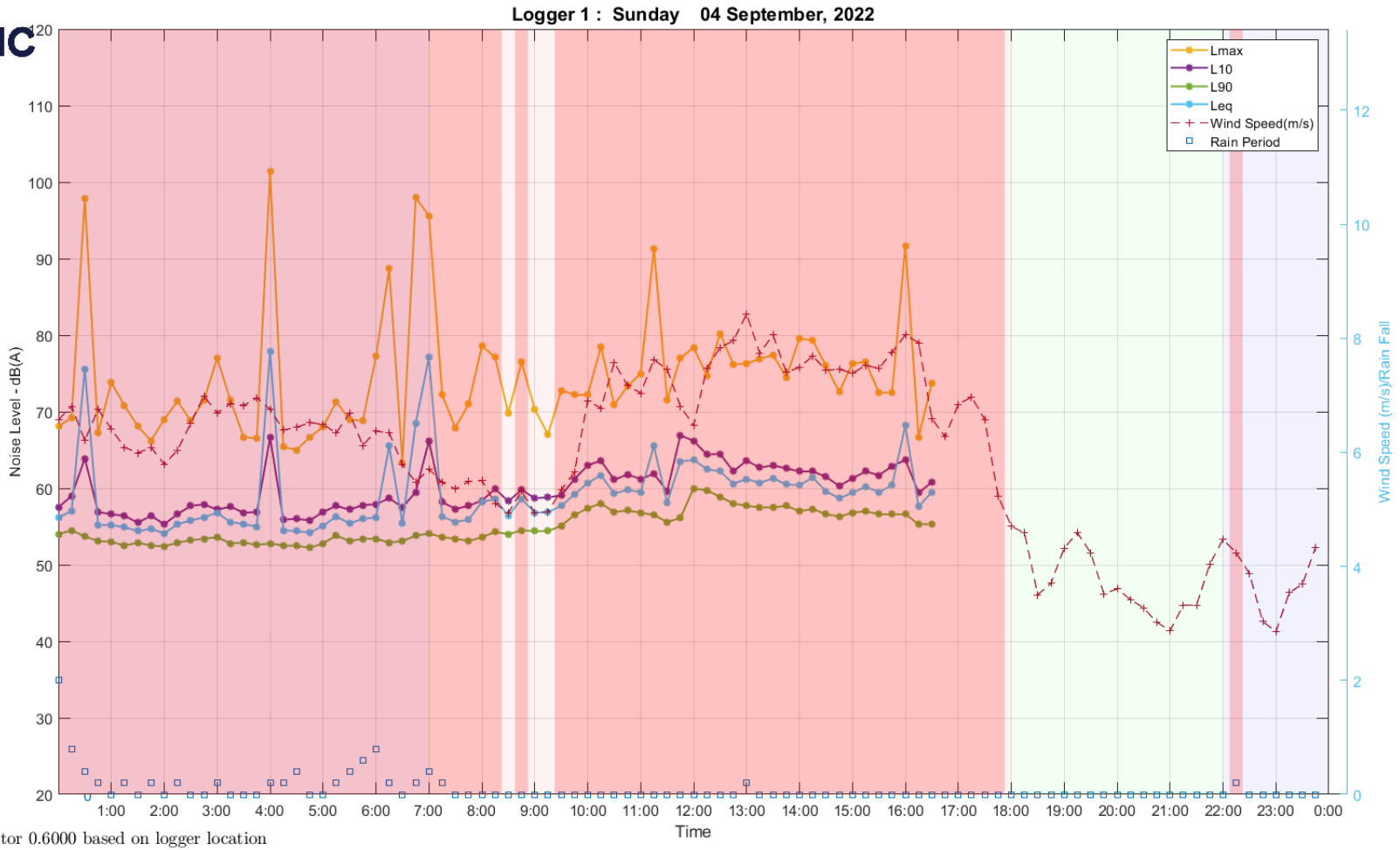
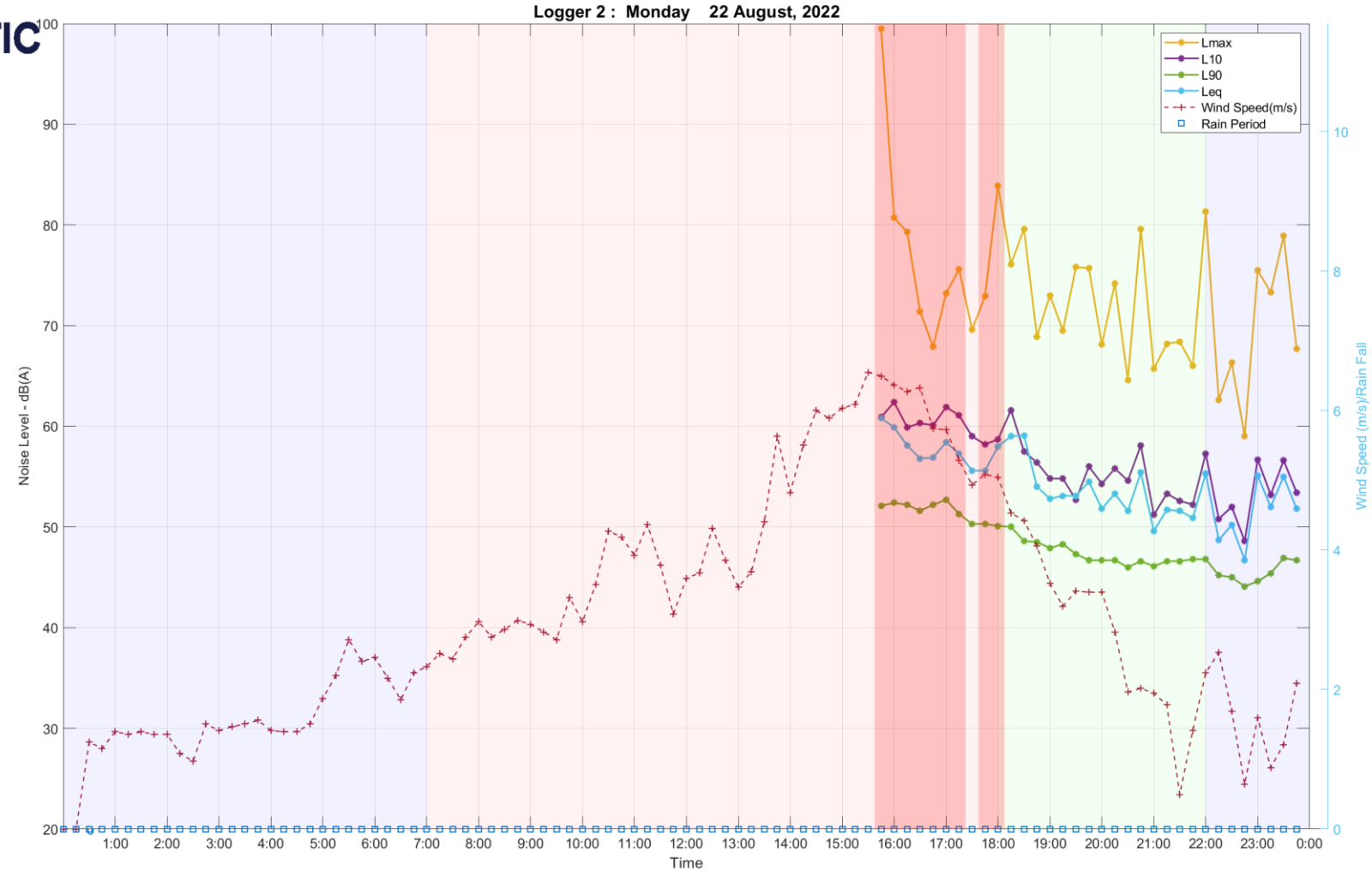


Wind Speed is corrected using factor 0.6000 based on logger location


Logger 2 : Monday 22 August, 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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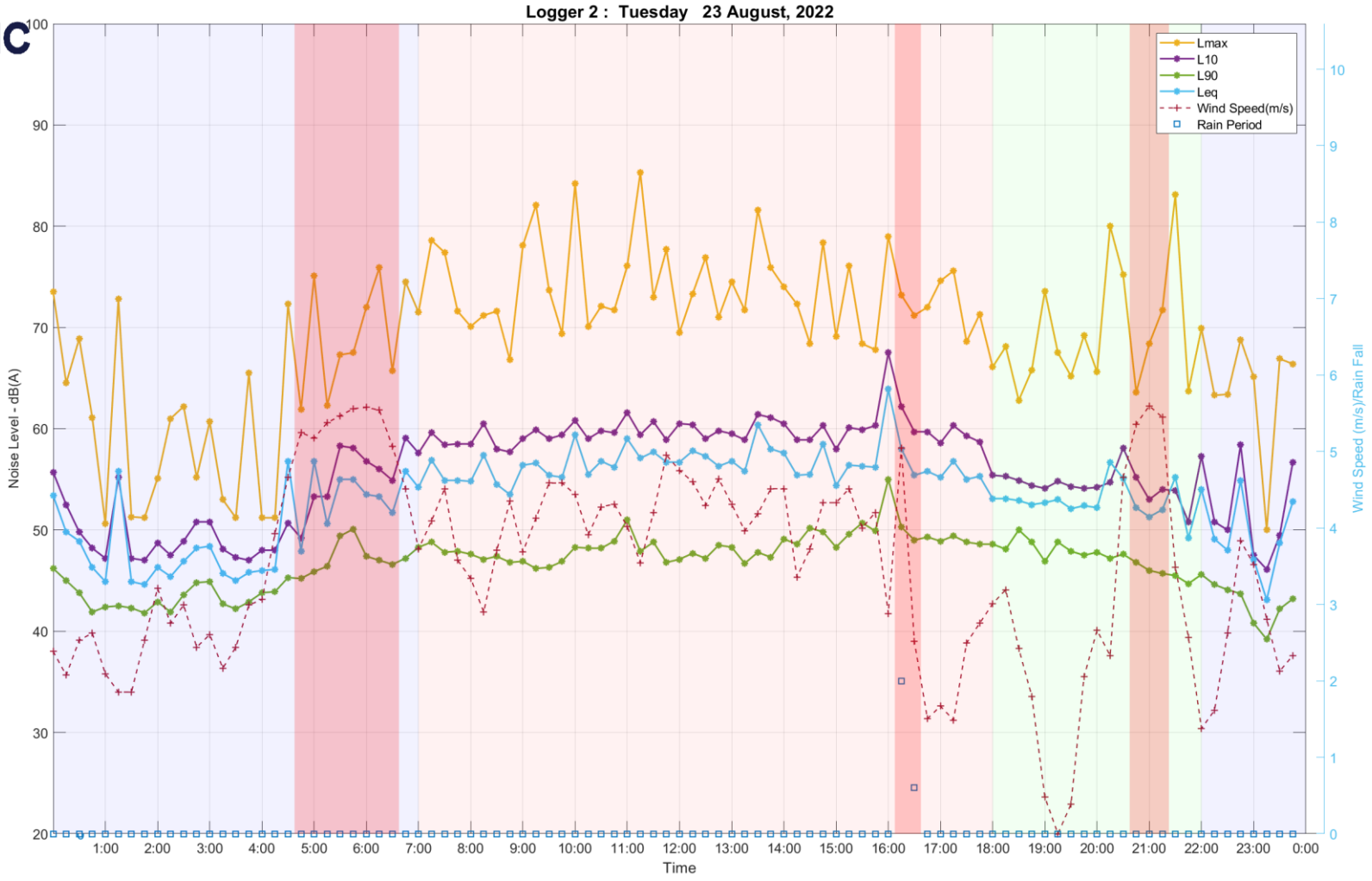
Logger 2 : Tuesday 23 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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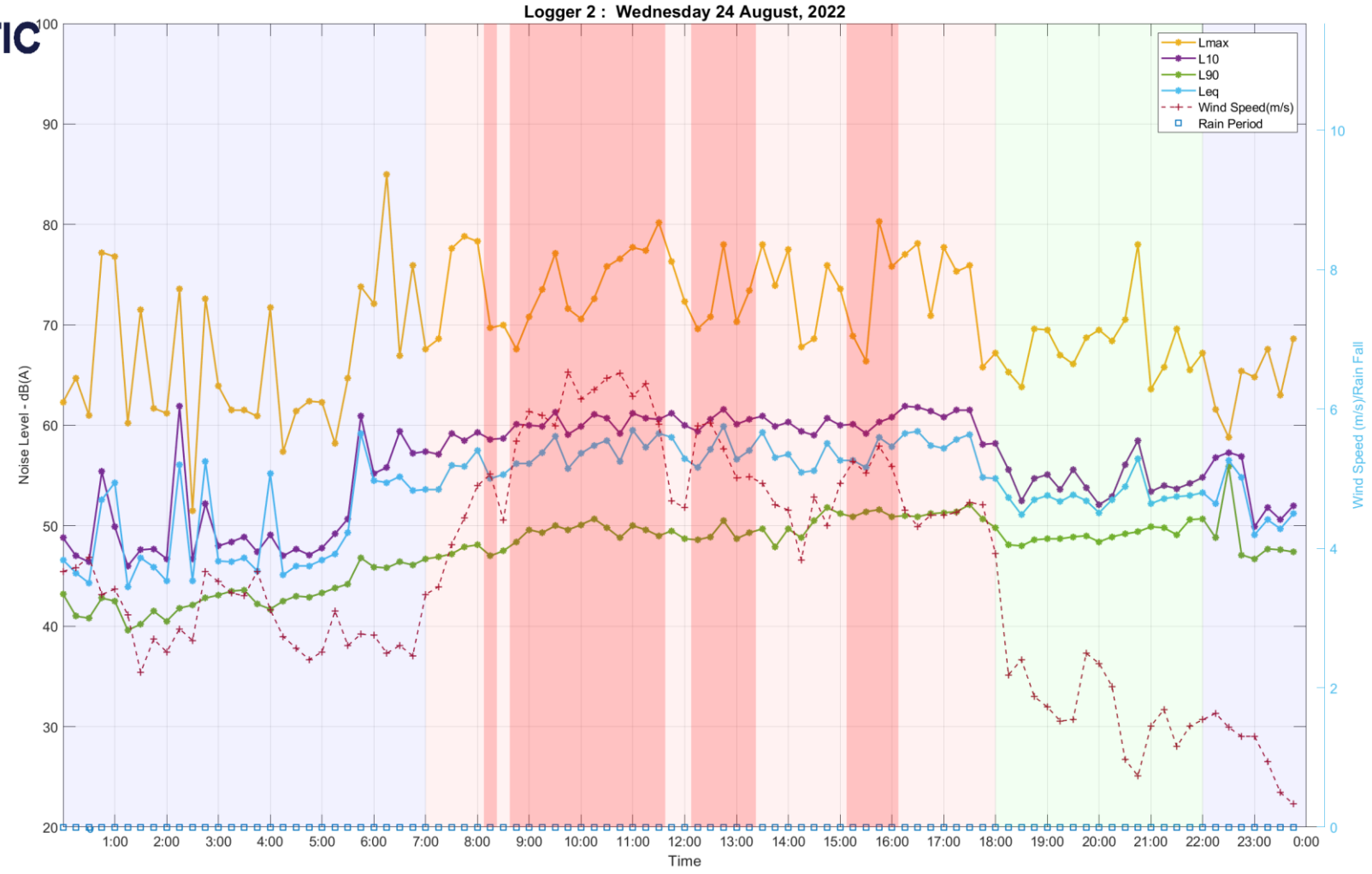
Logger 2 : Wednesday 24 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
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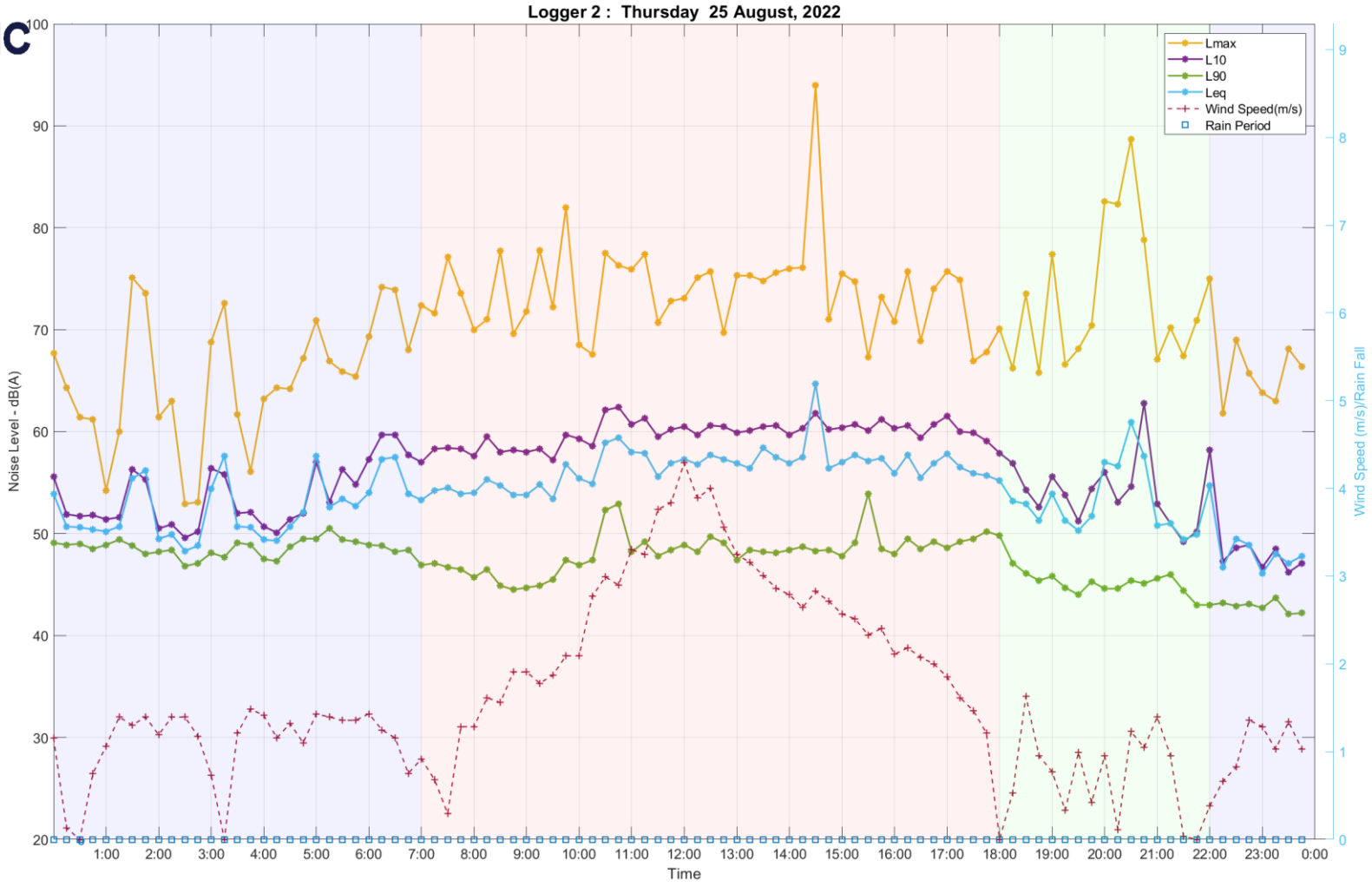
