

135 Badgerys Creek Road, Bradfield
Noise and Vibration Impact Assessment

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Attention To	Bradfield Corporation Pty Ltd

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1 INTRODUCTION

This *Noise and Vibration Impact Assessment* has been prepared on behalf of the Bradfield Corporation Pty Ltd (the Applicant) by Acoustic Logic Pty Ltd. It is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of a State Significant Development Application (SSDA) on land at 135 Badgerys Creek Road, Bradfield (the site).

This document addresses noise and vibration impacts assessed with the following:

- External traffic noise intrusion to the project site.
- Ground borne noise and vibration impact from the operation of Sydney Metro.
- Noise emission from the operation of Liquor & Gaming premise, childcare centre, loading dock and mechanical items.
- Noise and vibration impact from construction activities.

2 SITE DESCRIPTION

The site is located at 135 Badgerys Creek Road, Bradfield and is approximately 2.02ha in area. It is legally described as Lot 7 DP 243457 and is located approximately 250m to the future Bradfield Metro Station and 4km to the Western Sydney Airport. An aerial image of the site is provided in **Figure 1**.

The site shares a western frontage with Badgerys Creek Road. The eastern boundary of the site adjoins the State government-led Bradfield City Centre which is set to be a vibrant 24/7 global city, driving advancements in industry and will support 10,000 more homes and 20,000 new jobs in Western Sydney.

As defined by the Aerotropolis Precinct Plan, the site is located within the Aerotropolis Core Precinct which is envisioned as an attractive place for workers, residents and visitors. The Aerotropolis Core Precinct will leverage the positive economic impact of the adjacent Western Sydney Airport and Bradfield City Centre. It will attract business hubs, research and development, professional services and creative industries in addition to providing residential development within walking distance of the Bradfield Metro station and proximity to blue and green infrastructure.



Figure 1 – Site Aerial Map

Source: Nearmap / edited by Ethos Urban

3 PROPOSED DEVELOPMENT

The proposed development will seek consent for the redevelopment of the site, comprising:

- Enabling works including vegetation removal and earthworks;
- The construction of three buildings, comprising:
 - Residential use, including approximately 400 apartment units;
 - Hotel use, including approximately 450 hotel rooms;
 - Commercial use, including supermarket, food and drink and other commercial uses;
 - Medical centre use;
 - Childcare centre use;
- Construction of two basement structures, including approximately 800 carparking spaces;
- Public domain upgrades, including:
 - Construction of an internal road;
 - A public plaza;
- Rehabilitation and augmentation of the existing riparian corridor;
- Landscaping embellishments on the ground level and within the built form; and
- Services augmentation as required.

Refer to the Environmental Impact Statement for a detailed summary of the proposed development.

4 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In accordance with section 4.39 of the Environmental Planning & Assessment Act 1979 (EP&A Act), Secretary's Environmental Assessment Requirements (SEARs) for SSD 77458970 were issued on 30 January 2025. This report has been prepared to respond to the relevant issued Secretary's Environmental Assessment Requirements (SEARS), as set out in the table below.

Table 4-1 – SEARs Requirement

SEARs Requirement	Section of Report Where Response is Provided
12. Noise and Vibration Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	Assessment in accordance with relevant EPA guidelines: Section 12.2.
	Operational noise assessment: Section 13
	Construction noise and vibration assessment: Section 14
	Outline of proposed management and mitigation measures: Section 14.5, Section 15 & 16

5 SUMMARY OF MITIGATION MEASURES

This report concludes that the proposed mixed-use development is suitable and warrants approval subject to the implementation of the following mitigation measures.

Table 5-1 – Summary of Mitigation Measures

ID	Mitigation Measure
Construction Management – CM1	Façade complying construction presented in Section 10.2 is to be adopted during the design stage
Construction Management – CM2	A supplementary mechanical ventilation system is to be proposed for apartment living rooms with line of sight to childcare outdoor play area to provide an alternative source of outside air. Refer to Section 13.5.
Management Controls– MC1	Operational noise from retail and childcare centre shall be reviewed in separate applications when an operator is engaged. Noise emissions from licensed premises and operating of the childcare center shall comply with criteria in Section 12.5 and Section 12.6, respectively.

Following the implementation of the above mitigation measures, the remaining impacts are considered appropriate.

6 REFERENCED DOCUMENTS

This document addresses noise impacts associated with the following:

- Noise and vibration intrusion to the project site from traffic at surrounding streets, metro noise from Sydney Metro Western Sydney Airport Line and aircraft noise from the Western Sydney Airport.
- Noise emissions from operation and mechanical plant to service the project site (in principle).
- Noise and vibration emissions from construction activities from the site.

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

- Liverpool City Council *Re: Request for Council's Advice on SEARs – SSD-77458970 (Ref: SSD1-13/2024, Dated 8 January 2025).*
- Department of Planning, Housing and Infrastructure *Western Sydney Aerotropolis Development Control Plan (DCP) 2022 (September 2024).*
- Association of Australasian Acoustical Consultants (**AAAC**) *Guideline for Child Care Centre Acoustic Assessment*, version 3.0, September 2020.
- Australian Standard 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors (AS2107:2016).*
- NSW Liquor Act 2007
- NSW Environmental Protection Authority (**EPA**) *Noise Policy for Industry (NPI) 2017.*
- NSW DECC *Interim Construction Noise Guideline (ICNG) 2009.*
- German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures.*
- NSW Department of Environment and Conservation (**DECC**) *Assessing Vibration: A Technical Guideline (Feb 2006).*

This assessment has been conducted based on the architectural drawings provided to us, prepared by Plus Architecture, Job number 20799, dated 06/03/2025.

7 NOISE SOURCES

7.1 NOISE SOURCES IDENTIFIED

The main significant noise sources with potential to impact the site are:

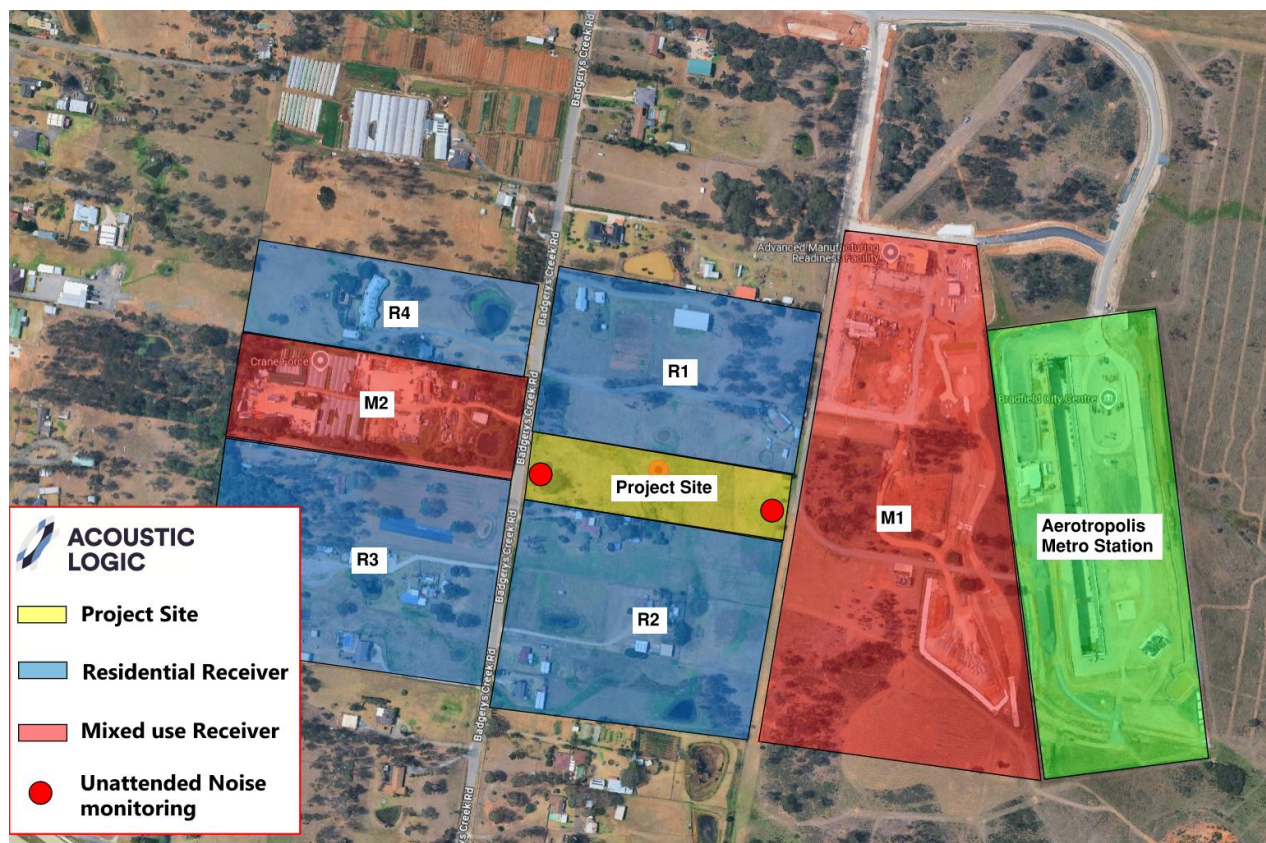
- Traffic noise from local roads. Reference to the Transport for NSW website indicates that Badgerys Creek Road carries daily traffic volumes less than 20,000 vehicles per day. The development should comply with the requirements of the **AS2107:2016**.
- Metro noise and vibration impact from Sydney Metro Western Sydney Airport Line. There will be **no airborne noise impact** from the metro line given the section of the metro line is underground. Ground borne noise and vibration impact will be assessed.

7.2 NOISE RECEIVERS IDENTIFIED

The nearest noise receivers around the site include:

- **R1:** Residential Receiver 1 – Residential houses to the north of the site at 145-155 Badgerys Creek Road, Bradfield.
- **R2:** Residential Receiver 2 – Residential houses to the south of the site at 115-125 Badgerys Creek Road, Bradfield.
- **R3:** Residential Receiver 3 – Residential houses to the southwest of the site at 72-90 Badgerys Creek Road, Bradfield..
- **R4:** Residential Receiver 4 – Residential houses to the northwest of the site at 102 Badgerys Creek Road, Bradfield.
- **M1:** Mixed-use Receiver 1 – Commercial and residential mixed-use developments at 215 Badgerys Creek Road, Bradfield.
- **M1:** Mixed-use Receiver 2 – Commercial and residential mixed-use developments at 100 Badgerys Creek Road, Bradfield.

A site map, measurement locations and surrounding receivers are presented in Figure 2.



8 ABBREVIATIONS AND DEFINITIONS

The following Abbreviations and definitions are used in this noise impact assessment.

dB	Decibels - unit for the measurement of sound
dB(A)	A-weighted decibels. Unit of measurement for broadband sound with the A-frequency weighting applied to approximate human loudness perception to sounds of different pitch.
L_{eq}	Energy, time averaged sound level
L_{max}	Maximum sound pressure level, fast response
L₉₀	Sound level exceeded for 90% of the measurement period
R_w	Frequency weighted sound reduction index.
NRC	Average absorption co-efficient for the octave bands with centre frequencies of 250Hz to 2 kHz inclusive.
Day*	For noise emissions assessment - the period from 7 am to 6 pm (Monday to Saturday) and 8 am to 6 pm (Sundays and public holidays). For transportation noise - the period from 7 am to 10 pm
Evening*	Refers to the period from 6 pm to 10 pm.
Night*	The period from 10 pm to 7 am (Monday to Saturday), and 10 pm to 8 am (Sundays and public holidays). For transportation noise - the period from 10 pm to 7am
Project Trigger Level	Target receiver noise levels for a particular noise-generating facility.
Assessment Background Level (ABL)	A-weighted background noise level representative of a single period. (Calculated in accordance with NPI unless noted otherwise)
Rating Background Level (RBL)	The overall, single-figure A-weighted background level representing each assessment period (day/evening/night) over the whole monitoring period. (Calculated in accordance with NPI unless noted otherwise)

* Unless nominated otherwise.

9 NOISE INTRUSION GUIDELINES AND ASSESSMENT CRITERIA

The noise intrusion to the project site shall comply with the requirements of the following documents:

- Department of Planning, Housing and Infrastructure *Western Sydney Aerotropolis Development Control Plan (DCP) 2022* (September 2024)
- Liverpool City Council *Re: Request for Council's Advice on SEARs – SSD-77458970* (Ref: SSD1-13/2024, Dated 8 January 2025), and
- Australian Standard 2107:2016 *Acoustics Recommended Design Sound Levels*.
- Association of Australasian Acoustical Consultants (**AAAC**) *Guideline for Child Care Centre Acoustic Assessment*, version 3.0, September 2020.

9.1 DEPARTMENT OF PLANNING, HOUSING AND INFRASTRUCTURE WESTERN SYDNEY AEROTROPOLIS DEVELOPMENT CONTROL PLAN (DCP) 2022 (SEPTEMBER 2024).

The Western Sydney Aerotropolis DCP 2022 requirement is a general requirement and does not provide numerical noise intrusion assessment criteria. Therefore, AS2107:2016 will be adopted to assess impacts.

9.2 LIVERPOOL CITY COUNCIL RE: REQUEST FOR COUNCIL'S ADVICE ON SEARS – SSD-77458970 (REF: SSD1-13/2024, DATED 8 JANUARY 2025).

Acoustic Assessment

The proposed development may be a source of offensive noise and potentially impact upon human health and amenity. An acoustic report shall be prepared by a suitably qualified acoustic consultant in accordance with the NSW Environment Protection Authority's 'Noise Policy for Industry' (2017). The cumulative effect of noise must be considered when assessing the impact upon receivers.

Where necessary, the report shall assess potential sleep disturbance and road traffic noise impacts in accordance with the NSW Environment Protection Authority's 'Noise Policy for Industry' (2017) and 'NSW Road Noise Policy' prepared by the Department of Environment, Climate Change and Water NSW (DECCW NSW) dated March 2011. The project noise trigger levels for the proposed development shall be selected according to the most stringent intrusive or amenity criteria. If required, recommendations and noise control measures shall be specified to achieve compliance with the assessment criteria. The assessment shall be representative of all noise generating activities on-site including but not limited to mechanical plant, patrons, deliveries and motor vehicle movements.

When assessing noise levels at commercial or industrial premises, the noise level shall be determined at the most affected point on or within the property boundary. Alternatively, when gauging noise levels at residences, the noise level shall be assessed at the most affected point on or within the residential property boundary. Where necessary, sound levels shall be adjusted in accordance with NSW Environment Protection Authority's guidelines for tonality, frequency weighting, impulsive characteristics, fluctuations and temporal content.

Residential Accommodation in or Adjacent to a Classified Road

*Council's records indicate that the proposed residential accommodation **is not located** on land in or adjacent to a road corridor for a freeway, tollway, transitway or any other road with an annual average daily traffic (AADT) volume of more than 20,000 vehicles.*

Residential Accommodation on Land in or Adjacent to a Rail Corridor

*Council's records indicate that the proposed residential accommodation **is not located** on land in or adjacent to a rail corridor that may be adversely impacted by noise or vibration.*

ANEF Contour

Despite the close proximity of the site to the Western Sydney Airport, Council records indicate that **the site is not within the ANEF Contour range**. This is supported in the scoping report which specifies that the site is perpendicular to the runways at the Western Sydney Airport, so no regular flight paths will be located directly over the site and no flights will circle the site prior to landing.

Based on the above, noise impacts from SEPP road, rail corridor and aircraft to the project site are not required. Traffic noise from local road will be assessed against criteria documented in AS2107:2016.

9.3 AUSTRALIAN STANDARD 2107:2016

AS2107:2016 specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table 1 in Section 5 of AS2107:2016, gives the following maximum internal noise levels for commercial buildings and residential buildings near major roads.

Table 9-1 – Recommended Design Sound Levels

Space /Activity Type	Recommended Design Sound Levels
Residential/hotel - Sleeping Areas	35-40 dB(A) L_{eq} (10pm-7am)
Residential/hotel - Living Areas	35-45 dB(A) L_{eq} (anytime)
Medical - ward	35-40 dB(A) L_{eq} (anytime)
Medical – other sensitive areas	40-45 dB(A) L_{eq} (when in use)
Commercial	40-45 dB(A) L_{eq} (when in use)
Retail	40-50 dB(A) L_{eq} (when in use)

9.4 AAAC GUIDELINE FOR CHILD CARE CENTRE ACOUSTIC ASSESSMENT

The guideline provides the following noise level requirements for external noise impacts on the proposed L3 childcare centre:

Table 9-2 – AAAC Noise Criteria for External Noise Impacts

Type of Occupancy	Noise Level Criteria dB(A) $L_{eq}(\text{period})$
Outdoor Play/Activity Areas	55dB(A) $L_{eq}(1\text{hr})$
Indoor Activity Areas ⁽¹⁾	40dB(A)dB(A) $L_{eq}(1\text{hr})$
Sleeping Areas ⁽¹⁾	35dB(A) $L_{eq}(1\text{hr})$

Table Notes:

1. Internal noise levels assessed with windows and doors closed.

9.5 ADOPTED PROJECT SPECIFIC CRITERIA

The following table provides the criteria adopted for this assessment based on the applicable instruments and guidelines.

Table 9-3 – Summarised Project Noise Assessment Criteria

Room	Noise Level dB(A) L_{eq}
Residential/hotel - Sleeping Areas	35 dB(A) L_{eq} (10pm – 7am)
Residential/hotel - Living Areas	40 dB(A) L_{eq} (anytime)
Medical - ward	35 dB(A) L_{eq} (anytime)
Medical – other sensitive areas	45 dB(A) L_{eq} (when in use)
Commercial	45 dB(A) L_{eq} (when in use)
Retail	50 dB(A) L_{eq} (when in use)
Childcare Centre – Outdoor Play/Activity Areas	55 dB(A) $L_{eq}(1hr)$
Childcare Centre – Indoor Activity Areas	40 dB(A) $L_{eq}(1hr)$
Childcare Centre – Sleeping Areas	35 dB(A) $L_{eq}(1hr)$

10 NOISE INTRUSION ASSESSMENT

An assessment has been undertaken for external transportation noise intrusion into the project building. The following methodology is used:

- External traffic noise levels at future façades are predicted using CoRTN traffic noise prediction model.
- Internal noise levels are then calculated to the centre of the room using the predicted octave band façade incident external noise levels and, for each façade element, correcting for the exposed area, octave band sound transmission loss and room sound power to pressure correction. The room noise level was calculated by accumulating all significant noise paths.

Envelope performance requirements to comply with the noise criteria stipulated in Section 9.5 have been assessed and are provided in Section 10.2.

10.1 MEASURED EXISTING EXTERNAL NOISE LEVELS

Existing noise levels from the transportation sources have been measured using the methodology outlined in Appendix B3 of the RNP as a basis, and representative noise levels determined from analysis of the data. Appendix A summarises the measurements and data obtained, and the calculated noise descriptors. These are summarised in the following table.

Table 10-1 – Ambient Noise Levels

Location	Time of Day	Ambient Noise Level (dB(A) $L_{eq,period}$)
Western Boundary (Facing Badgerys Creek Road)	Day (7am to 10pm)	54
	Night (10pm to 7am)	52
Eastern Boundary	Day (7am to 10pm)	54
	Night (10pm to 7am)	48

10.1.1 CALCULATION OF EXTERNAL ROAD NOISE LEVELS

The measured noise levels have been used as a basis for predicting noise levels around the development by:

- Accounting for any likely changes in traffic volumes in the long term.

Badgerys Creek Road is classified as a sub-arterial road. With the operation of metro station in the near future, the following increase in noise levels are predicted with the increase of traffic volumes in year 2036 (referenced from M2A Sydney Metro – Western Sydney Airport Technical Paper 2 Noise and vibration (October 2020)):

- Daytime: 2.4dB(A)
- Nighttime: 0.7dB(A)

The above increase has been adopted to calculate future façade noise level resulting from traffic.

- Correcting for different distances between the noise source compared to the monitoring location.
- Barrier effects, where applicable.
- Reflections off adjacent structures, where significant.

The CoRTN traffic noise prediction model has been used to calculate the above adjustments indicated above.

