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2-4 Burleigh St & 20-24 Railway Parade, Burwood

Noise and Vibration Impact Assessment

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1 EXECUTIVE SUMMARY

This report has been prepared to assess the impact of noise generated by nearby transportation and commercial sources on the occupant amenity of the proposed mixed-use development at 2-4 Burleigh St & 20-24 Railway Parade, Burwood.

The following noise sources potentially impacting the proposed development have been identified:

- Traffic noise from Burleigh Avenue and Railway Parade.
- Train Noise from Burwood Station and associated rail line.

NSW planning instruments, guidelines and local authority planning guidelines (where applicable) have been used to develop project specific assessment criteria.

Noise impacts have been predicted at the subject development based on site measurements. The predicted impacts have been assessed against the project specific criteria. Measures needed to mitigate any identified potential impacts have been determined and are presented in the report. Section 9 of the report summarises the complying mitigation and development controls determined.

The assessment has demonstrated that the proposed development is able to provide an adequate level of amenity in respect on noise impact from nearby road and commercial premises provided with the incorporation of the mitigation indicated in this assessment.

Apart from above, a noise and vibration emission assessment has been conducted for the potential noise impacts associated demolition, construction and operation of the development.

The assessment includes:

- Establishment of assessment criteria for noise impacts. The criteria are based on planning instruments, guidelines and standards relevant to the potential impacts identified.
- The predicted likely operational noise emission impacts have been assessed against the assessment criteria to determine whether adverse impacts on surrounding properties are likely.
- The predicted likely construction noise and vibration impacts have been assessed against the assessment criteria to determine whether impacts on surrounding properties are likely and the proposed mitigation measures.
- An assessment of whether ambient noise levels on the site generated by local environmental noise sources (road and rail) are likely to adversely impact occupant amenity.
- Physical and management controls to mitigate any adverse impacts indicated by the analysis have been identified.

2 INTRODUCTION

This Acoustic Logic report is in support of a State Significant Development Application (SSD-77260958) for a 39 storey mixed use tower located at 2-4 Burleigh St and 20-24 Railway Parade, Burwood.

The proposal will deliver a mixed use development containing a hotel with 120 rooms, commercial office premises and a residential flat building with 48 dual key residential apartments. The development also includes 5 storey basement parking.

The following surrounding sources have been assessed in this report:

- Local roads: Vehicle travelling on Railway Parade and Burleigh Street, and
- Train and Station Noise: Resultant from Burwood Station.
- Noise emissions from mechanical plant to service the project site (in principle).
- Preliminary construction noise and vibration impacts including mitigation measures.

The subject site and local context are indicated in Figure 1.

This assessment has been conducted using the architectural plans provided by PTI architecture dated 08/08/2025.

3 RESPONSE TO SEARS

The assessment addresses the project Secretary's Environment Assessment Requirements (SEARs) in the following table.

12. Noise and Vibration Provide a noise and vibration impact 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.	• Noise and Vibration Impact Assessment

4 REFERENCED DOCUMENTS

4.1 BACKGROUND INFORMATION USED

The assessment is based on architectural drawings prepared by PTI architecture. Refer to Appendix E.

4.2 GUIDELINES

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

- NSW Department of Planning document – "*State Environmental Planning Policy* (**SEPP**) (*TRANSPORT & INFRASTRUCTURE*) 2021".
- NSW Department of Planning document – "*Development near Rail Corridors and Busy Roads – Interim Guideline*" (**DNRCBR**) 2009.
- Australian Standard 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors ("**AS2107:2016**")
- EPA Interim Construction Noise Guideline ("**ICNG**")
- Burwood Development Control Plan 2023 ("**DCP**").
- NSW EPA – 'Noise Policy for Industry' ("**NPI**") October 2017.

5 SITE DESCRIPTION AND THE PROPOSAL

5.1 SITE DESCRIPTION

The site is located within Burwood, a suburb of the Burwood Local Government Area located approximately 10km west of the Sydney CBD.

The site is located on the southern side of Railway Parade and to the south of the Main Suburban railway line and sits at the corner of Burleigh Stret and Railway Parade. This site comprises of 5 parcels of land identified as follows:

- 20 Railway Parade – Lot C in DP 438222;
- 22 Railway Parade – Lot B in DP 438222;
- 24 Railway Parade – Lot A in DP 438222.
- 2 Burleigh Street – Lot D in DP 438222; and
- 4 Burleigh Street – Lot E in DP 438222.

The site is located within the Burwood Town Centre which contains a number of mixed use developments comprising commercial, retail, medical and residential land uses. The locality is characterised by a diverse range of developments, ranging from single storey dwellings to 30 storey commercial and residential buildings

The immediate locality is to support high density development given its location within close proximity to Burwood Railway Station, as evidenced by the applicable built form controls which allow for building heights of 70m, and up to 140m on some sites.

Existing on the site are single storey buildings, both detached and attached, occupied by various small businesses, including a family medical practice, tutoring business and a hearing clinic. Shared vehicle access is provided on Burleigh Street to a small carpark shared by all of the existing buildings.

The site is relatively flat will a fall of approximately 1m from the Railway Parade frontage to the southern boundary.

The site is almost entirely built over with the only vegetation existing on the site limited to small areas of grass and three small trees along the Railway Parade frontage.

5.2 PROJECT DESCRIPTION

The SSD Application will seek consent for the construction of a 39-storey mixed use development containing a hotel with 120 rooms, commercial office premises and a residential flat building with 48 dual key residential apartments and 5 levels of basement car parking.

It should be noted that demolition of the existing buildings across the site will be completed under an existing Complying Development Certificate, and as such will not form part of this application.

The proposed development is described in detailed in the Architectural Plans prepared by PTI Architecture and the Environmental Impact Statement prepared by Planning Ingenuity.

5.3 NOISE RECEIVERS IDENTIFIED

The nearest noise receivers around the site include:

- **R1:** Residential Receiver 1 – Two storey residential development located to the eastern boundary at 18 & 18A Railway Parade.
- **R2:** Mixed-Use Receiver 1 – Mixed use tower located south east of the site at 16 Railway Parade.
- **R3:** Residential Receiver 2 – Two storey residential dwellings located south of the site on Burleigh Street.
- **R4:** Place of Worship Receiver 1 – Orthodox Church located west of the site at 26 Railway Parade.
- **R5:** Residential Receiver 3 – Multistorey mixed use tower to the south west at 7-9 Burleigh Street.
- **R6:** Commercial Receiver 1 – Two storey commercial building to the south at 6 Burleigh Street.

Figure 1 – Site Plan Showing Local Context (Source: NSW SDT Explorer)

- Site
- Residential
- Mixed Use
- Place of Worship
- Commercial
- Unattended Measurement
- Attended Measurements

6 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
L_{90}	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.

7 NOISE AND VIBRATION INTRUSION CRITERIA

7.1 BURWOOD 2023 DCP ASSESSMENT CRITERIA

The Burwood DCP 2023 requirement is a general requirement and does not provide numerical assessment criteria. The development is within close proximity of a rail corridor therefore further reference is made to the TI SEPP 2021.

7.2 TI SEPP 2021

Sensitive development adjacent to major roadways must have regard to TI SEPP Clause 2.120.

Section 2.120 Impact of Road Noise or Vibration on Non-Road Development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

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

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

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7am,

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

7.3 DEVELOPMENT NEAR RAIL CORRIDORS OR BUSY ROADS – INTERIM GUIDELINE

This guideline provides general and specific advice for the planning and assessment of noise sensitive development impacted by roads and railways, and in particular those uses required to be addressed under the TI SEPP. The assessment criteria broadly mirror those in the TI SEPP.

7.3.1 Internal Noise Criteria – Airborne Noise

Table 3.1 of the guideline (repeated below) summarises the internal noise levels that should be achieved in noise sensitive developments. The $L_{eq,15hr}$ descriptor is recommended to assess noise levels in habitable rooms of non-residential development.

Table 1 – DNRCBR Airborne Noise Criteria

Building Use	Room	Noise Level dB(A) L_{eq}
Residential	Sleeping Area (Bedroom)	35 (10pm to 7am)
	Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40 (7am to10pm)

7.3.2 Railway Ground Vibration and Regenerated Noise

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

Tactile Vibration

Intermittent vibration generated by train movements should comply with the criteria in *Assessing Vibration: a Technical Guideline (DECC 2006)*. The guideline is based on British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)". This standard includes guidance for the assessment of human response to building vibration, including intermittent vibrations such as those caused by trains.

Human response to vibration has been shown to be related to:

- The number and duration of events.
- Sensitivity of the human activity occurring.
- Human response to vibration at different frequencies. Humans are more sensitive to vibrational frequencies less than 80Hz.
- The orientation of the person (sitting/standing).

To account for the different sensitivity of humans to different frequencies, the standard includes curves of equal annoyance for various orientations and vibration frequency. These curves are applied as correction filters to obtain a single number (frequency weighted) vibration level that reflects human response to vibration the range of frequencies and vibration magnitudes present in the disturbing vibration.

To account for the time variance in vibration level, the standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively, the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. Table 2 indicates the "preferred" values in the **Assessing Vibration Guideline**. For this project, the aim will be to not exceed the "Preferred Values".

Table 2 – Intermittent Vibration Dose Values ($m/s^{1.75}$)

Place	Day	Night
Residential	0.20	0.13
Commercial/ Function/ Lobby/ Café (conservatively assessed as "office" space)	0.40	0.40

Ground Borne Noise

DNRCBR recommends that ground borne noise in residential buildings should not exceed 40 dB(A) (daytime) and 35 dB(A) (night-time) (95 percentile of the maximum noise level measured on slow time response).

DNRCBR does not require structure radiated ground borne vibration to be assessed when ground borne noise is likely to masked by airborne noise. Assessment is typically only needed if the building is located over a railway tunnel or is otherwise significantly screened from a surface railway so there is no or minimal airborne noise.

For the proposed buildings, ground borne noise will be masked by airborne noise and an assessment of ground borne noise is not required.

7.3.3 Ventilation

The DNRCBR recommends that when "windows open" noise levels are excessive, that is when that "windows open" noise level exceeds the "windows closed" criterion by more than 10 dB(A), the occupants should be able to *"leave their windows closed, if they so desire, and also meet the ventilation requirements of the Building Code of Australia (BCA)."*

7.3.4 Australian Standard 2107:2016

AS2107-2016 recommends design criteria for internal spaces within various types of spaces/occupancies to ensure a healthy, comfortable and productive environment for the occupant.

Table 3– Recommended Design Sound Level

Occupancy/Activity Type	Recommended Design Sound Level
Restaurants	40-50 dB(A)L_{eq}
General office areas	40-45 dB(A)L_{eq}
Function areas	40-45 dB(A) L_{eq}

7.4 ADOPTED PROJECT SPECIFIC CRITERIA

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

Table 4 – Noise Assessment Criteria

Building Use	Room	Noise Level dB(A) L_{eq}
Residential	Sleeping Area (Bedroom)	35 dB(A) $L_{eq\ (nighttime)}$
	Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40 dB(A) $L_{eq\ (anytime)}$
Non-Residential Spaces	All Rooms	45 dB(A) $L_{eq,\ (anytime)}$

Table 5 – Intermittent Vibration Dose Values ($m/s^{1.75}$)

Place	Day	Night
Residential	0.20	0.13
Commercial/ Function/ Lobby/ Café (conservatively assessed as "office" space)	0.40	0.40

8 NOISE AND VIBRATION ASSESSMENT

An assessment of noise impact has been undertaken using the following methodology:

Internal noise levels were 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 7.4 have been assessed and are provided in Section 9.

8.1 EXTERNAL NOISE LEVELS

Existing noise levels from environmental noise 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 6 – Rating Background Noise Level

Location	RBL (dB(A) $L_{90,period}$)	
Northern Facade	Day (7am to 6pm)	50
	Evening (6pm-10pm)	48
	Night (10pm to 7am)	40
Southern Facade	Day (7am to 6pm)	47
	Evening (6pm-10pm)	46
	Night (10pm to 7am)	40

Table 7 – Ambient Noise Level

Location	Ambient Noise Level (dB(A) $L_{eq,period}$)	
	Day (7am to 10pm)	**Night (10pm to 7am)**
Northern Facade facing Railway Parade	60	57
Southern Facade	57	54

8.2 RAILWAY GROUND VIBRATION

The impact of tactile vibration and ground borne (regenerated) noise have been assessed using the vibration levels measured at the site (refer Appendix C). Floor vibration has been predicted taking into account:

- Predicted ground vibration levels at the building based on the measured vibration levels.
- Ground to building losses and other natural attenuation through the building,
- Amplification/floor resonance effects.

The predicted vibration dose values within the proposed development will remain compliant with the "low probability" tactile vibration assessment criterion.

9 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.

9.1 BUILDING ENVELOPE

The assessment indicates that the building envelope is required to be upgraded beyond what is considered to be a "standard" form of construction to comply with the internal noise criteria.

9.1.1 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 8 – Complying Glazing Constructions

Building Use	Rooms	Glazing Construction	Acoustic Seals
Residential	L3 to L6 Facing Railway Parade	10.38mm Laminated	**Yes**
	L6 to L9 Facing Railway Parade	6.38mm Laminated	
	L9 and above Facing Railway Parade	6.38mm Laminated	
	L3 to L6 Facing Burleigh Ave	10.38mm Laminated	
	Remaining (incl. communal areas)	6.38mm Laminated	
	All Operable Louvres	Safetyline Jalousie 6.5mm Vlam Hush	
Commercial	All	6.38mm Laminated	

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 9 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 9 – Minimum Rw of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
6.38mm Laminated	31
Safetyline Jalousie 6.5mm Vlam Hush	35
10.38mm Laminated	35

9.1.2 External Roof and Ceiling Construction

The roof is proposed to be of concrete construction and is acoustically acceptable without any further treatment. In the event any penetrations are required through the external lining of any of the system for other building services, gaps should be filled with acoustic sealant to ensure compliance with acoustic criteria stipulated within this report.

9.1.3 External Walls

External walls of concrete/ masonry construction will not require acoustic upgrading. For the glazed curtain wall, refer to Section 9.1.1. A 350mm curtain wall zone has been nominated to be further developed with the façade consultant and curtain wall manufacturer at CC stage.

In the event any penetrations are required through the external lining of any of the system for other building services, gaps should be filled with acoustic sealant to ensure compliance with acoustic criteria stipulated within this report. Should light weight constructions be utilised a detailed analysis of the wall construction should be completed by an appropriately qualified acoustic consultant.

9.2 VENTILATION REQUIREMENTS

With respect to natural ventilation of a dwelling, NSW Planning requirements allow internal noise levels to be up to 10 dB(A) higher than the specified criterion with windows and doors to a dwelling open to allow for ventilation.

Based on the current layouts and noise levels from surrounding roads, assessment of internal noise levels with 'windows open' indicates:

- Unit 1A, 1B and 2A types on all residential levels facing Railway Parade and the rail corridor will require windows to be closed to achieve internal noise requirements.
- All remaining units will be able to retain windows or doors open to 5% of the floor area whilst maintaining nominated internal noise levels.