Logger 2 : Thursday 25 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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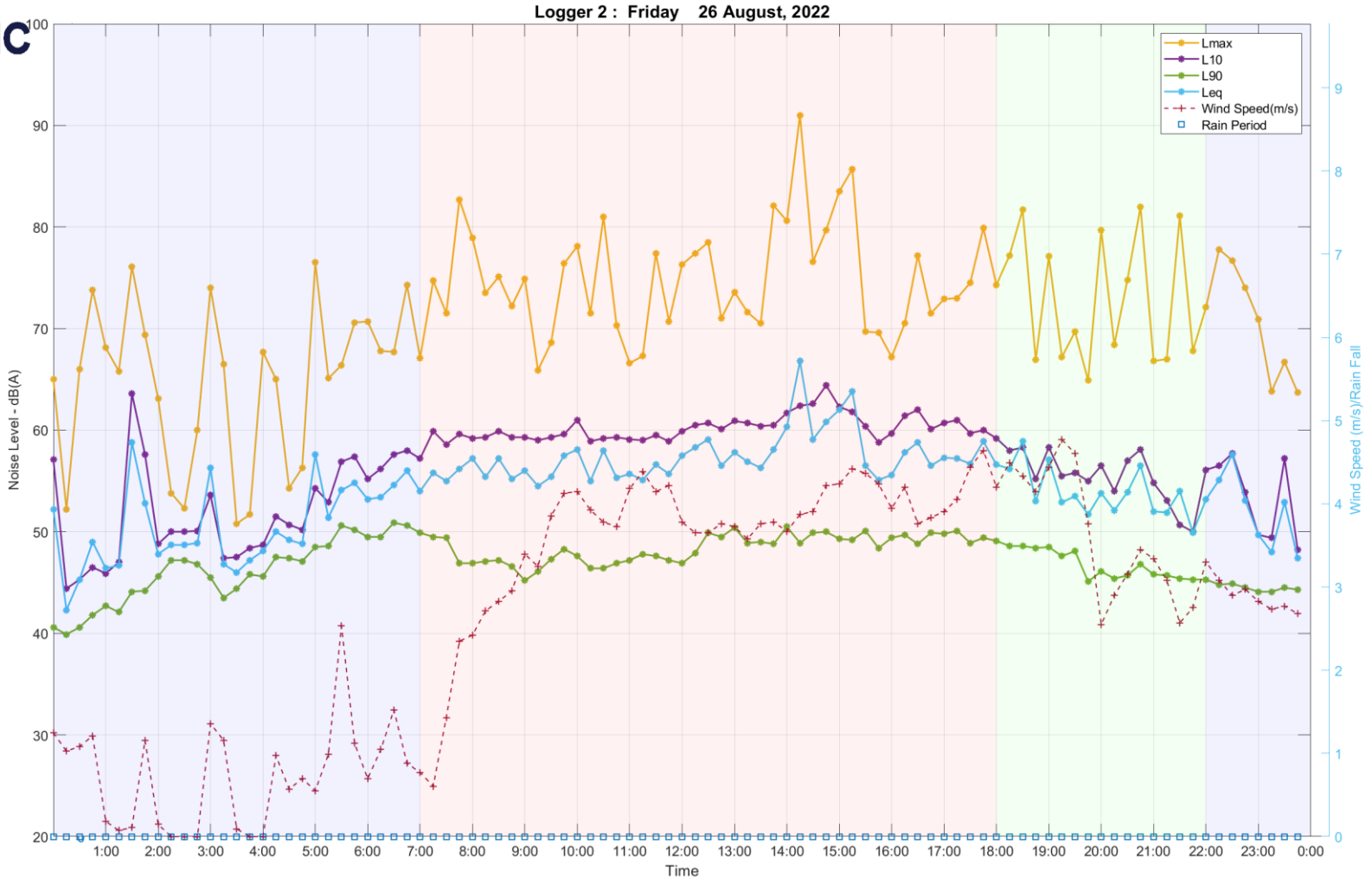
Logger 2 : Friday 26 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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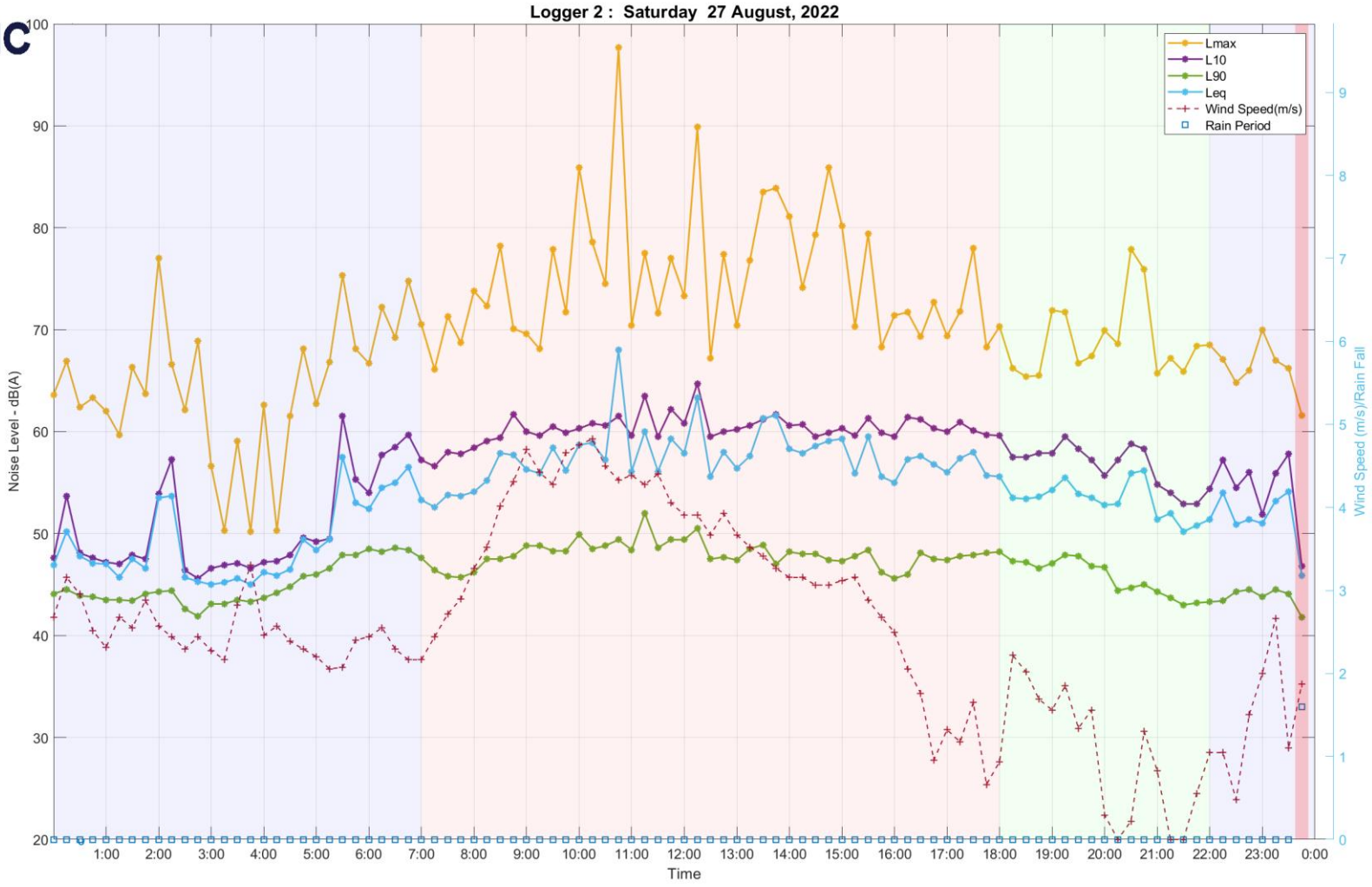
Logger 2 : Saturday 27 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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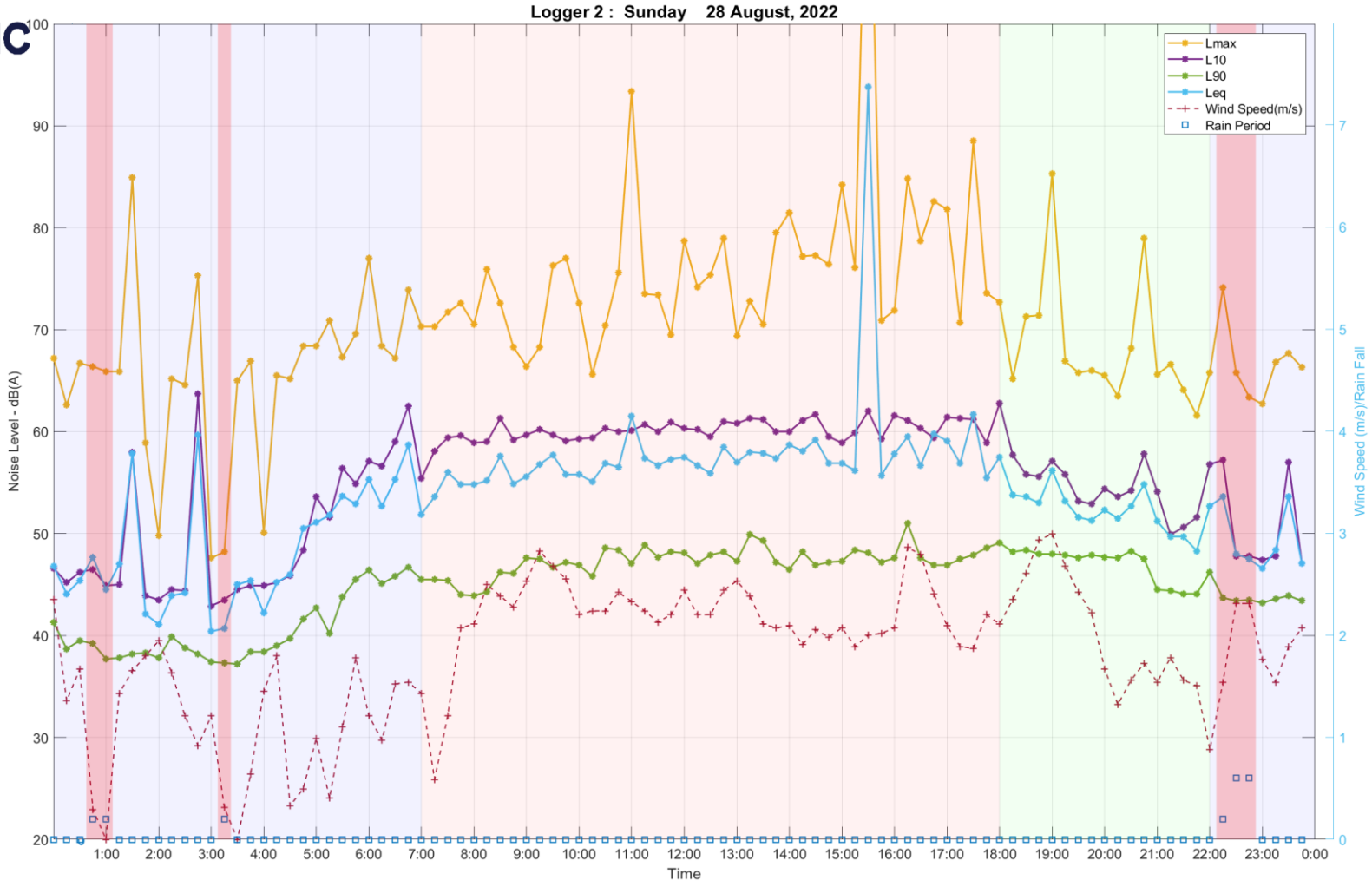
Logger 2 : Sunday 28 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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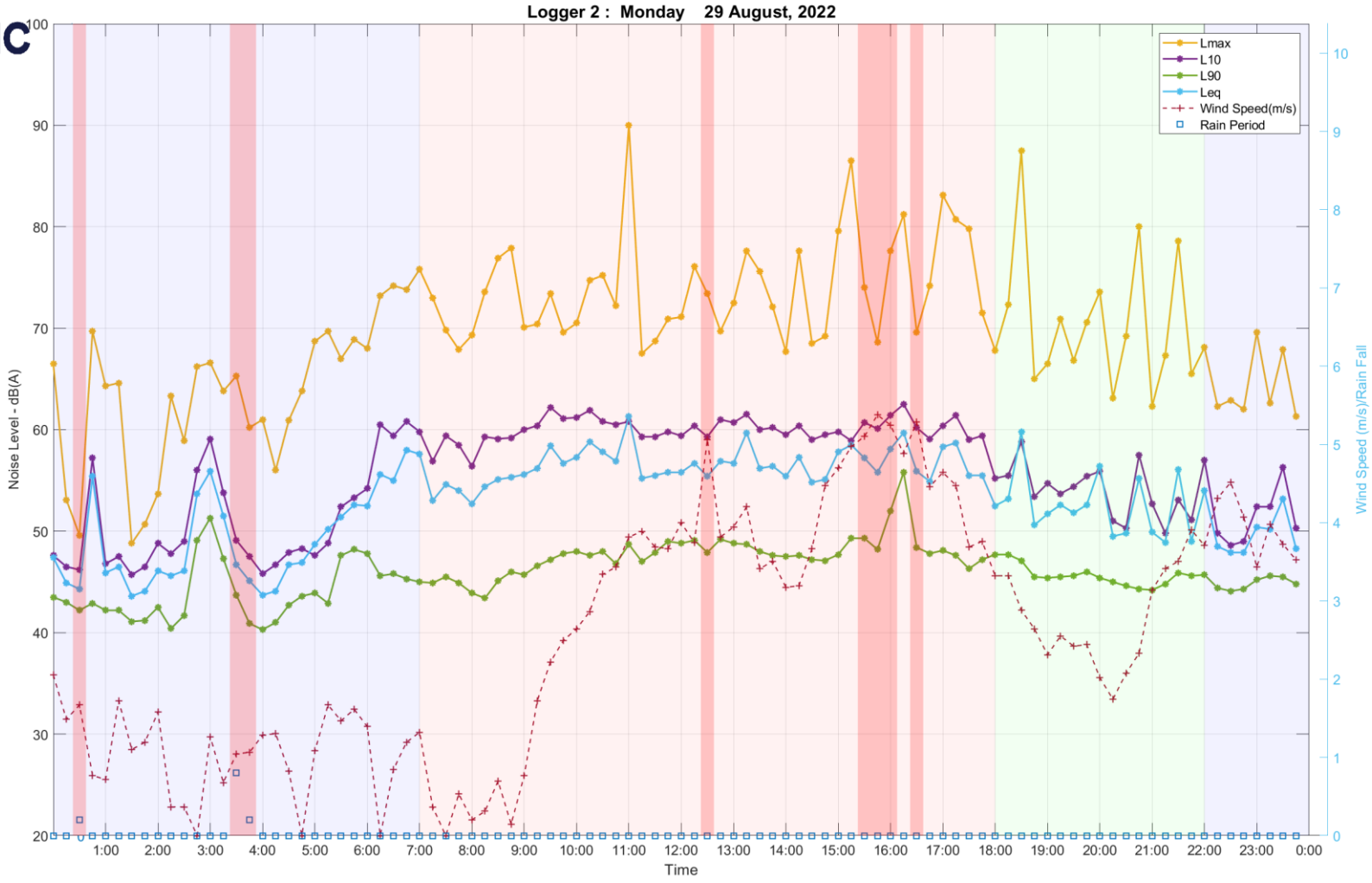
Logger 2 : Monday 29 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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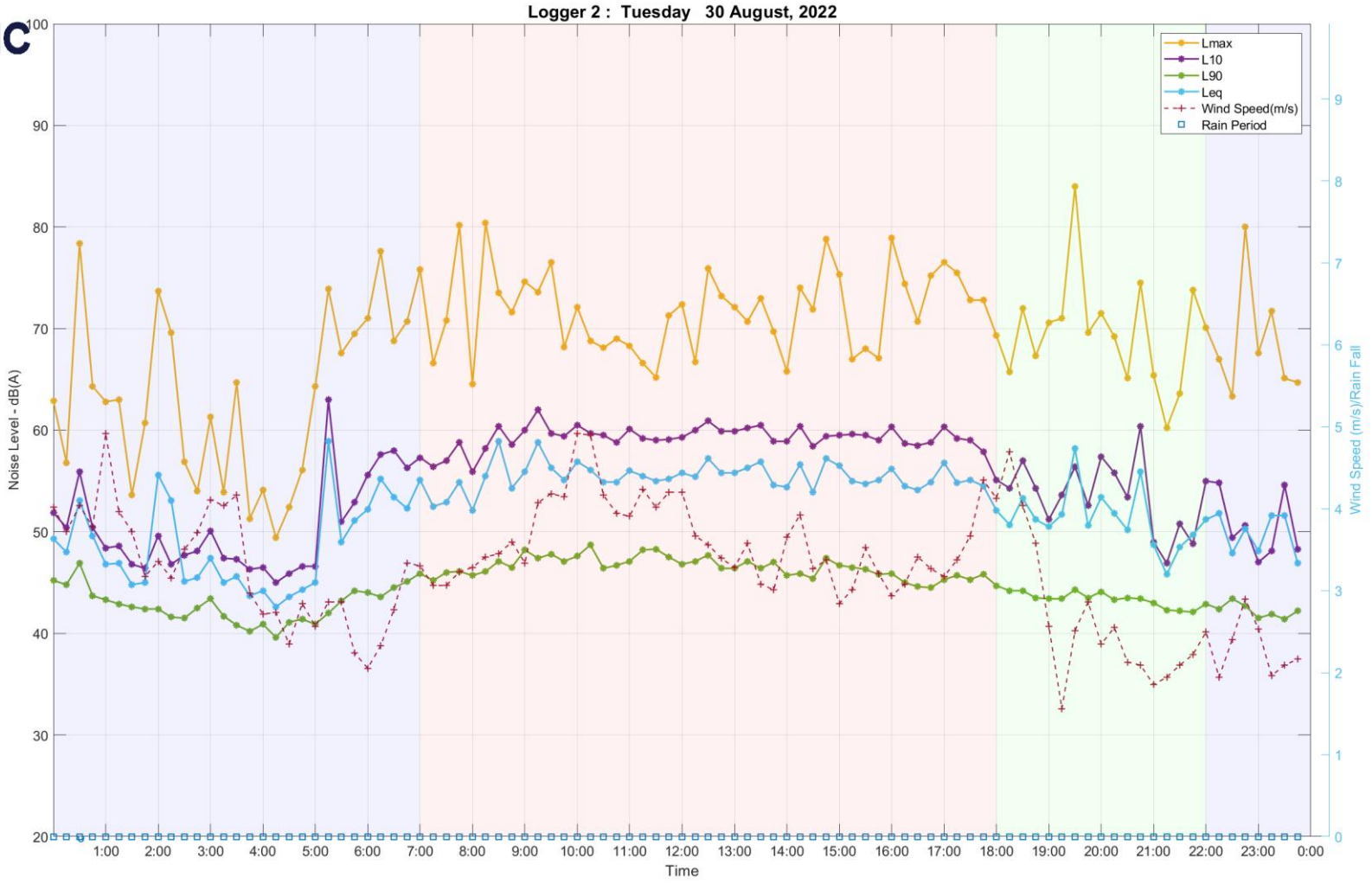