10.2 COMPLYING MITIGATION

Assessment of façade requirements to achieve required indoor noise levels has been undertaken. Dimensions of rooms, setbacks from roadways, window openings and floor areas have been used.

The following treatment is indicated for the proposed development to comply with the nominated assessment criteria.

10.2.1 GLAZED WINDOWS AND DOORS

Acoustically rated external windows and doors are required. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria.

All external windows and doors listed are required to be fitted with Q-lon type (or equal) acoustic seals. **(Mohair Seals are unacceptable)**. The suitability of alternative seal types should be determined to an appropriately qualified acoustic expert.

The complying constructions are listed below.

Table 10-2 – Complying Glazing Constructions

Building	Facade	Space	Glazing Construction	Acoustic Seals
Building A	All facades	Bedrooms	6.38mm Laminated	Yes
		Living rooms		
Building B	Northwestern façade (above childcare centre OPA)	Bedrooms	10 mm Float	Yes
		Living rooms		
	All other facades	Bedrooms	6.38mm Laminated	Yes
		Living rooms		
Building C	Western Façade (facing Badgerys Creek Road)	Bedrooms	10 mm Float	Yes
		Living rooms		
	All other facades	Bedrooms	6.38mm Laminated	Yes
		Living rooms		

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.

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

In addition to complying with the minimum scheduled glazing thickness, the R_w rating of the glazing fitted into open-able frames and fixed into the building opening should not be lower than the values listed in Table 10-3 below. This will require the use of acoustic seals around the full perimeter of open-able frames and the frame will need to be sealed into the building opening using a flexible sealant.

Table 10-3 – Minimum R_w of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
6.38mm Laminated	31
10 mm float or 6/12/6 IGU	33

10.2.2 EXTERNAL ROOF AND CEILING CONSTRUCTION

External roof will be constructed from concrete hence no acoustic upgrade is required.

In the event that any penetrations are required through the external skin, an acoustic sealant should be used to minimise all gaps.

10.2.3 EXTERNAL WALLS

External walls constructed from concrete/masonry elements will not require any acoustic upgrading to achieve the acoustic requirements.

In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

10.3 SUMMARY

Given the complying constructions in Section 10.2 are adopted, internal noise levels resulting from external transportation noise will comply with the internal noise design criteria in Section 9.5.

11 SYDNEY METRO INDUCED VIBRATION ASSESSMENT

11.1 PROJECT CRITERIA

This section of the report nominates criteria applicable to nearby receivers which will be impacted by the future the operation of the Sydney Metro Western Sydney Airport Line adjacent to the project site. The following guidelines and standards have been referenced:

- British Standard BS 7385:1990 Part 2 *Evaluation and measurement for vibration in buildings – part 2*
- Australian Standard AS2670:1990 *Vibration and Shock – Guide to the evaluation of human exposure to whole body vibration*
- NSW EPA *Assessing Vibration: A Technical Guideline*, and
- NSW Department of Planning *Developments near Rail Corridors or Busy Roads – Interim Guideline*.

11.1.1 GROUND BORNE NOISE

Development located adjacent to railway lines must be assessed in accordance with Clause 2.100 of the SEPPT&I 2021. It is noted that the requirements of this standard are achieved when assessed in accordance with the NSW Department of Planning DNRCBR. The section relevant to ground borne noise is as follows:

Where buildings are constructed over or adjacent to land over tunnels, ground borne noise may be present without the normal masking effect of airborne noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground borne L_{Amax} noise limit of 40dBA (daytime) or 35dBA (night-time) measured using the "slow" response time setting on a sound level meter.

Table 11-1 – Internal Railway (Metro) Noise Level Criteria for Ground Borne Noise

Location	Time of Day	Internal Ground Borne Noise Criteria dB(A)L _{max} (SLOW)
Living and sleeping areas	Day (7am-10pm)	40
	Night (10pm-7am)	35

11.1.2 TACTILE VIBRATION

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

The NSW Planning Interim Guideline references the NSW EPA *Assessing Vibration- A technical guideline* which recommends that habitable rooms should comply with the criteria therein which is in line with the requirements of British Standard BS 6472:1992 "*Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*".

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. This standard 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 2670 "*Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80Hz)*" which represent 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.

This 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 overall value is then compared to the levels in Table 11-2. For this project the aim will be for a low probability of adverse comment.

Table 11-2 – Vibration Dose Values (m/s^{1.75}) above Which Various Degrees of Adverse Comment May Be Expected in Residential Buildings

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16hr day (Daytime)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night (Night time)	0.13	0.26	0.51

11.2 SYDNEY METRO IMPACT ASSESSMENT

Operational structure borne noise and vibration expected to be generated by the Sydney Metro Western Sydney Airport Line are detailed in the M2A document *Sydney Metro – Western Sydney Airport Technical Paper 2 Noise and vibration* (October 2020). The report details the expected acoustic and vibration impacts on existing properties along the proposed rail line.

11.2.1 GROUND BORNE NOISE IMPACT

The project site will be located in Noise Catchment Area 12 (NCA) where the closest existing properties has been assessed is located at 180 Badgerys Creek Rd, Bradfield NSW 2556. Given the project site is located further way from the metro tunnel comparing to the above residents, ground borne noise impact will be able to comply with the night-time ground borne noise criteria.

Figure 3 and Figure 4 indicate the predicted ground borne noise close to the project site. Operational ground borne noise is shown to comply with the project requirement, namely, $35L_{Amax(slow)}$ for residential night time ground borne noise criteria.

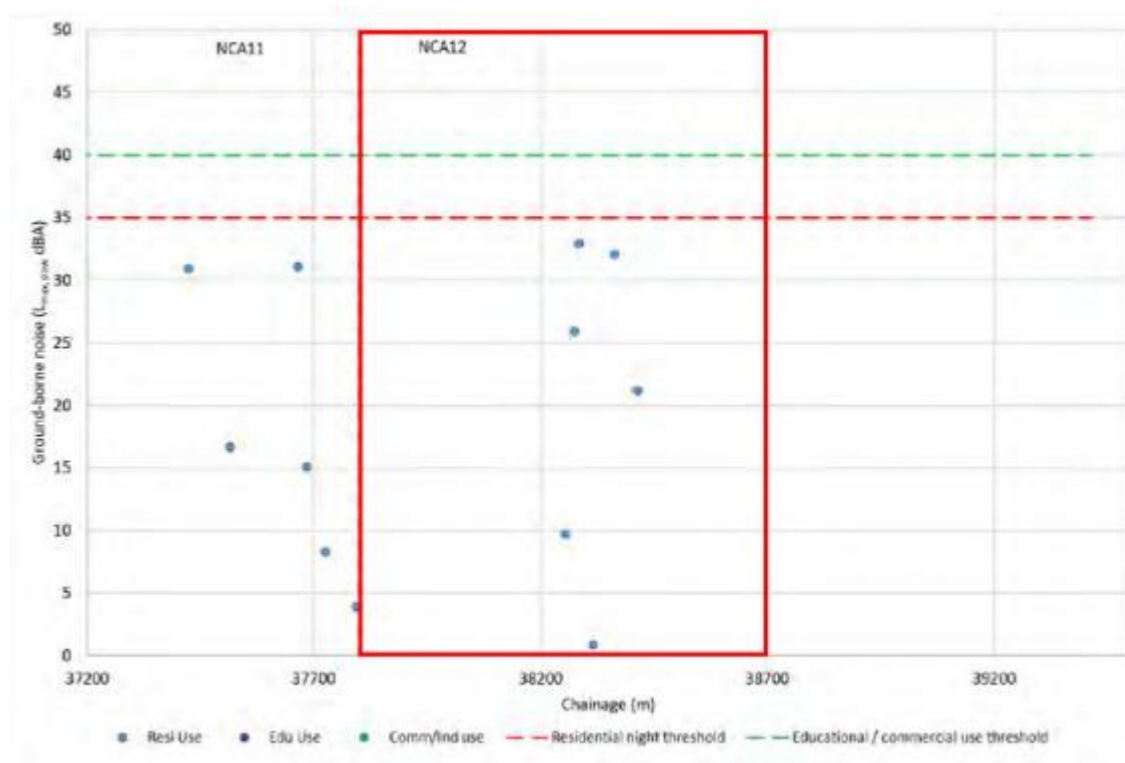


Figure 3 – Predicted Operational Ground-borne Noise Levels Induced by Metro



Figure 4 – Predicted Operational Ground-borne Noise Levels Induced by Metro

11.2.2 VIBRATION IMPACT

Section 5.6.2 of the M2A document *Sydney Metro – Western Sydney Airport Technical Paper 2 Noise and vibration* (October 2020) states the following:

Estimated vibration dose value predictions

Estimated vibration dose value (eVDV) predictions indicate that all buildings assessed are below the preferred VDV values shown in Table 5-4. The highest predicted eVDV is 0.087 m/s^{1.75} which is lower than 0.13 m/s^{1.75} preferred vibration target for residential dwellings at night.

It is important to note that the overall exposure time to operational vibration is very small (approximately 30 minutes during the day, and 12 minutes during night), and therefore the predicted eVDVs are compliant by a substantial margin for most buildings. The predicted compliance does not mean that individual events (train pass-bys) would not be perceived by receivers.

In any case, the ground-borne noise criteria are more stringent, and would drive the design for ground-borne noise and vibration mitigation.

Given the project site is located further way from the metro tunnel comparing to the above residents, vibration impact is believed to comply with the night-time vibration criteria 103dB_v (0.14mm/s).

We also note that the predictions detailed in the M2A report assume the noise/vibration level on the ground floor of each residence, however for the project site there are additional levels (commercial/gym/supermarket) prior to the first level containing residential apartments. As vibration travels up the building, there will be additional attenuation, further reducing the impact of future occupants.

11.3 SUMMARY

As discussed in the above sections, both ground borne noise and vibration impact from the operation of the Sydney Metro Western Sydney Airport Line to the project site will comply with the criteria in Section 11.1. No additional attenuation method is required.

12 NOISE EMISSION CRITERIA

12.1 NOISE SOURCES

The following significant noise sources have been identified as requiring assessment:

- Entertainment (patrons and music) noise emissions from licensed premises.
- Services plant noise emissions.
- Noise from truck movements in the loading dock.
- Operational noise from proposed childcare centre.
- Management of noise from waste collection and other site activities.

12.2 NOISE EMISSION GUIDELINES

The noise sources in Section 12.1 have different characteristics. Consequently, they require different impact assessment methodologies. A list of the noise emission guidelines is presented below:

- Department of Planning, Housing and Infrastructure *Western Sydney Aerotropolis Development Control Plan (DCP)* 2022 (September 2024)
- NSW Liquor Act 2007
- Association of Australasian Acoustical Consultants (**AAAC**) *Guideline for Child Care Centre Acoustic Assessment*, version 3.0, September 2020.
- Liverpool City Council *Re: Request for Council's Advice on SEARs – SSD-77458970 (Ref: SSD1-13/2024, Dated 8 January 2025)*, and
- NSW Environmental Protection Authority *Noise Policy for Industry (NPI)* 2017.

For each type of noise source, adopted guidelines is summarised in the following table.

Table 12-1 – Noise Impact Assessment - Applicable Guidelines

Noise Source	Guideline Adopted	Comment
Patrons and music	Liquor & Gaming and Liverpool Council advise on SEARs	Refer discussion below
Services plant	NPfl	Noise from plant assessed
Truck movements in loading dock	NPfl	Vehicle noise impacts assessed
Operation noise from childcare centre	AAAC	Noise from the use of indoor/outdoor play areas
Management of noise from waste collection and other site activities	NGLG	Activities managed to minimise impacts

12.3 WESTERN SYDNEY AEROTROPOLIS DEVELOPMENT CONTROL PLAN (DCP) 2022 (SEPTEMBER 2024).

The Western Sydney Aerotropolis DCP 2022 requirement is a general requirement and does not provide numerical noise emission assessment criteria. Therefore, council's advice and NPI requirements will be adopted to assess impacts.

12.4 LIVERPOOL CITY COUNCIL RE: REQUEST FOR COUNCIL'S ADVICE ON SEARS – SSD-77458970 (REF: SSD1-13/2024, DATED 8 JANUARY 2025).

Licensed Premises and Entertainment Venues

Noise from licensed premises and late night entertainment venues may interfere unreasonably with the comfort and repose of sensitive receivers. To prevent impacts on human health and amenity, the Application shall be supported by an acoustic report prepared by a suitably qualified acoustic consultant.

The acoustic report shall demonstrate compliance with the following assessment criteria:

- The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) by more than 5 dB between 7:00am and 12:00 midnight at the boundary of any affected residence.*
- The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) between 12:00 midnight and 7:00am at the boundary of any affected residence.*
- Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00am.*

In addition, the acoustic consultant shall assess the cumulative noise impact arising from the proposed licensed premises in accordance with the NSW Environment Protection Authority's 'Noise Policy for Industry' (2017). The proposed development may generate additional traffic and affect existing residential or other noise-sensitive land uses. Therefore, road traffic noise impacts may need to be assessed in accordance with the 'NSW Road Noise Policy' prepared by the Department of Environment, Climate Change and Water NSW (DECCW NSW) dated March 2011.

Where necessary, the report shall specify recommendations and noise control measures to achieve compliance with the project noise trigger levels for the proposed development. In addition, the assessment shall be representative of all noise generating activities undertaken on-site including but not limited to mechanical plant and motor vehicle movements. When assessing noise levels at commercial or industrial premises, the noise level shall be assessed at the most affected point on or within the property boundary.

Alternatively, when assessing noise levels at residences, the noise level shall be assessed at the most affected point on or within the residential property boundary. Sound levels may need to be adjusted in accordance with NSW Environment Protection Authority guidelines for tonality, frequency weighting, impulsive characteristics, fluctuations and temporal content.

The acoustic report shall include a detailed Venue and Patron Management Plan for the licensed premises. The Plan shall address means by which the licensed premises will control noise from the facility. As a minimum, the Plan shall include: hours of operation of all parts of the premises; patron capacity; patron security; pass out process; queuing areas; complaint handling processes; staff training; management of patrons and outdoor areas; noise attenuation measures; outdoor smoking areas; music provision; lighting outside the premises and disposal and collection times for waste.

The acoustic report and Venue and Patron Management Plan shall be submitted to Council with the Development Application.

12.5 PATRONS AND MUSIC NOISE ASSESSMENT CRITERIA – NSW LIQUOR ACT 2007

12.5.1 EXTERNAL RECEIVERS

From mid-2024, the Vibrancy Reforms legislation designates Liquor and Gaming NSW as the regulator of entertainment sound-related complaints for all licensed premises.

To help Liquor and Gaming NSW effectively carry out this role, amendments have been made to relevant pieces of legislation. These amendments will ensure that entertainment sound emanating from licensed premises is solely managed through the *Liquor Act 2007*. This means that noise-related conditions of development consent and 'offensive noise pollution' laws will no longer apply when such matters are regulated by the *Liquor Act 2007*.

The Vibrancy Reforms will also increase the number of disturbance complainants needed for a complaint to be formally considered. The number will increase from 3 to 5 (and the complainants must be from different households). Complainants must also attempt to resolve disputes with the licensee before lodging a complaint.

How long a complainant has been living in the household (referred to as the "order of occupancy" in the legislation) will become a central consideration in disturbance complaints. This will help to prevent when newcomers to a neighbourhood work to shut down or wind back the entertainment offerings and/or operating hours of established venues.

The Vibrancy Reforms:

- Remove restrictions on live entertainment that generally seek to restrict the type of live music, whether it is amplified or not, the location on the site, etc.
- Conditions of development consent relating to noise emitted from licenced premises or trading hours cease to have effect.
- Formalise procedures related to complaints including who is able to make a complaint and the minimum number of complainants.
- Vary how noise is assessed depending on the "order of occupancy".

When the licenced premises was operating prior to the complainant occupying their premises, a more relaxed test is applied, that is an *order of occupancy* test rather than *unduly disturbed*.

In addition, a complainant cannot be considered to be *unreasonably and seriously disturbed* if the alleged disturbance was reasonably foreseeable by the complainant, or if the complainant could take reasonable steps to mitigate the impact of the disturbance on the complainant but did not.

Notwithstanding:

- Clause 79A of the Liquor Act states Licensed premises must not disturb quiet and good order of neighbourhood. A licence does not authorise business to be conducted on licensed premises in a way that unduly disturbs, or unreasonably and seriously disturbs, the quiet and good order of the neighbourhood in which the licensed premises are located.
- The Secretary may add noise abatement conditions on a licence when valid complaints are received in a manner permitted by the acts, or the Secretary is satisfied the quiet and good order of the neighbourhood of the licensed premises are being unduly disturbed.

Objective tests to determine the levels of impact corresponding to *unreasonably and seriously disturbed* and *unduly disturbed* have not been established.

Historically, Liquor and Gaming typically applied the following licenced premises noise limits at residential receivers:

The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) by more than 5dB between 7:00 am and 12:00 midnight at the boundary of any affected residence.

The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) between 12:00 midnight and 7:00 am at the boundary of any affected residence.

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00 am.

The historically applied limits can be used to indicate if residential receivers are likely to be *unduly disturbed* where a new licenced premises is proposed.

The three relevant Licenced premises assessment periods are Day (7am to 6pm), Evening (6pm to 10pm) and late evening (10pm to midnight). Project specific criteria have been determined for each most affected receiver location using these guidelines and the measured rating background noise level applicable to the operating time.

Table 12-2 – NSW Liquor & Gaming Noise Emission Objectives Criterion (dB(A) $L_{10,15min}$) – Surrounding Residents

Receiver	Time	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	A-wt
R1 – R4	Day (BG+5dB)	47	48	41	36	35	37	43	38	14	46
	Evening (BG+5dB)	47	48	41	36	35	37	43	38	14	46
	Late evening (BG+5dB)	47	48	41	36	35	37	43	38	14	46

12.5.2 RESIDENTIAL RECEIVERS WITHIN THE DEVELOPMENT

The recently introduced Vibrancy Reforms indicate that the Order of Occupancy needs to be considered when assessing impacts from licenced premises to residential receivers. Where the resident should have reasonably been aware of a licenced premises then it is incumbent on them to take reasonable steps to mitigate noise impacts.

Accordingly, for this development the dwellings potentially impacted by emissions from licenced premises will be provided with upgraded facades and an alternative outside air supply.

For residential apartments within the development, it is proposed that an internal noise level criteria is adopted based on Australian Standard AS 2107:2016 recommended internal noise levels, an approach commonly applied in similar scenarios.

Based on this approach, the proposed combined patron and music internal noise level criteria from F&B tenancies to residential apartments within the development is as follows:

- *35dB(A) $L_{eq(worst\ 1\ hour)}$ for bedrooms (internally, with windows closed); and*
- *40dB(A) $L_{eq(worst\ 1\ hour)}$ for main living areas (internally, with windows closed).*

Section 3.2 of the guideline states the following regarding noise criteria to residential receptors:

3.2.1. Outdoor Play Area

The noise impact from children at play in a child care centre differs from the domestic situation in that it is a business carried out for commercial gain, the number of children can be far greater than in a domestic situation and the age range of the children at the centre does not significantly vary over time as it would in a domestic situation. However, the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play, in some circumstances, can be pleasant, with noise emission generally only audible during the times the children play outside. Night time, weekend or public holiday activity is not typical and child care centres have considerable social and community benefit.

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

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

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

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

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:

- *1.5 m above ground level;*
- *On a balcony at 1.5 m above floor level;*
- *Outside a window on the ground or higher floors.*

3.2.2. Other Noise Emission

The cumulative $L_{eq,15}$ minute noise emission level resulting from the use and operation of the child care centre, with the exception of noise emission from outdoor play discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above. This includes the noise emission resulting from:

- *Indoor play;*
- *Mechanical plant;*
- *Drop off and pick up;*
- *Other activities/operations (not including outdoor play).*

Background noise levels adopted are presented in Table A-3. The following table summarises the noise criteria determined using the AAAC Guideline for the various noise sources at the nearby residential properties.