The specific location and extent of the above apartments may be reviewed as part of the detailed design of the building.

We note that a supplementary mechanical ventilation system can be provided for all apartments within the development (including those which are less noise exposed) in order to provide an alternative source of outside air.

We also note that although the assessment indicates that elevated noise levels would be present in some apartments with windows open, there is no specific restriction on how future residents can operate the façade. Occupants would be able to adjust their windows and doors as desired to achieve a higher level of natural ventilation or a lower level of noise. In the event windows were to be fully closed (to achieve maximum noise separation), then supplementary outside air would be available for ventilation.

Any supplementary ventilation system or façade opening proposed to be installed to provide ventilation to apartments should be acoustically designed to ensure that the internal noise level requirements are achieved. For mechanically assisted ventilation (such as centralised or individual apartment outside air fans), it should be acoustically designed so that internal noise levels within apartments are appropriate, and any external noise emissions to surrounding noise sensitive receivers is within the requirements detailed Section 10.3 of this report.

10 NOISE EMISSION CRITERIA

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

- Burwood Development Control Plan 2023 ("**DCP**")
- NSW EPA – 'Noise Policy for Industry' ("**NPI**") October 2017

10.1 BURWOOD DEVELOPMENT CONTROL PLAN 2023

The Burwood DCP 2023 does not provide numerical assessment criteria for noise emissions. Therefore, the **NPI** will be adopted to assess emissions.

10.2 NSW EPA NOISE POLICY FOR INDUSTRY (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 1.
- 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.

10.3 SUMMARISED NOISE EMISSION CRITERIA

Table 10 – 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, R2, R3 & R5 Residential	Day	47	**52**	58	N/A
	Evening	46	51	**48**	N/A
	Night	40	45	**43**	45 L_{eq} **55 L_{max}**
R2 & R5 Commercial	When in use	N/A	N/A	**63**	N/A
R4 Place of Worship	When in use	N/A	N/A	**40 (internal)**	N/A

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

11 NOISE EMISSION ASSESSMENT

11.1 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.

It is likely that condensers and other mechanical plant will be placed on the level 15 and 32 plant levels. Louvres can be blanked off on the southwestern corner if required to minimise noise emissions to the R5 tower. Noise emissions to the R2 tower will be shielded by the lift core on the eastern side of the building.

Noise emissions from all mechanical services to the closest receivers should comply with the requirements of Section 10.3.

Notwithstanding the above, an assessment of preliminary plant layouts and locations is presented below, noting that it is likely for layouts or equipment types to vary during the detailed design phase of the project.

- Major fans (typically with a sound power level over 80db(A) – such as kitchen exhaust, major toilet exhaust and major relief air fans) will require acoustic treatment if located externally. Wherever possible for major fans 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.

- Condensers are to be selected to include night mode cards which can reduce noise emissions during the night time period.

- To ensure compliance with NPfI requirements during the day, evening and night time, additional review is recommended following final plant selection and review.

11.2 NOISE FROM THE LOADING DOCK AND CARPARK

Accessibility to the loading dock is located on Burleigh Avenue and access to the underground carpark via Railway Parade. Operational noise levels from the proposed loading dock/carpark facilities have been predicted and assessed against the NSW EPA Noise Policy for Industry criteria detailed in Section 10.2 based on the information provided in the traffic report prepared by Solution Traffic Engineers.

Operational noise emissions are predicted based on the following sound power levels.

Table 11 – Source Sound Power Levels

Noise Source	Sound Power Level
Truck Manoeuvring @ 10km/h (MRV/delivery truck under 14.7 metres)	100dB(A)
Smaller Delivery Truck travelling at up to 10km/h	90dB(A)
Car/Van travelling at up to 10km/h	84dB(A)

Based on the information above, predicted noise levels from the loading dock and car park access have been summarised in the tables below.

Acoustic Logic assume that the loading dock will only be utilised throughout the daytime period and peak basement carpark movements will be throughout the evening period.

Table 12 – Predicted Cumulative Noise Levels from the Use of Loading Dock

Worst Affected Receiver	Predicted Noise Level $dB(A)L_{eq(15min)}$ [1,2]	Criteria Noise Level $dB(A)L_{eq(15min)}$	Complies
R1 (Residential Receiver)	52 (external)	52 (external)	Yes
R4 (Place of Worship)	38 (internal)	45 (internal)	

Table Notes:

1. Based on up to 1 large trucks, 1 small delivery truck, and up to 2 car/van deliveries 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. Acoustic Logic assumes a 10dB(A) noise reduction occurs through a window open for natural ventilation.

Table 13 – Predicted Cumulative Noise Levels from the Use of Basement Car Park

Worst Affected Receiver	Predicted Noise Level $dB(A)L_{eq(15min)}$ [1]	Criteria Noise Level $dB(A)L_{eq(15min)}$	Complies
Nearest residential receiver **R1**	45	48	Yes

1. Based on up to 35 vehicles accessing the basement carpark in any given 15 min period. Each vehicle is assumed to travel at 10km/h.

11.3 RESIDENTIAL COMMUNAL OUTDOOR SPACES

In regard to the proposed level 2 and level 38 residential communal outdoor areas, we note the following:

- Towards to east at R1 is currently a residential flat building where the lowest storey is on a lower plane than the proposed level 2 communal outdoor area.
- Towards the east at R2 is currently a mixed-use tower that overlooks the level 2 communal outdoor area.
- The level 38 communal area is shielded from local receivers on all sides as the highest storey of the local towers are all on a lower plane than the proposed level 38 communal outdoor area
- Landscaping/ planting is being used to visually screen the communal areas to the surrounding receivers.
- The communal area is for the use of residents only. General activities to be associated with its use is anticipated to be mainly passive activities.
- Additionally, use of the area would also be part of the strata management plan, and be subject to ongoing controls or restrictions to how it is used, for example:
    - Limits on the times of use.
    - Limits on the types of activities which can be undertaken (for example, the playing of amplified music).
    - Restrictions on the numbers of people which can use the space at given times.

11.4 HOTEL INDOOR SPACES

- Function rooms have the potential to generate high levels of operational noise.
- 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 is typically controlled through management controls to ensure internal noise levels are not excessive. Doors should be kept closed unless low noise functions are expected.
- Predicted noise levels to local receivers is < 40dB(A) with up to 200 patrons in any given function room and hotel restaurant/ bar at any given time through a closed façade.
- A minimum glazing construction of 6.38mm laminated (Rw 31) will provide adequate noise reduction for internal noise breakout from patrons. If amplified music may be used in the space, this glazing can be upgraded to 10.38mm laminated (Rw 35).
- The hotel gym, restaurant and kitchen on level 1 are recommended to include a resiliently hung 13mm plasterboard ceiling with 75mm thick 11kg/m^3 glasswool insulation in the ceiling cavity and minimum 200mm thickness of concrete slab.

11.5 HOTEL OUTDOOR SPACES

- It is expected that compliance with relevant noise emission objectives is to be reviewed based on a separate planning approval as part of a fit-out development application subject to the specific operations of each individual commercial tenancy once operators have been determined. Tenancies are capable of achieving noise emission objectives provided the appropriate acoustic treatments and management controls are implemented for each specific application.

- If tenancies were to become licensed for the service of alcohol, this use would be subject to a separate planning application which would be accompanied by a noise impact assessment of the proposed use typical for Liquor and Gaming NSW. Acoustic treatments and management controls could be applied to these tenancies use to achieve the relevant noise emission requirements from internal activities (such as upgraded glazing); however, the use of external areas (if any) would be likely management of patron numbers/hours of use to achieve compliance.

Indicative calculations have been made based on the following parameters. A background + 5dB(A) assessment level was adopted similar to what was typically used for liquor licensed assessments prior to the Vibrancy Reforms.

- 10 patrons in the outdoor area servicing function room 1 and 2 respectively on level 1 and level 37 western outdoor area.

- 40 patrons in the hotel outdoor area on level 2 and northern outdoor area on level 37 respectively.

- 20 patrons in the hotel pool deck on level 38.

- 1 in 2 patrons in all areas speaking at raised voice (77dB(A) SWL).

- The outdoor areas are not used during the night time period (10pm-7am)

Predicted noise levels to local receivers are provided below.

Table 14 – Hotel Outdoor Spaces to Local Residents

Residential Receiver	Predicted Noise Level dB(A)$L_{eq(15min)}$ [(1)]	Criteria Noise Level dB(A)$L_{eq(15min)}$	Complies
R1	< 40	51 (evening)	Yes
R2	< 40	51 (evening)	Yes
R3	< 40	51 (evening)	Yes
R5	50	51 (evening)	Yes

We note that:

- Noise generated by the outdoor areas is predicted to be below 45dB(A) internally at R4 (place of worship) with a conservative 10dB(A) façade reduction based on a window open for natural ventilation.

- The noise generated by the outdoor areas to the site itself is considered neighbourhood noise and no documented acoustic legislation can be applied.

- Even so, noise intrusion into the residential units shall be below those described in Section 7.4. The glazing requirements in Section 9.1.1 adequately reduce noise to be below those described above.

11.6 RECOMMENDATIONS

Predicted noise levels from operation of the proposed development show that it is capable of meeting the noise emission requirements at all times.

It is recommended that a review and detailed design of all mechanical plant associated with the site be undertaken prior to the issue of a construction certificate to ensure plant noise levels meet the noise emission requirements detailed in Section 10. Any review of mechanical plant noise should take into consideration the operational noise levels from the site, such that the cumulative noise does not exceed the PNTL's.

All feasible and reasonable noise mitigation measures have been applied to reduce noise levels and the following recommendations are presented:

- Engines should be turned off during loading and unloading movements, thus effectively having no idling noise during the loading and unloading operations.
- Only 4 truck movements (MRV/delivery truck under 14.7 metres) are to be allowed in any given 1-hour period. Deliveries shall be managed accordingly.
- Loading Dock is only to operate throughout the daytime period (7:00am to 6:00pm).
- An acoustic barrier is to be implemented as per the below.

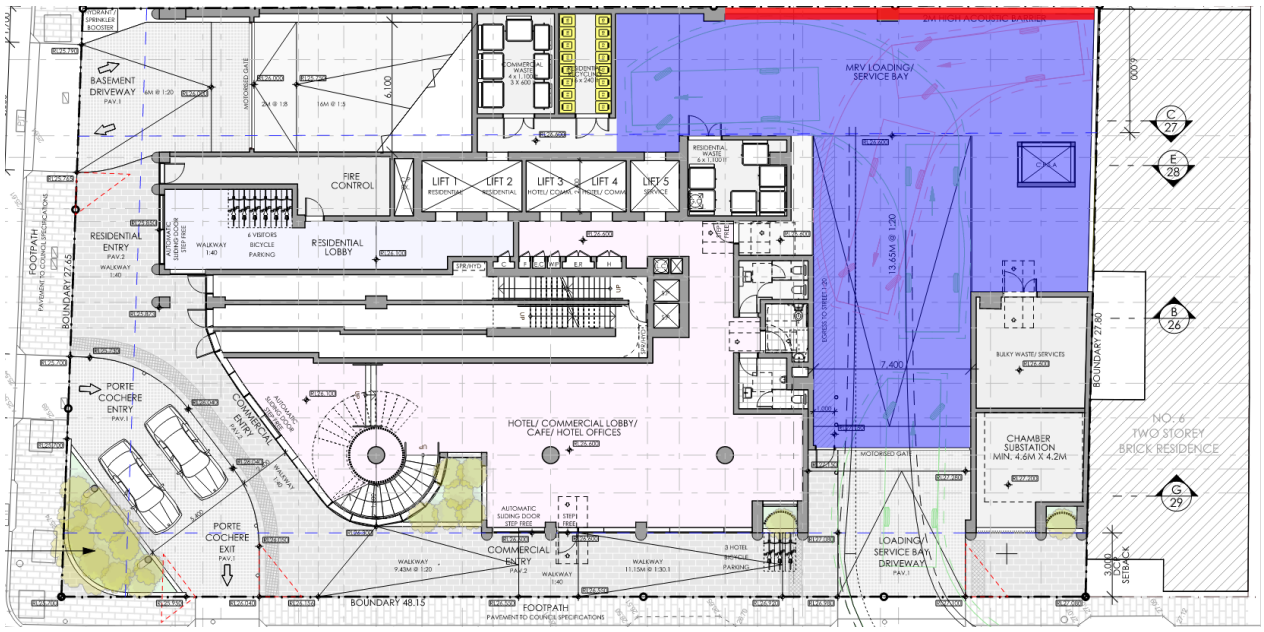

Figure 2 – Proposed Acoustic Barrier

- Recommended acoustic barrier around the loading dock is presented in the figure above. Barriers are to be constructed to the minimum height outlined from the RL as presented in the ground floor plan. The barrier is to be constructed of lapped and capped timber, plexiglass, 4mm Perspex, Colorbond, 9mm fibrous cement sheet or equivalent, installed with no gaps between the panels, and maximum of a 20mm gap at the bottom to allow water flow if required.
- All recommended minimum constructions in Sections 11.1-11.6 are to be iterated in CC stage based on further progressed design development.

Noise modelling predicts that noise emissions will comply to all sensitive receivers. If an increase of the loading dock usage is expected, additional acoustic review will be required.

12 CONSTRUCTION NOISE AND VIBRATION

A quantitative evaluation of the proposed works has been undertaken to identify those activities that have the potential to adversely impact nearby properties.

The assessment uses site specific noise and vibration management levels developed using the EPA ICNG. The predicted, receiver noise and vibration levels will be compared to the management levels to identify those activities that are likely to require additional management, above what is considered to be normal good practice.

12.1 CONSTRUCTION NOISE MANAGEMENT LEVELS

12.1.1 Residential Receivers

Residential noise management levels are based on the "rating background noise level" ("**RBL**") applicable to the receivers. RBL's are typically determined by measuring the ambient noise environment using the methodology in the EPA NPI. The measurements, analysis and RBL's determined for this project are summarised in Appendix A.

The ICNG construction noise management levels are summarised in the following table, along with how they should be used to manage impacts.

Table 15 – Construction Noise Management Levels

Management Level $L_{Aeq,(15min)}$*	**How to Apply**
Noise affected Management Level ("**NML**") RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur.

*** Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.**

The ICNG recommended standard hours are as follows:

- Monday to Friday – 7:00am to 6:00pm
- Saturday – 8:00am to 1:00pm
- No work on Sundays or public holidays

12.1.2 Other Land Uses

For other land uses, the management levels are absolute noise levels, independent of the prevailing noise environment, so monitoring of the prevailing environment is not generally required for these uses. The ICNG construction noise management levels for uses other than residential dwellings are summarised in the following table.

Table 16 – Construction Noise Management Levels – Non Residential Uses

Land Use	Management Level, $L_{Aeq\ (15min)}$ (applies for times when properties are being used)
Commercial and Retail Outlets	70 (external)
Places of worship	45 (internal)

12.1.3 Receiver Noise Management Levels

The project specific NML's for the most impacted receivers are summarised in the following table using the objectives tabled above and the adopted RBL's.