Logger 2 : Tuesday 30 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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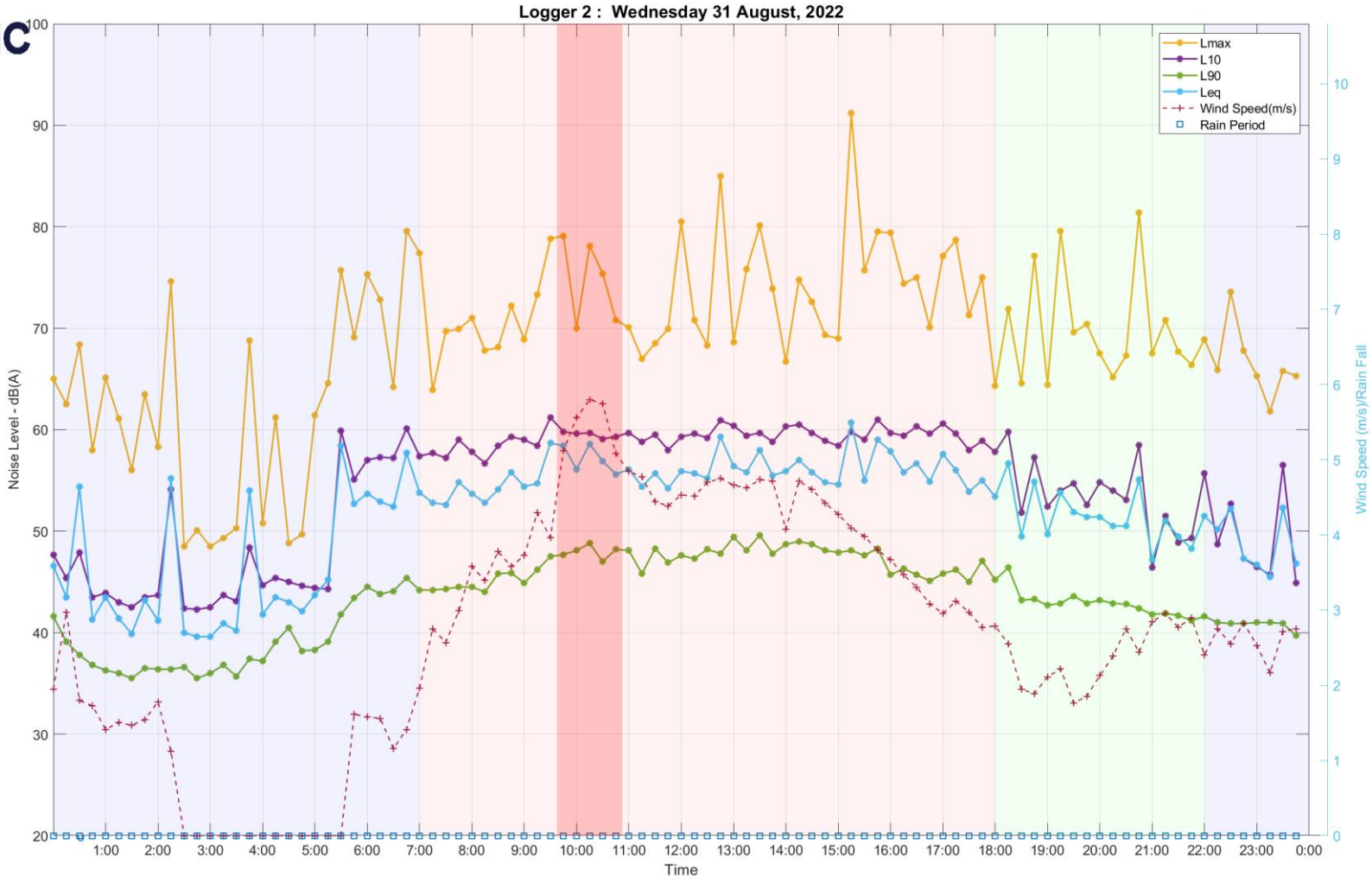
Logger 2 : Wednesday 31 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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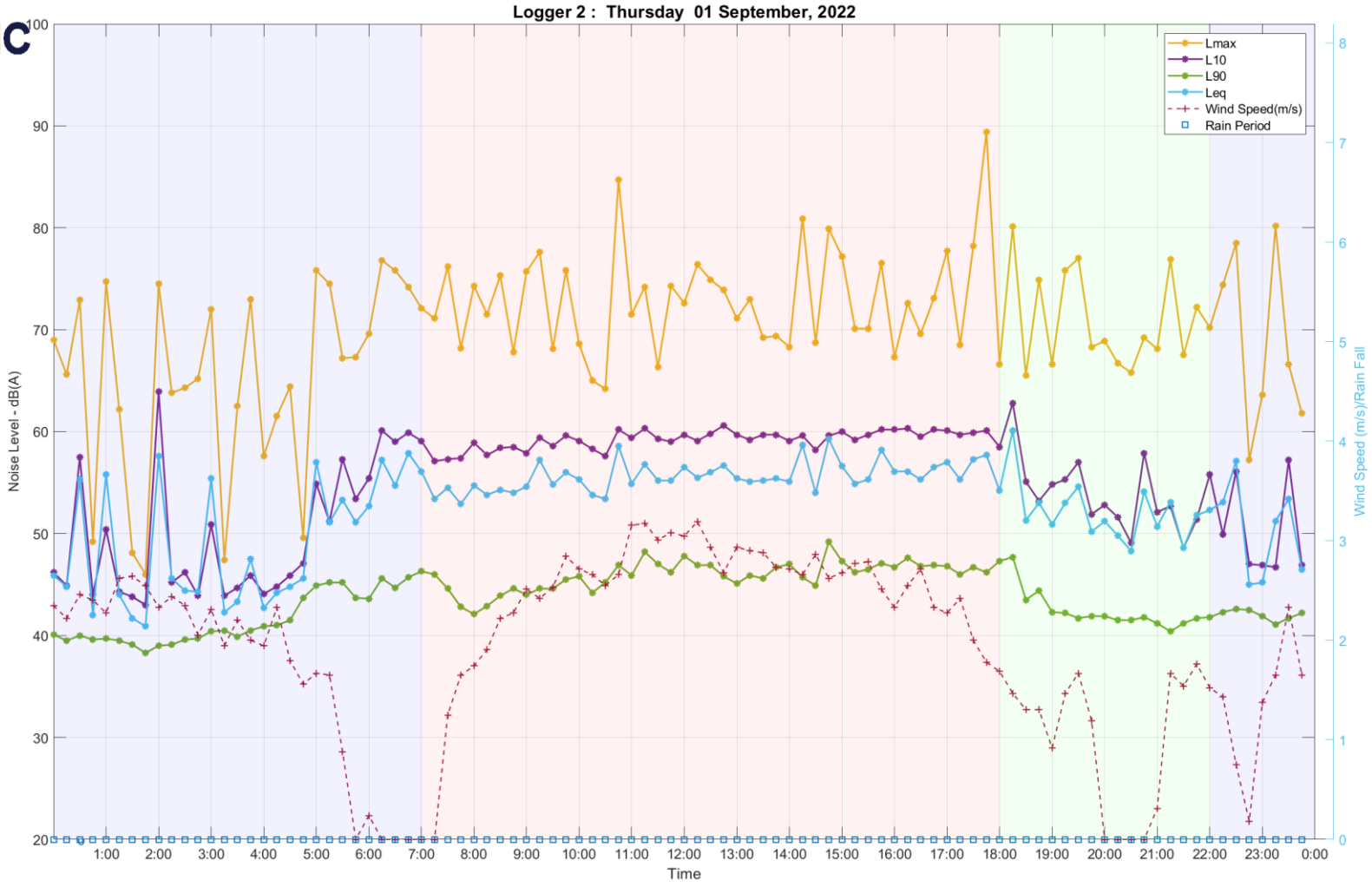
Logger 2 : Thursday 01 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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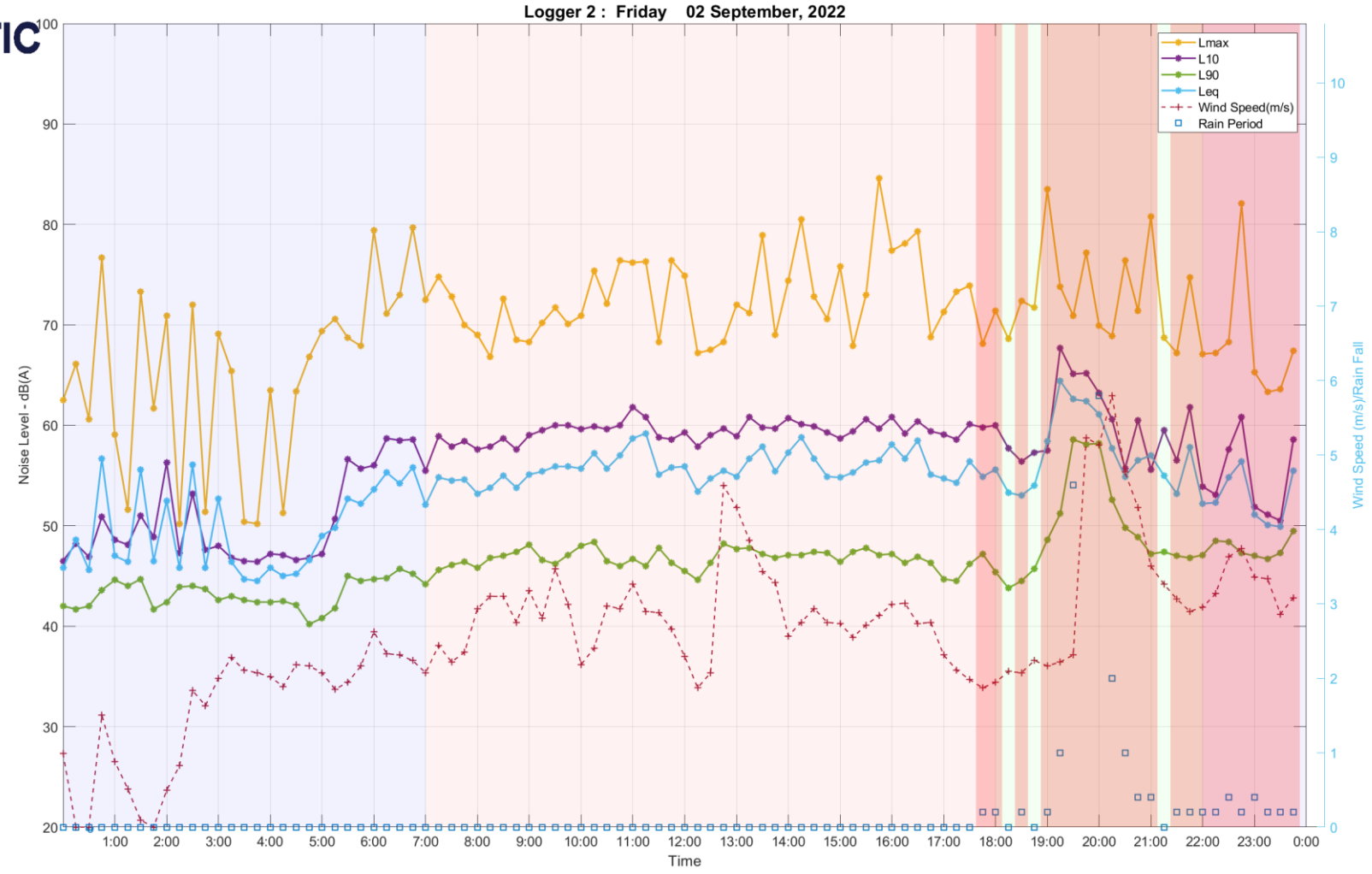
Logger 2 : Friday 02 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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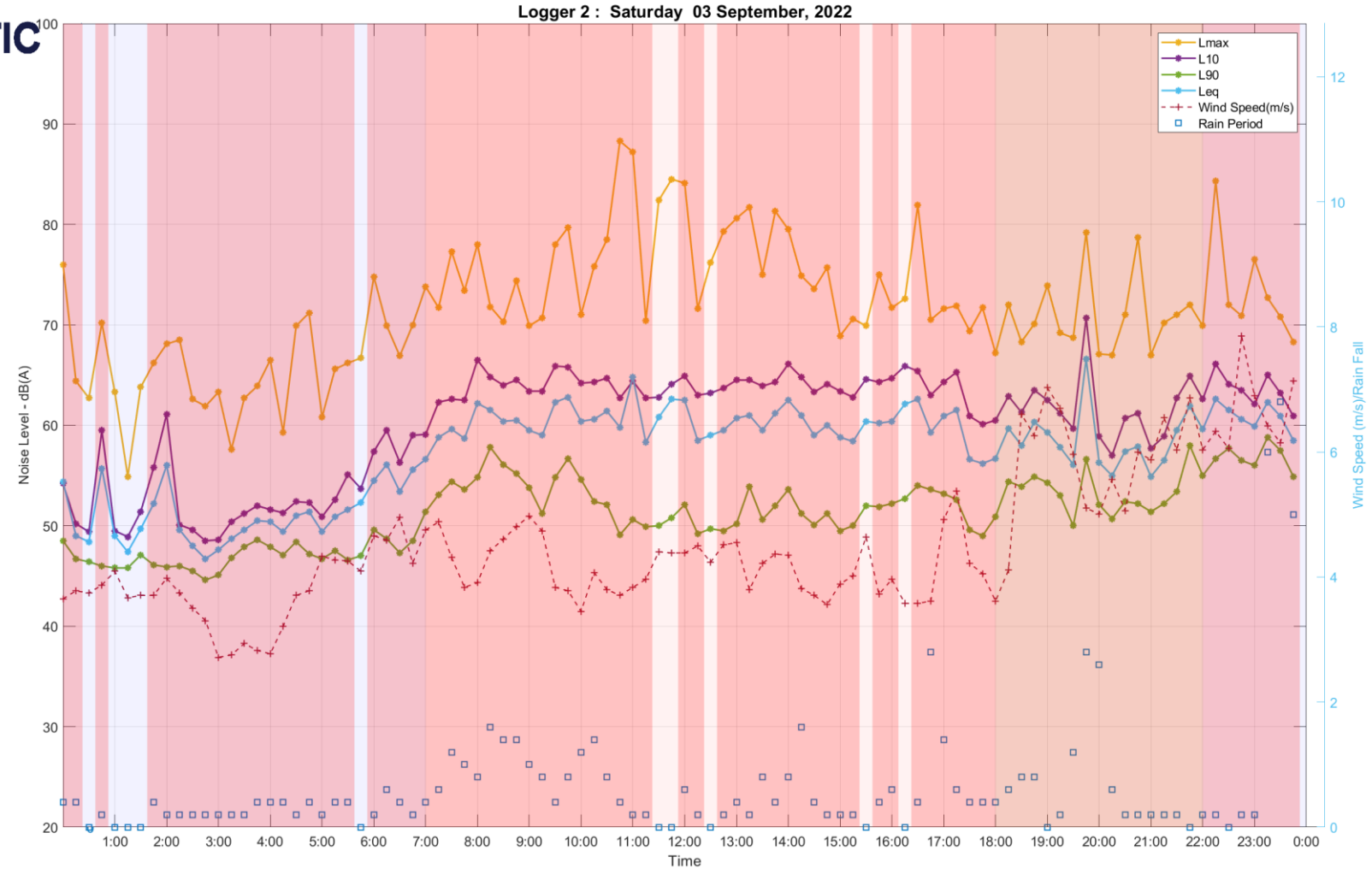