Table 12-3 – AAAC Noise Emission Criteria

Type of Noise Source	Time of Day	Rating Background Noise Level dB(A)_{Leq(period)}	Criterion dB(A)_{Leq(15 minute)}
Outdoor Play	Day	41	46 (more than 4 hrs play) 51 (Up to 4 hrs play) ¹
Indoor Play Drop off & Pick up Mechanical Plant	Day	41	46 ²

Table Notes:

1. Where outdoor play is limited to 2 hours in the morning, and 2 hours in the afternoon.
2. Combined level

The criteria above are applicable to residents and receivers external to the development. For residents within the development, further discussion is provided in Section 13.5.

12.7 MECHANICAL PLANT AND LOADING DOCK NOISE ASSESSMENT CRITERIA - NSW EPA NPI 2017

Criteria to assess noise emissions from the operation of the proposed development have been developed using the NPI. This policy was primarily developed to assess noise impacts from industrial development, but can also be adapted to assess other types of development such as commercial buildings and air conditioning plant.

For each receiver type:

- Receivers have been grouped into “catchments”. These are receivers that have been assessed as having similar characteristics (receiver type and ambient noise level). These are shown in Figure 2.
- For each catchment, representative noise assessment trigger levels have been determined based on NPI guidelines. The trigger levels have been adopted in this assessment as criteria. These will be used to indicate whether additional mitigation is needed to manage noise emissions.
- For each catchment, noise emissions have been assessed to the most impacted receiver. This means that impacts at all other receivers within that catchment will be less. Compliance at the most impacted receiver will therefore also result in compliance at all other receivers within the catchment.

For residential receivers, three criteria are assessed:

- Intrusive assessment– that is, how audible is the emitted noise compared to ambient, background noise). Criteria are determined relative to the measured rating background noise level.
- Amenity assessment – that is, how loud is the absolute level of industrial noise, including cumulative noise from other industrial sources. The NPI nominates appropriate amenity noise levels depending on the receiver type and prevailing noise environment/zoning.
- Maximum Noise assessment – will high-level, short-term noise events cause adversely impact sleep at night? Trigger levels are determined relative to the measured night rating background, and assessed outside rooms where sleep is likely to occur.

For residential receivers, noise emissions are assessed against the trigger levels to determine the likely extent of impacts. The lower of the relevant intrusiveness and amenity trigger levels are adopted. Noise emissions lower than the trigger levels indicate there is no adverse impact. A maximum noise level assessment is separately undertaken if night time emissions occur.

For other receiver types, only an “amenity” assessment is required.

Appendix A summarises the results of ambient noise monitoring. Appendix B provides the derivation of NPI trigger levels for each of the receivers. These are summarised in the following table.

12.8 SUMMARISED NOISE EMISSION CRITERIA

Table 12-4 – Mechanical and Loading Dock – Project Specific Trigger Levels

Location/Receiver Type	Time	RBL dB(A) L ₉₀	Trigger Noise Level (dB(A) L _{eq,15min})		
			Intrusiveness	Amenity	Max Event
R1-R4 - Residential	Day	41	46	53	N/A
	Evening	41	46	43	N/A
	Night	41	46	38	46 L_{eq} 56 L_{max}
C1-C2 - Commercial	When in use	N/A	N/A	63	N/A

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

Table 12-5 – NSW Liquor & Gaming Noise Emission Objectives Criterion (dB(A) L_{10,15min}) – Surrounding Residents

Receiver	Time	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	A-wt
R1 – R4	Day (BG+5dB)	47	48	41	36	35	37	43	38	14	46
	Evening (BG+5dB)	47	48	41	36	35	37	43	38	14	46
	Late evening (BG+5dB)	47	48	41	36	35	37	43	38	14	46

Table 12-6 – AAAC Noise Emission Criteria

Type of Noise Source	Time of Day	Rating Background Noise Level dB(A)$L_{eq}(\text{period})$	Criterion dB(A)$L_{eq}(15 \text{ minute})$
Outdoor Play	Day	41	46 (more than 4 hrs play) 51 (Up to 4 hrs play) ¹
Indoor Play Drop off & Pick up Mechanical Plant	Day	41	46 (combined level)

13 NOISE EMISSION ASSESSMENT

13.1 MECHANICAL PLANT NOISE

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

Noise emissions from all mechanical services to the closest residential, childcare and commercial receivers should comply with the requirements of Section 12.8.

13.1.1 PRELIMINARY MECHANICAL TREATMENT ADVICE

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

- Major fans (typically with a sound power over 80dB(A) – such as kitchen exhaust, major toilet exhaust and major relief air fans) may require acoustic treatment if located externally near sensitive receivers. It is recommended that axial (as opposed to roof mounted fans) are to be used as this will enable acoustic treatment to be incorporated within ductwork running to atmosphere and with attenuators if necessary. In addition to the location of the equipment, acoustic treatments to the major plant items may include silencers, treatment to ducting, time control, operational limitations, and vibration isolation.
- Supply and exhaust fans may be located within plant rooms or in rooftop plant areas. These units typically emit high noise levels and require acoustic treatment such as silencers and internal lined ductwork. Silencer requirements would be determined once fan selections have been completed.
- Other minor plant items, such as bathroom or kitchen exhaust fans, may also be required. These items typically emit relatively low noise levels and may require minimal acoustic treatment of a standard nature, such as internally lining of ductwork.
- Residential Condensers: The project may include external residential condenser units which will be located on condenser farms on each floor or balconies. Providing condenser equipment is selected using suitable noise level data, then acoustic treatments can be implemented such as screening, enclosures, and treatment to exhaust to ensure that the relevant noise emission criteria will be achieved.

Cumulative assessment of both plant noise with other noise sources is recommended when conducting acoustic design of plant items. Compliance with EPA acoustic criteria (as set out in Section 12.8) will be achievable, provided that detailed acoustic review of plant items is undertaken once plant is selected, and acoustic treatments similar to those outlined above are adopted.

The above recommendations are indicative. Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

13.2 NOISE FROM FUTURE COMMERCIAL/RETAIL TENANCIES

Residential apartments are proposed to be located above or adjacent to lower level commercial/retail use spaces within the development. We note the following:

- General retail outlets are expected to have a minimal impact on proposed residential uses.
- Licensed tenancies (especially those which are proposed to operate during the night time period) will have a higher potential acoustic impact, pending their capacity and siting.
- Noise from internal spaces are typically controlled through management controls to ensure internal noise levels are not excessive, and to ensure the façade is not open during noise sensitive periods of the day (i.e. after 10pm, and before 7am).
- In the event any tenancies were to incorporate liquor licensing or an outdoor dining area, this would likely be subject to a separate approval, at which time the proposal would need to demonstrate compliance with the relevant noise emission criteria. With respect to noise transmission through the floor slab (internal/external noise transmission), the construction of an appropriate ceiling may be required, depending on the level of noise expected to be generated by the proposed use.

13.3 NOISE FROM MEDICAL USE

Noise from typical medical use (including patient wards, consultation rooms, operating theatres/day surgeries, imaging departments and administrative offices) are not expected to generate a significant level of noise that would result in adverse impact to nearby noise sensitive receivers.

The potential for noise impacts from hospital use will be associated with mechanical plant and equipment. A review is to be undertaken at CC stage to determine suitable acoustic treatments to achieve satisfactory noise emission goals identified in Section 12.7 of this report.

13.4 NOISE FROM THE LOADING DOCK AND CARPARK

Three loading docks are proposed in the project site with one in each building (namely building A, B and C). The locations of loading dock entrance/exit are:

- Building A loading dock: entrance located on the ground floor to the northeast corner of the site connected to the centre loop west.
- Building B loading dock: entrance located on the ground floor to the northwest corner of building B connected to the proposed new street (slow).
- Building C loading dock: entrance located on the ground floor to the south of building C connected to Road 07.

Operational noise levels from the use of the proposed loading dock/carpark facilities are predicted and assessed against the NSW EPA *Noise Policy for Industry* criteria detailed in Section 12.8 based on information provided in the *Transport and Accessibility Impact Assessment prepared by asongroup (Project number P2775, dated 23 September 2025)*.

Operational noise emissions are predicted based on the following source noise levels.

Table 13-1 – Average (L_{eq}) Source Noise Levels

Noise Source	Sound Power Level
Medium Rigid Vehicle slowly manoeuvring at up to 10km/h	100dB(A) L_{eq}
Small Rigid Vehicle slowly manoeuvring at up to 10km/h	90dB(A) L_{eq}
Car/Van travelling at up to 10km/h	84dB(A) L_{eq}

Operational noises are hence predicted to all nearby residential receivers and results are summarised below:

Table 13-2 – Predicted Cumulative Noise Levels from the Use of Loading Dock/Carpark

Receiver	Predicted Noise Level $dB(A)L_{eq(15min)}^{(1,2)}$	Criteria Noise Level $dB(A)L_{eq(15min)}$	Complies
R1	35	NSW EPA Project Criteria: 46 (Daytime) 43 (Evening) 38 (Night)	Yes
R2	36		Yes
R3 (M1, M2)	<20		Yes
R4	<20		Yes

Table Notes:

1. Based on up to 1 medium truck, 1 small truck, and up to 20 car in any given 15min period. Each vehicle is assumed to travel at 10km/h, and have their engines on for up to 1 minute while manoeuvring within the loading dock.
2. Above assessment is based on assumption that carpark entry is open. If required, further attenuation will be provided with the roller shutter being installed and closed during loading.

Note that the above assessment is based on 2 truck movements during a single 15-minute period, which would represent a worst-case scenario. In practice, it is unlikely that this intensity of use would be realised or even practicable, and so the actual noise impact to surrounding receivers would be reduced. Notwithstanding, the above demonstrates the ability of the loading to meet noise emission requirements, even when used intensively.

13.5 NOISE FROM CHILDCARE CENTRE

Operational conditions (hours of use or child capacities) for the Level 3 childcare centre have not yet been determined for the development. It is expected that a separate application will be submitted by the childcare operator. Current plans show the following:

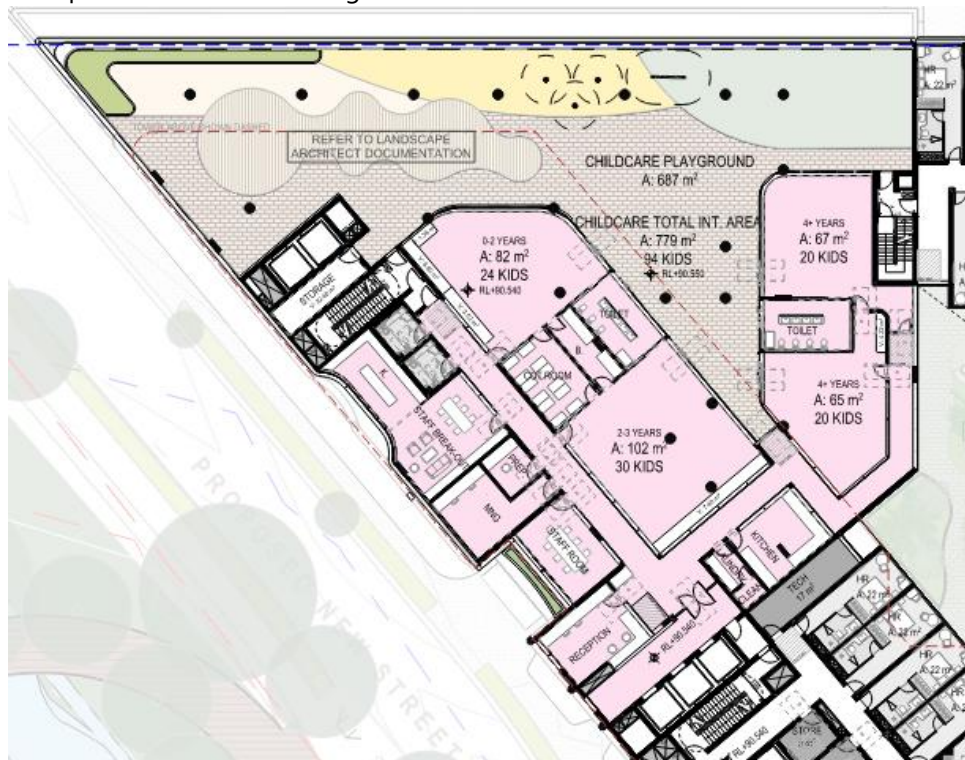


Figure 5 – Proposed Level 3 Childcare (Area in Pink)

Notwithstanding the above, we note the following:

- Noise from internal play areas will be easily controlled through selection of suitable building shell materials and management controls (i.e. number of children in each space, ensuring windows and doors are closed when used for noisy activities).
- Noise from external play areas will have the greatest impact to nearby residences. In considering of the information above:
 - The childcare outdoor play area is located on level 3 the north-western corner of building B. Noise to receivers external from the project development are to comply with the requirements nominated in Section 12.8 of this report.
 - For residences within the project development, the ongoing design and development of the project allows for acoustic treatments to be incorporated within the residential façade rather than at the source of the noise. It is proposed that an internal noise criteria instead be adopted to be applied with the doors and windows of residences closed. This approach is consistent with the assessment of other external noise sources (such as road/rail impacts).
- Australian Standard AS2107:2016 *Recommended Design Sound Levels and Reverberation Times for Building Interiors* recommends the following internal noise targets for residential uses (houses and apartments in inner city areas or entertainment districts or near major roads):
 - Living Areas: 35 to 45dB(A)_{Leq}
 - Sleeping Areas (Night time): 35 to 40dB(A)_{Leq}

The above noise levels are typically specified for continuous or quasi-steady state sources of noise such as mechanical plant. Typically, there is a lower tolerance of noise from commercial activities, or noise outside of the control of the occupant. As such, it would be reasonable to adopt a more stringent internal noise level for operation of the childcare centre, than from internal services noise within the apartments themselves, for example. Further, by adopting a lower internal noise level from commercial uses on the site, cumulative increases are avoided from other sources of external noise such as road traffic or the future light rail.

This assessment will adopt a 30dB(A) internal noise goal for use of the childcare impacting apartments within the project building, being 5dB(A) below the lower range presented within AS2107:2016.

The above noise levels would be achieved where external windows or doors are closed. As such, it may be desirable to provide a supplementary source of ventilation to apartments which are potentially affected by noise from the operation of the proposed childcare centre (and specifically the outdoor play areas). We note that it is common for external play areas to only operate after 7am (outside of the night time period), and as such it is possible that this would only be required to living spaces.

14 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

14.1 LIVERPOOL CITY COUNCIL RE: REQUEST FOR COUNCIL'S ADVICE ON SEARS – SSD-77458970 (REF: SSD1-13/2024, DATED 8 JANUARY 2025).

Construction Noise and Vibration Assessment

Given the location of the proposed development, the inclusion of an underground basement carpark and the close proximity to existing residential dwellings, a site-specific Construction Noise and Vibration Assessment prepared by a suitably qualified acoustic consultant shall be submitted for review. The Construction Noise and Vibration Assessment must include an assessment of expected noise impacts and detail feasible work practices to be adopted to avoid, remedy or mitigate construction noise and vibration impacts.

The Construction Noise and Vibration Assessment shall take into consideration and be consistent with the following documents:

- *'Interim Construction Noise Guideline' published by the Department of Environment and Climate Change NSW (DECC 2009/265) dated July 2009,*
- *Assessing Vibration: A Technical Guideline published by the Department of Environment and Conservation (NSW EPA), February 2006*
- *Structural damage criteria as presented in German Standard DIN4150-Part 3 "Structural vibration in buildings – Effects on structures" and British Standard BS7385-Part 2: 1993 "Evaluation and Measurement for Vibration in Buildings.*

The assessment is to include, but not necessarily be limited to the following information:

- *Identification of nearby residences and other noise sensitive land uses;*
- *Assessment of expected noise and vibration impacts;*
- *Detailed examination of feasible and reasonable work practices that will be implemented to minimise noise and vibration impacts;*
- *Strategies to promptly deal with and address noise and vibration complaints;*
- *Details of performance evaluating procedures (for example, noise and vibration monitoring or checking work practices and equipment);*
- *Methods for receiving and responding to complaints;*
- *Procedures for notifying nearby residents of forthcoming works that are likely to produce noise and vibration impacts; and*
- *Reference to relevant licence and consent conditions.*

14.2 CONSTRUCTION NOISE MANAGEMENT LEVELS

Noise associated of construction activities on the site will be assessed in accordance with the NSW DECC *Interim Construction Noise Guideline (ICNG)* 2009.

The “quantitative” assessment procedure, as outlined in the ICNG will be used. The quantitative assessment method requires: Determination of noise generation goals (based on ambient noise monitoring); Prediction of operational noise levels at nearby development; and if necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

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

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

A summary of the above recommended noise levels from the ICNG is presented below.

Table 14-1 – Noise Management Levels at Residential Receiver

Receiver	“Noise Affected” Level dB(A) $L_{eq(15min)}$	“Highly Noise Affected” Level dB(A) $L_{eq(15min)}$
R1 - R4 M1 & M2 (Residential section)	51 (BG+10) externally at façade	75

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

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

14.3 CONSTRUCTION VIBRATION OBJECTIVES

Vibration associated with excavation activities on the site will be assessed in conjunction with the following guidelines:

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

14.3.1 ASSESSING AMENITY (HUMAN COMFORT GUIDELINES)

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

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

Table 14-2 – BS 6472 Vibration Criteria

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

Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g. continuous construction or maintenance activity. (DECC, 2009).

Note 2: Impulsive vibration relate to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g. occasional loading and unloading, or dropping of heavy equipment. (DECC, 2009).

14.3.2 STRUCTURE BORNE VIBRATION (DAMAGE CRITERIA)

German Standard DIN 4150-3 (2016) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

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

It is noted that if measured vibration levels do not exceed the guidelines listed in the following table, damage that will reduce the serviceability of the building will not occur, and if damage to the building does occur, it is assumed that the damage is related to other causes. Furthermore, the DIN4150-3 guideline states the following regarding the limits presented in Table 1 of the standard:

"Exceeding the guideline values does not necessarily lead to damage. Should they be exceeded, however, further investigations may be necessary, such as determining and evaluating the stresses as detailed in 4.3 and 4.4."

Table 14-3 – Table 1 – DIN 4150-3 (2016)) – Guideline Values for Vibration Velocity, $v_{i,max}$, for Evaluating the Effects of Short-Term Vibration on Structures

	TYPE OF STRUCTURE	Guideline values for $v_{i,max}$ in mm/s				
		Foundation, all directions, $i = x, y, z$, at a frequency of			Topmost floor, horizontal direction, $i = x, y$	Floor slabs, vertical direction, $i = z$
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz ^(a)	All Frequencies	All Frequencies
L/C	1	2	3	4	5	6
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings) buildings that are under a preservation order)	3	3 to 8	8 to 10	8	20 ^(b)

NOTE: Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

- At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.*
- It may be necessary to lower the guideline value markedly to prevent minor damage*

14.4 CONSTRUCTION NOISE EMISSION ASSESSMENT

The proposal is to prepare the site and build 3 new residential buildings. An indicative construction scope is summarised as following:

- **Site Preparation Stage:** Site clearance.
- **Excavation Stage:** Excavate and piling for basement levels.
- **Construction Stage:** Construct new residential buildings.

It is envisaged that construction scope and staging would be further refined in subsequent stages of the development approval and documented (along with additional impacts or considerations) within a *Construction Environmental Management Plan*.

14.4.1 SOURCE NOISE DATA

In this section, typical equipment/processes anticipated to be used during the construction of the project site are outlined in the table below with A-weighted sound power levels. The equipment list is prepared based on our experience with similar projects. Typically, the most significant sources of noise or vibration generated during a construction project will be excavation.

Table 14-4 – Sound Power Levels of Equipment

Equipment /Process	Typical Sound Power Level dB(A)	Duty
10t Vibratory roller	109	100%
1t skidsteer loader	110	75%
Piling Rig	112	100%
Mobile Crane	113	25%
Concrete pump	109	100%
Concrete Pump Truck	109	100%
20T Medium Rigid Trucks	103	10%
Powered Hand Tools (Electric)	102	50%

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

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

Noise levels take into account correction factors (for tonality, intermittency where necessary).

14.4.2 METHODOLOGY

Noise from the loudest typical construction activities for all stages of works have been predicted to the nearest most affected sensitive receivers.