Table 17 – Noise Management Levels for Most Impacted Receivers

Location/Receiver	RBL dB(A) L_{90}	NML dB(A) L_{eq}	HANML dB(A) L_{eq}
R1	50	60	75
R2	50	60	75
R3	47	57	75
R4	-	45 (internal)	-
R5	47	57	75
R6	-	70	-

12.2 CONSTRUCTION VIBRATION MANAGEMENT LEVELS

12.2.1 Amenity Management

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels (extracted from Tables 2.2 and 2.4 of the guideline) are presented in the following table for various types of vibration:

Table 18 -(Table 2.2 Assessing Vibration: A Technical Guideline) – Preferred and Maximum Weighted RMS Values for Continuous and Impulsive Vibration Acceleration (m/s2) 1-80Hz

Location	Assessment Period [1]	Preferred values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous Vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.02	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night-time	0.04	0.029	0.080	0.058
Impulsive Vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

1 Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am.

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate task require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of this policy, and other guidance documents (e.g. relevant standards) should be referred to. Source: BS6472-1992.

Table 19 -(Table 2.4 Assessing Vibration: A technical guideline) – Acceptable Vibration Dose Values for Intermittent Vibration (m/s1.75)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum Value	Preferred value	Maximum Value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

1 Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am.

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS6472-1992.

12.2.2 Structure Damage Risk Criteria

12.2.2.1 Generally

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 20 -(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.

a At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.

b It may be necessary to lower the guideline value markedly to prevent minor damage

12.3 CONSTRUCTION NOISE ASSESSMENT

12.3.1 Preliminary Proposed Construction Activities

Preliminary review of typical construction activities has been conducted. Noise impacts from construction activities on the amenity of the surrounding identified sensitive receivers, will be predicted in this section. Typically, the most significant sources of noise or vibration generated during a construction project will be the demolition, excavation and civil works for the site.

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

Table 21 – Sound Power Level of Loudest Proposed Equipment

Construction Stage	Loudest Equipment /Process	Typical Sound Power Level dB(A)
Shoring and Bulk Excavation	Excavator	110
Civil Works	Crane - Fixed	113

12.3.2 Predictions

Construction noise emissions to nearby development depend on the activities being undertaken at the time, and where on the site the activities occur.

Construction noise levels at the surrounding receivers have been predicted based on the following inputs.

- The plant sound power levels indicated in Appendix D. These have been corrected for estimated typical operation duty indicated in the table using 10 x log(% duty/100).
- Corrections for source to receiver distance attenuation including air absorption (20°C , 70% RH, neutral wind conditions).
- Barrier or directivity attenuation where present.
- Source heights – 1.5m above the ground/building level of the noise source location, unless noted otherwise.
- Source locations are indicated in the Site Management Plan provided by Conquest

Table 22 – Predicted Noise Impacts for Shoring and Bulk Excavation

Location/Receiver	Highest Predicted Level dB(A) L_{eq}	NML dB(A) L_{eq}	HANML dB(A) L_{eq}	Requires Assessment of Additional Management
R1	67-77	57	75	Yes
R2	62-67	57	75	
R3	60-69	57	75	
R4	53-63 (internal)*	45 (internal)	-	
R5	61-70	57	75	

**Acoustic Logic assume a 10dB(A) noise reduction occurs through a window open for natural ventilation.*

Table 23 – Predicted Noise Impacts for Civil Works

Location/Receiver	Highest Predicted Level dB(A) L_{eq}	NML dB(A) L_{eq}	HANML dB(A) L_{eq}	Requires Assessment of Additional Management
R1	70-80	57	75	Yes
R2	65-70	57	75	
R3	63-72	57	75	
R4	56-65 (internal)*	45 (internal)	-	
R5	64-73	57	75	

**Acoustic Logic assume a 10dB(A) noise reduction occurs through a window open for natural ventilation.*

The analysis indicated that:

- All receivers will be subject to noise exceeding the NML.
- Some receivers will be subject to noise exceeding the HANML.
- The distance separation between the sensitive noise receivers is minimal.

12.3.3 Site Specific Recommendations

In light of the above, we recommend:

- The scheduling of construction activities should be undertaken to reasonably minimise noise impacts to all surrounding land uses.
    - In this regard, highly noise intrusive works such as hammering should not take place prior to 8am.
- Materials handling/vehicles:
    - Trucks 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).
- High Noise Generating Demolition:
    - Where high noise generating demolition are proposed to be undertaken, respite hours should be implemented to reduce the impact on surrounding receivers.
- Complaints handling:
    - An after hours contact number is to be displayed outside of the building site, so that in the event that surrounding developments believe that a noise breach is occurring, they may contact the site.

12.4 ASSESSMENT OF VIBRATION

12.4.1 Vibration Producing Activities

Demolition of the existing structures has the potential to produce significant ground vibration.

12.4.2 Vibration Management

The following principles should be considered to manage adverse vibration impacts:

- Obtaining separate structural or specialist advice for critical or fragile structures as to the level of damage risk.
- Selection of processes that minimise structure and ground vibration – generally avoiding percussive methods.
- Use smallest plant that is able to efficiently undertake the work activity.
- Lay vibration absorbing mats to cushion impacts from falling debris.
- Application of vibration dampening pads to metal surfaces subject to impacts.
- When demolishing, cut control joints in structures to form vibration "breaks", or work away from sensitive receiver locations to form natural vibration breaks in propagation path.
- Monitoring of structures using attended and/or unattended monitors with alarms.
- Time scheduling works to minimise amenity impacts.
- Communicating with affected receivers.

13 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with the proposed mixed use building to be located at 2-4 Burleigh St & 20-24 Railway Parade, Burwood. Based on our assessment the following has been concluded.

Provided that the recommendations set out in Section 9.1 of this report are employed, internal noise levels shall satisfy the requirements outlined in:

- NSW Department of Planning document – "*State Environmental Planning Policy* (**SEPP**) (*TRANSPORT & INFRASTRUCTURE*) 2021"; and
- NSW Department of Planning document – *"Development near Rail Corridors and Busy Roads – Interim Guideline"* (**DNRCBR**) 2009.
- Australian Standard 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors ("**AS2107:2016**")

Provided that recommendations set out in Section 1 of this report are employed, external noise emissions shall satisfy the requirements outlined in:

- Burwood Development Control Plan 2023 ("**DCP**")
- NSW EPA – 'Noise Policy for Industry' ("**NPI**") October 2017

Construction Noise and Vibration impacts have been assessed using the EPA Interim Construction Noise Guideline ("**ICNG**").

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

Yours faithfully,

Acoustic Logic Pty Ltd
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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 & train noise levels surrounding the site, 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).

L_{90} – 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 L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

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

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

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

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 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 Canterbury weather station.

- 14/03/2024 Night
- 16/03/2024 Evening/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 0.3 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.

Table 24 – RBL – Location 1 Traffic Monitor

Date	Noise Level dB(A) $L_{90, period}$		
	Day	Evening	Night
13/03/2024	-	48	39
14/03/2024	49	49	0
15/03/2024	50	48	39
16/03/2024	47	-	-
17/03/2024	49	46	38
18/03/2024	50	50	40
19/03/2024	50	49	42
20/03/2024	51	48	40
Adopted RBL	**50**	**48**	**40**

Table 25 – RBL – Location 2 Background Monitor

Date	Noise Level dB(A) $L_{90, period}$		
	Day	Evening	Night
13/03/2024	-	44	40
14/03/2024	47	47	-
15/03/2024	47	45	40
16/03/2024	44	-	-
17/03/2024	46	44	39
18/03/2024	47	46	41
19/03/2024	48	46	42
20/03/2024	48	46	40
Adopted RBL	**47**	**46**	**40**

A.3 ATTENDED MONITORING

A.3.1 Equipment Used

Attended noise monitoring was conducted using:

- Rion NL-42 (Type 2) sound level meter

The sound level meter equipment used retain current calibration - either manufacturers' calibration or NATA certified calibration, and were field calibrated at the beginning and the end of the measurement with no significant drift in calibration noted.

A.3.2 Locations Monitored

The attended monitoring locations are described below.

- Attended 1 – Train Arriving and Departing at closest Railway Platform 6 of Burwood Station. Taken on the property boundary on 21st March 2025.
- Attended 2 – Traffic Noise Measurement of Railway Parade, 3m from curb on 21st March 2025.
- Attended 3 – Traffic Noise Measurement of Burleigh Street on 21st March 2025.
- Attended 4 – Traffic Noise Measurement of Burleigh Street on 4th August 2025
- Attended 5 – Traffic Noise Measurement of Belmore Street on 4th August 2025.

A.3.3 Results

Table 26 – Attended Noise Monitoring Results

Measurement Location	Time of Measurement	Measured Noise Level
Railway Parade, 3m from curb (Rail pass-by)	21st March 2025 – 02:00pm	62 dB(A)L_{Aeq}
Railway Parade, 3m from curb (Traffic)	21st March 2025 – 04:00pm	63 dB(A)L_{Aeq}
Burleigh Street, 3m from curb (Traffic)	21st March 2025 – 04:15pm	56 dB(A)L_{Aeq}
Burleigh Street, 3m from curb (Traffic)	4th August 2025 – 12:30pm	*61 dB(A)L_{Aeq}
Belmore Street, 3m from curb (Traffic)	4th August 2025 – 12:45pm	61 dB(A)L_{Aeq}

*Affected by loading noise on the street at 7-9 Burleigh Street.

A.3.4 Summarised Traffic Noise Levels

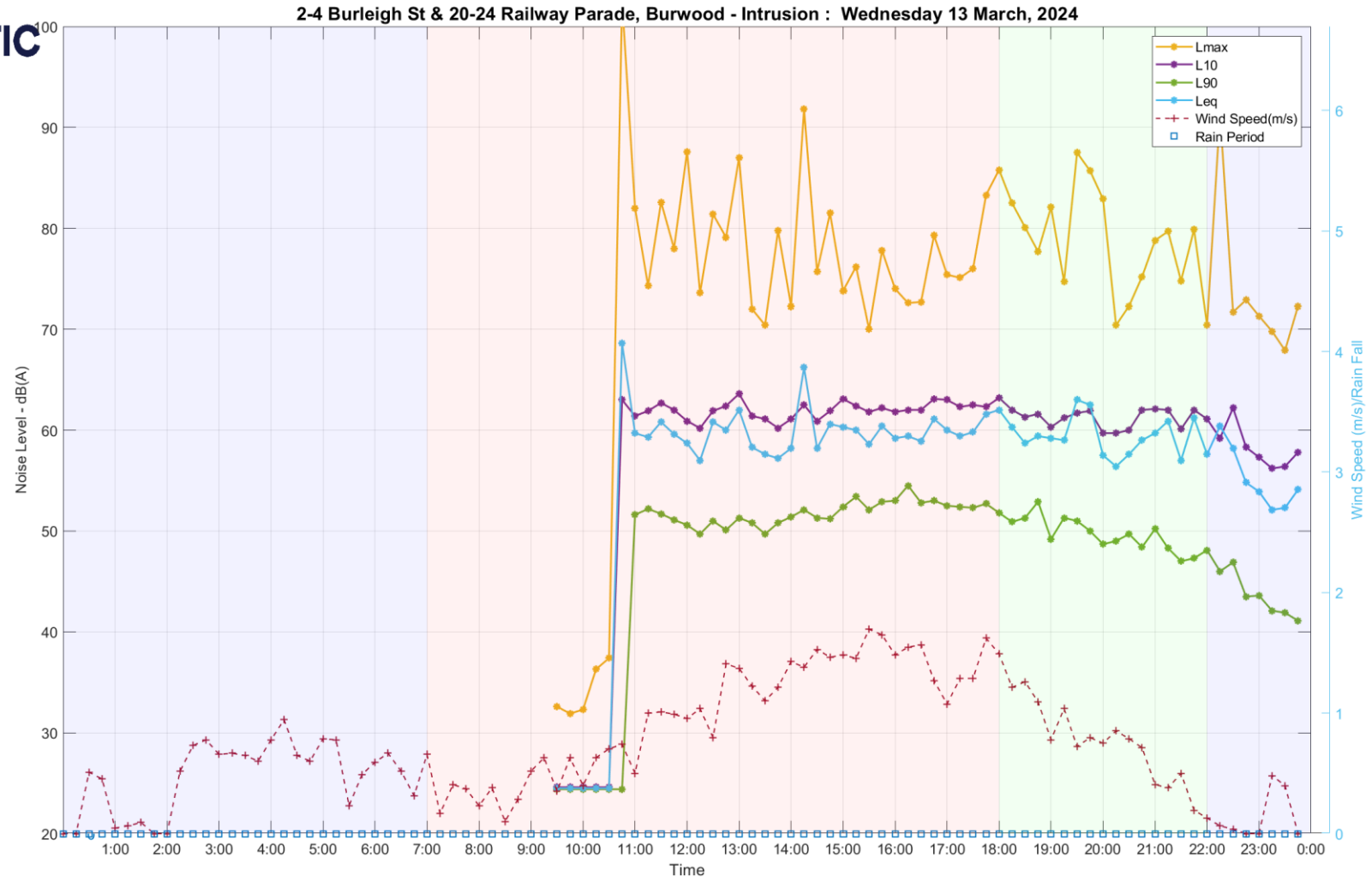
The following noise levels for the site have been established based on long term monitoring of the development site.