Logger 2 : Saturday 03 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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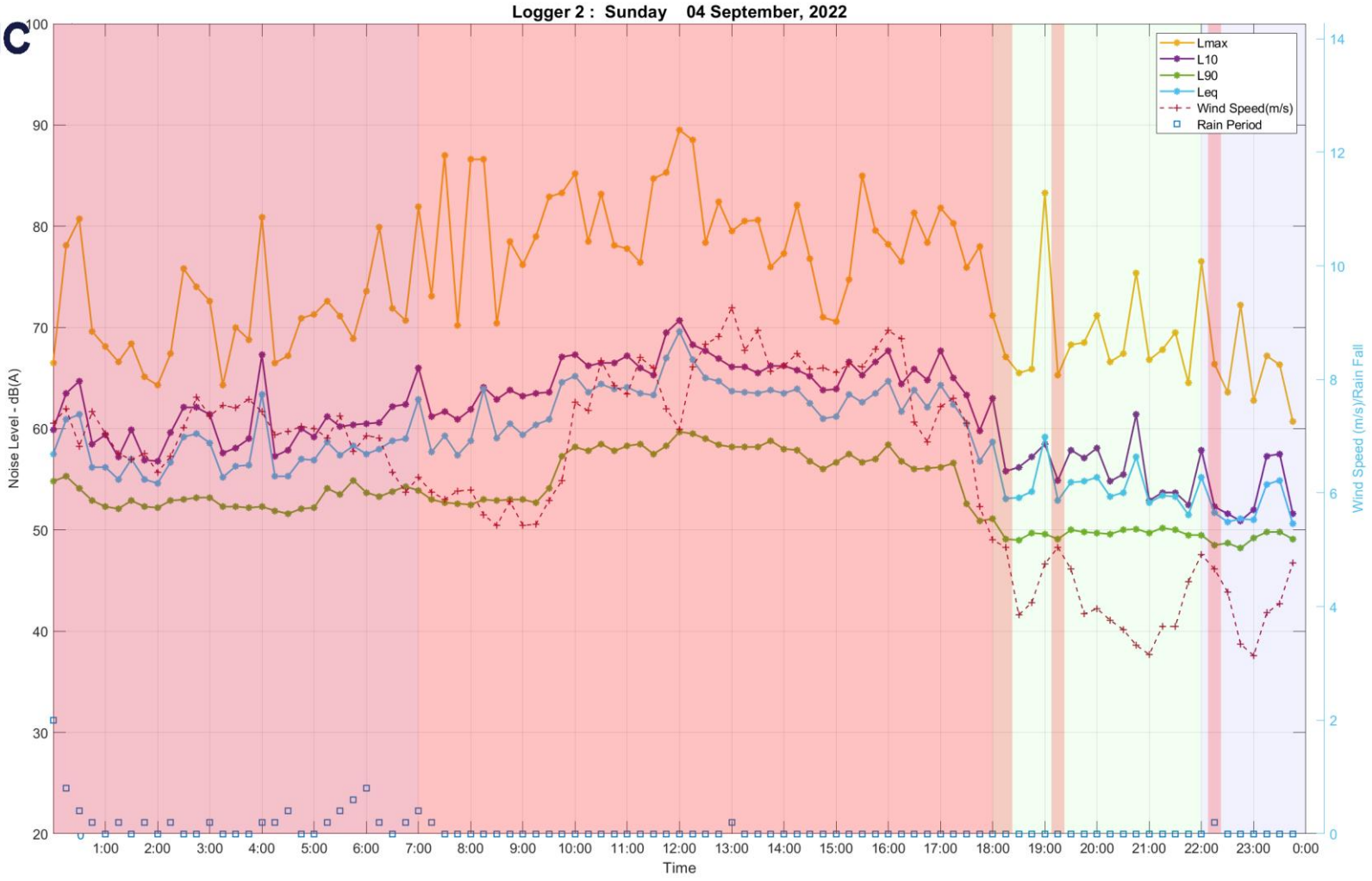
Logger 2 : Sunday 04 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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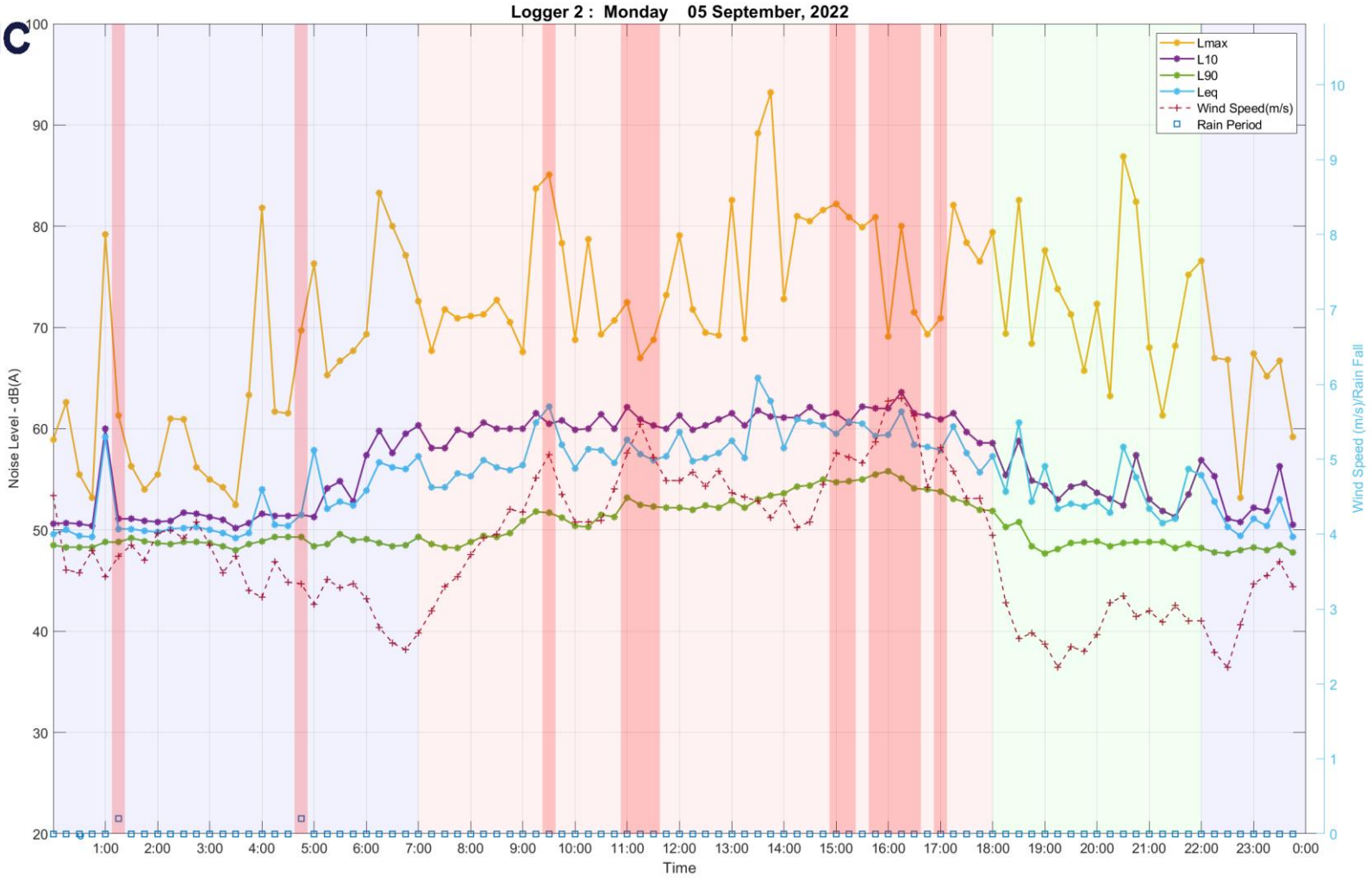
Logger 2 : Monday 05 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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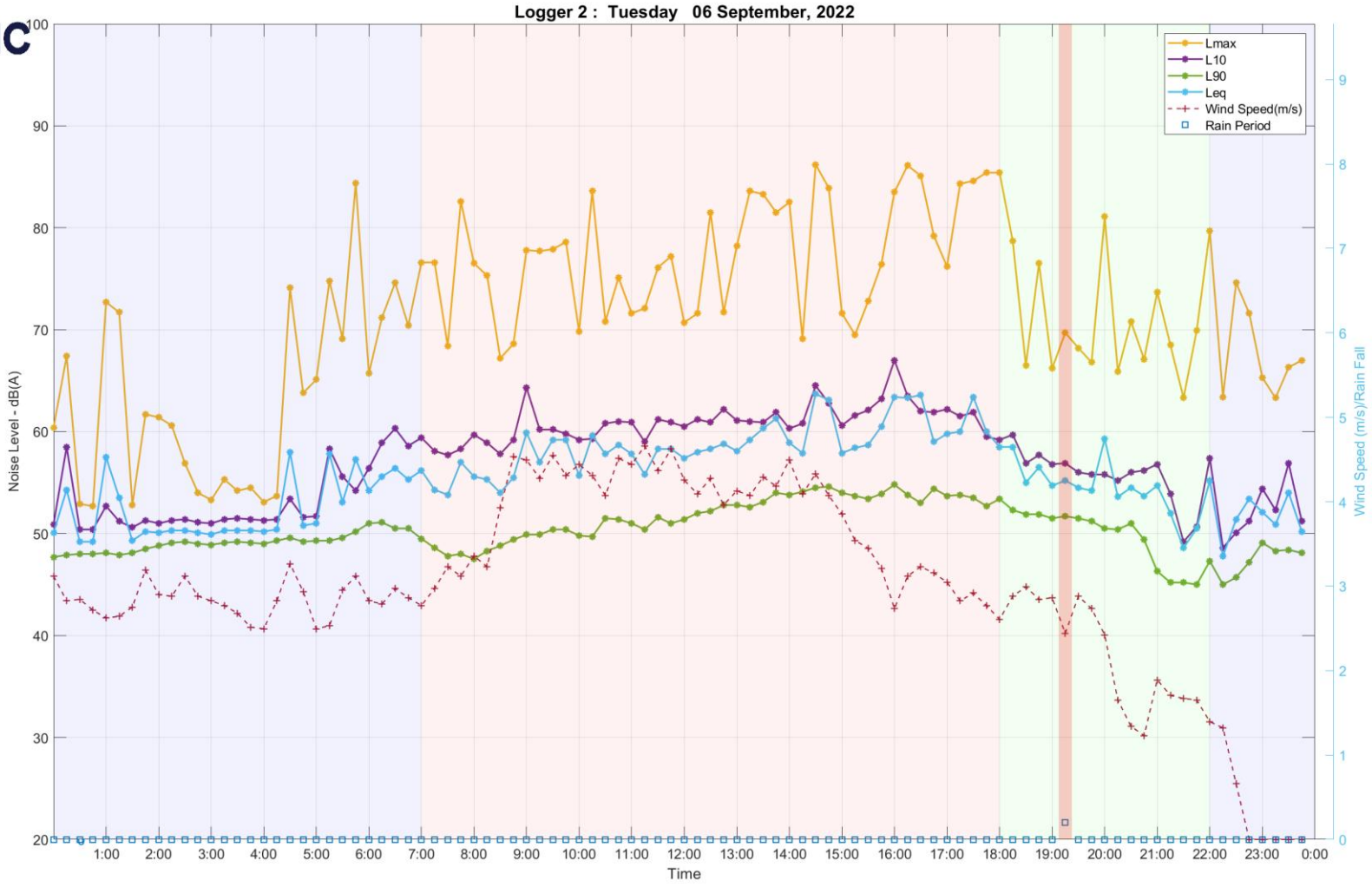
Logger 2 : Tuesday 06 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
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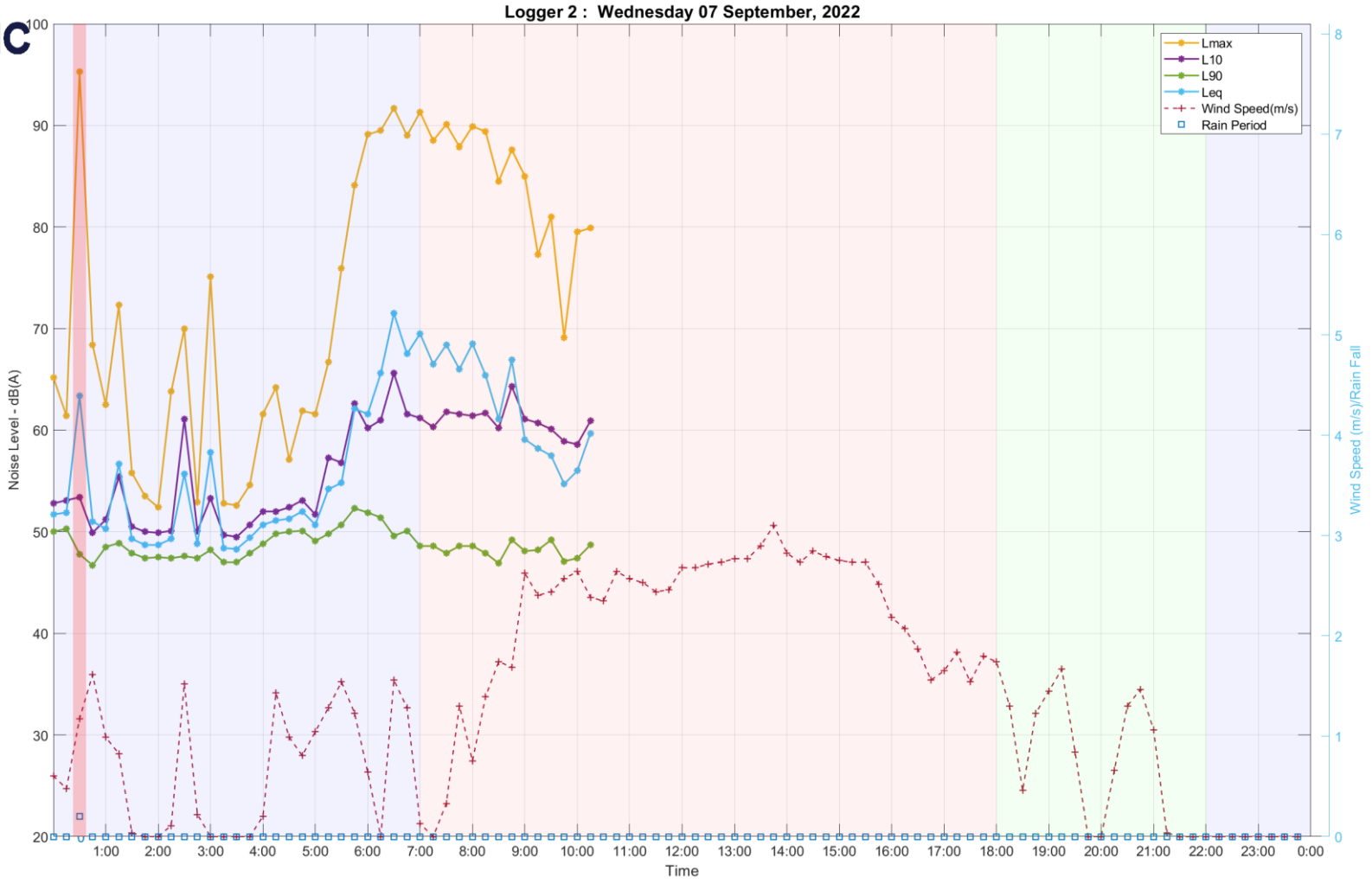
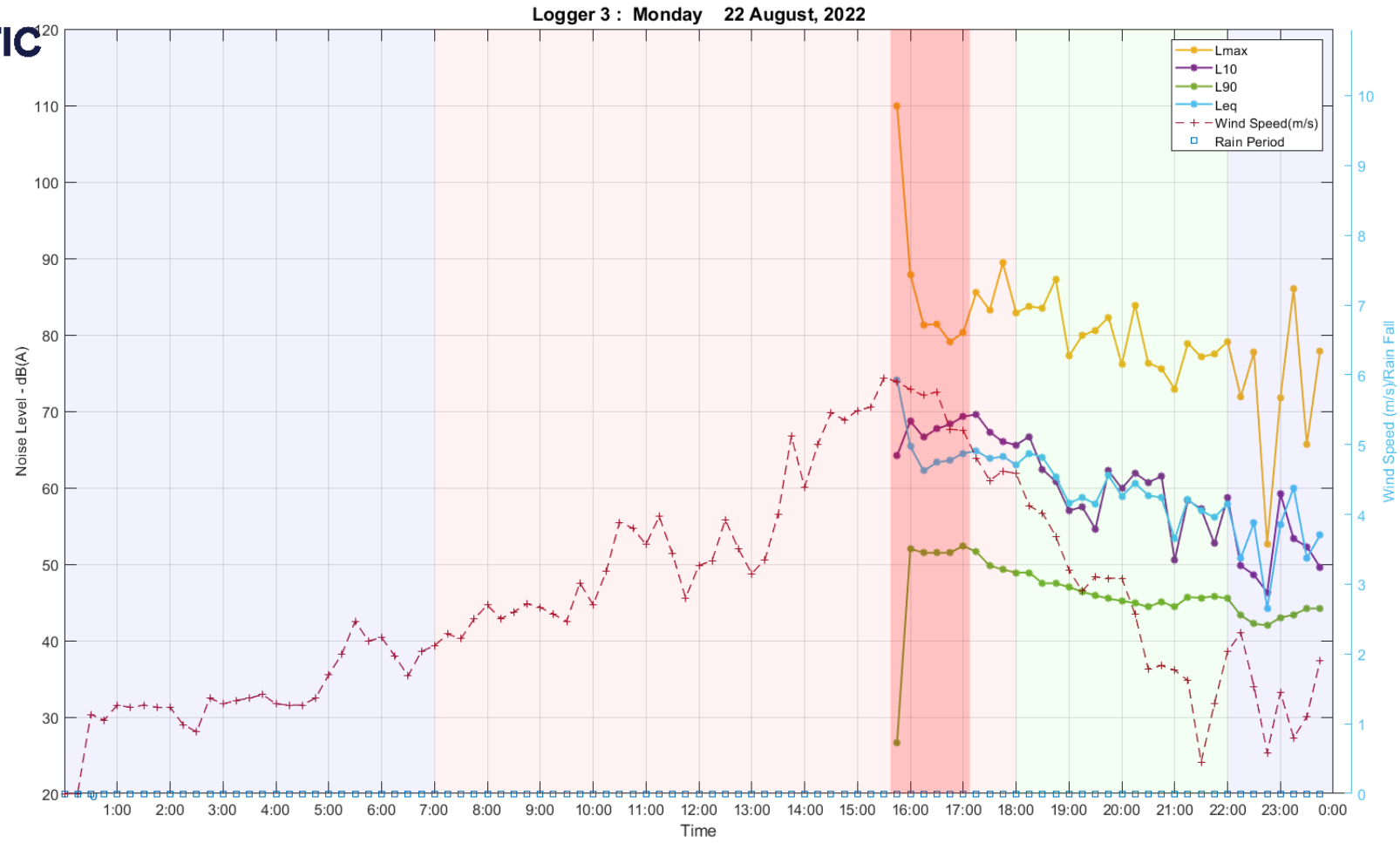


Wind Speed is corrected using factor 0.6600 based on logger location