Predictions take into account:

- The distance between the noise source and the receiver.
- The screening effect provided by any building structure or building shell, if applicable. In particular, noise from works proposed during the fit-out stages when the building shell will screen these activities from the surrounding sensitive receivers.

Recommended standard hours for construction work presented in Section 2.2 of the NSW DECC ICNG 2009 has been adopted for this project.

14.4.3 RECOMMENDED HOURS OF WORK

The following construction hours are proposed under the standard hours noise management levels of the ICNG:

- Monday to Friday – 7:00am to 6:00pm.
- Saturdays – 8:00am to 1:00pm.
- Sundays and Public Holidays – No works.

14.4.4 PREDICTED NOISE LEVELS

Maximum noise impacts from the construction equipment listed above have been predicted to the nearest noise receivers and presented below. Given the size of the site predicted noise levels will change significantly depending on where the noise source is located. As such, a noise level range has been presented, giving expected noise levels for activities 'farthest from' to 'nearest to' the receiver.

Table 14-5 – Predicted Construction Noise Levels – R1

Activity	Predicted Noise Level	Criteria	Comment
10t Vibratory roller	56-67	NML 51dB(A) HNML 75dB(A)	Predicted noise levels generally exceed the NML 51dB(A) but below the HNML 75dB(A)
1t Skid-steer loader	56-67		
Piling Rig	59-68		
Mobile Crane	54-63		
Concrete pump	56-65		
Concrete Pump Truck	56-65		
20T Medium Rigid Trucks	40-49		Predicted noise levels below the NML 51dB(A)
Powered Hand Tools (Electric)	46-57		Predicted noise levels exceed the NML 51dB(A) but below the HNML 75dB(A)

Table 14-6 – Predicted Construction Noise Levels – R2 & M1

Activity	Predicted Noise Level	Criteria	Comment
10t Vibratory roller	56-70	NML 51dB(A) HNML 75dB(A)	Predicted noise levels generally exceed the NML 51dB(A) but below the HNML 75dB(A)
1t Skid-steer loader	56-70		
Piling Rig	59-69		
Mobile Crane	54-64		
Concrete pump	56-66		
Concrete Pump Truck	56-66		
20T Medium Rigid Trucks	40-50		Predicted noise levels below the NML 51dB(A)
Powered Hand Tools (Electric)	46-60		Predicted noise levels exceed the NML 51dB(A) but below the HNML 75dB(A)

Table 14-7 – Predicted Construction Noise Levels – R3 & R4& M2

Activity	Predicted Noise Level	Criteria	Comment
10t Vibratory roller	55-59	NML 51dB(A) HNML 75dB(A)	Predicted noise levels generally exceed the NML 51dB(A) but below the HNML 75dB(A)
1t Skid-steer loader	55-59		
Piling Rig	58-62		
Mobile Crane	53-57		
Concrete pump	55-59		
Concrete Pump Truck	55-59		
20T Medium Rigid Trucks	39-43		Predicted noise levels below the NML 51dB(A)
Powered Hand Tools (Electric)	45-49		

14.5 GENERAL DISCUSSION

Noise

- Noise impacts on nearby development will be dependent on the activity and where on the site the activity is undertaken. Excavation works (e.g., piling) tend to be the loudest typical activity. Work close to the site boundaries will have the greatest impact on nearby receivers.

Initial analysis indicates:

- **Residential Receivers R1-R4, M1 & M2 (Residential section):** Construction noise levels are predicted to be below the HNML 75dB(A) for all the proposed equipment. Noise levels are predicted to exceed NML 51dB(A) for most of the equipment when work is conducted close to the site boundary.

Noise impacts can be further minimised using the following:

- Selection of equipment and process.
- Location of static plant.
- Use of screens or enclosures and erection of hoarding (typically only feasible for static plant).
- Scheduling of noisy activities and provision of respite periods.

Detailed construction noise planning is typically undertaken after engagement of a builder and a construction program is prepared (i.e., after DA stage) and therefore, detailed planning is not possible at this stage.

In light of the above, we recommend:

- During preparation of the construction program (CC stage), acoustic review of proposed construction activities and plant/methods should be undertaken to identify work items likely to exceed Noise Management Levels.
- For those activities likely to generate high noise levels, the analysis should identify where on the site are the areas likely to result in high noise levels. This will then assist in determining the likely time period for which high noise levels will occur.
- Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.
- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent excessive impact.

Vibration

The highest levels of vibration are likely to be produced when excavation activities are undertaken with the use of piling rig. This activity would only produce a moderate level of vibration close to the work site. Given the distance attenuation between existing residential receivers and the project site, the impact at the surrounding properties is moderate considering amenity and structure damage.

Where required, vibration monitors may be installed at critical locations to determine any impact. Ongoing review and assessment of vibration impact will be conducted throughout the construction process to determine appropriate vibration levels. The specific location and quantity of vibration monitors to monitor residential houses are to be determined in consultation with the builder and structural engineer.

15 NOISE AND VIBRATION MANAGEMENT AND CONTROLS

Notwithstanding that the assessment indicates noise and vibration emissions will generally comply with the noise and vibration management levels, emissions should be minimised as part of best practice endeavours, and contingency measures should be put into place to respond to complaints or if it is found the processes needed to complete the tasks vary from those envisaged in this assessment.

The recommended measures are provided below.

15.1 NOISE AND VIBRATION MONITORING, REPORTING AND RESPONSE PROCEDURES

Given the relatively low level of impact predicted, monitoring would only be required in response to complaints, if the processes needed to complete the tasks vary from those envisaged in this assessment, or if works outside of standard hours are proposed.

Noise and vibration monitoring may either consist of manned and/or unmanned measurements. Active monitoring may be undertaken during the construction work phase of the project if required in the event complaints are received from neighbours.

In the event that complaints are received from neighbours the following process should be considered:

1. Assessing impacts and determining the offending plant/equipment/process.
2. Locating the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implementing additional acoustic treatment in the form of localised barriers, silencers etc.
4. Selecting alternative equipment/processes.

Where monitoring is required and indicates exceedances of the predicted noise impacts immediate action should be taken to identify any further controls as required to reduce noise emissions so that the noise limits are complied with. Monitoring of the activities following the implementation of these additional controls will be undertaken to confirm compliance.

15.1.1 REPORTING REQUIREMENTS

The following is an example of reporting which may be kept on site:

1. A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed below.
2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.
3. Any noise exceedances occurring including, the actions taken and results of follow up monitoring.
4. A report detailing complaints received and actions taken shall be presented.
5. All monitoring and reporting shall be conducted in conjunction with the conditions of consent.

15.1.2 RESPONSE PROCEDURES

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

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

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Indicate what operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Validation of the remedial action.
- Summary of feedback to the complainant.

The flow chart that follows illustrate the process followed to assess construction activities prior to the start of work on site and well as the ongoing investigation into noise during the construction period.

15.2 GENERAL NOISE CONTROL METHODS

The determination of appropriate additional noise control measures will be dependent on the particular activities and the construction equipment and plant identified as requiring future acoustic treatments to those already identified in this report. This section provides an outline of available methods which have previously been used on similar construction sites and may be possible on this site.

15.2.1 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

Where a particular activity or plant and equipment is found to generate noise levels that exceed the management levels, it may be possible to select an alternative approach or plant and equipment. For example, the use of excavator mounted hydraulic hammers of the site may potentially generate high levels of noise. By carrying this activity by using concrete saws or smaller plant here practical, construction noise levels and/or length of exposure to construction noise levels may be reduced.

15.2.2 ACOUSTIC BARRIERS

The placement of barriers at the source is generally only effective for static plant. Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

The degree of noise reduction provided by barriers is dependent on the amount by which the line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

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

15.2.3 SILENCING DEVICES

Where construction methodologies or plant and equipment permit, investigate the use of silencing devices. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts, for example.

15.2.4 TREATMENT OF SPECIFIC EQUIPMENT

In certain cases, it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

15.2.5 ESTABLISHMENT OF SITE PRACTICES

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

15.2.6 NOTIFICATION

Notification of affected receivers of the progress of works, particularly when short-term activities likely to create higher noise levels occur, can in many cases minimise community reaction.

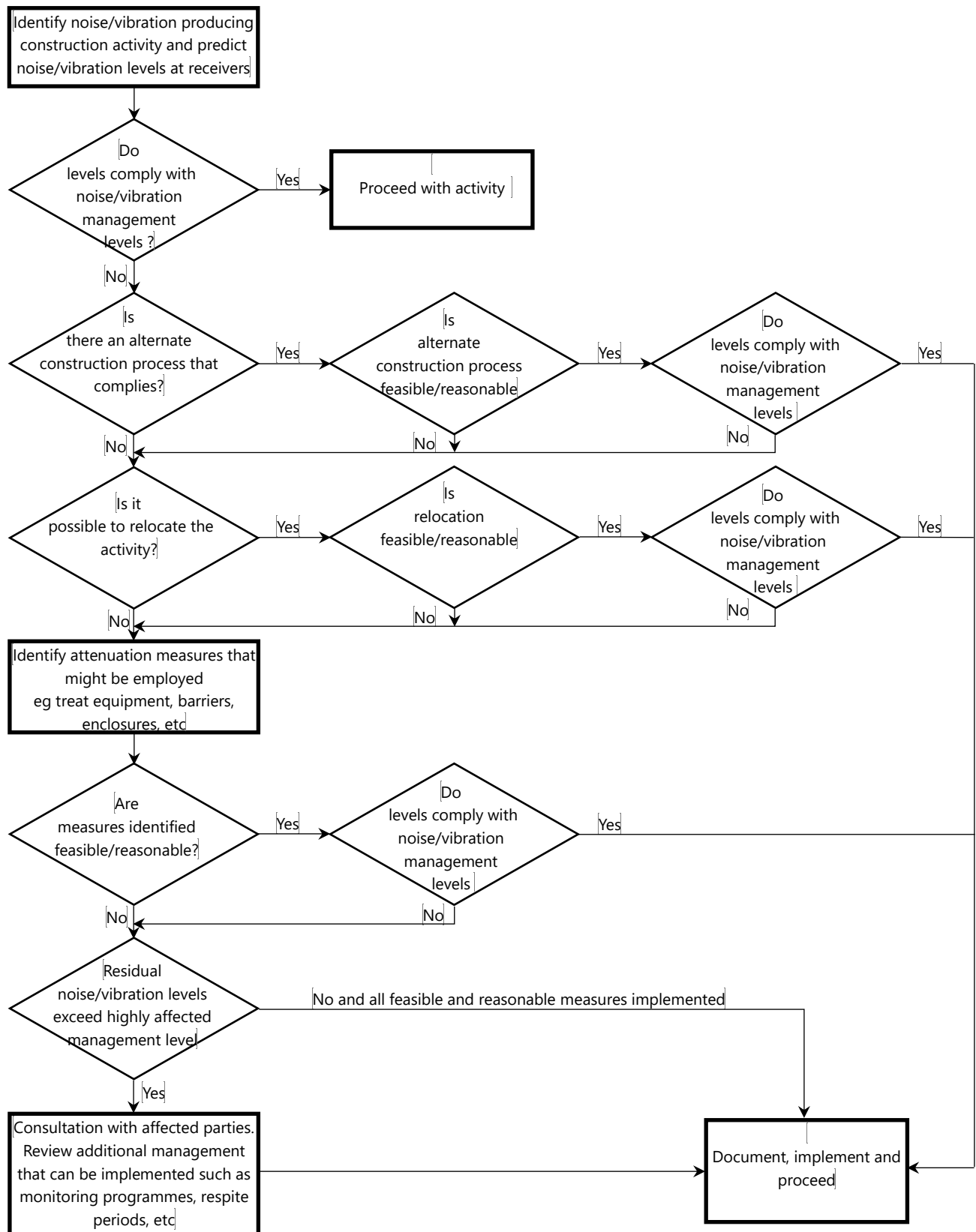
15.3 SITE SPECIFIC RECOMMENDATIONS

In light of the above, we recommend:

- **Community consultation/notification:** Notification (leaflet or similar) of nearby residents is recommended, detailing the duration of piling works.
- **Quiet Work Methods/Technologies:**
 - The primary noise generating activity at the site will be the excavation period. As much as practicable, use of quieter excavation methods is to be adopted.
 - Excavation is conducted initially using excavator with bucket (quietest excavation method), then use of rock saws or rippers if required. Use of the loudest excavation equipment is used only when other options are not available.
 - It is recommended to use rock saws near all boundaries to reduce vibration and noise levels if required.
 - Materials handling/vehicles:
 - Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.
 - Avoid careless dropping of construction materials into empty trucks.
 - Trucks, trailers and concrete trucks (if feasible) should turn off their engines during idling to reduce noise impacts (unless truck ignition needs to remain on during concrete pumping).
- **Complaints handling:**
 - An after hours contact number is displayed outside of the building site, so that in the event that surrounding development believes that a noise breach is occurring, they may contact the site.
 - In the event of complaint, the procedures outlined in Section 16 are adopted. Additional methods of control of construction noise and additional noise control measures which may be adopted by the site are detailed in Section 15.
- **Noise and vibration monitoring:** in case of complaints received from neighbouring residents, long term noise and vibration monitoring shall be conducted at closest receivers.

16 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that will be followed in assessing construction activities.



17 CONCLUSION

This report presents an assessment of noise and vibration impacts associated with the proposed 135 Badgerys Creek Road, Bradfield . Based on the information provided above we conclude the following:

Provided complying constructions presented in Section 10.2 of this report are adopted, internal noise levels for the development will comply with the acoustic requirements of the following documents:

- Liverpool City Council *Re: Request for Council's Advice on SEARs – SSD-77458970* (Ref: SSD1-13/2024, Dated 8 January 2025).
- Department of Planning, Housing and Infrastructure *Western Sydney Aerotropolis Development Control Plan (DCP) 2022* (September 2024).
- Association of Australasian Acoustical Consultants (**AAAC**) *Guideline for Child Care Centre Acoustic Assessment*, version 3.0, September 2020.
- Australian Standard 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Ground borne noise and vibration impact from the operation of Sydney Metro have been analysed with reference to the M2A document *Sydney Metro – Western Sydney Airport Technical Paper 2 Noise and vibration (October 2020)*, both ground borne noise and vibration impact to the project site will comply with the project criteria.

Noise emission criteria from the operational of the development has been set up using the following documents:

- Liverpool City Council *Re: Request for Council's Advice on SEARs – SSD-77458970* (Ref: SSD1-13/2024, Dated 8 January 2025).
- Department of Planning, Housing and Infrastructure *Western Sydney Aerotropolis Development Control Plan (DCP) 2022* (September 2024).
- NSW Liquor Act 2007
- Association of Australasian Acoustical Consultants (**AAAC**) *Guideline for Child Care Centre Acoustic Assessment*, version 3.0, September 2020.
- NSW Environmental Protection Authority *Noise Policy for Industry* 2017.

Once detailed location and selections of all proposed mechanical plant are known, an acoustic review should be undertaken to ensure compliance with the above. This should be undertaken during CC stage.

Operational noise from retail and childcare centre shall also been reviewed in separate applications when an operator is engaged.

Construction noise and vibration management levels have been established and preliminary assessed in this report. Construction noise and vibration impacts will generally comply with the following documents. A full construction noise and vibration management plan can be prepared in CC stage.:

- NSW DECC Interim Construction Noise Guideline 2009.
- German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*.

- NSW Department of Environment and Conservation *Assessing Vibration: A Technical Guideline* (Feb 2006).

Yours faithfully,

A handwritten signature in black ink, appearing to be 'Peipei Feng', written in a cursive style.

Acoustic Logic Pty Ltd

Peipei Feng

APPENDIX A AMBIENT NOISE MONITORING

This appendix summarises the ambient noise data measured near the subject site, and the calculated noise level descriptors adopted to characterise the existing noise environment.

Monitoring has been undertaken to provide the following ambient data:

- Traffic noise levels from local roads, and
- Background noise levels for the project site.

A.1 UNATTENDED LONG TERM NOISE MONITORING

A.1.1 AMBIENT 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 on a continuous basis over this period, and statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters 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 steady state and quasi-steady state noise sources (such as traffic noise).

L₉₀ – This is commonly used as a measure of the background noise level as it represents the noise level heard in the quieter periods during the measurement interval. The L₉₀ 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 L₉₀ level.

L₁₀ 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.

L₁ is sometimes used in place of L_{max} to represent a typical noise level from a number of high-level, short-term noise events.

A.1.2 EQUIPMENT USED

Unattended noise monitoring was conducted using the following equipment:

- Rion NL-42 (Type 2).
- Rion Sound Level calibrator Type NC 74.

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, unless noted otherwise.

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.

A.1.3 LOCATIONS MONITORED

Detailed locations of the noise monitoring are presented in Figure 2.

A.1.4 WEATHER AFFECTED AND EXTRANEOUS/OUTLYING DATA

Periods affected by adverse weather conditions are indicated on the following data graphs. Weather data was obtained from records provided by the Bureau of Meteorology for the Badgerys Creek weather station.

The following periods have been identified as likely to contain significant periods of non-representative data and have been excluded from the assessment:

- 21/5/2025 Day/Evening/Night.
- 22/5/2025 Day/Evening.
- 25/5/2025 Night.
- 26/5/2025 Night.

As the Bureau of Meteorology wind data is typically obtained at an exposed location at 10m above ground level, and the monitoring locations were at a more sheltered locations a wind multiplying factor of 0.6 has been applied to the BOM data to estimate the wind speed at the microphone location.

A.2 CALCULATION OF REPRESENTATIVE AMBIENT NOISE LEVELS

The ambient, assessment and rating background levels have been determined from the unattended, long-term noise monitoring data based on the methodology in the Noise Policy for Industry Fact Sheet B.

A.2.1 RATING BACKGROUND NOISE LEVELS

The following tables summarise the assessment background noise levels (ABL) for each location. Note that where no ABL is indicated, this is because that period was significantly affected by adverse weather or other extraneous noise.

In accordance with the NPI, if the calculated:

- evening rating background noise level is higher than the day level, the day rating background noise level has been adopted for the evening period.
- night rating background noise level is higher than the evening level, the evening rating background noise level has been adopted for the evening period.
- day rating background noise level was less than 35 dB(A), a "default" background of 35 dB(A) has been adopted.
- evening or night rating background noise level was less than 30 dB(A), a "default" background of 30 dB(A) has been adopted.

Where monitoring was conducted within 3m of a significant sound reflecting surface, 2.5 dB(A) has been subtracted from the calculated rating background to account for an increase in noise from reflections.

Table A-1 – RBL – Western Logger Facing Badgerys Creek Road

Date	Noise Level dB(A) L ₉₀ , period		
	Day	Evening	Night
Tuesday 20/05/2025	-	41	36
Wednesday 21/05/2025	-	-	-
Thursday 22/05/2025	-	-	42
Friday 23/05/2025	38	48	41
Saturday 24/05/2025	41	48	40
Sunday 25/05/2025	38	47	-
Monday 26/05/2025	42	43	-
Tuesday 27/05/2025	44	46	44
Wednesday 28/05/2025	45	43	41
Calculated RBL	41	46	41
Adopted RBL	41	41*	41

*Adopted from daytime background noise level according to NPI.

Table A-2 – RBL – Eastern Logger Facing Metro

Date	Noise Level dB(A) L₉₀, period		
	Day	Evening	Night
Tuesday 20/05/2025	-	41	37
Wednesday 21/05/2025	-	-	-
Thursday 22/05/2025	-	-	39
Friday 23/05/2025	36	50	42
Saturday 24/05/2025	41	49	42
Sunday 25/05/2025	37	48	-
Monday 26/05/2025	43	42	-
Tuesday 27/05/2025	44	49	45
Wednesday 28/05/2025	49	45	44
Calculated RBL	42	48	42
Adopted RBL	42	42*	42

*Adopted from daytime background noise level according to NPI.

Given the eastern noise monitor facing the metro is potentially affected by ongoing construction activities in the area, the lower values from the two monitors are adopted as the RBLs of the nearby residential receivers and presented as follows:

Table A-3 – Adopted RBL for Neighbouring Residents

Time	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Late Evening (10pm-12am)
Noise Level dB(A) L₉₀, period	41	41	41	41

A.2.2 AMBIENT NOISE LEVELS – NOISE INTRUSION ASSESSMENT

The $L_{eq,15hr}$ (day period, 7am to 10pm) and $L_{eq,9hr}$ (night period, 10pm to 7am) ambient noise level descriptors have been calculated from the data, and are summarised in the following table.