Table 27 – Traffic Noise Levels

Location	Time of Day	Summarised Traffic Noise Levels – dB(A) L_{eq}
Railway Parade	Daytime 7am – 10pm	63 dB(A) $L_{eq\ (15hr)}$
	Night-time 10pm – 7am	60 dB(A) $L_{eq\ (9hr)}$
Burleigh Street	Daytime 7am – 10pm	57 dB(A) $L_{eq\ (15hr)}$
	Night-time 10pm – 7am	54 dB(A) $L_{eq\ (9hr)}$

A.4 UNATTENDED MONITORING CHARTS

A.4.1 Location 1 – Traffic Monitor


2-4 Burleigh St & 20-24 Railway Parade, Burwood - Intrusion : Wednesday 13 March, 2024
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
20
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
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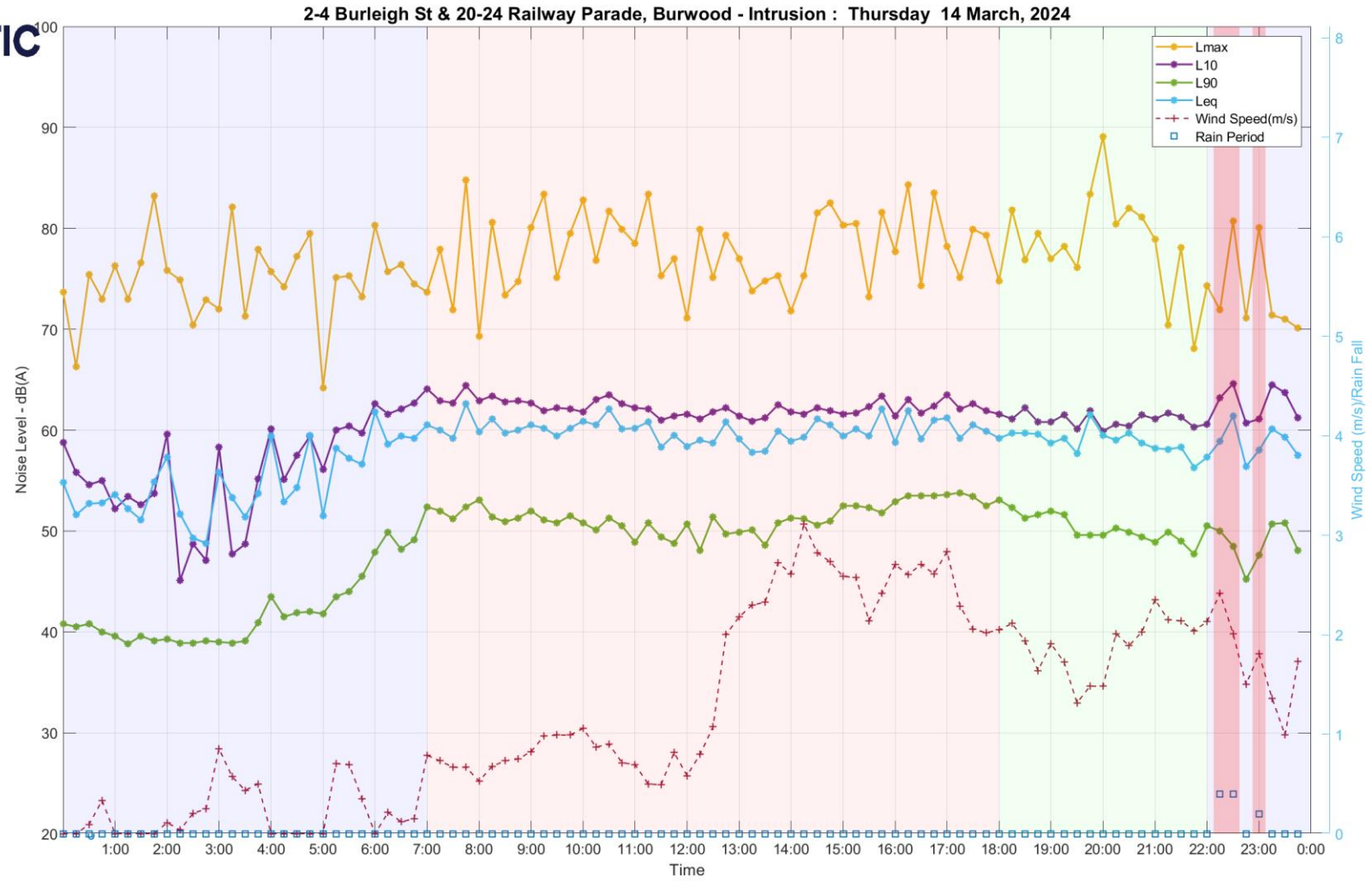
2-4 Burleigh St & 20-24 Railway Parade, Burwood - Intrusion : Thursday 14 March, 2024
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
80
70
60
50
40
30
20
8
7
6
5
4
3
2
1
0
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
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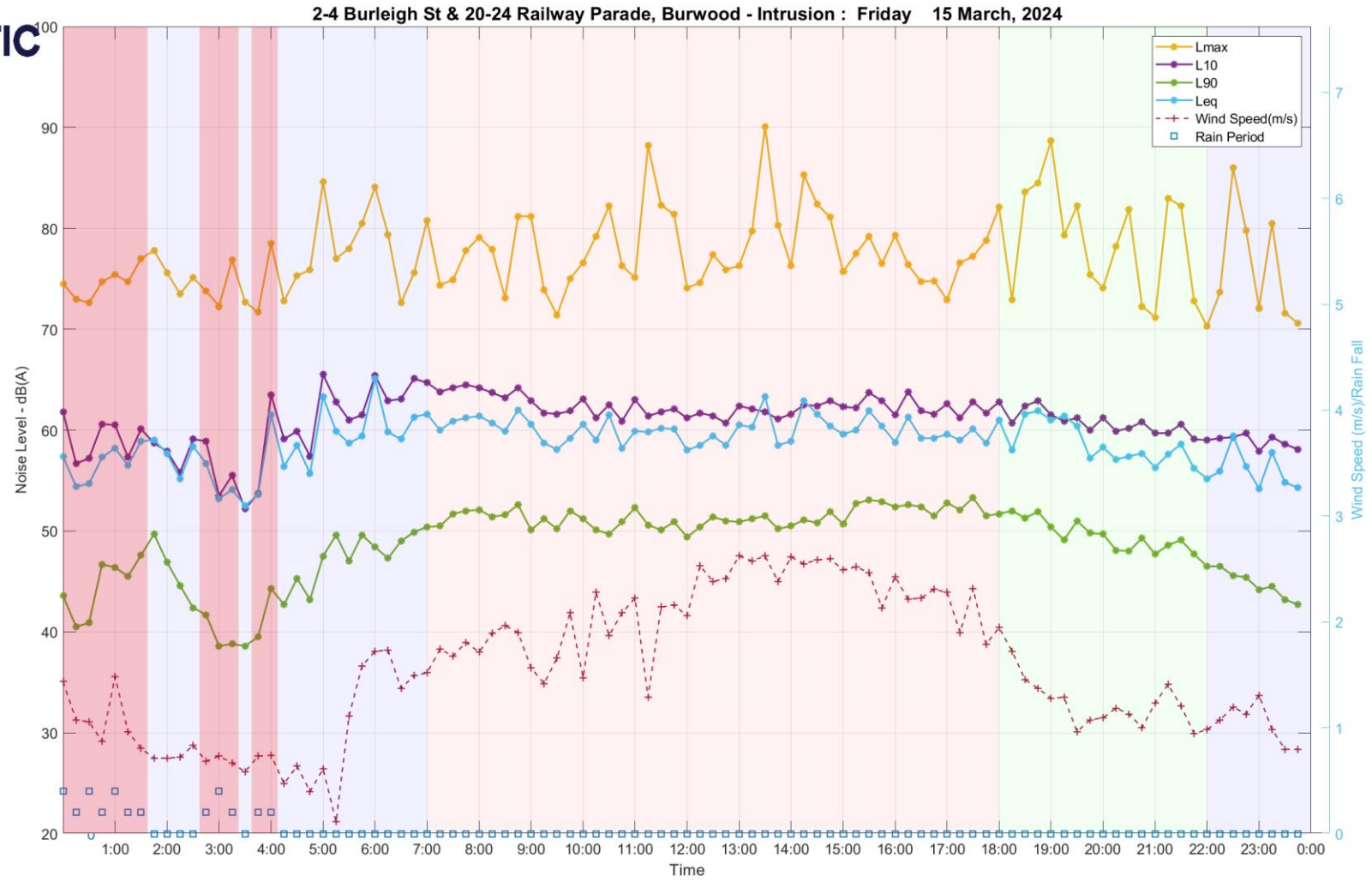
2-4 Burleigh St & 20-24 Railway Parade, Burwood - Intrusion : Friday 15 March, 2024