Logger 3 : Monday 22 August, 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
50
40
30
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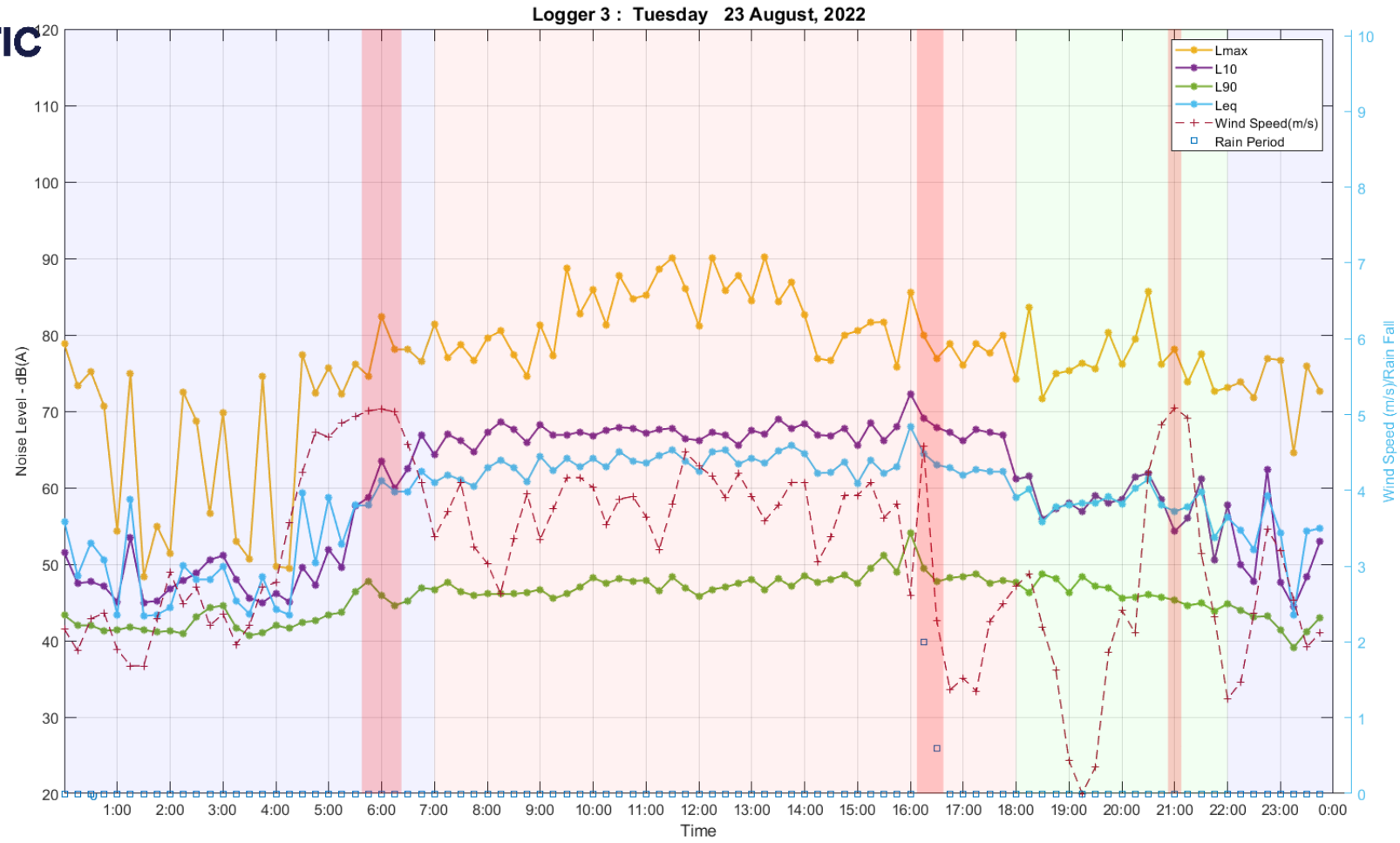
Logger 3 : Tuesday 23 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
90
80
70
60
50
40
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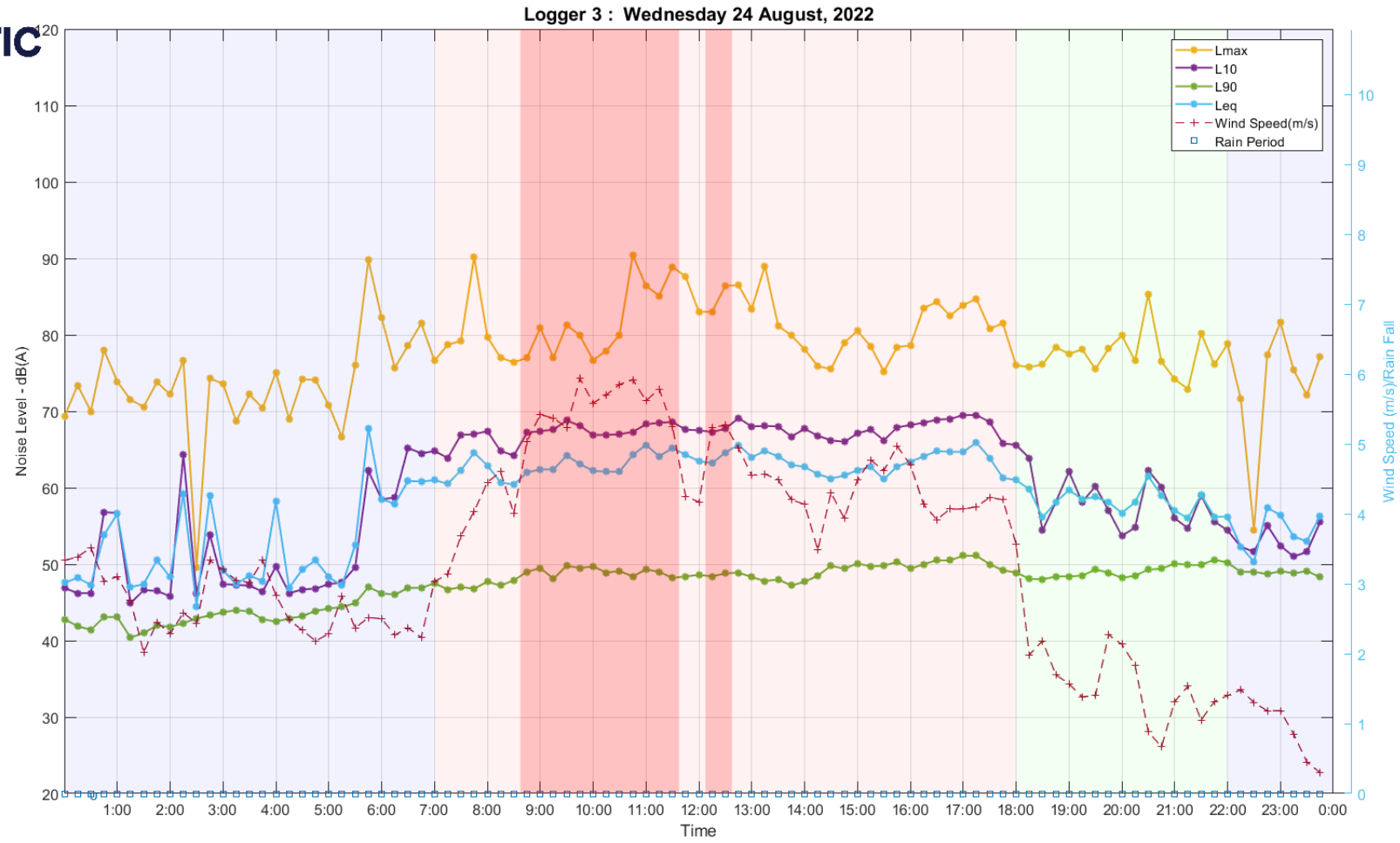
Logger 3 : Wednesday 24 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
90
80
70
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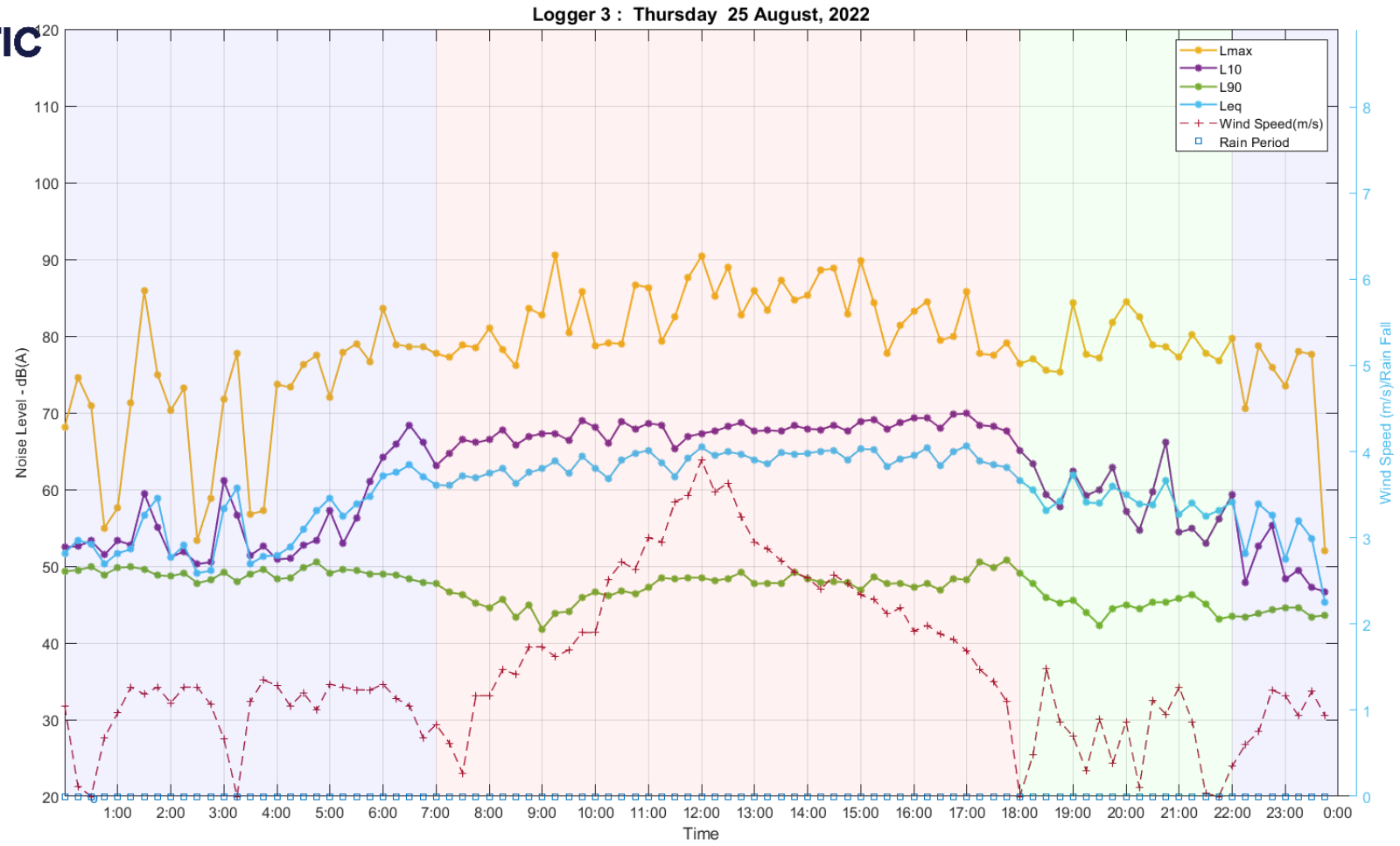
Logger 3 : Thursday 25 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
90
80
70
60
50
40
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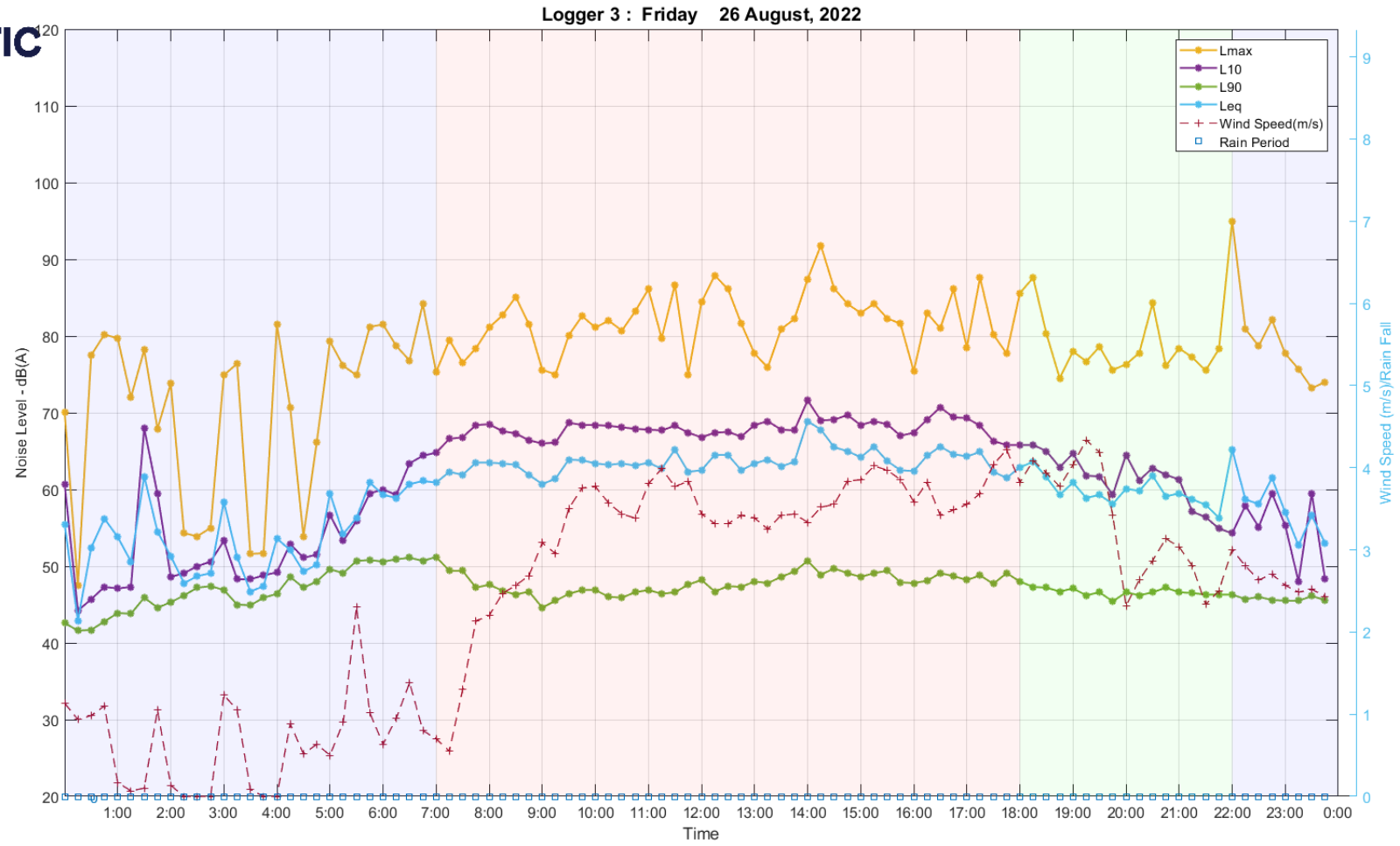
Logger 3 : Friday 26 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