Table A-4 – Ambient Noise Levels

Location	Ambient Noise Level (dB(A) $L_{eq,period}$)	
	Day (7am to 10pm)	Night (10pm to 7am)
Western Façade (Facing Badgerys Creek Road)	54	52
Eastern Façade (Facing Metro)	54	48

A.3 ATTENDED BACKGROUND NOISE SPECTRUM MEASUREMENT

Background noise spectrum measurements have also been conducted on site. The measured results as presented below.

Table A-5 – Spectrum Measurements L_{90}

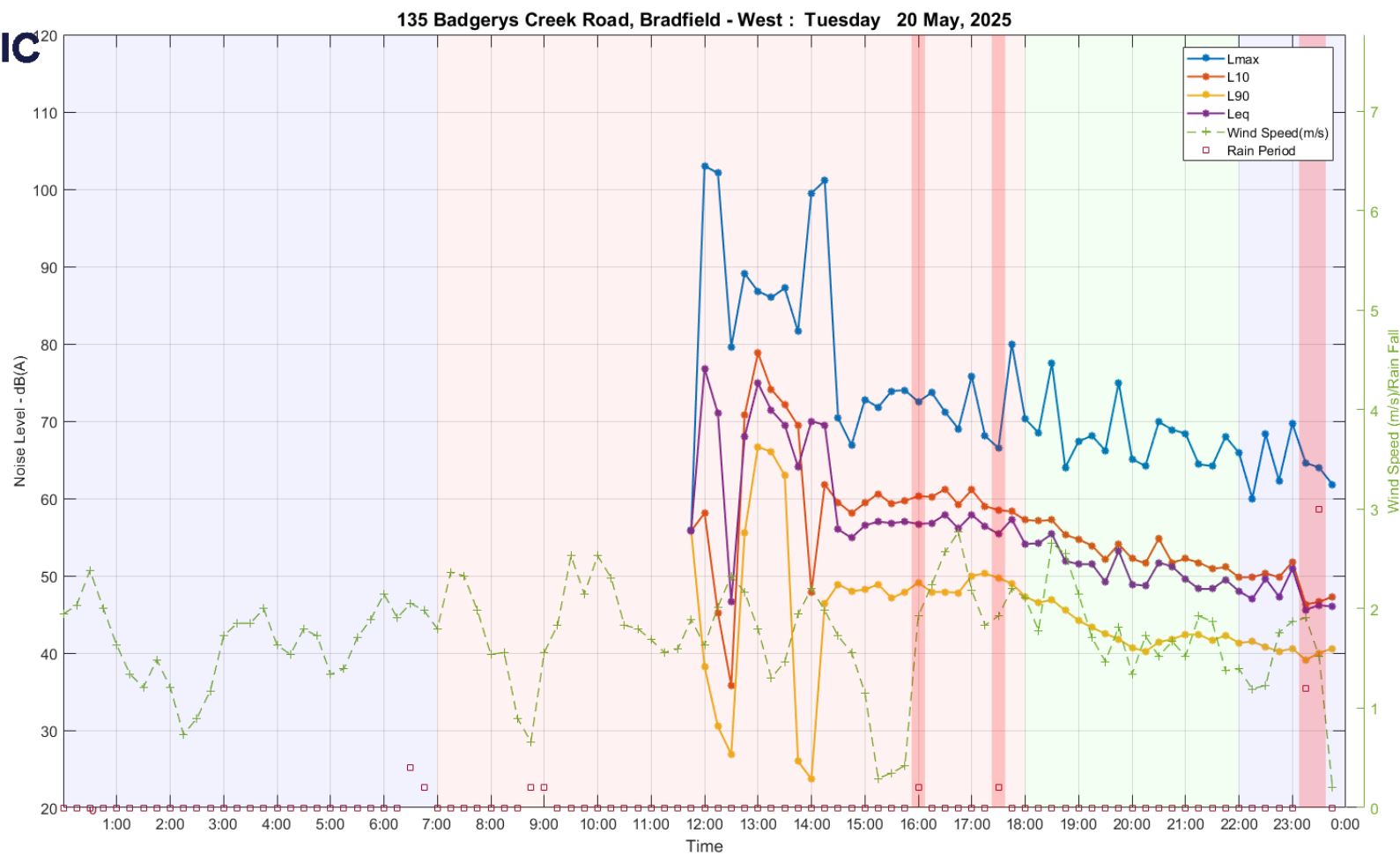
Location	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Badgerys Creek Road (Externally)	50	51	44	39	38	40	46	41	17	49

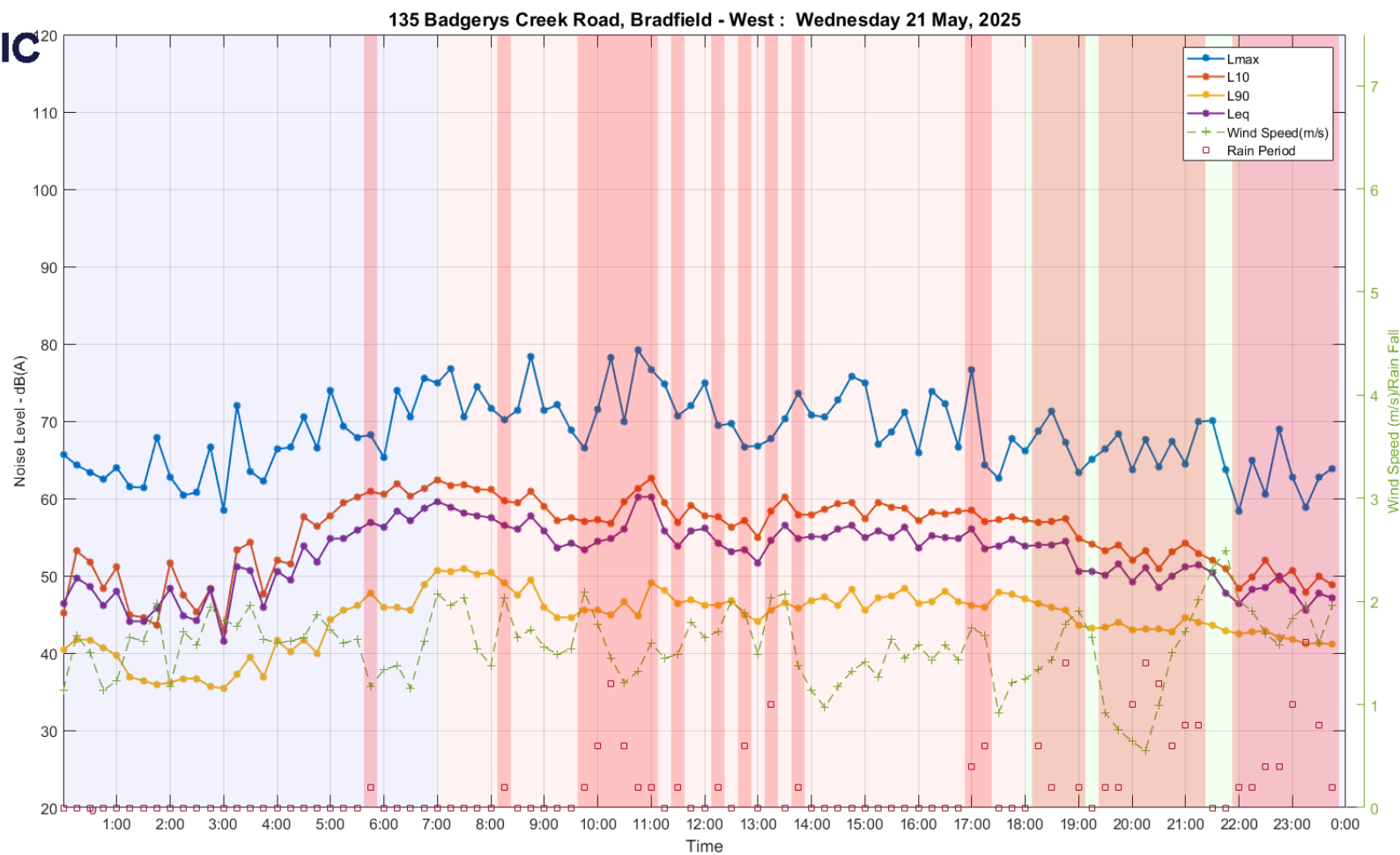
In order to establish the entertainment (patron and music) noise emission criteria for residential receivers, above noise spectrum has been adjusted based on the calculated background noise levels for each period and presented below.

Table A-6 – Summarised Background Noise Spectrum (Externally) L_{90}

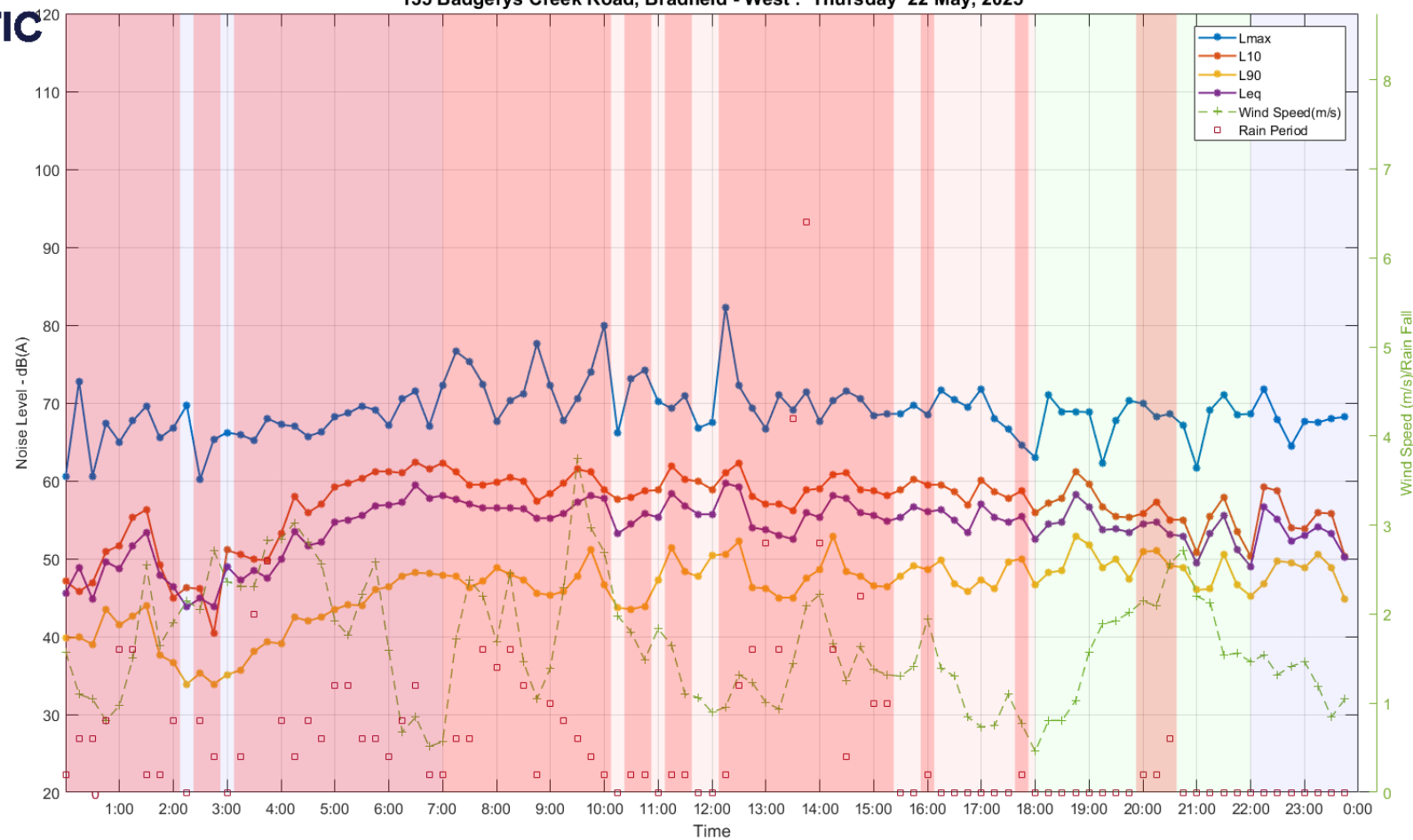
Receiver/ Time Period	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
R1 - R4 Day/Evening/Night	42	43	36	31	30	32	38	33	9	41