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time
100
90
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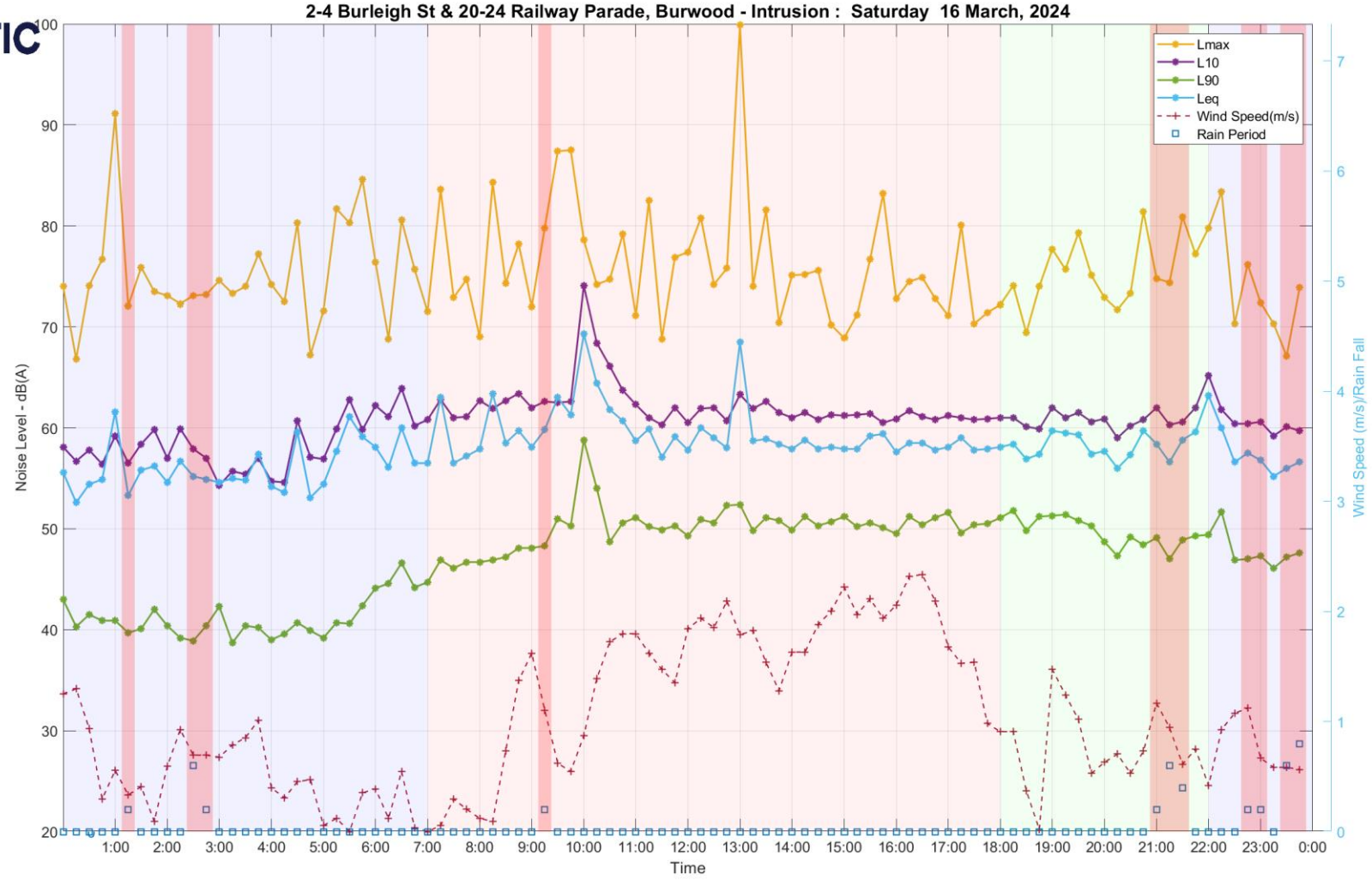
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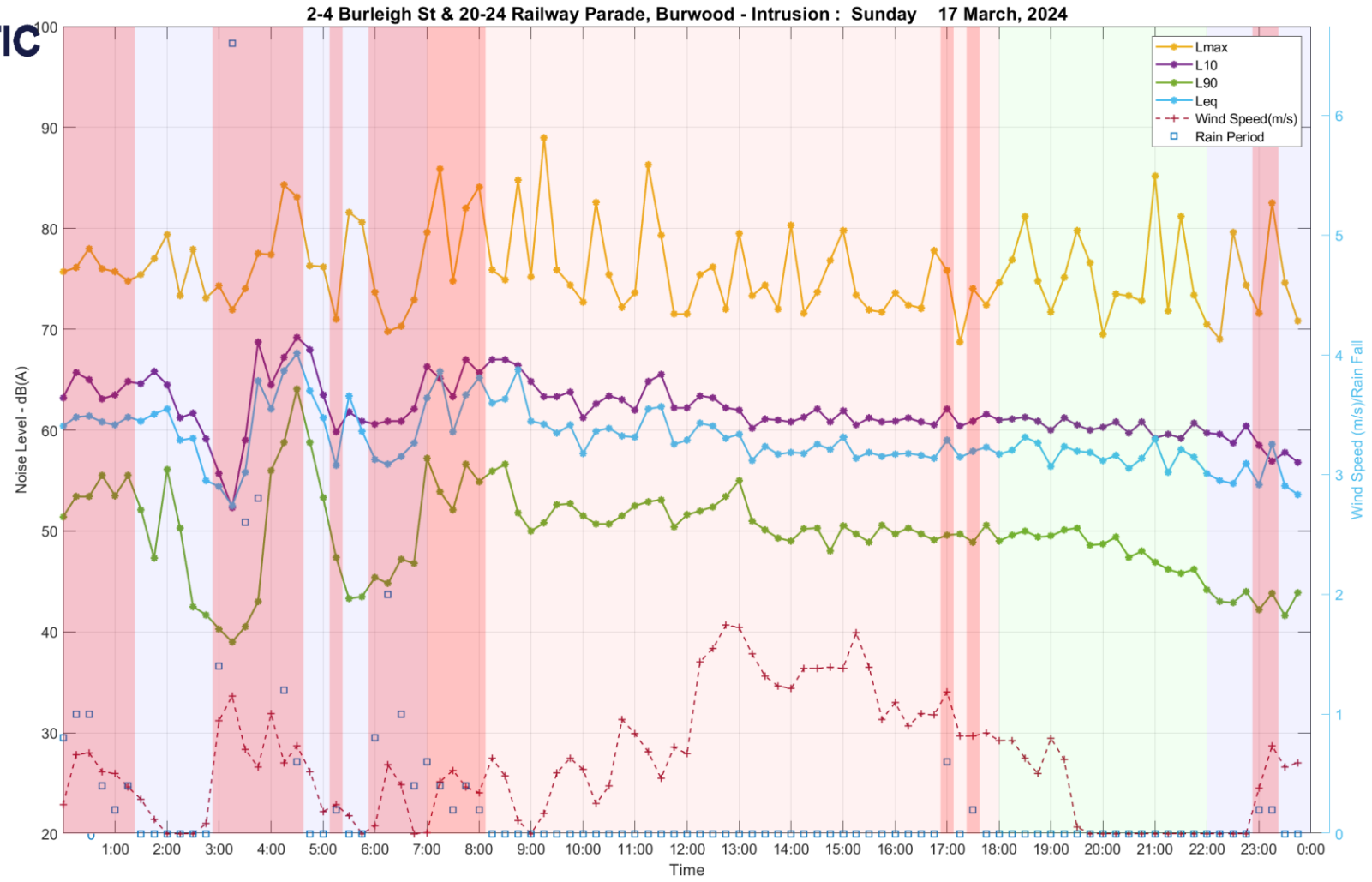
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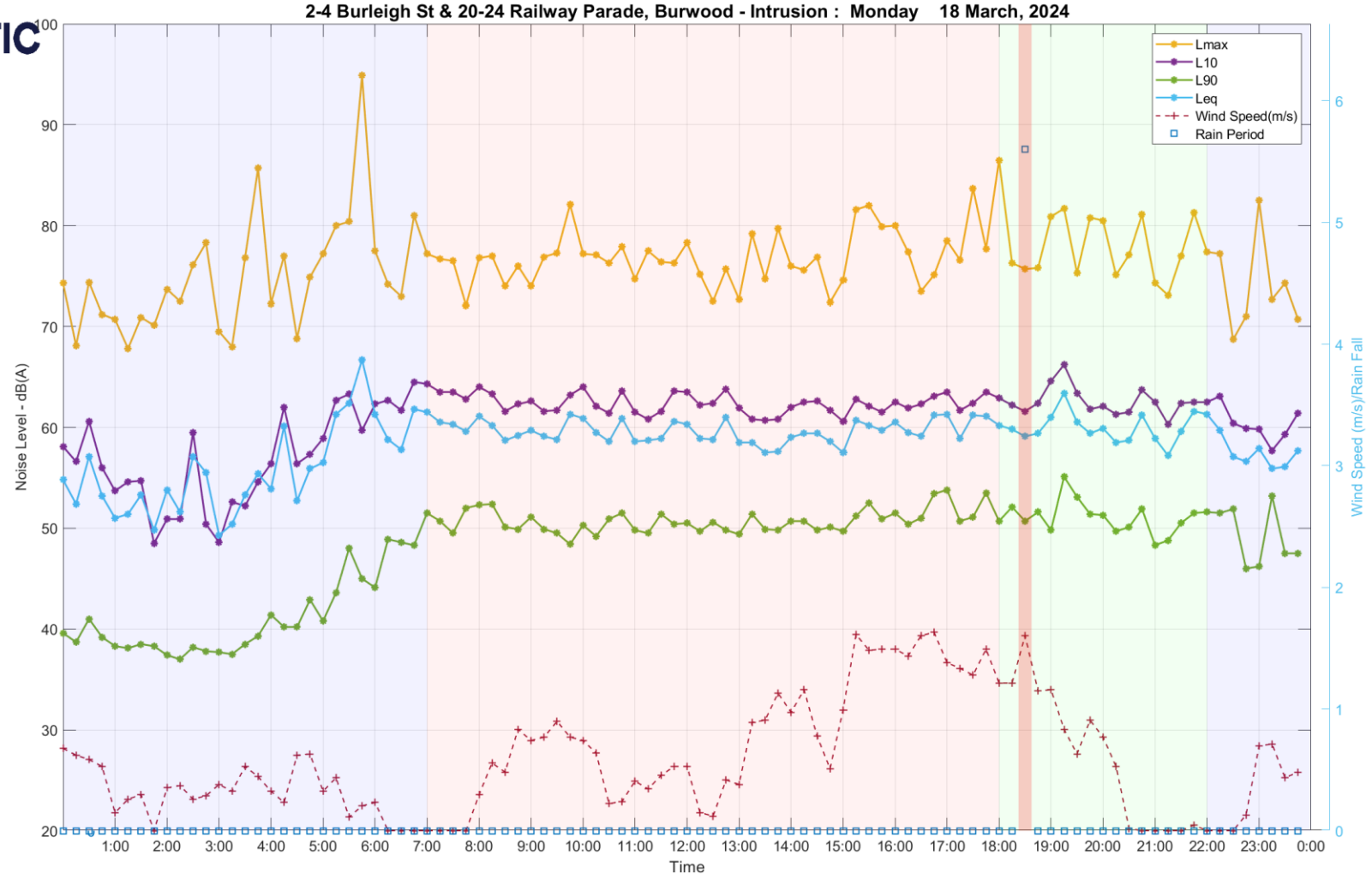
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Noise Level - dB(A)
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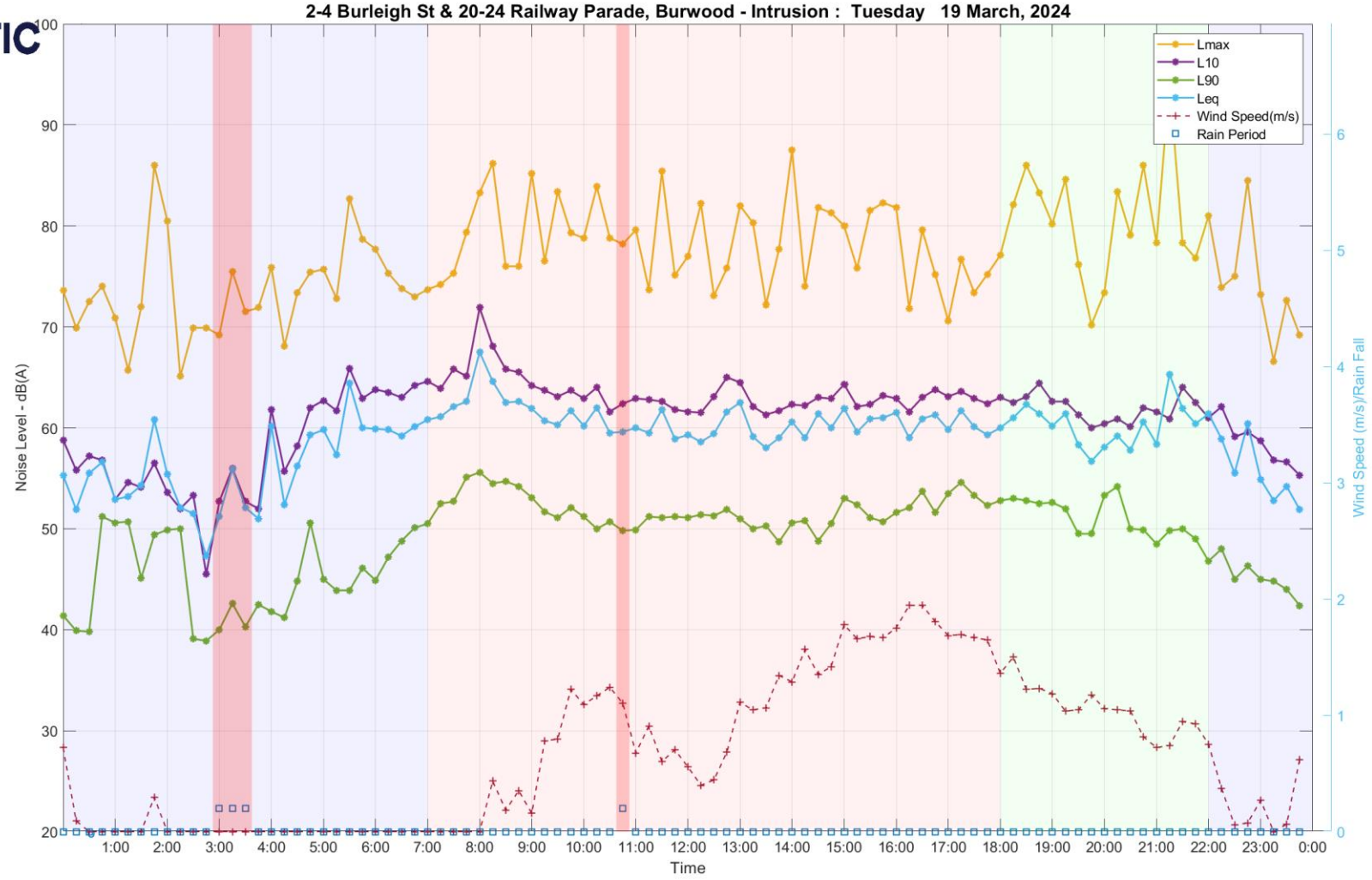
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Wind Speed(m/s)
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Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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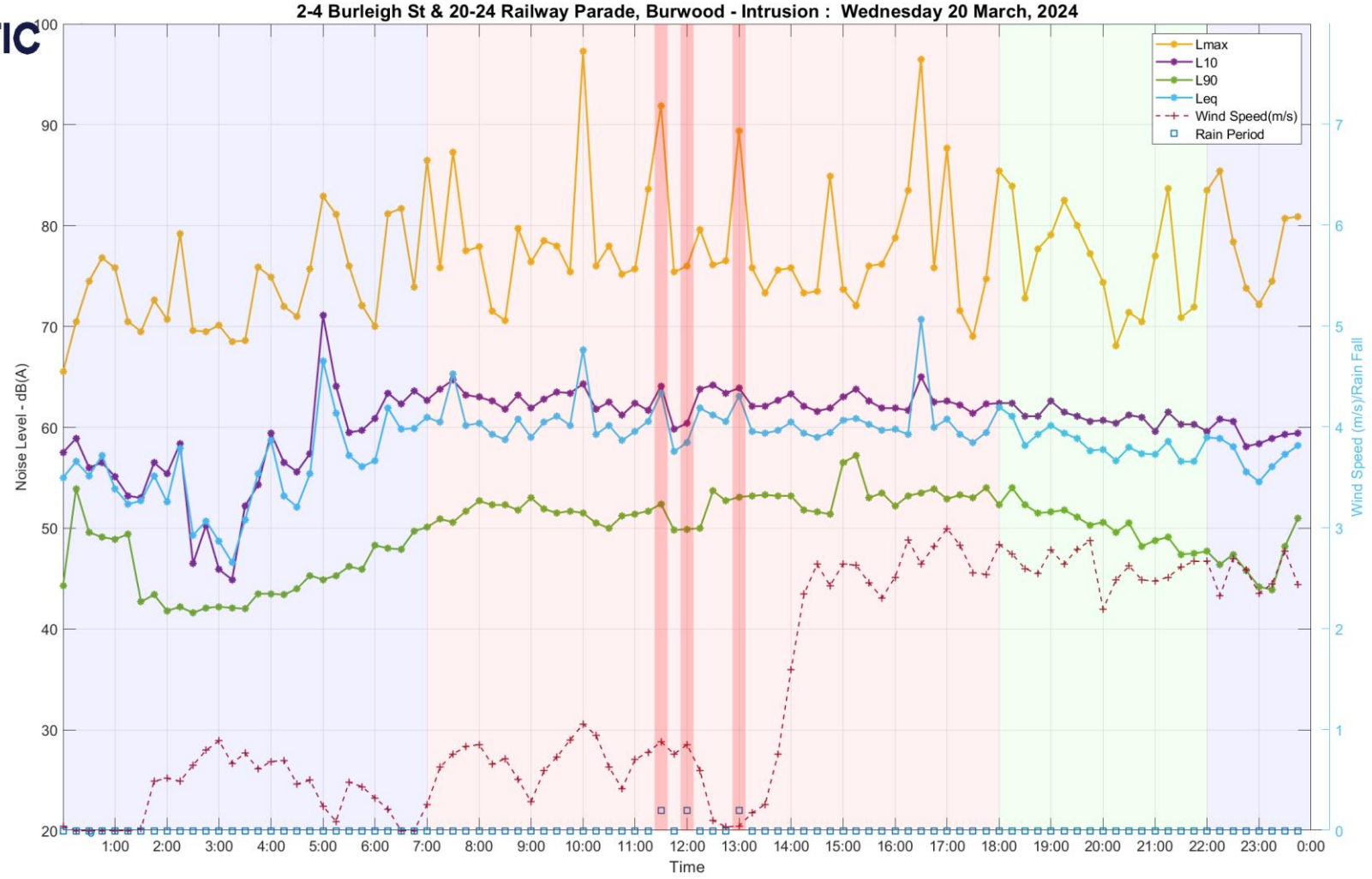
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Wind Speed(m/s)
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Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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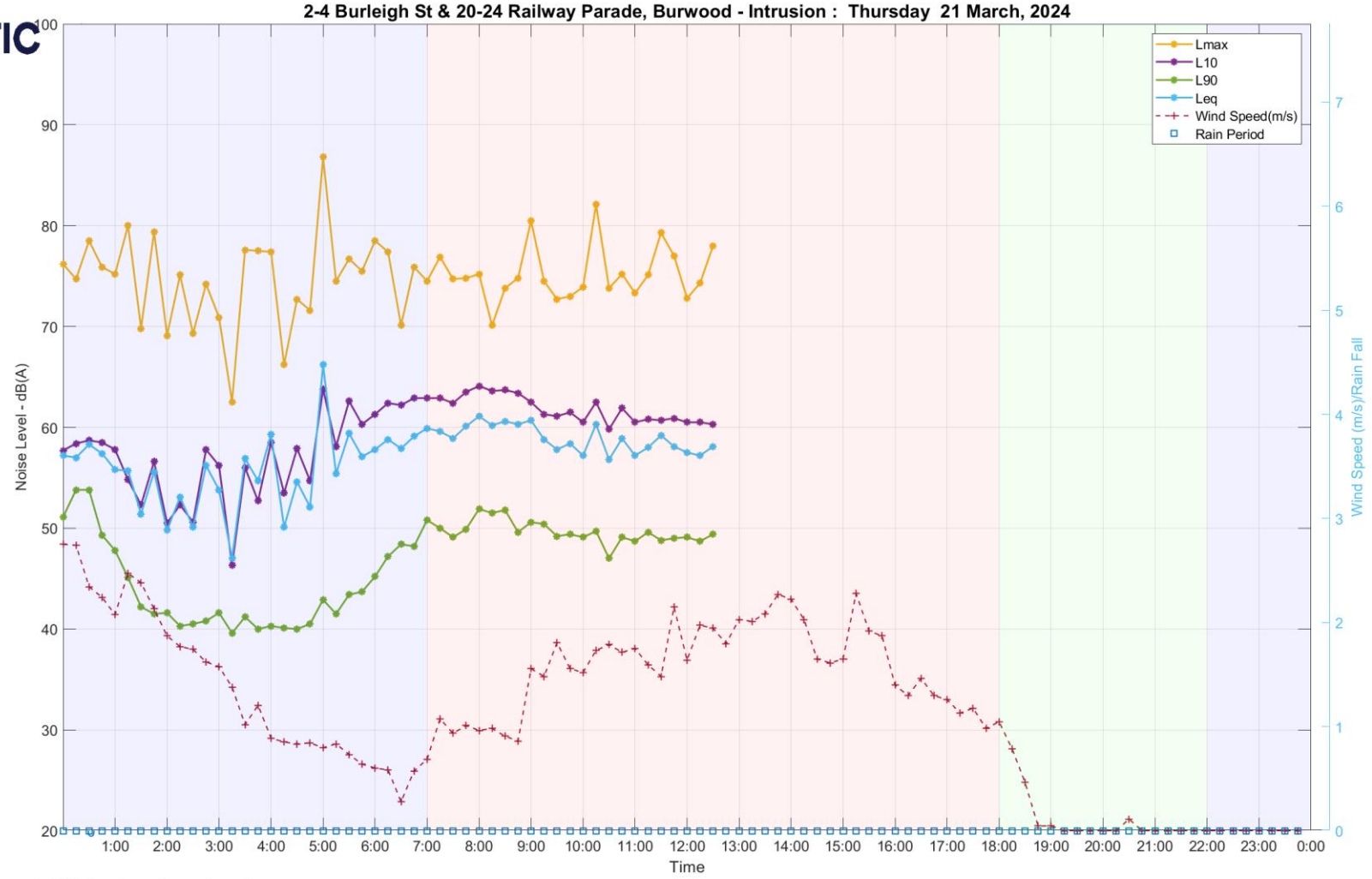
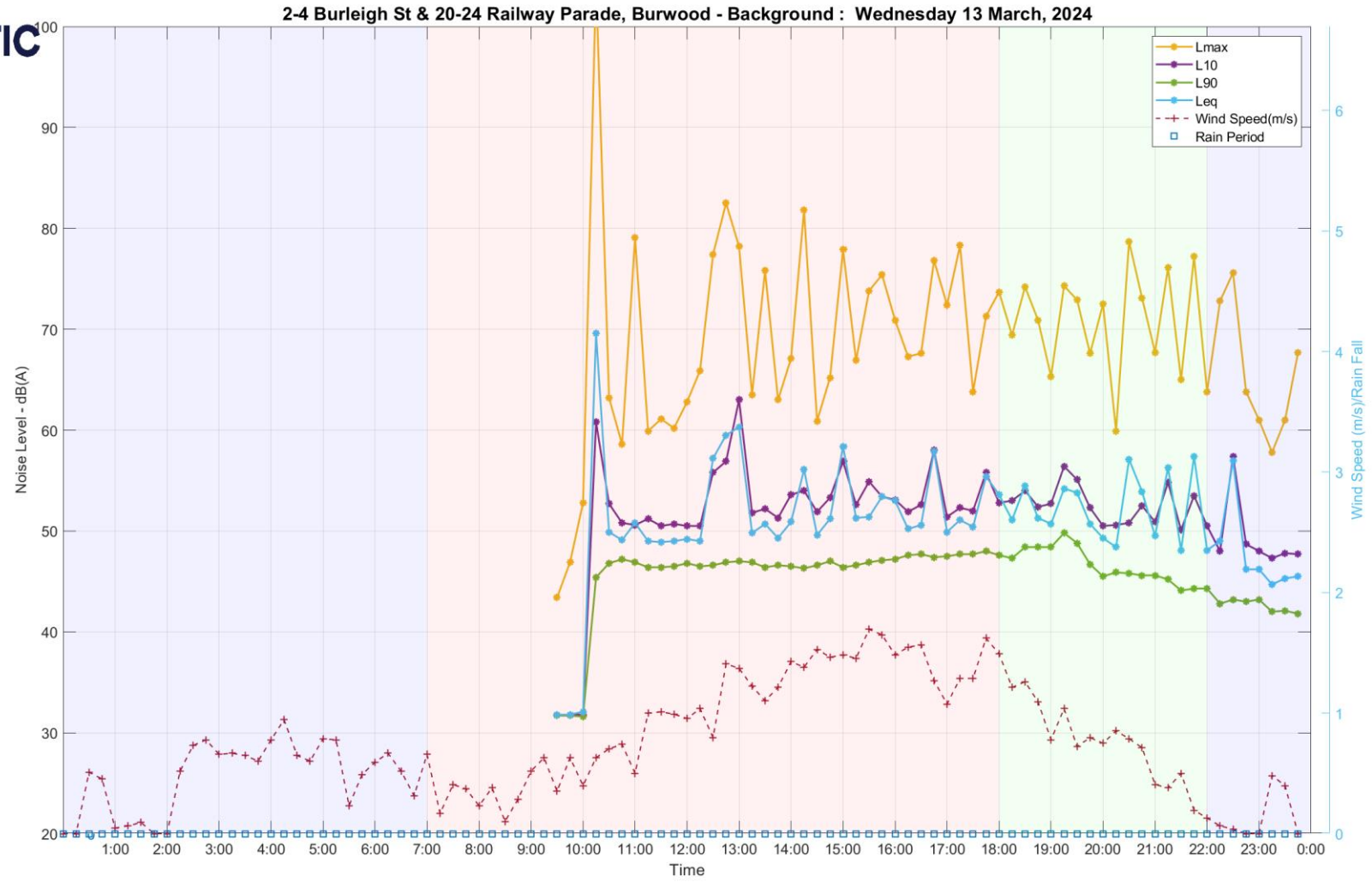