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70
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40
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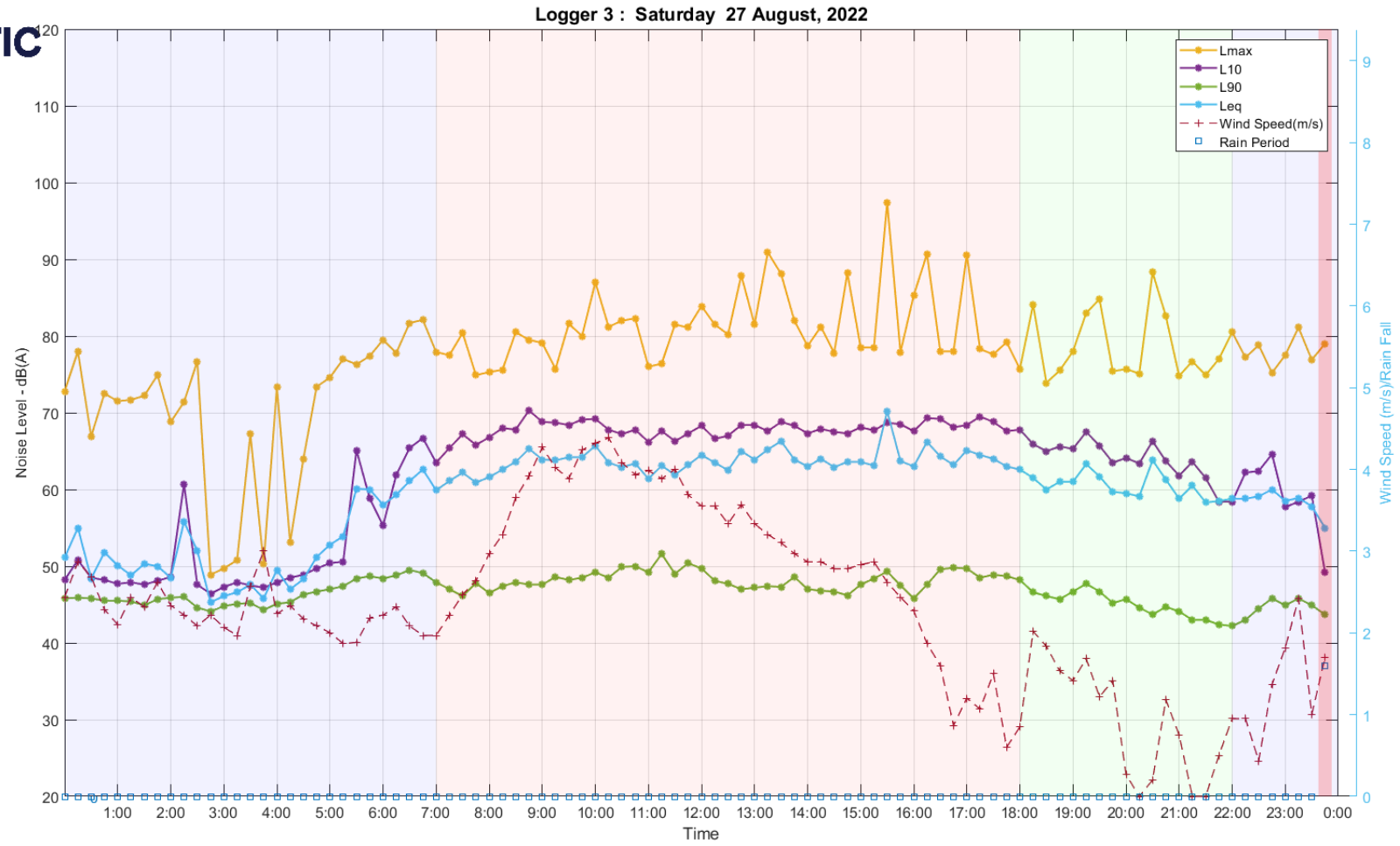
Logger 3 : Saturday 27 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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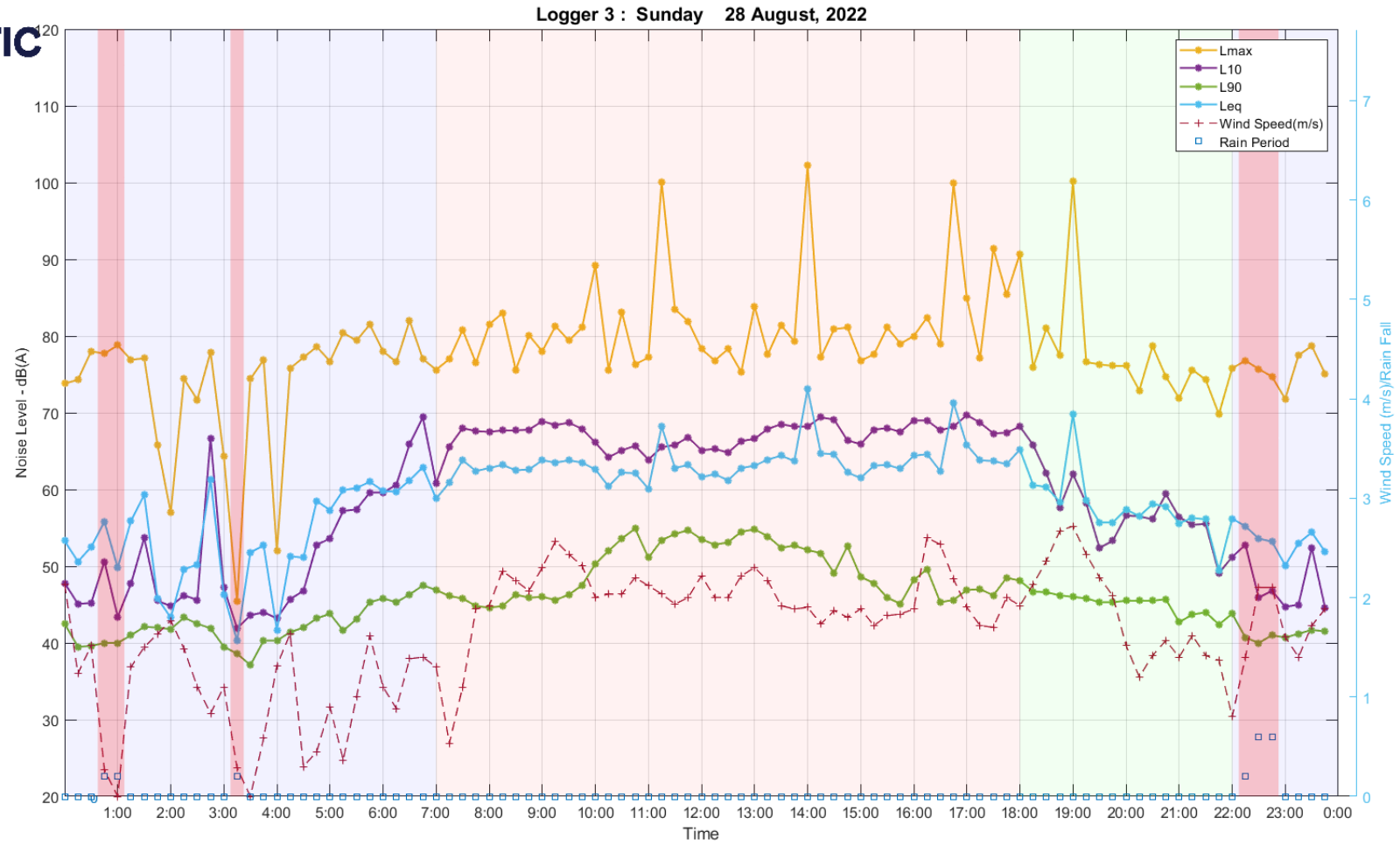
Logger 3 : Sunday 28 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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100
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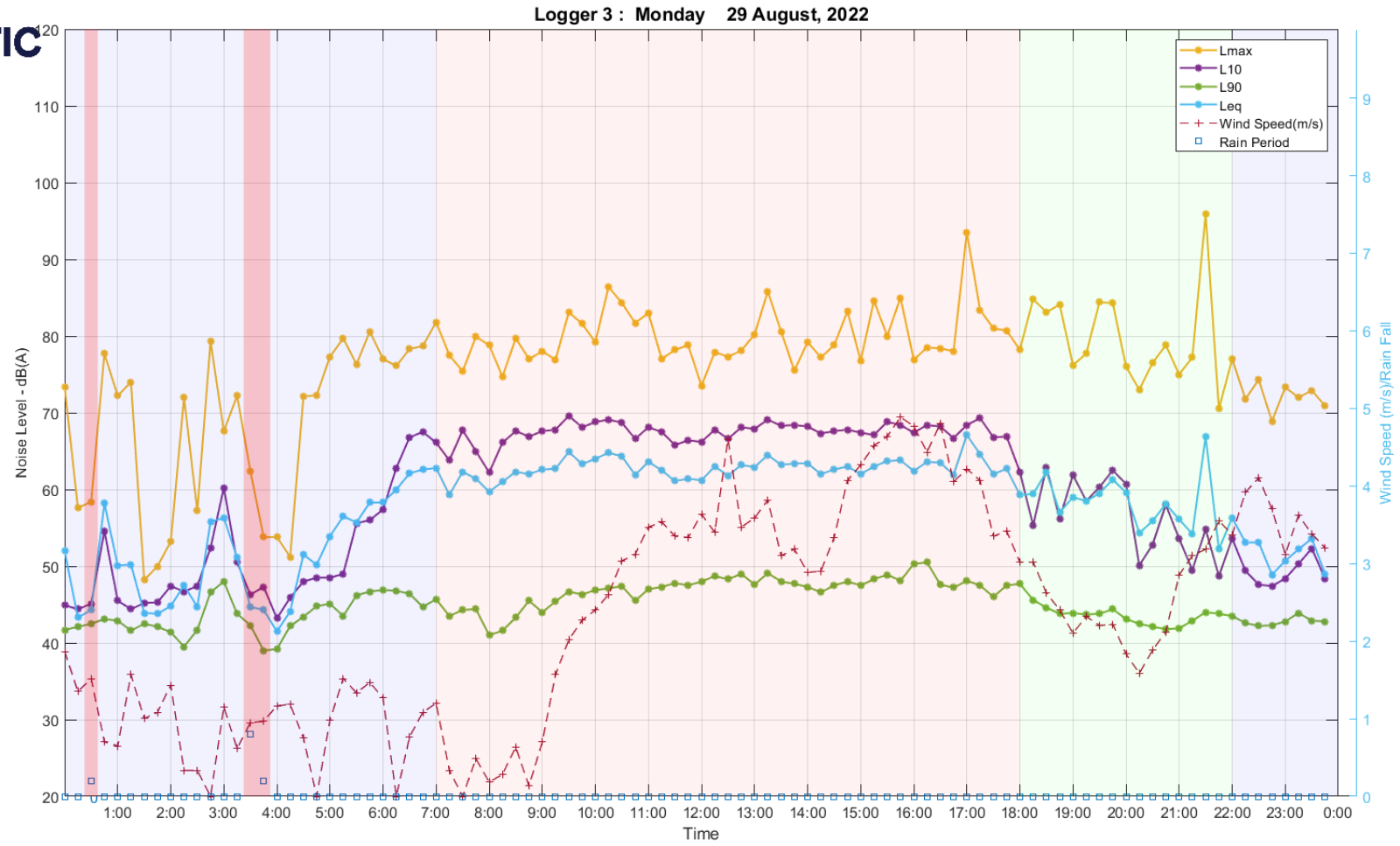
Logger 3 : Monday 29 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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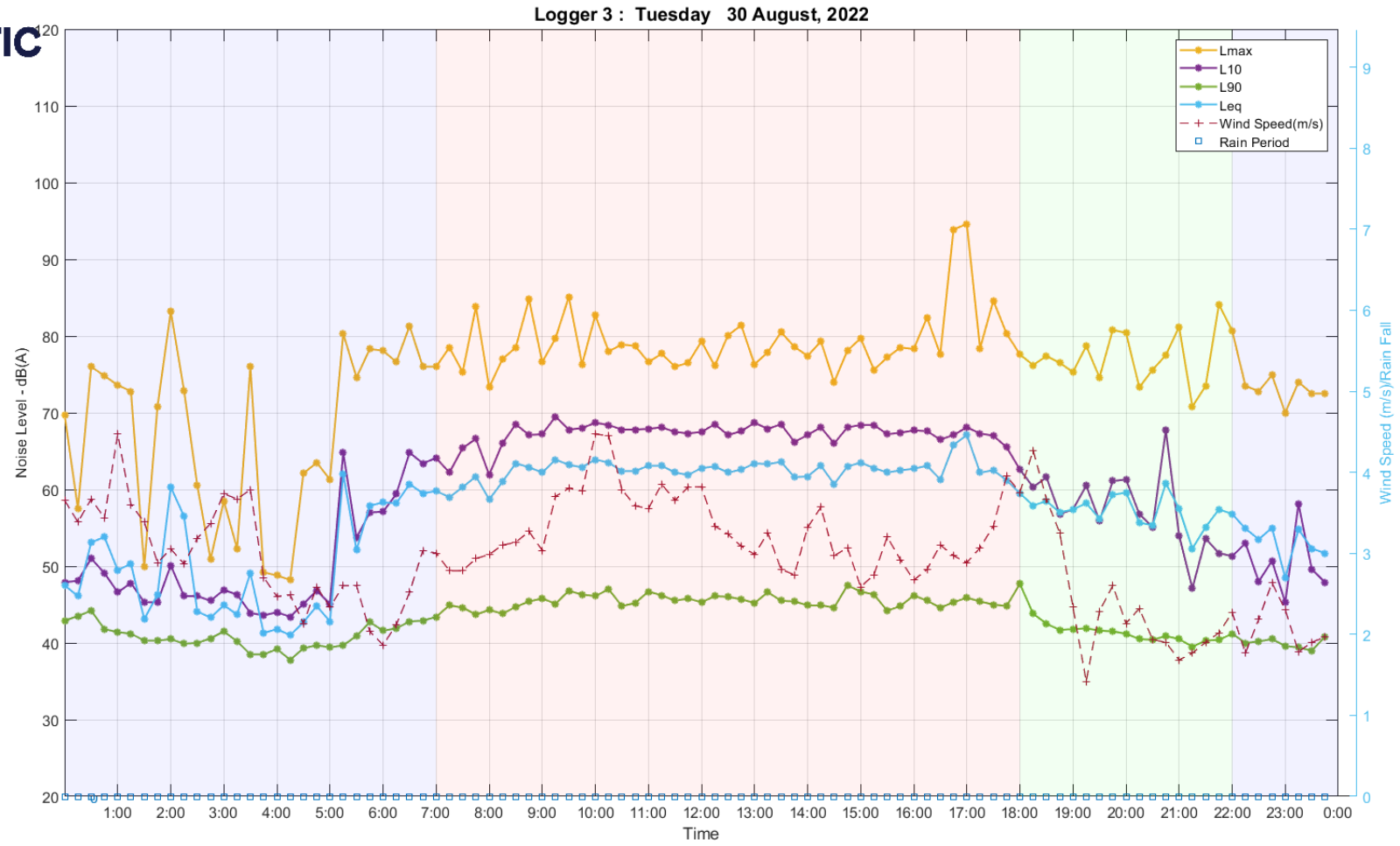