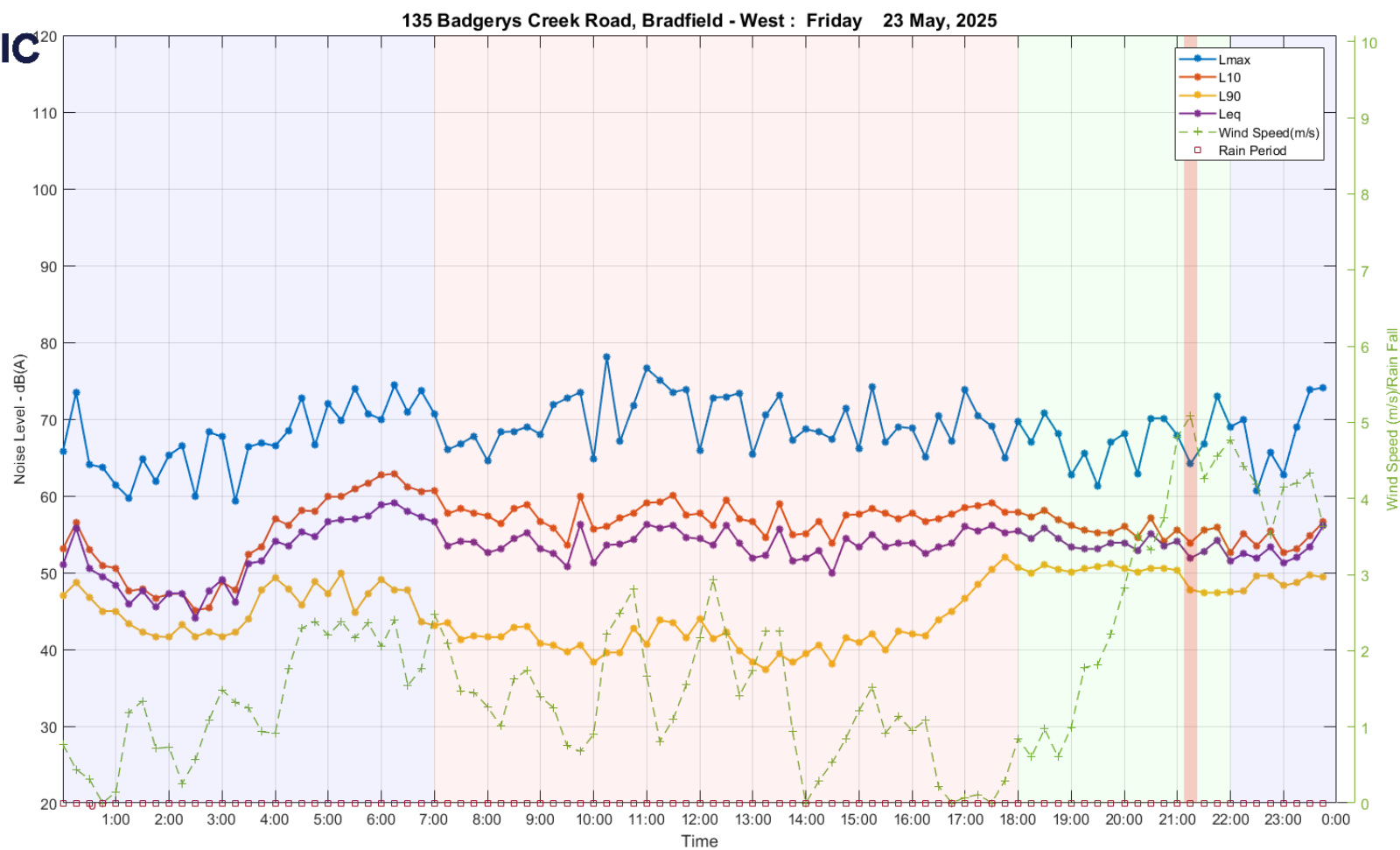
A.4 UNATTENDED MONITORING DATA GRAPHS

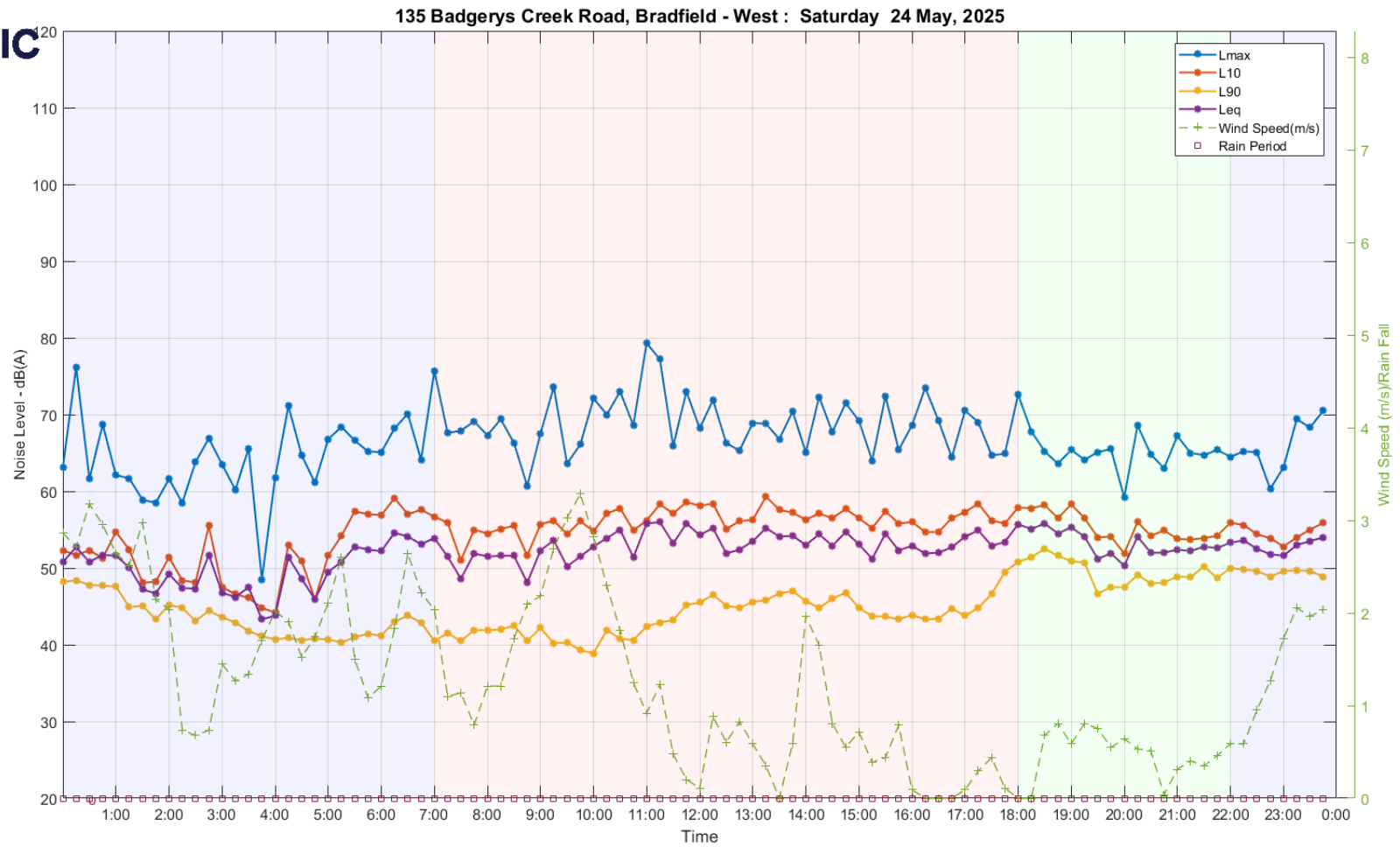


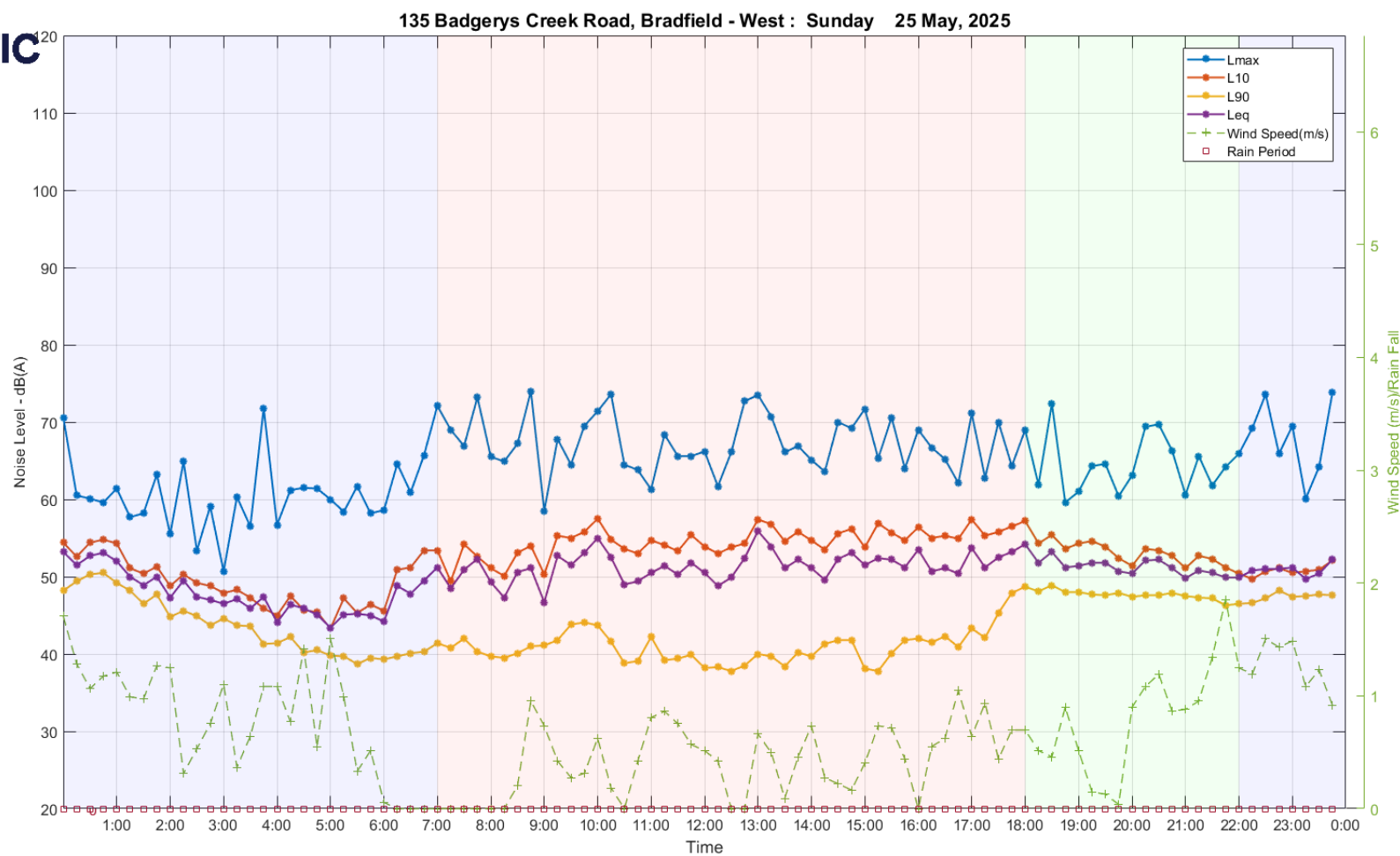


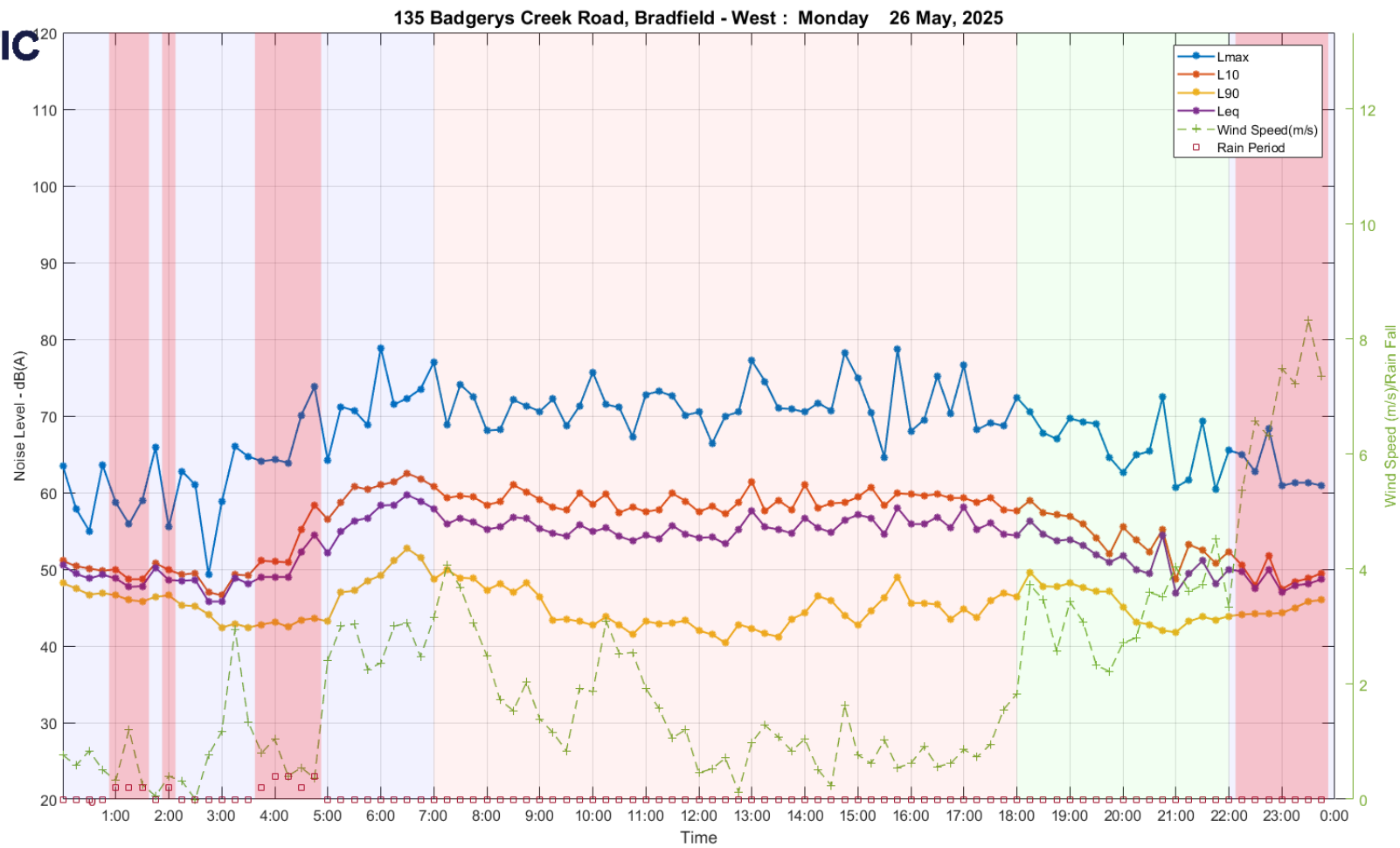
135 Badgerys Creek Road, Bradfield - West : Thursday 22 May, 2025