Wind Speed is corrected using factor 0.3333 based on logger location

A.4.2 Location 1 – Traffic Monitor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Noise Level - dB(A)
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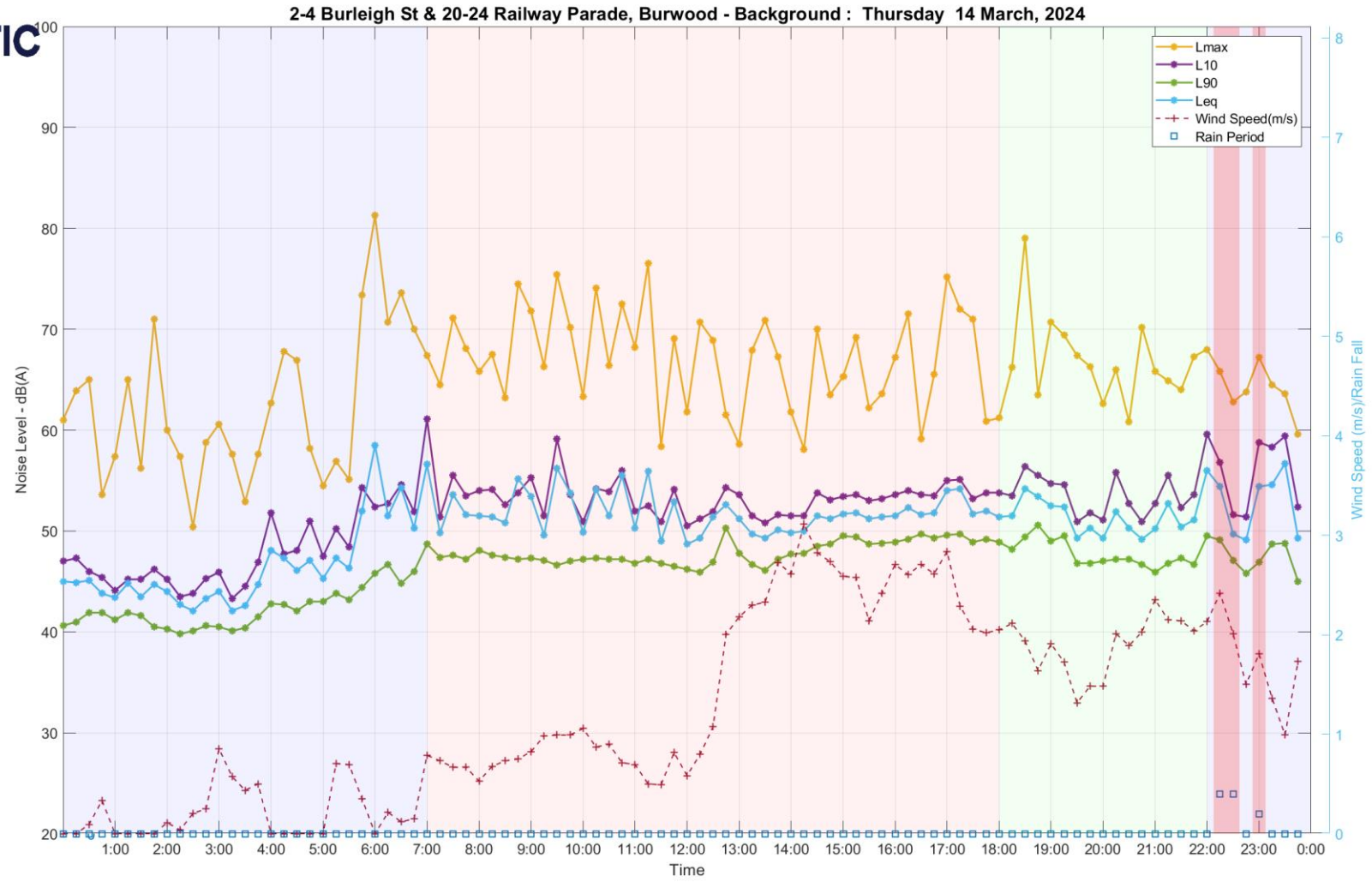
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Wind Speed(m/s)
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Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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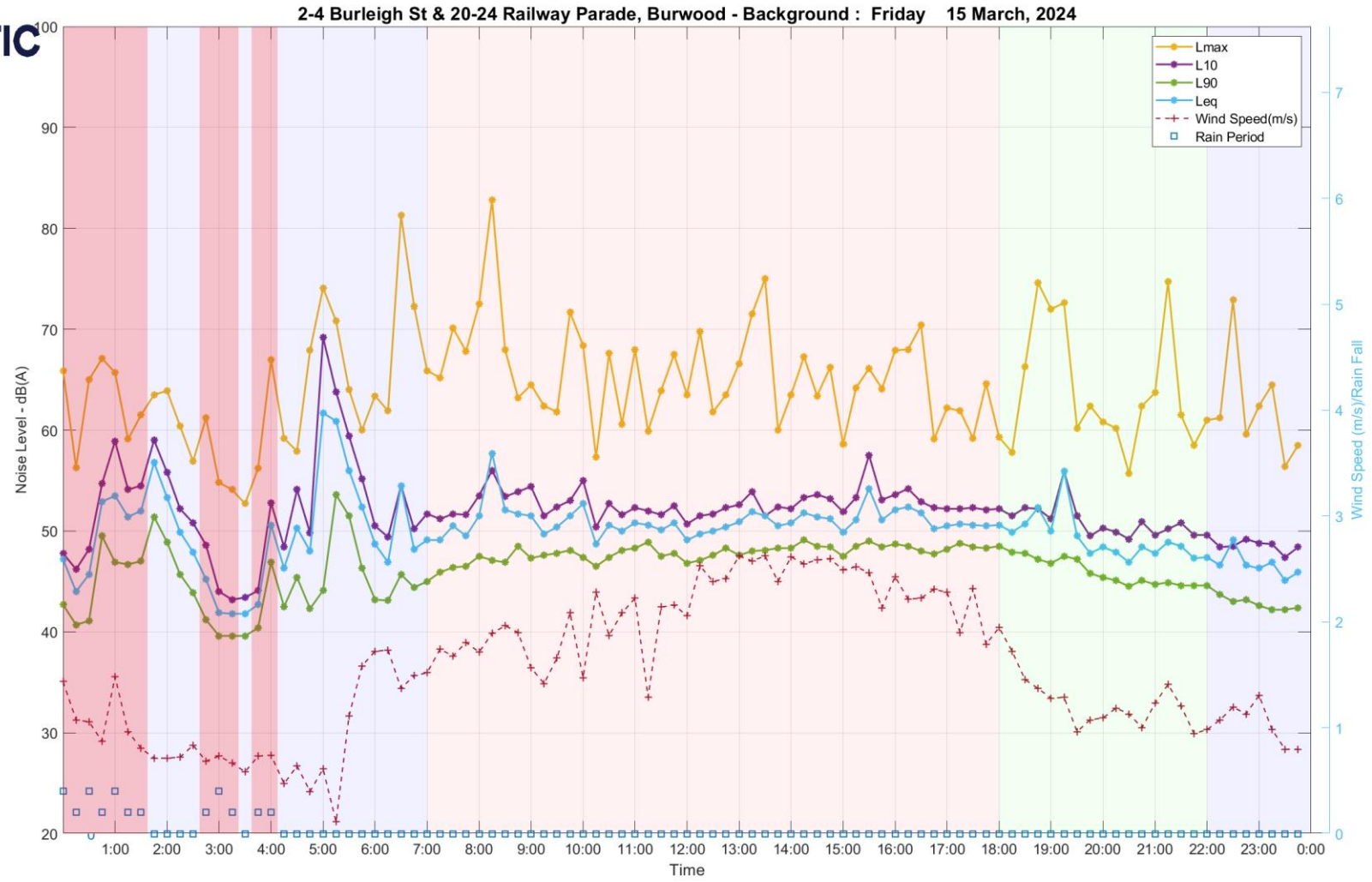
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Wind Speed(m/s)
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Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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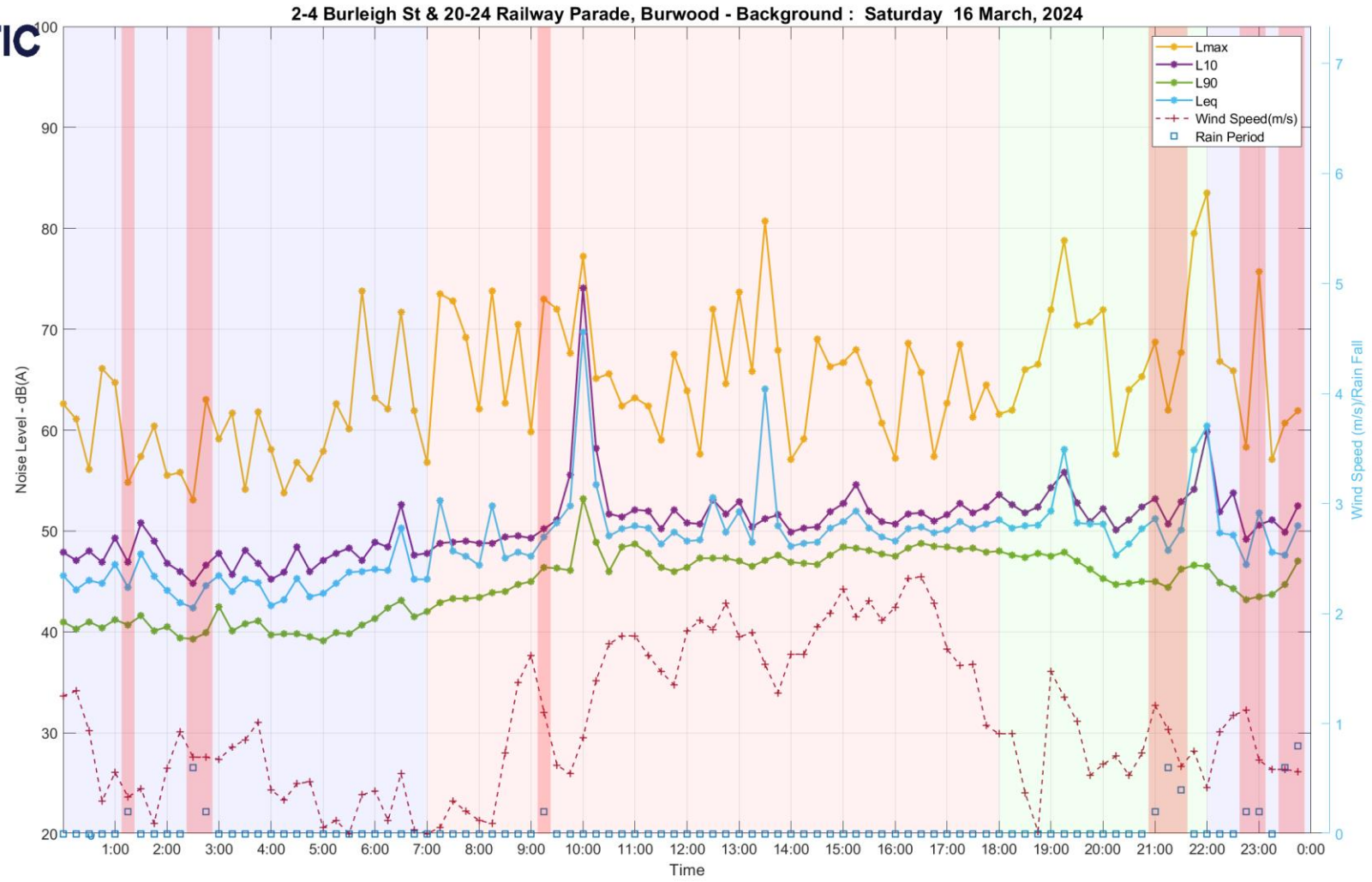
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Wind Speed(m/s)
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Noise Level - dB(A)