Logger 3 : Tuesday 30 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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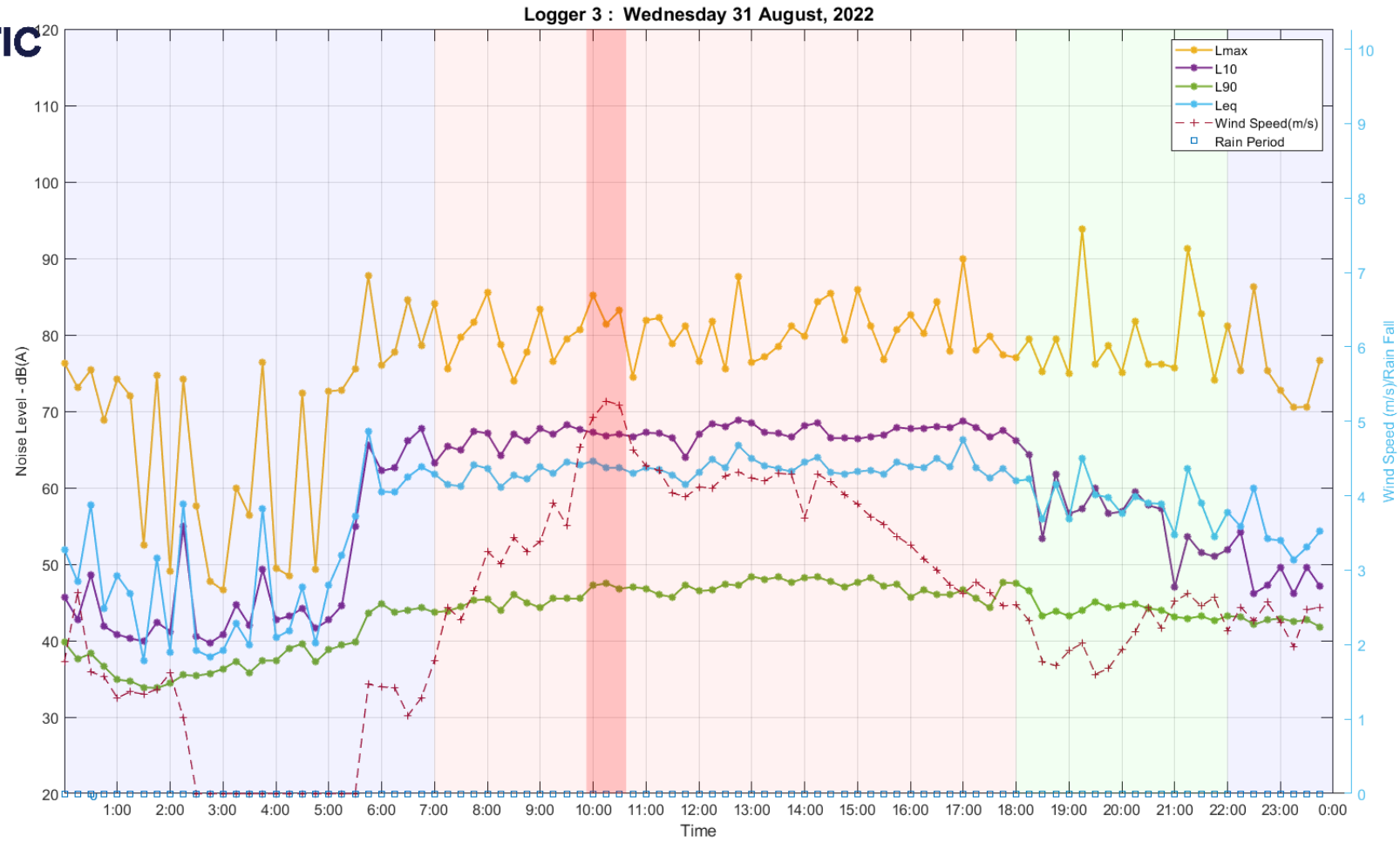
Logger 3 : Wednesday 31 August, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
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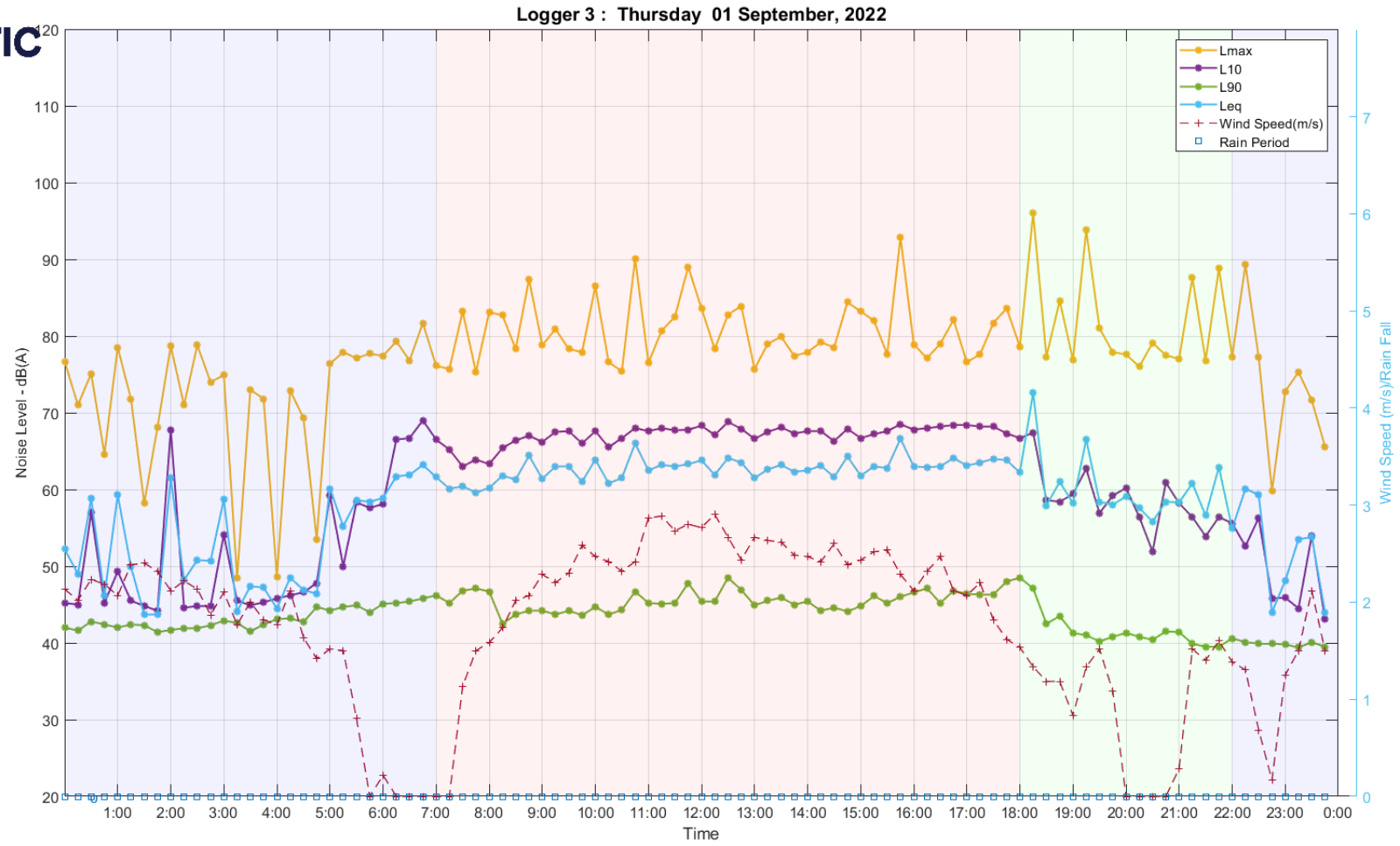
Logger 3 : Thursday 01 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
100
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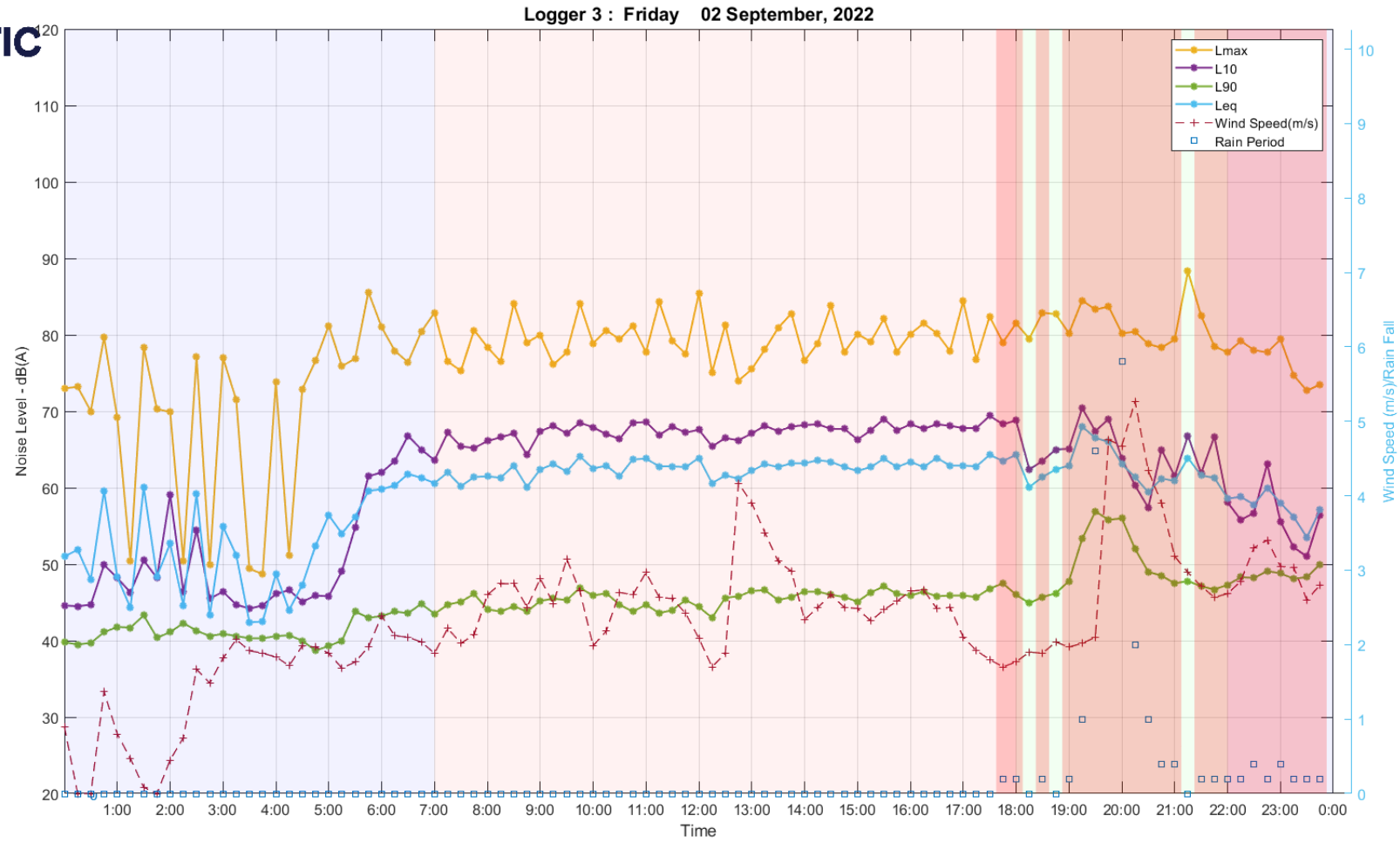
Logger 3 : Friday 02 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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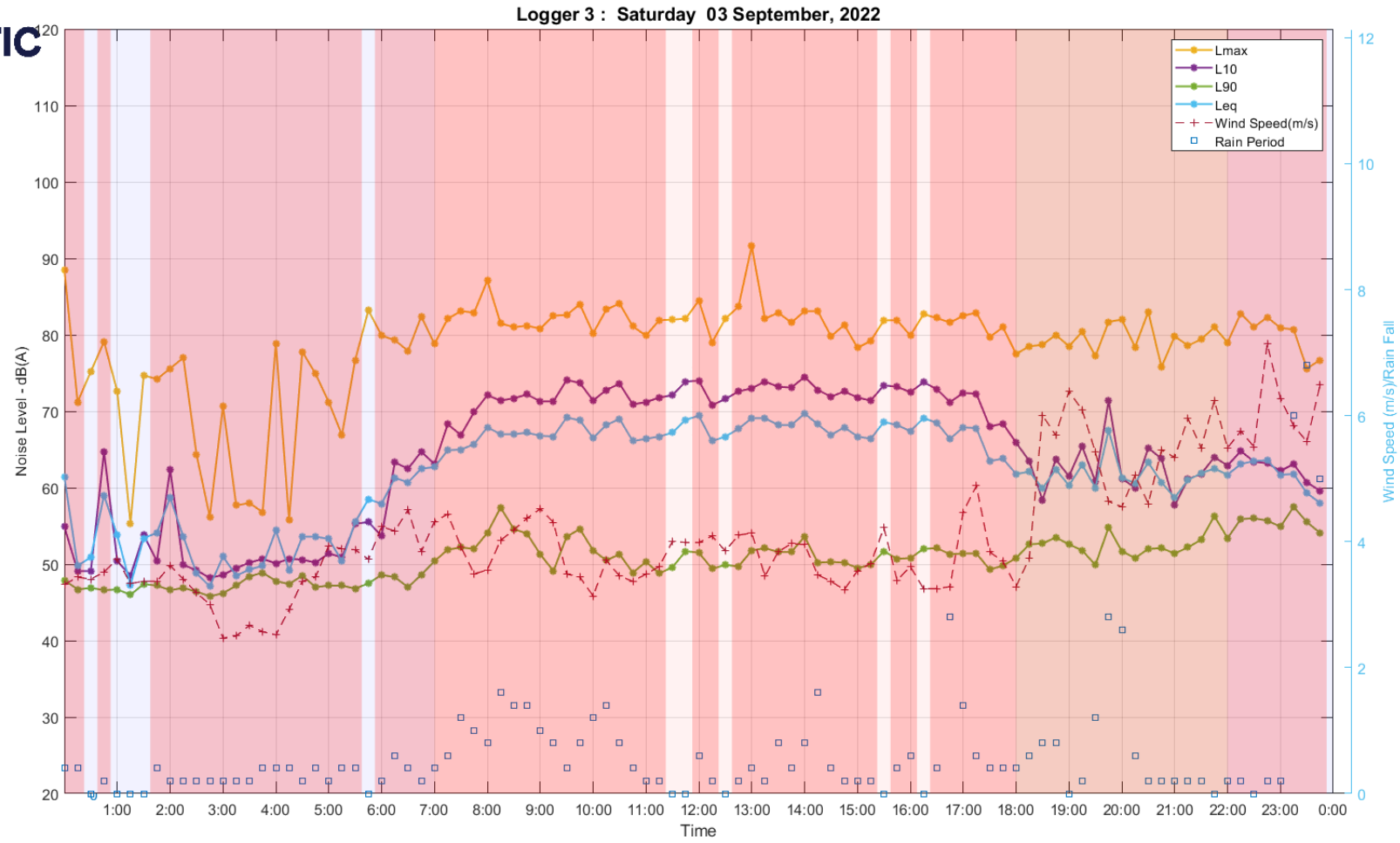