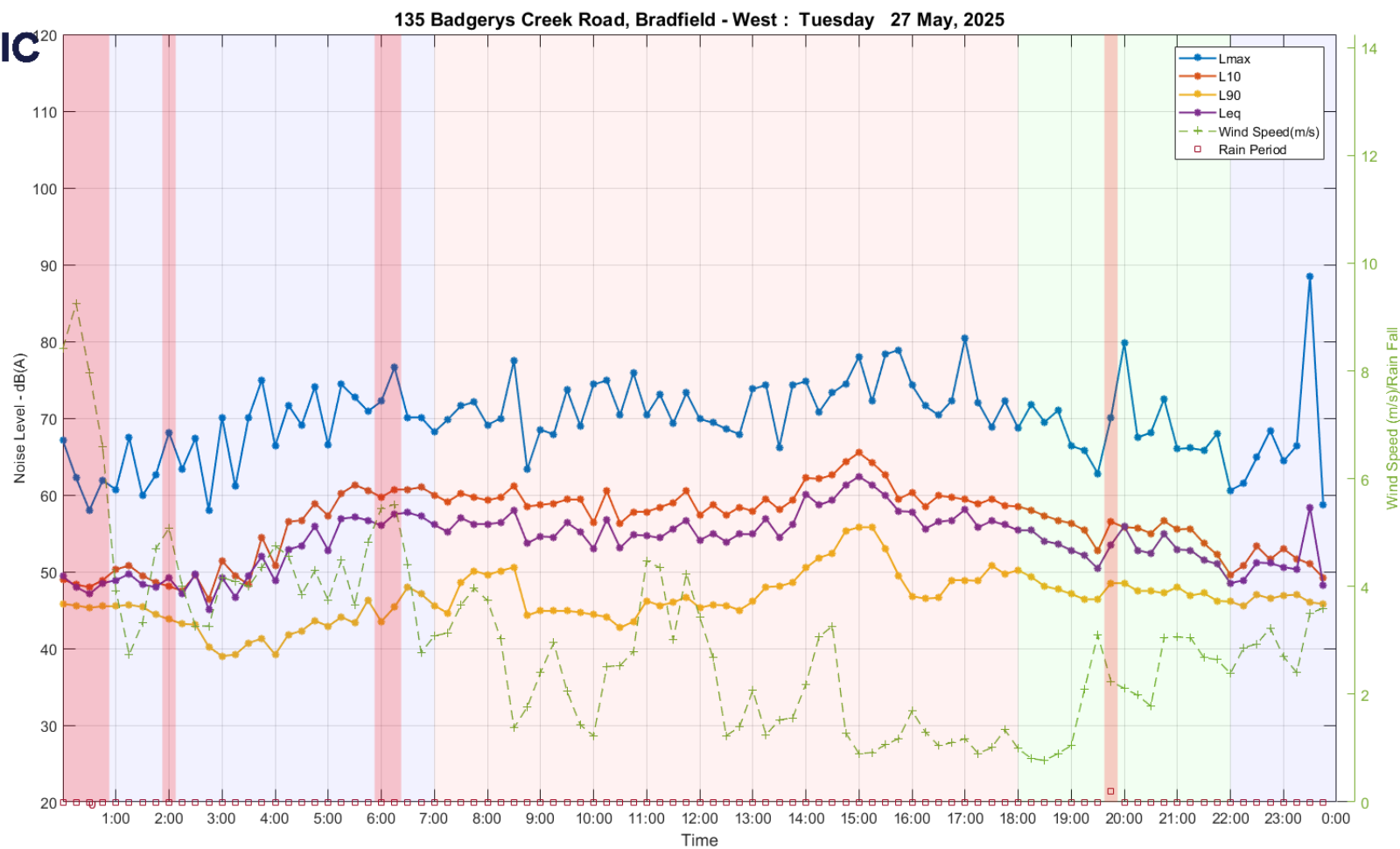


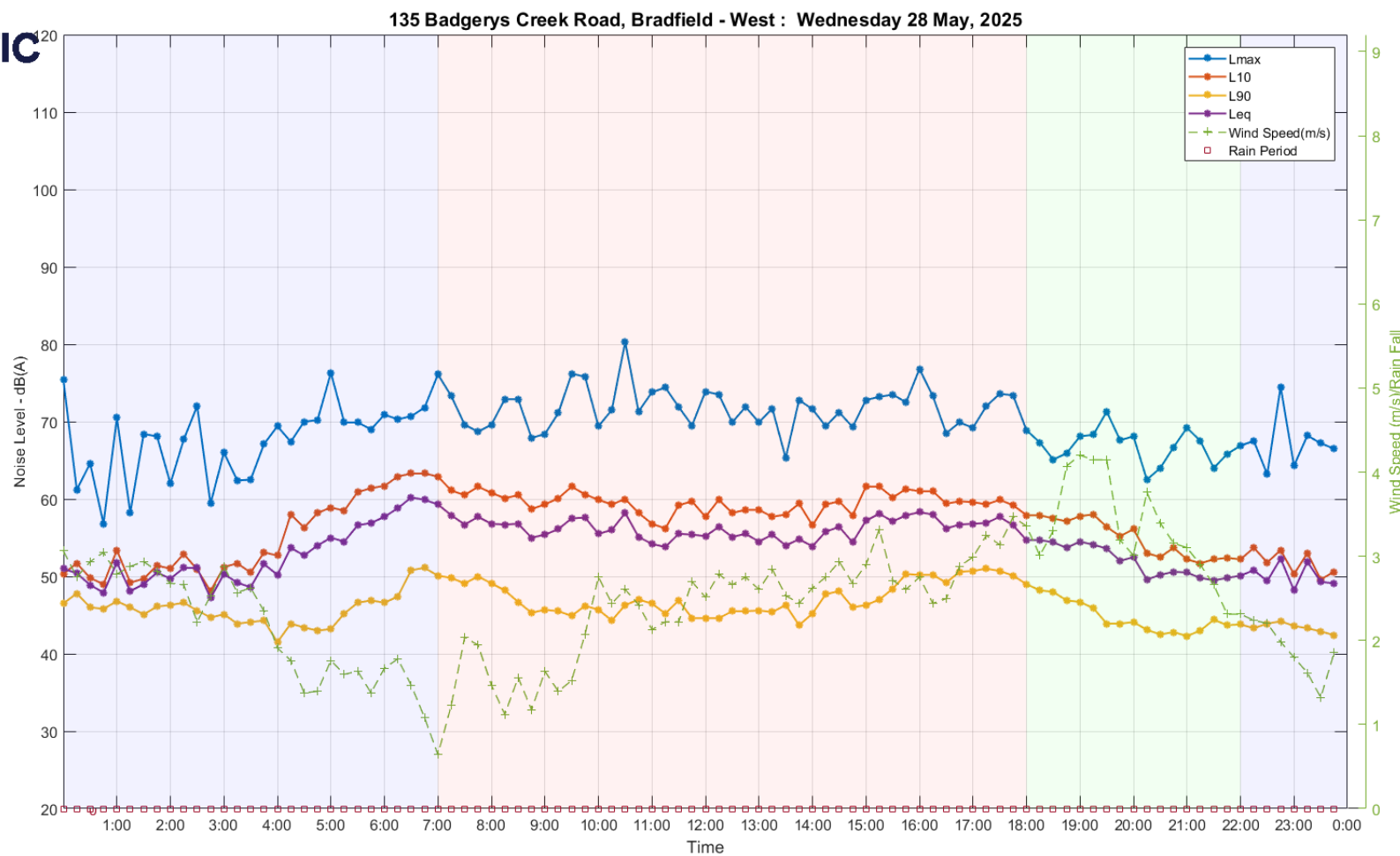


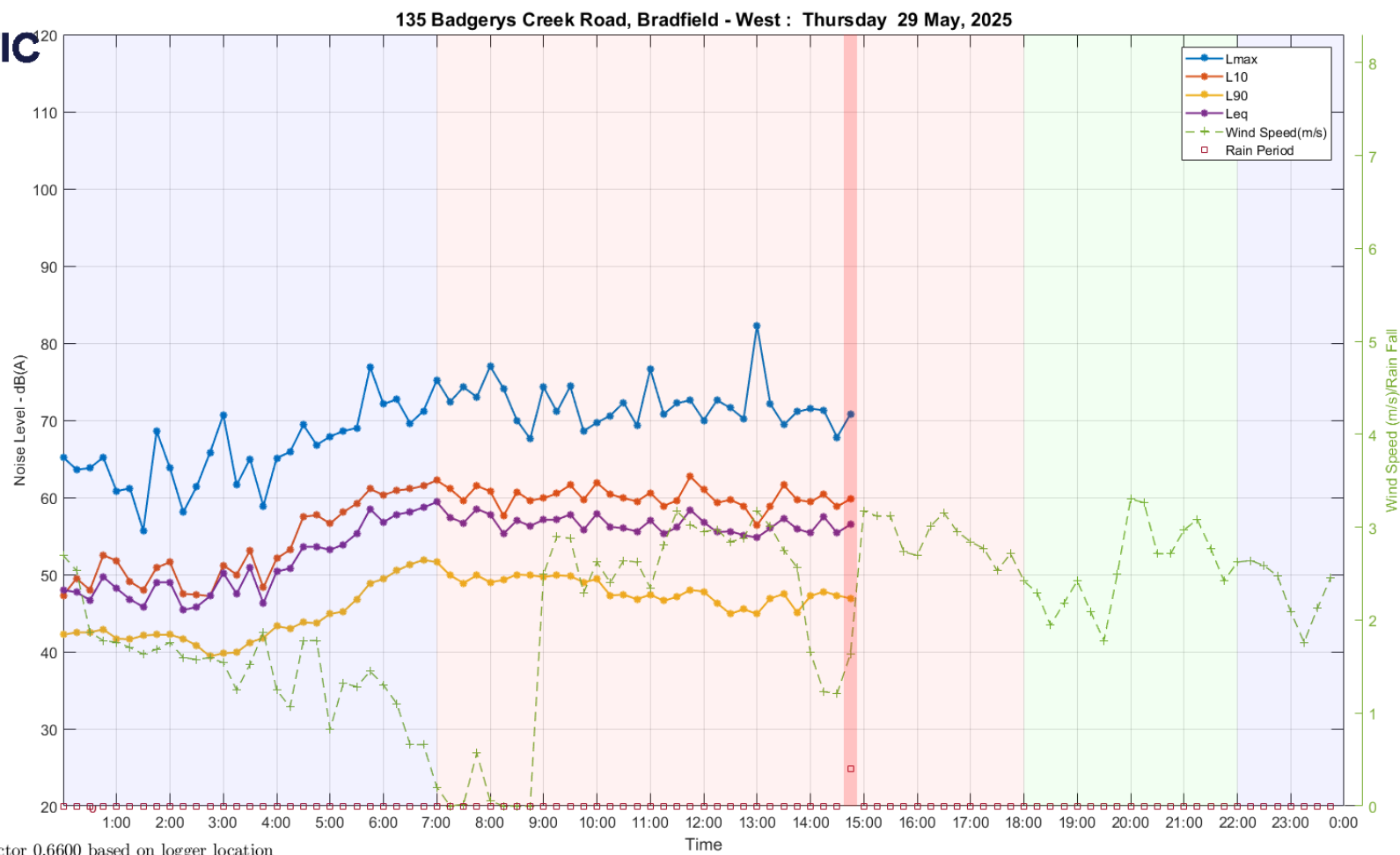


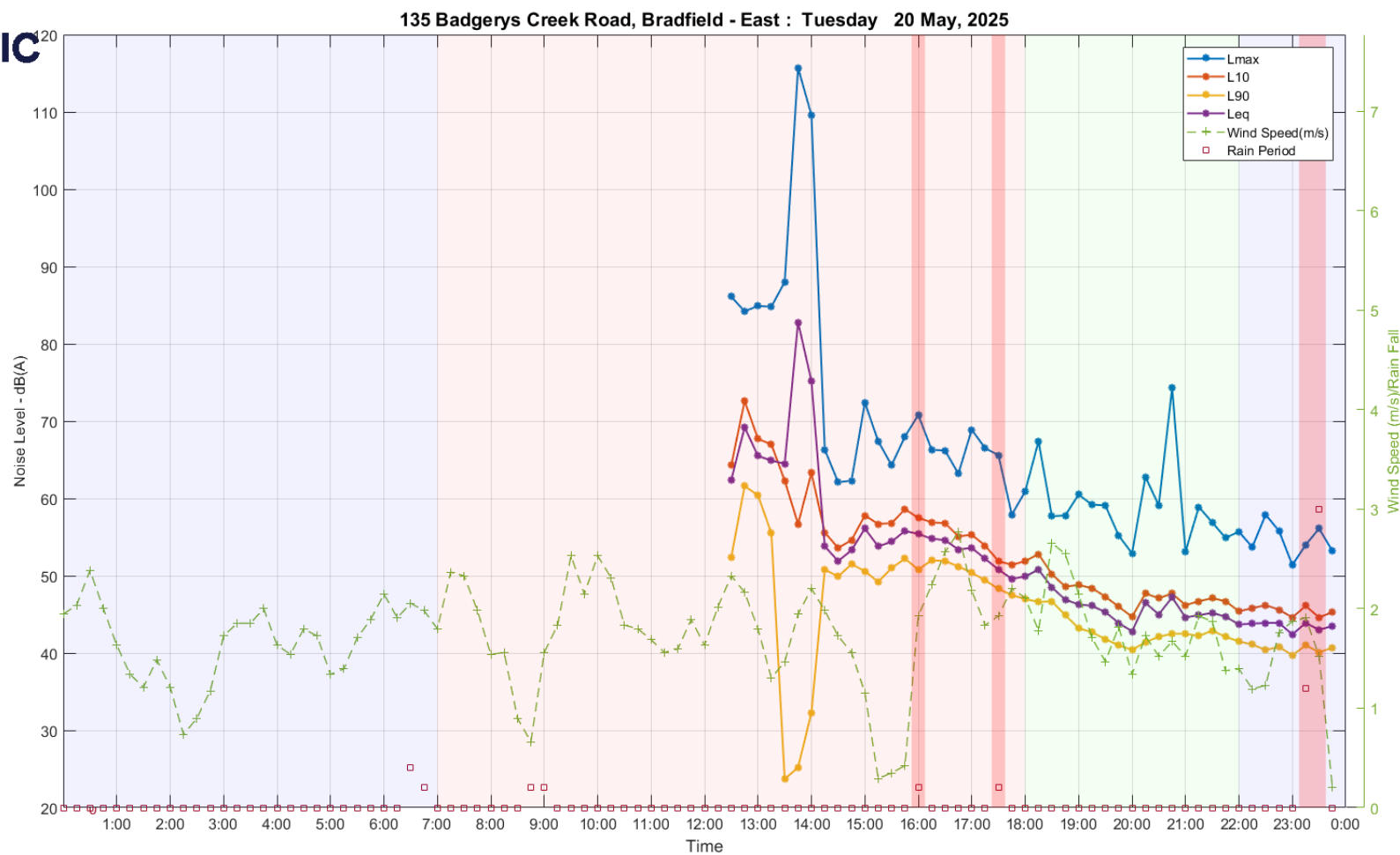


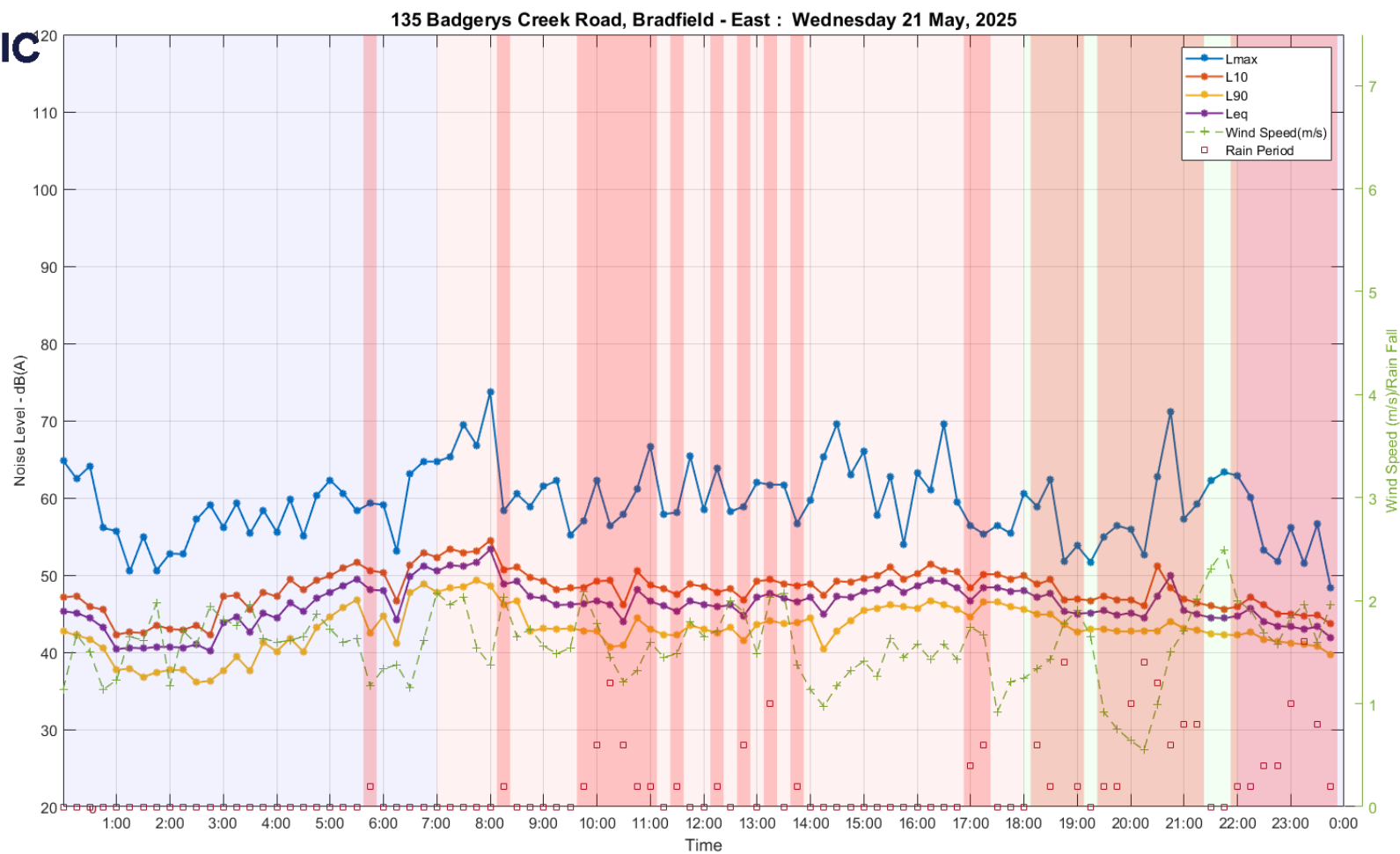




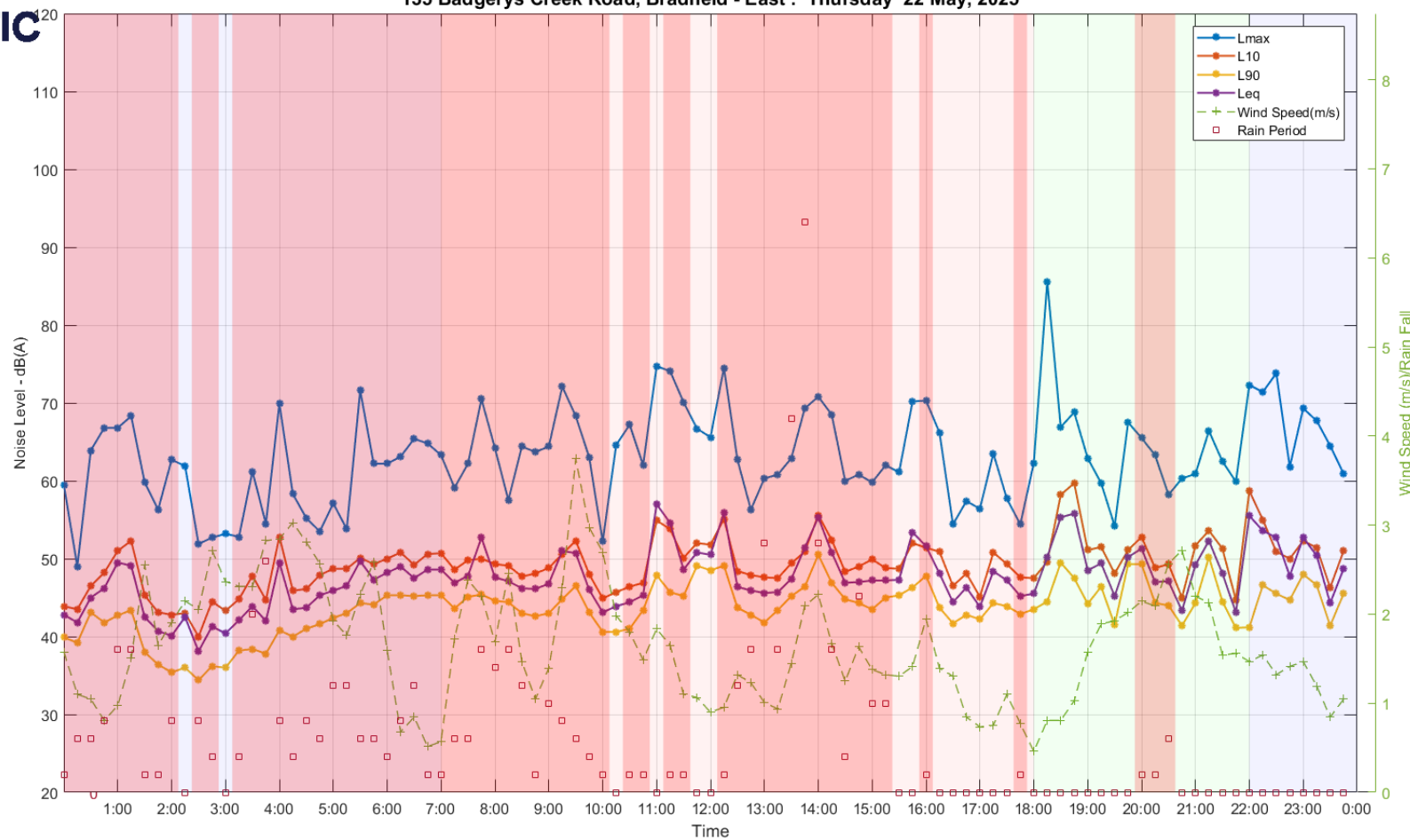


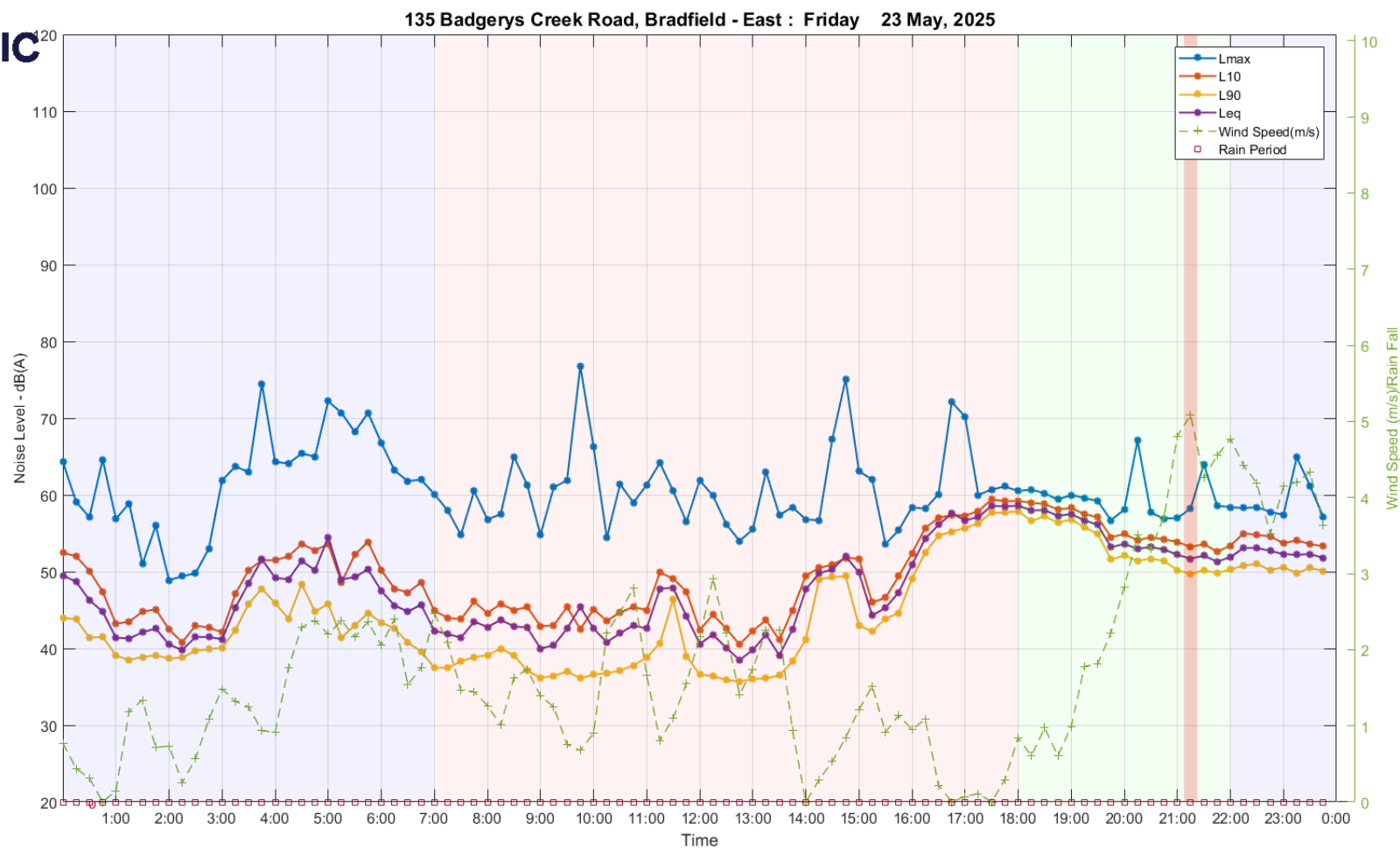


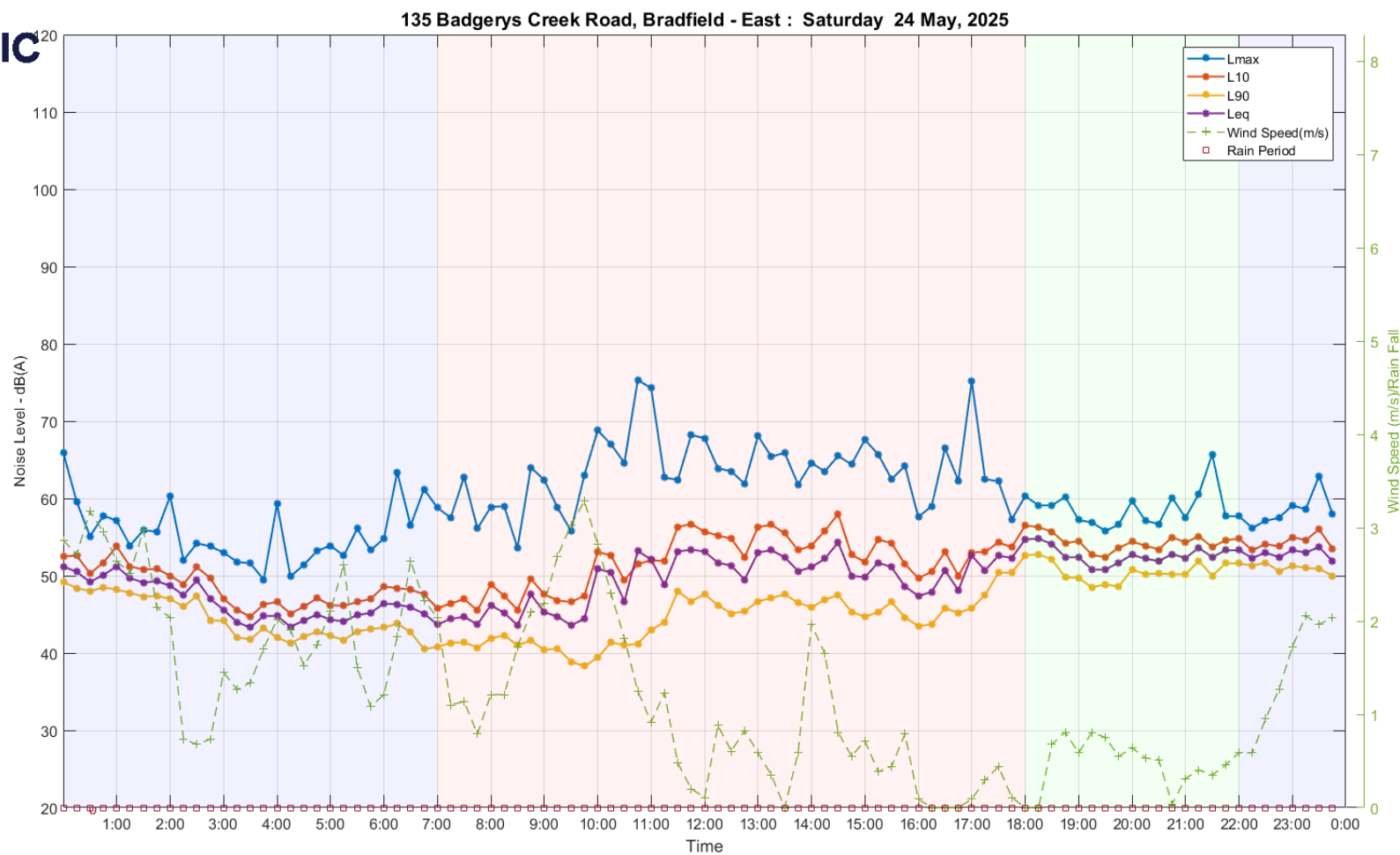


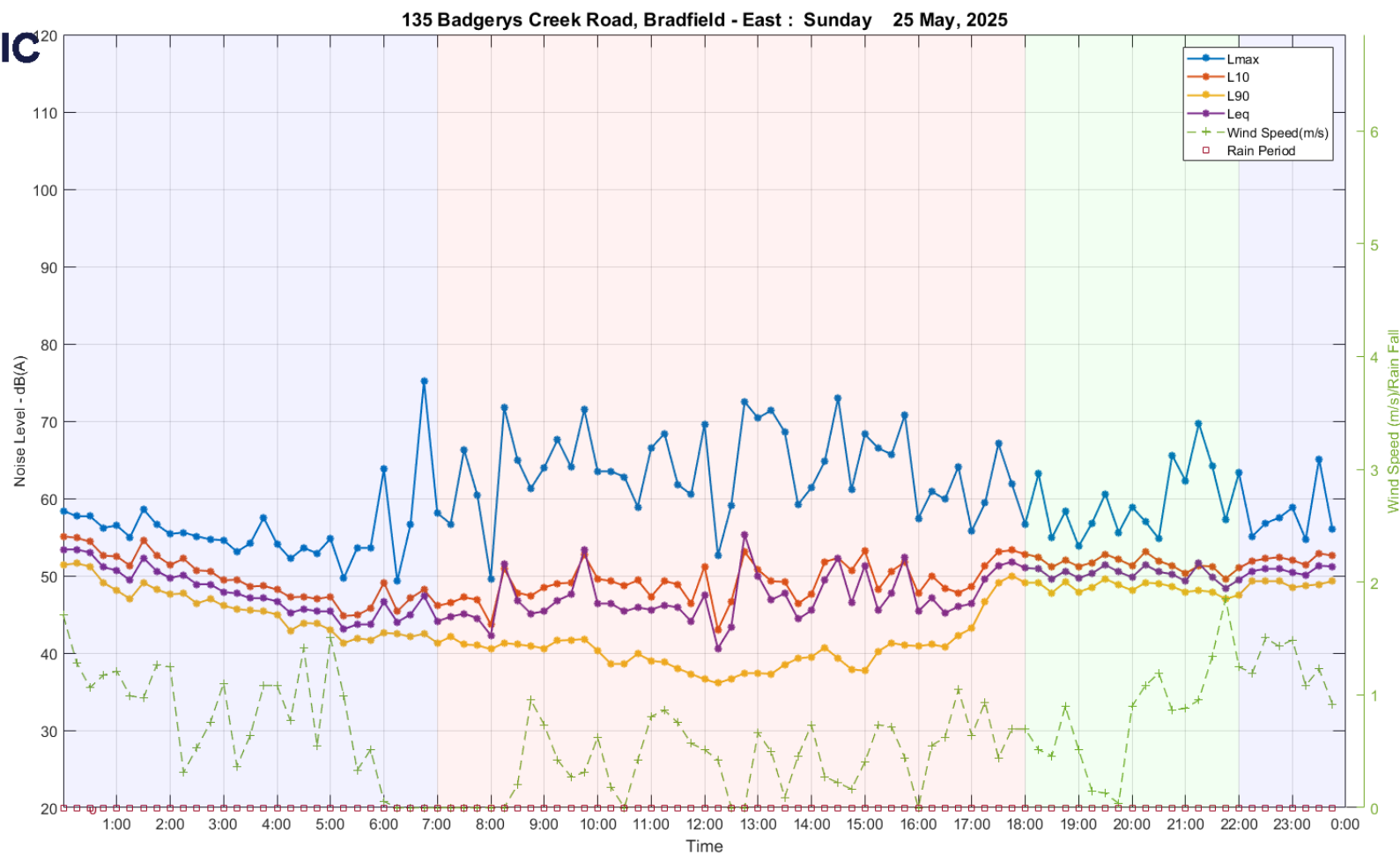


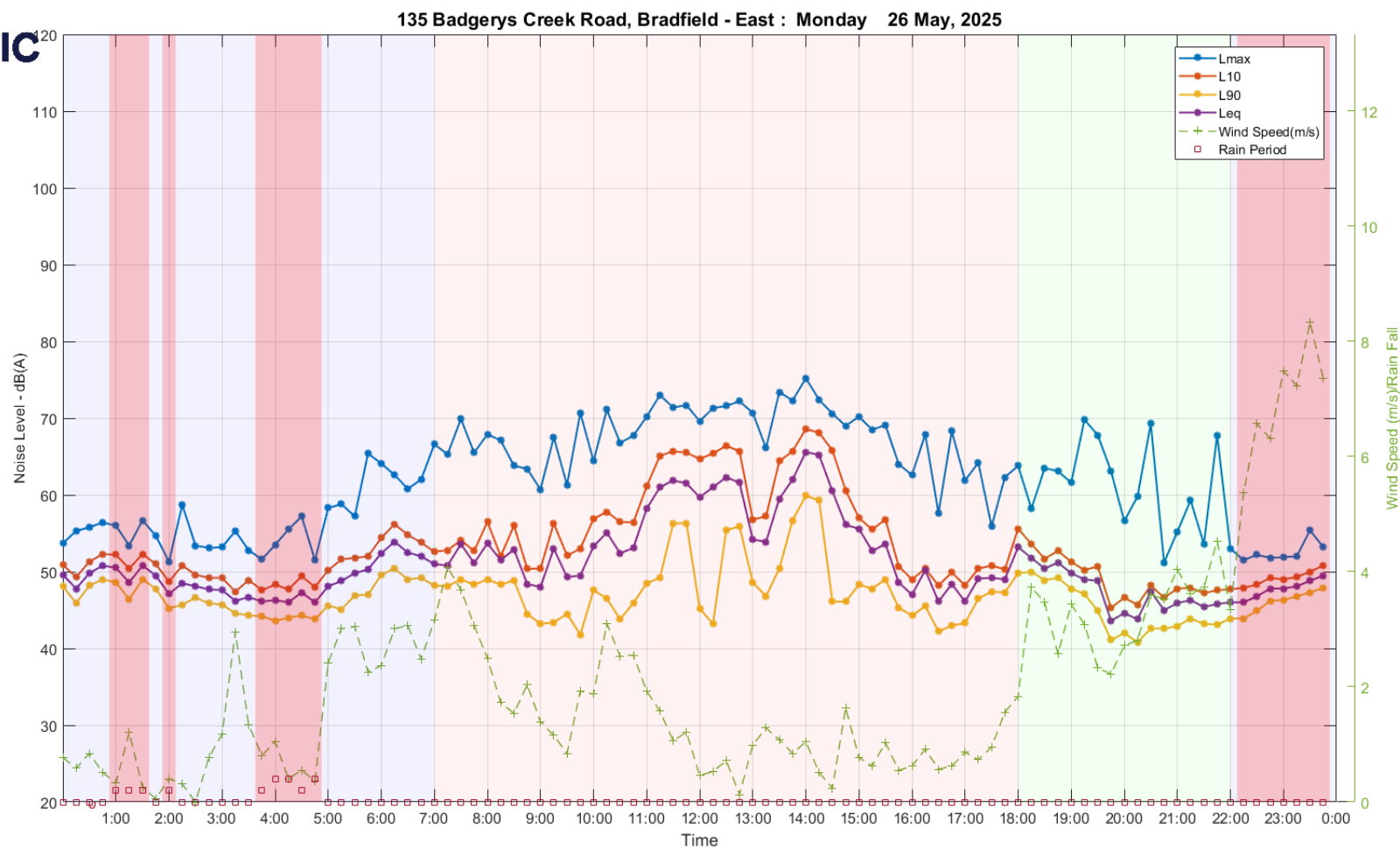
135 Badgers Creek Road, Bradfield - East : Thursday 22 May, 2025

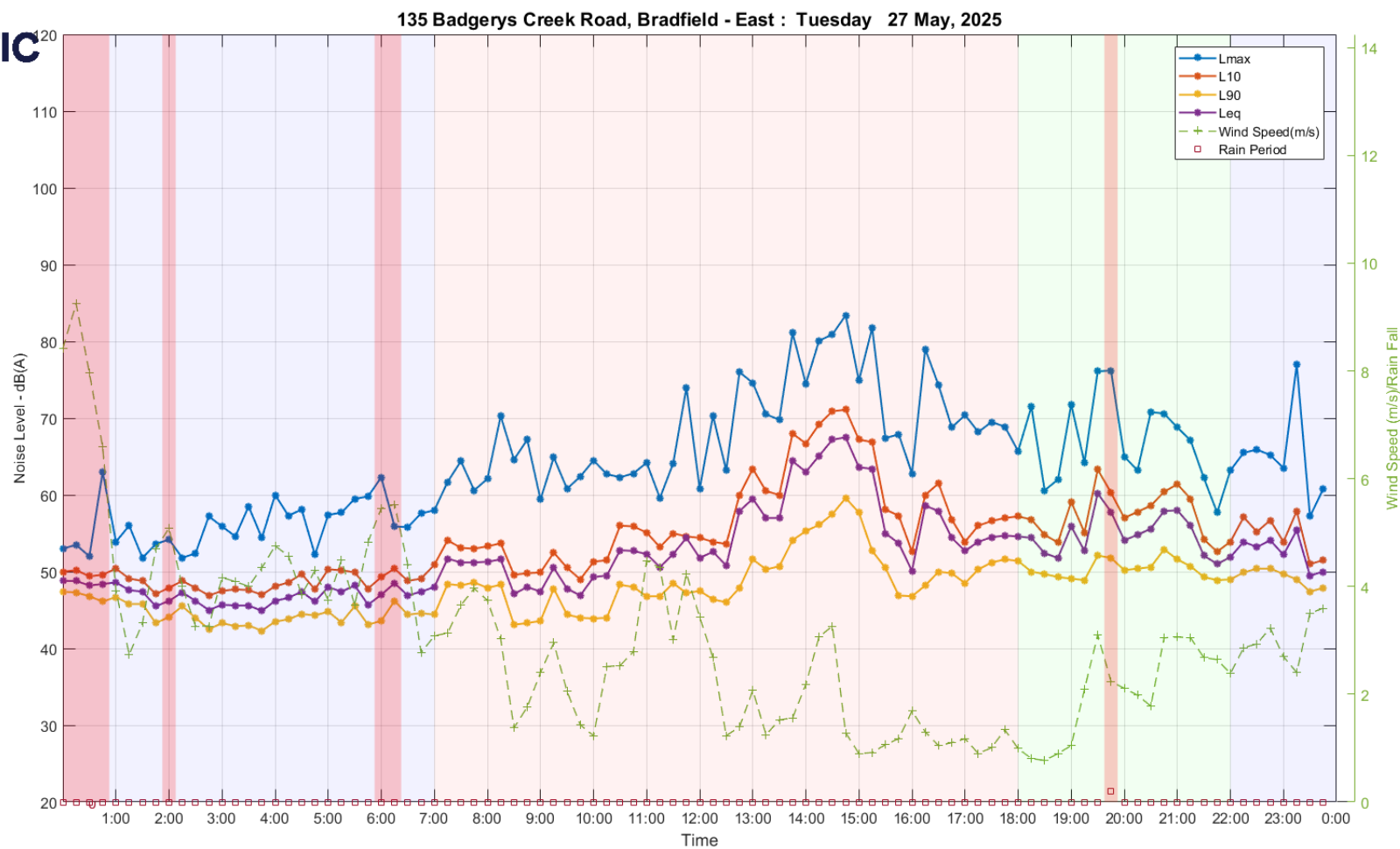


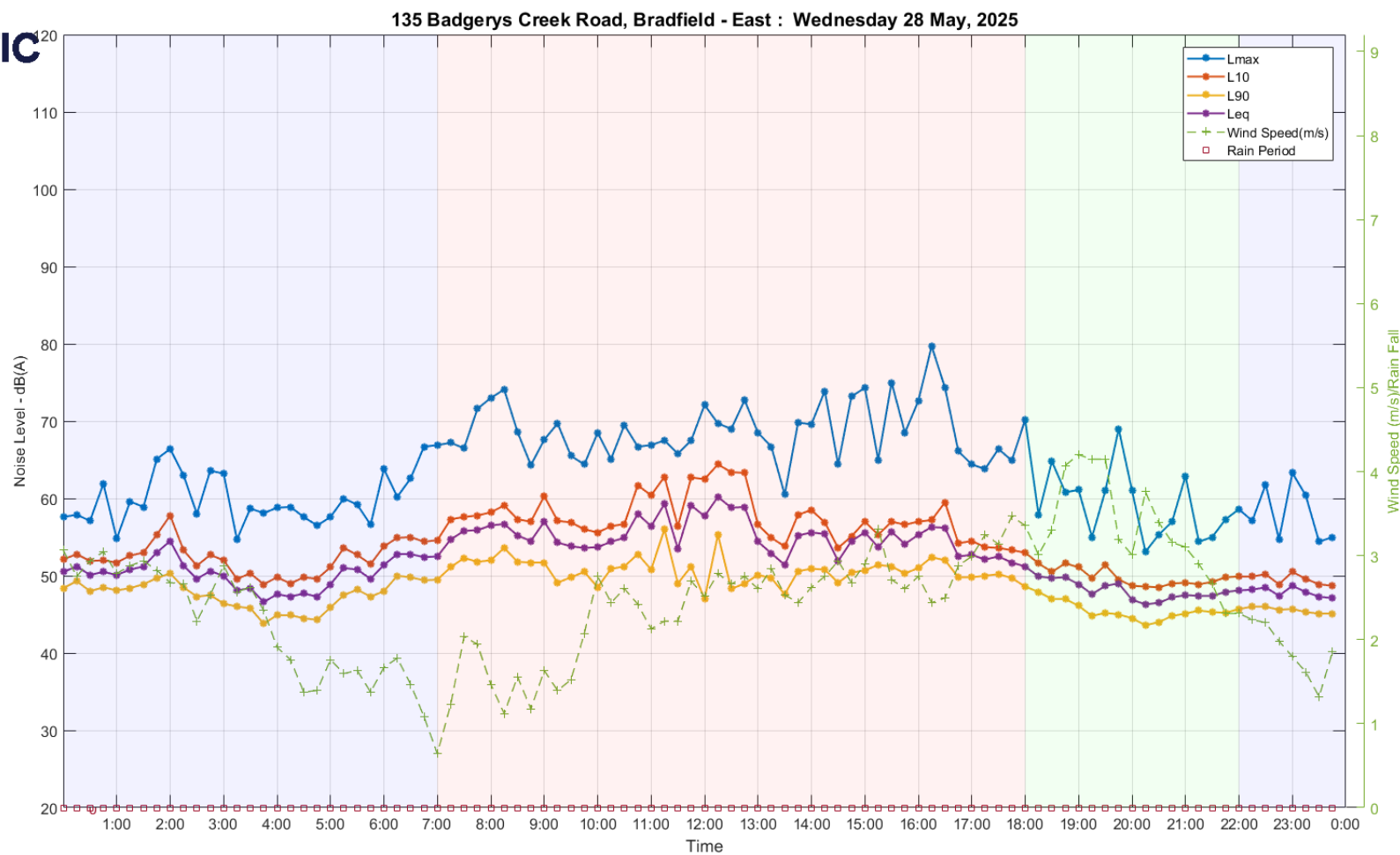




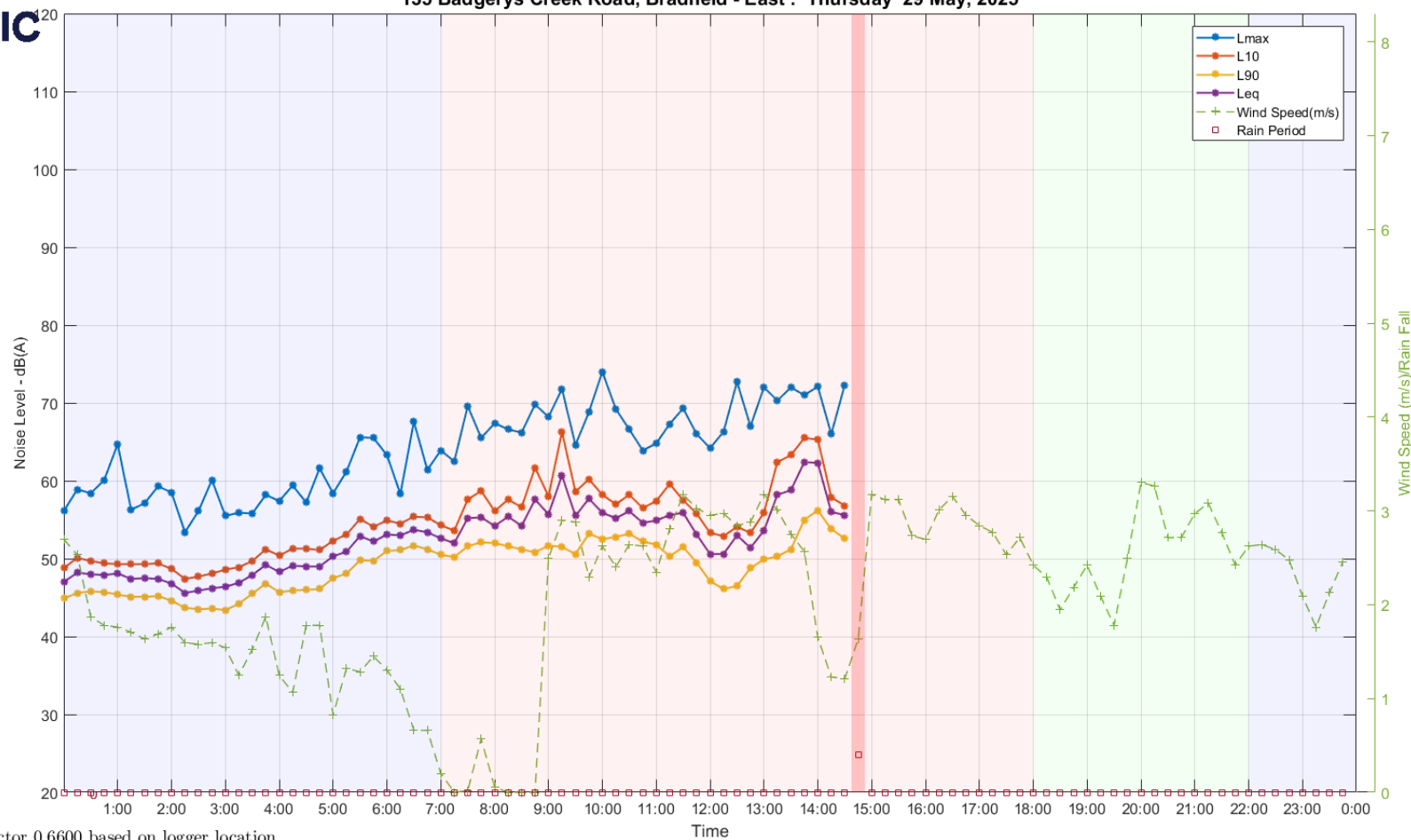








135 Badgerys Creek Road, Bradfield - East : Thursday 29 May, 2025



Wind Speed is corrected using factor 0.6600 based on logger location

APPENDIX B EPA NOISE POLICY FOR INDUSTRY TRIGGER LEVELS

Project specific assessment trigger levels have been determined for each noise source applying at the identified potentially most impacted receivers.

B.1 NPI TRIGGER LEVELS

The NPI requires noise impacts at residential receivers to be assessed in 3 ways:

- Whether the emitted noise is unreasonably loud relative to ambient background noise. (which the EPA calls the "intrusiveness" trigger level).
- Whether the noise emitted is unreasonably loud in an absolute sense, and consistent with surrounding land use and environment. ("amenity" trigger level)
- For night noise emissions, whether discrete noise events are likely to adversely impact sleep ("maximum noise level" trigger levels).

For other receiver types only the amenity trigger level is relevant.

B.1.1 INTRUSIVENESS

The $L_{eq,15min}$ descriptor is used for the intrusiveness trigger level, and is set at a level that is 5dB(A) above the rating background noise level for the relevant period.

B.1.2 AMENITY

Table 2.2 of the NPI (repeated below) sets out acceptable noise levels for various receiver types.

There are 3 categories of residential receivers - rural, suburban, urban. The nearest residential receivers to the subject site are categorised as "suburban" receivers. Categories for non-residential uses are also indicated in the table.

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

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

NPI Table 2.2: Amenity Noise Levels			
Receiver	Noise Amenity Area	Time of Day	Recommended Amenity Noise Level <i>L</i>_{Aeq}
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels motels caretakers' quarters holiday accommodation permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table)