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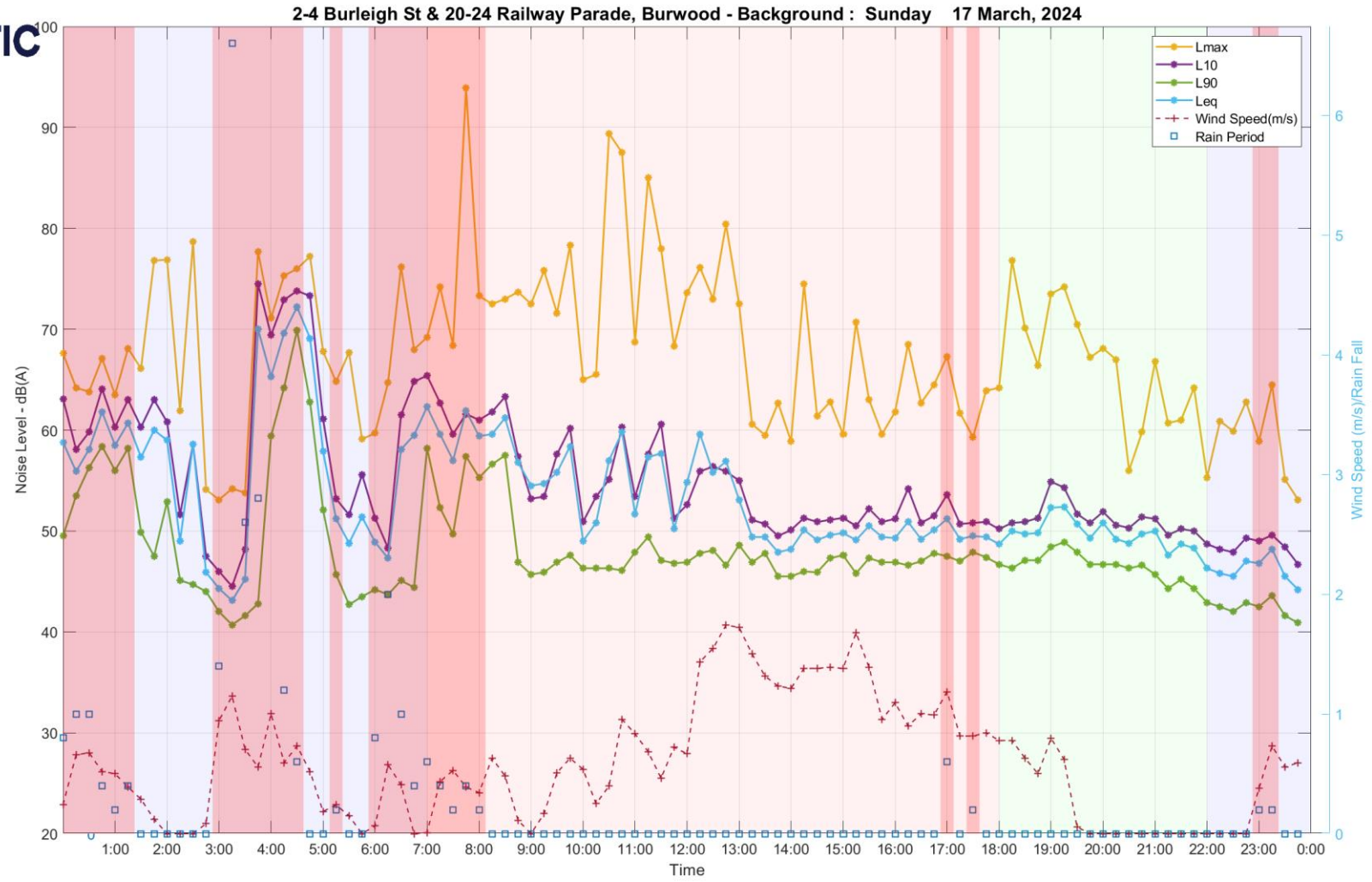
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Lmax
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Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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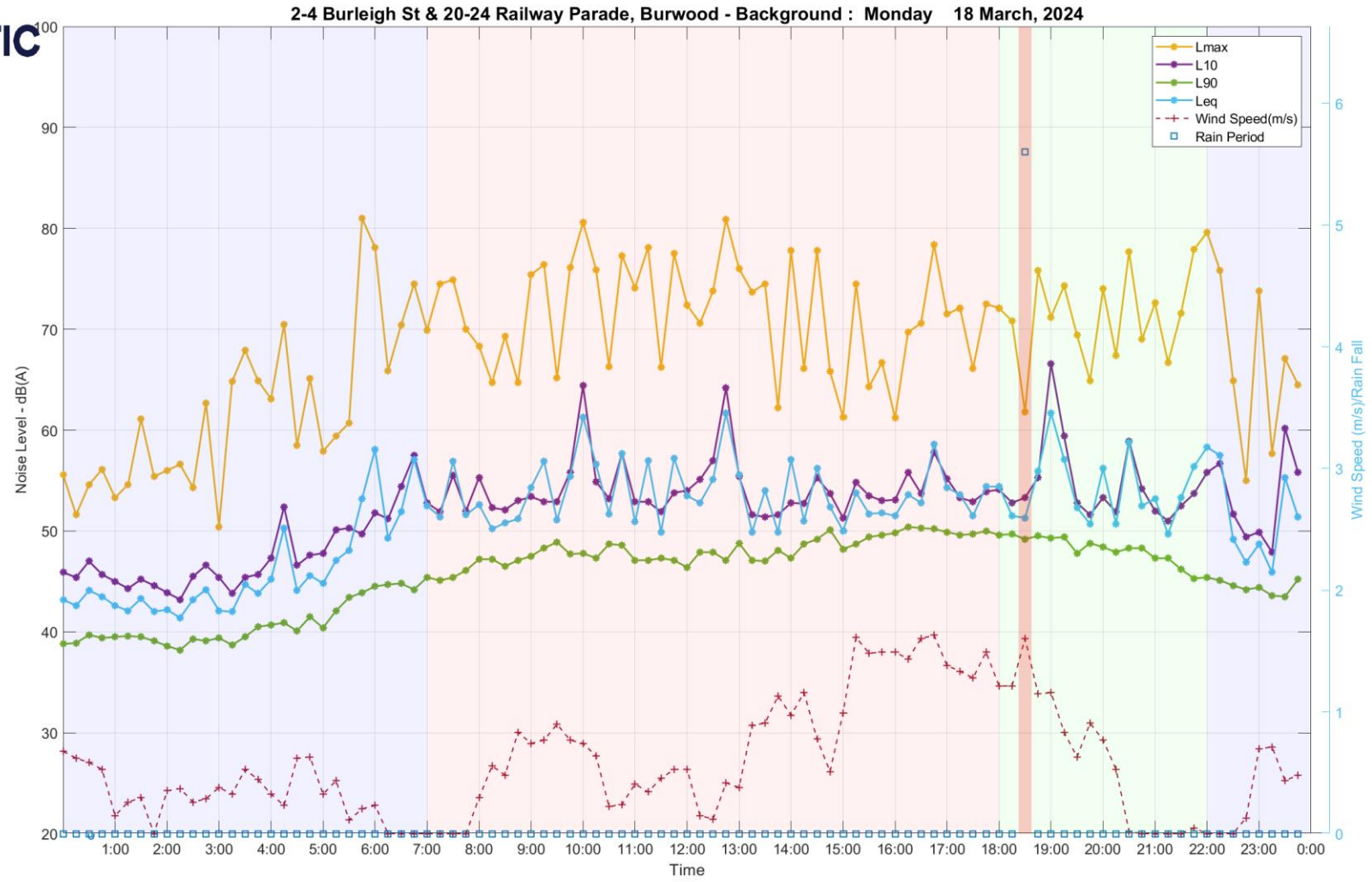
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Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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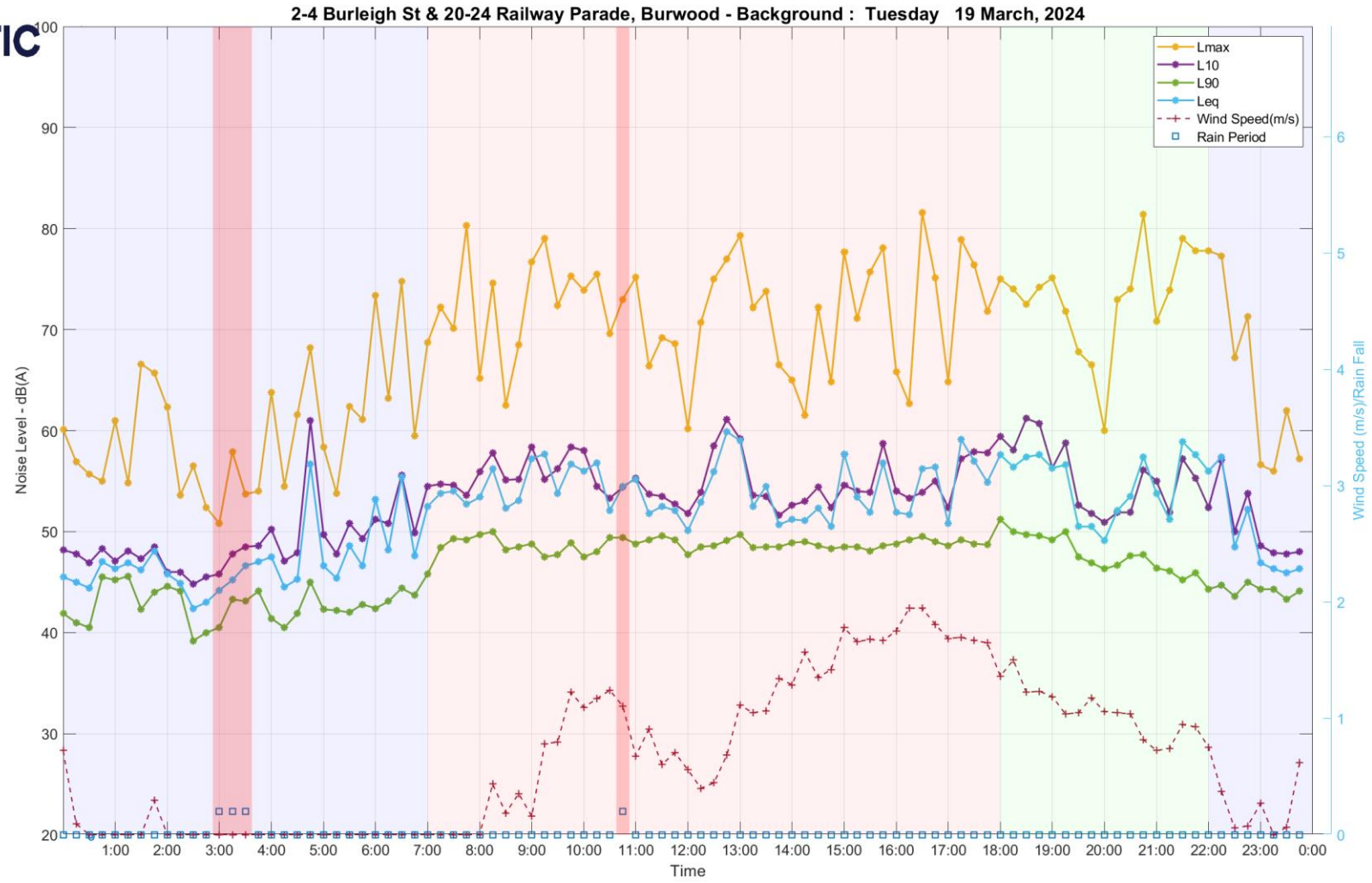
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Wind Speed(m/s)
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Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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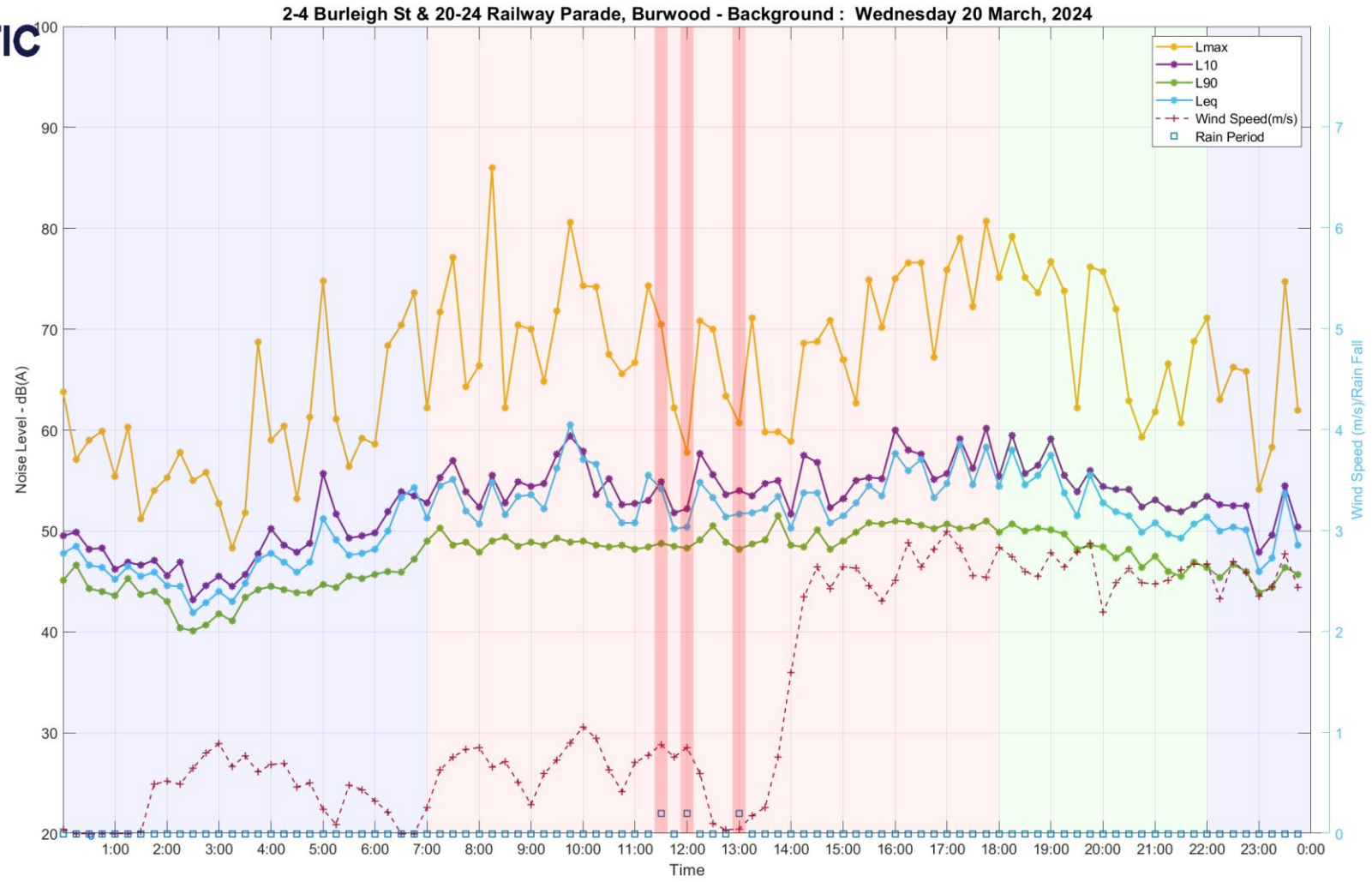
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Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
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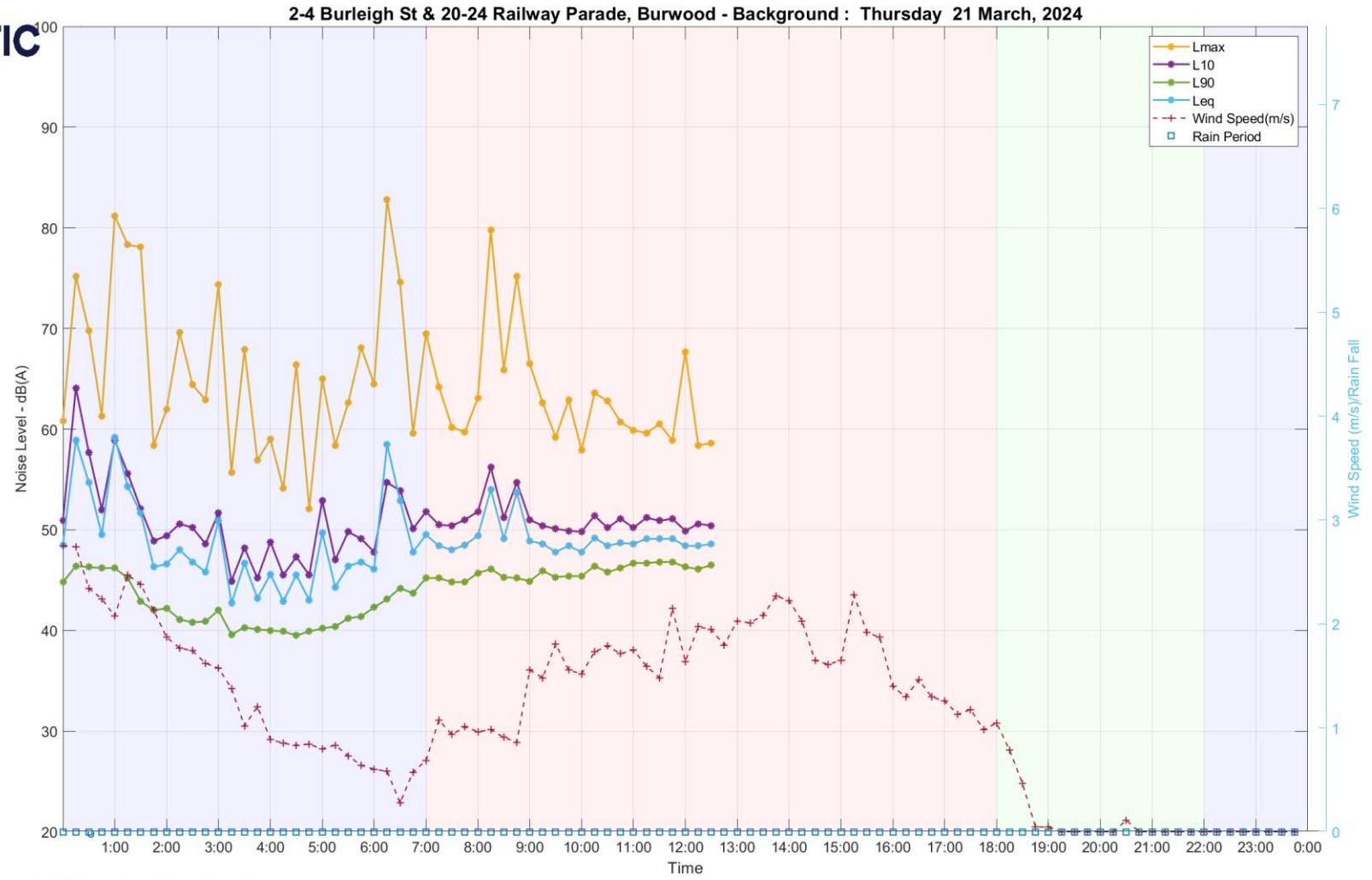