Logger 3 : Saturday 03 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
110
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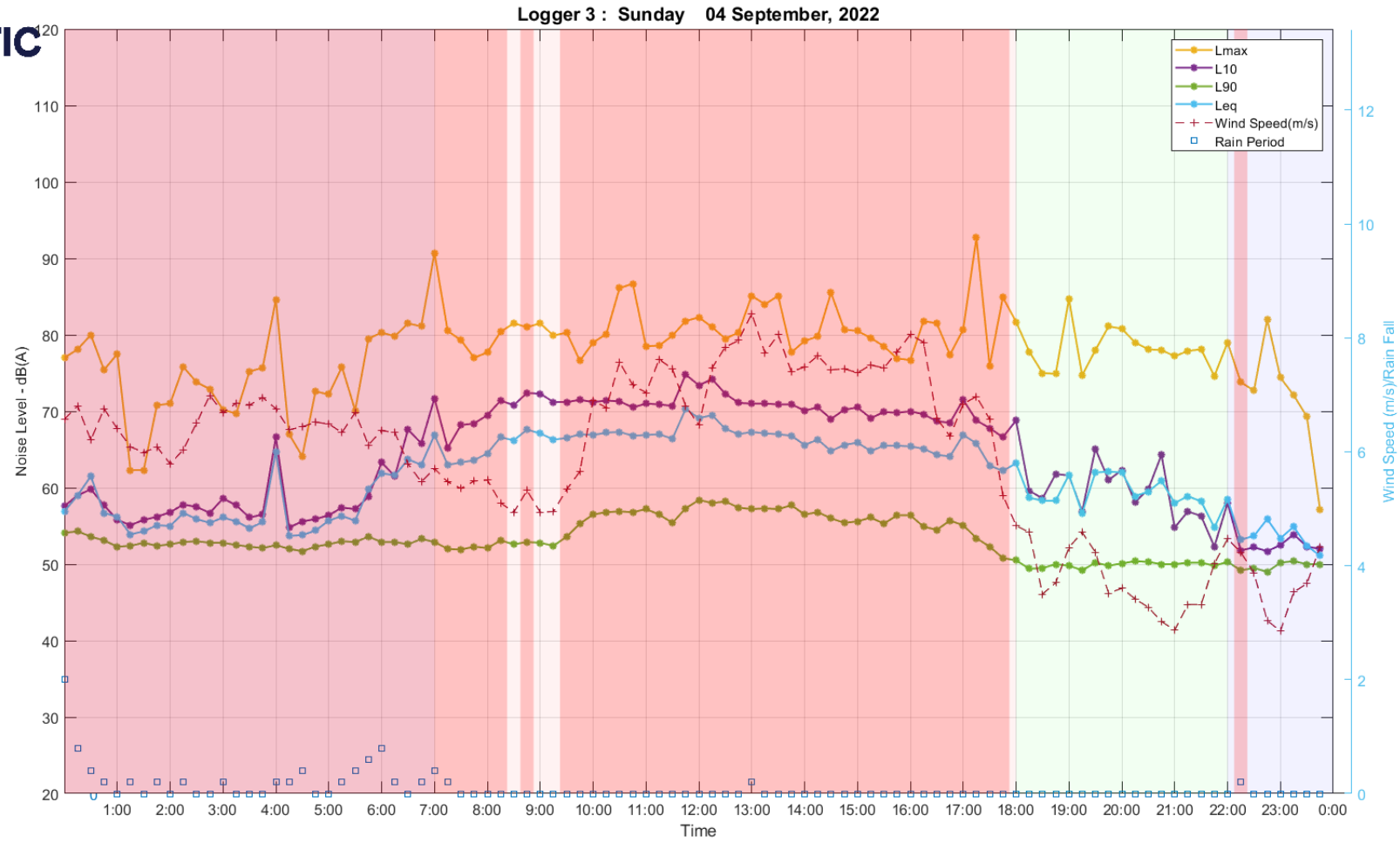
Logger 3 : Sunday 04 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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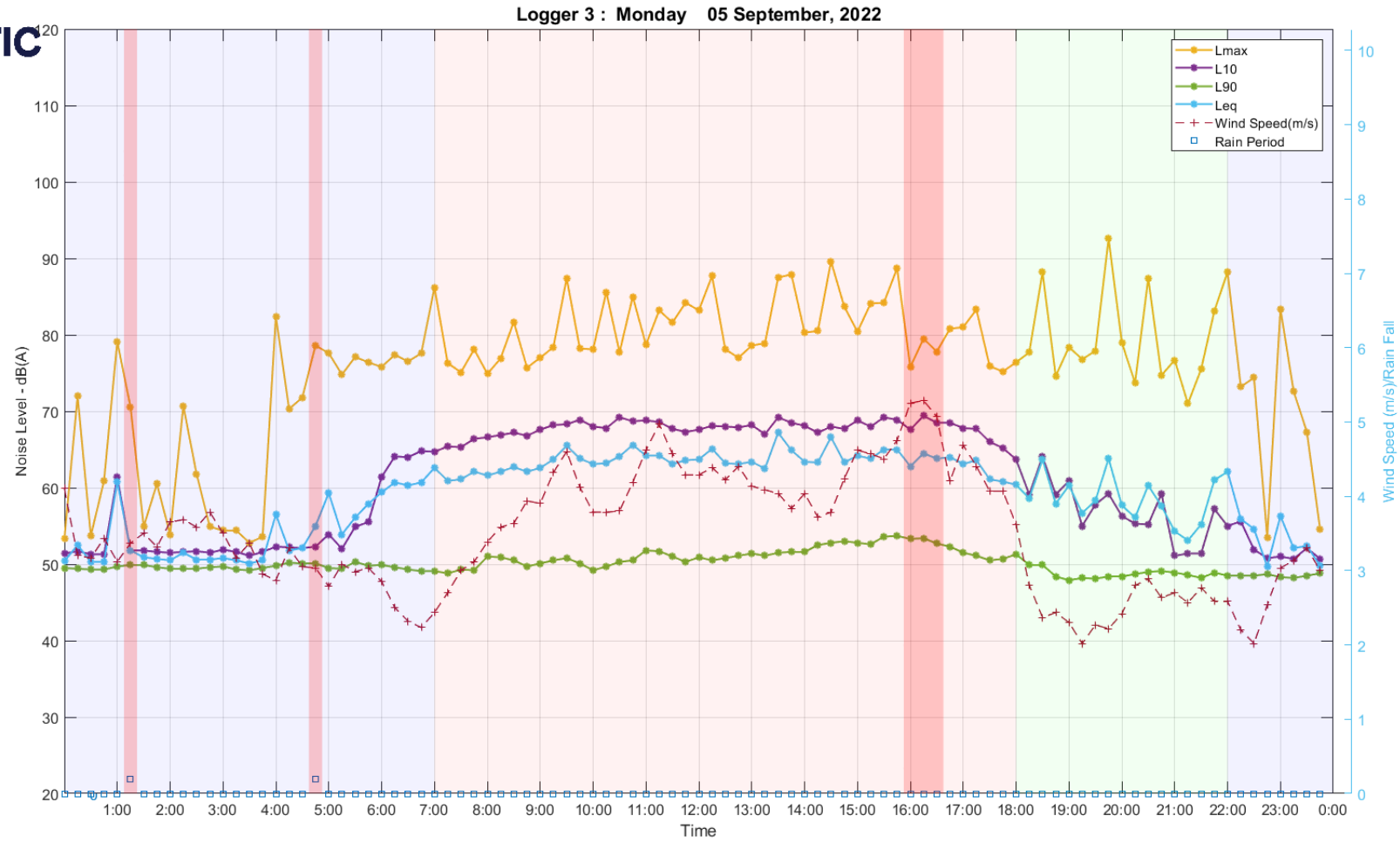
Logger 3 : Monday 05 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
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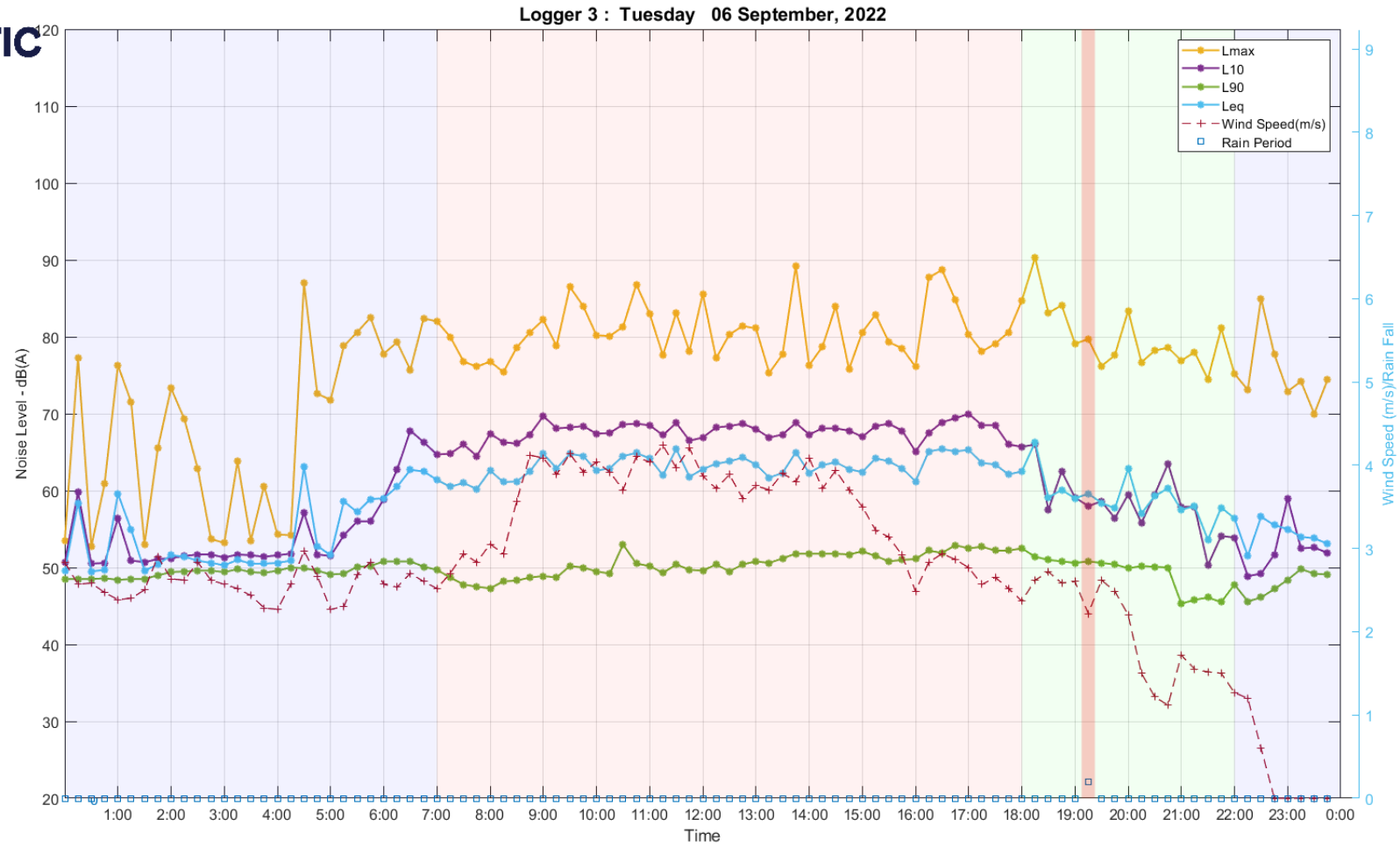
Logger 3 : Tuesday 06 September, 2022
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
120
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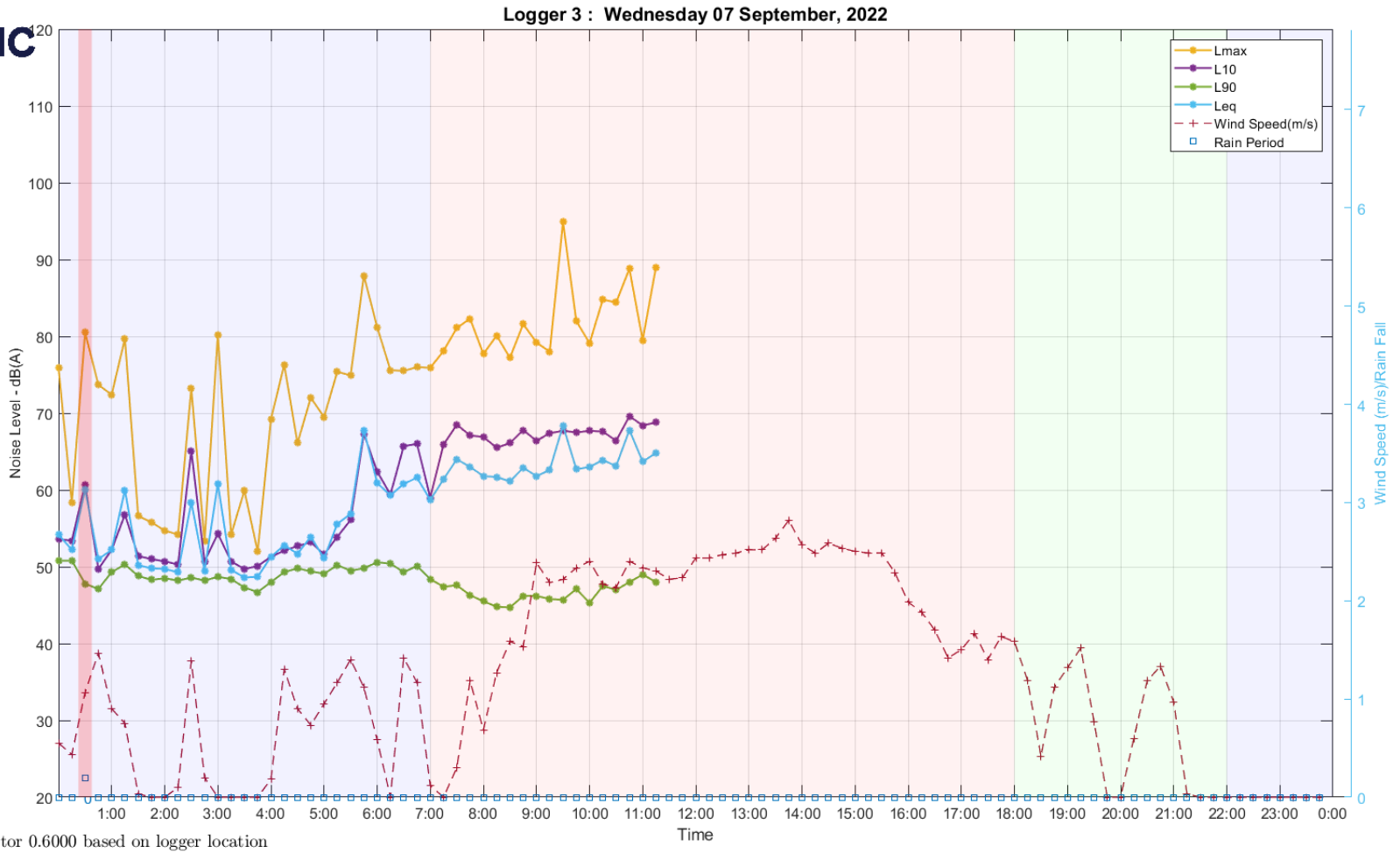

Wind Speed is corrected using factor 0.6000 based on logger location