Hospital ward internal external	All All	Noisiest 1-hour Noisiest 1-hour	35 50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dB(A) to recommended noise amenity area

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

Types of receivers are defined as follows:

- rural residential – see Table 2.3
- suburban residential – see Table 2.3
- urban residential – see Table 2.3
- industrial interface – an area that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB or an area defined in a planning instrument. Beyond this region the amenity noise level for the applicable category applies. This category may be used only for existing situations (further explanation on how this category applies is outlined in Section 2.7)
- commercial – commercial activities being undertaken in a planning zone that allows commercial land uses
- industrial – an area defined as an industrial zone on a local environment plan; for isolated residences within an industrial zone the industrial amenity level would usually apply.

Time of day is defined as follows:

- day – the 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.

(These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hr)}$.

B.1.3 MAXIMUM NOISE LEVEL ASSESSMENT

The purpose of this assessment is to identify whether discrete, night time noise events have the potential to produce adverse sleep impacts.

Section 2.5 of NPI recommends the following procedure to assess the potential for adverse sleep disturbance.

Where the subject development/ premises night -time noise levels at a residential location exceed:

- $L_{eq(15min)}$ 40 dB(A) or the prevailing RBL (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.

B.2 PROJECT SPECIFIC TRIGGER LEVELS

The following table summarises the trigger levels applying at each of the identified “most impacted” receivers. These have been determined based on the NPI methodology described above and the measured rating background noise levels.

The trigger levels in bold indicate the most stringent trigger level at each location.

Table B-1 – Project Specific Trigger Levels

Location/Receiver Type	Time	RBL dB(A) L ₉₀	Trigger Noise Level (dB(A) L _{eq,15min})		
			Intrusiveness	Amenity	Max Event
R1-R4 - Residential	Day	41	46	53	N/A
	Evening	41	46	43	N/A
	Night	41	46	38	46 L_{eq} 56 L_{max}
C1-C2 - Commercial	When in use	N/A	N/A	63	N/A

Project trigger levels are highlighted in bold.