Wind Speed is corrected using factor 0.3333 based on logger location

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 "urban" 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:

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

NPI Table 2.2: Amenity Noise Levels			
Receiver	**Noise Amenity Area**	**Time of Day**	**Recommended Amenity Noise Level L_{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 28 – 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, R2, R3 & R5 Residential	Day	47	**52**	58	N/A
	Evening	46	51	**48**	N/A
	Night	40	45	**43**	45 L_{eq} **55 L_{max}**
R2 & R5 Commercial	When in use	N/A	N/A	**63**	N/A
R4 Place of Worship	When in use	N/A	N/A	**40 (internal)**	N/A

APPENDIX C VIBRATION MEASUREMENTS

C.1 EQUIPMENT USED

Vibration measurements were conducted using a SV958A 4 channel sound and vibration analyser with an external Tri axial accelerometer. The accelerometer was screwed to a metal spike which was hammered into the soil.

C.2 RESULTS

C.2.1 TACTILE VIBRATION

Table 29 summarise the measurements including passby vibration levels, train type and track location.

Table 29 – Predicted Ground Borne Vibration Levels

Train Number	Measurement Location	Time	Track	Train Type	Direction of Travel	Tactile Vibration VDV
1	New façade line facing railway	2:25pm	Near	Electric Passenger	Arriving	0.0004
2		2:25pm	Far		Departing	0.0007
3		2:39pm	Near		Arriving and Departing	0.001
4		2:43pm	Near		Departing	0.001
5		2:45pm	Far		Departing	0.0009
					For Period (eVDV)*	<0.006

*Vibration total VDV. Day period is 7am to 10pm and night is 10pm to 7am. Based on a minimum of 1000 trains passing through in any given day/night period.

Tactile vibration within the buildings have been predicted based on the measured ground vibration levels taking into account (where applicable) ground to building losses, structure amplification and floor to floor losses between ground floor and the affected level. The floor vibration levels and the number of rail movements based on available timetable data were used to determine the estimated overall vibration dose (eVDV) at the proposed development. The results are presented the table below.

Table 30 – Vibration Dose Values

Time Period	Calculated eVDV $m/s^{1.75}$
Day	< 0.2
Night	< 0.13

APPENDIX D CONSTRUCTION PLANT NOISE AND VIBRATION EMISSION LIMITS

This section provides the plant noise and vibration levels adopted in the assessment.

D.1 NOISE

The following table presents typical sound power levels for construction plant used in this assessment.

The following have been considered to establish typical plant A-weighted sound power levels:

- Transport for NSW Construction Noise and Vibration Strategy (April 2018).
- Previous measurements undertaken by Acoustic Logic.
- AS 2436-2010 "Guide to noise and vibration control on construction, demolition and maintenance sites (Appendix A).

The equipment sound power spectra are based on information in the DEFRA database, and when not available from that source, from manufacturer's data or from measured spectra taken by this office of similar machinery.

Items identified as having annoying characteristics have been penalised by adding 5dB to the levels in the Transport for NSW's noise data base.

The emission levels in the table assume that machinery operates continuously (i.e. 100% duty), which is not always be the case. For example, excavators may load trucks intermittently for 5 minutes in every 15-minute assessment period so their duty would be 33%. The duty correction used in the assessment is indicated in the table.

Construction, Demolition and Civil works Machinery Effective Sound Power Levels based on Continuous operation (100% duty)

Equipment	Approx. Size/ Weight/Model	Sound Power Level (dBA) 100% Duty (inc Penalties)	Duty	Unweighted Octave Band Sound Power Levels, dB (includes Applicable Penalties)							
				63	125	250	500	1000	2000	4000	8000
Asphalt - Truck & Sprayer	-	106	100%	112	110	104	102	99	97	100	92
Backhoe	-	111	66%	113	107	103	111	104	103	98	94
Chainsaw – petrol*	4-5hp	114	50%	92	106	103	111	113	114	112	109
Compactor	-	106	100%	99	101	97	100	100	100	96	93
Compressor	-	109	25%	127	116	107	102	100	98	101	90
Crane - Fixed	-	113	50%	120	115	116	112	106	99	93	87
Crane - Franna	20 tonne	98	50%	108	104	99	91	92	91	84	78
Crane - Mobile	-	113	25%	115	114	108	109	108	108	99	90
Crane - Truck mounted	20 to 60 tonne	108	25%	112	109	107	105	103	100	95	87
Crusher – Rock*	-	118	100%	135	128	121	123	117	113	108	101
Dozer	CAT D9	116	75%	112	116	114	114	111	108	102	94
Dozer	CAT D10	121	75%	130	131	122	114	115	111	109	105
Elevated work platform - scissor lift	-	98	10%	100	97	94	94	94	91	85	83
Elevated work platform	-	97	10%	108	106	92	93	90	89	88	79
Excavator - tracked	3 tonne	90	75%	101	91	88	88	85	83	78	72
Excavator - tracked	6 tonne	95	75%	102	104	95	89	89	87	82	77
As above + hydraulic hammer*	6 tonne	115	75%	110	113	110	114	117	113	111	106
Excavator - tracked	10 tonne	100	100%	104	100	99	97	95	92	86	81
As above + hydraulic hammer*	10 tonne	118	75%	124	124	121	116	118	116	114	109
Excavator - tracked	20 tonne	105	75%	107	114	106	101	98	97	93	90
Excavator - tracked	30 tonne	110	75%	113	113	107	107	105	102	97	91
As above + hydraulic hammer*	-	122	75%	125	123	119	123	121	121	118	114
Excavator - tracked	40 tonne	115	75%	111	114	113	110	110	109	104	97
Grader	-	113	100%	114	113	109	105	110	104	100	91

Equipment	Approx. Size/ Weight/Model	Sound Power Level (dBA) 100% Duty (inc Penalties)	Duty	Unweighted Octave Band Sound Power Levels, dB (includes Applicable Penalties)							
				63	125	250	500	1000	2000	4000	8000
Generator - diesel/petrol	6kW	103	100%	115	110	102	98	97	95	92	80
Generator - attenuated	30kW	92	100%	95	95	93	86	85	86	82	79
Grinder*	-	105	50%	86	80	81	89	99	106	102	102
Jackhammer	-	113	75%	108	97	93	96	96	101	109	110
Lighting Tower	-	80	100%	73	73	73	73	73	73	73	73
Lighting - Daymakers	-	98	100%	110	105	97	93	92	90	87	75
Light Vehicle - 4WD	-	103	10%	96	96	96	96	96	96	96	96
Line Marking Truck	-	108	100%	114	112	106	104	101	99	102	94
Loader - Front-end (wheeled)	23 tonne	112	75%	118	118	107	109	105	103	102	94
Loader - Skidsteer	1/2 tonne	107	75%	112	115	104	106	101	98	92	92
Loaders - Skidsteer	1 tonne	110	75%	113	104	108	108	104	103	97	91
Loader - Tracked	0 to 50 kW	115	75%	108	108	108	108	108	108	108	108
Loaders- Tracked	200 to 300 kW	121	75%	114	114	114	114	114	114	114	114
Pavement Laying Machine	-	114	100%	117	114	111	110	109	106	104	95
Pavement Profiler	-	117	100%	116	122	114	112	112	109	105	102
Pile Driver – Vibratory*	-	121	50%	121	120	117	120	122	120	115	105
Piling Rig - Bored	-	112	100%	112	120	109	108	106	104	96	89
Piling Rig Lmax – Impact*	-	151	n/a	137	138	143	152	152	148	143	138
Piling Rig Leq- Impact*	-	134	100%	124	125	128	135	135	132	127	121
Pump - Concrete	-	109	100%	115	107	101	102	104	104	97	89
Rattle gun (hand held)	-	104	50%	82	81	81	87	96	98	98	98
Roller - smooth drum	-	107	100%	114	112	102	100	102	100	96	90
Roller - large pad foot	-	109	100%	120	111	103	107	105	98	95	89
Roller – Vibratory*	10 tonne	109	100%	125	116	108	112	110	103	100	94
Saw – Concrete*	-	118	75%	120	122	114	114	113	114	118	116
Scraper/Grader	-	113	100%	120	122	113	107	107	105	100	95

Equipment	Approx. Size/ Weight/Model	Sound Power Level (dBA) 100% Duty (inc Penalties)	Duty	Unweighted Octave Band Sound Power Levels, dB (includes Applicable Penalties)							
				63	125	250	500	1000	2000	4000	8000
Truck - Concrete	-	109	100%	112	103	95	98	99	107	89	84
Truck - Dump	15 tonne	110	10%	114	111	111	107	104	103	97	90
Truck - Medium rigid	20 tonne	103	10%	109	107	101	99	96	94	97	89
Truck - road truck/ truck and dog	30 tonne	108	10%	123	109	101	100	104	99	98	91
Truck - Vacuum (NDD or non-destructive digger)	-	109	75%	111	112	97	102	101	104	103	96
Tub Grinder/Mulcher	40-50hp	116	100%	105	106	110	110	112	111	105	96
Vibrator – Concrete*	-	113	100%	122	120	120	113	109	112	110	105
Water Cart	-	107	100%	106	107	101	105	99	100	96	91
Welding equipment	-	110	50%	104	105	106	105	106	103	98	93
Wrench - Impact	-	111	50%	81	84	89	91	95	101	107	107

APPENDIX E ARCHITECTURAL DRAWINGS

The following drawings provided by PTI Architecture has been reproduced below.