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65-71 Burdett Street, Hornsby

DA Acoustic Assessment (Aged Care)

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1 INTRODUCTION

Acoustic Logic has been engaged to conduct an acoustic assessment of potential noise impacts associated with the proposed aged care facility development to be constructed at 65-71 Burdett Street, Hornsby.

This report addresses noise impacts associated with the following:

- Traffic noise impacts from Burdett Street; and
- Noise emissions from:
    - Mechanical plant
    - Outdoor communal areas
    - Deliveries
    - Car park usage
    - Additional traffic generation

Acoustic Logic have utilised the following documents and regulations in the assessment of noise emanating from the development:

- Hornsby Shire Council – '*Hornsby Development Control Plan 2013';*
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*; and
- NSW EPA – '*Noise Policy for Industry (NPfI) 2017*'.
- NSW EPA – '*NSW Road Noise Policy*'.

This assessment has been conducted using the architectural drawings for D.A Submission, provided by Gartner Trovato Architects (see details below).

Table 1-1 - Architectural Sheet Information

Drawing Number	Drawing Title	Revision	Date
DA-05	SITE / ROOF PLAN	B	22/10/2020
DA-06	BASEMENT – SERVICE + CARPARK LEVEL		
DA-07	LOWER GROUND FLOOR		
DA-08	GROUND FLOOR [ENTRY LEVEL]		
DA-09	FIRST FLOOR LEVEL		
DA-10	ELEVATION [SHEET 01]		
DA-11	ELEVATION [SHEET 02]		
DA-12	SECTIONS [SHEET 01]		
DA-13	SECTIONS [SHEET 02]		

2 SITE DESCRIPTION

The proposed development, located at 65-71 Burdett Street, Hornsby, will include construction of a 3-storey high aged care facility, including 2 basement levels. The development, including the surrounding receivers identified below, are located within the 'Low Density Residential' zone (R2) per the Hornsby Local Environmental Plan 2013.

Onsite acoustic surveying has been carried out by this office on the surrounding environment. The main noise item around the proposed development is Burdett Street, adjoining the site to the south.

The nearest noise receivers around the project site include:

- Receiver 1 – Residential receivers situated immediately west of the project site;
- Receiver 2 – Residential receivers situated immediately north of the project site;
- Receiver 3 – Residential receivers situated immediately east of the project site;
- Receiver 4 – Residential receivers situated south of the project site, across Burdett Street;

A site map, measurement description and surrounding receivers are presented in Figure 1 below.

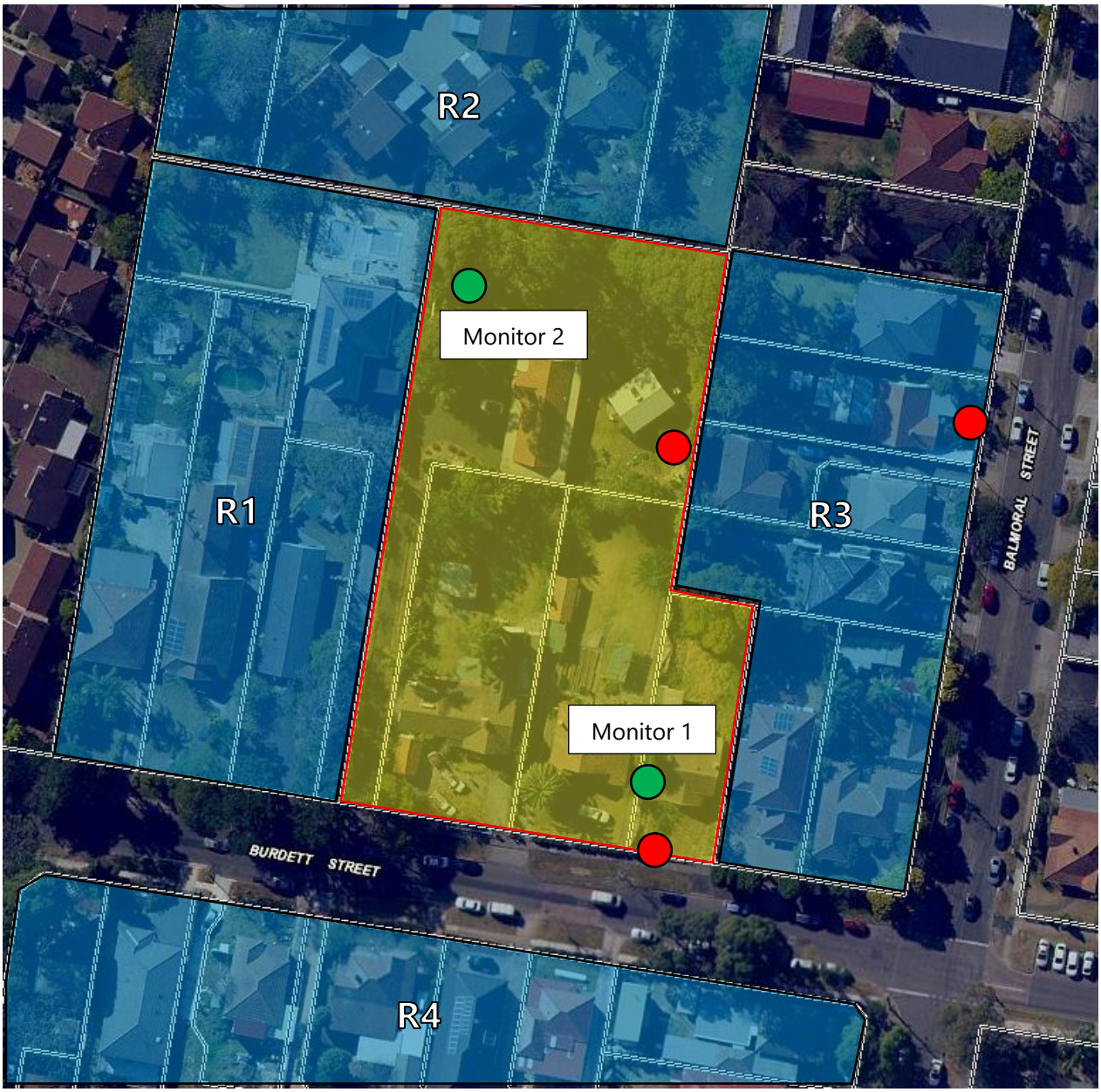


Figure 1 – Site Survey and Monitoring Positions
Sourced from SixMaps NSW

Proposed Site

Residential Receiver

Unattended Noise Monitor

Attended Measurement

3 NOISE DESCRIPTORS

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

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

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

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

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

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

The L_{max} parameter represents the loudest noise event during a measurement period.

4 AMBIENT NOISE SURVEY

Background noise levels have been measured through both long-term noise monitoring and attended short-term measurements. These are detailed below.

4.1 MEASUREMENT EQUIPMENT

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

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

4.2 MEASUREMENT LOCATIONS

See Figure 1 for a layout of these locations.

4.3 MEASUREMENT PERIOD

The long-term monitoring periods are as follows:

- Monitor 1 was between 02/10/2019 to 10/10/2019.
- Monitor 2 was between 24/09/2020 to 01/10/2019.

The attended measurements were conducted on 02/10/2019 and 24/09/2020.

4.4 MEASURED BACKGROUND NOISE LEVELS

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

Appendix A and B provides detailed results of the unattended noise monitoring. Adverse weather affected data was excluded from the assessment.

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

Table 4-1 - Rating Background Noise Levels

Location	Time of day	Rating Background Noise Level dB(A)$L_{90(Period)}$
Receiver 1, 2 and 3	Day (7:00am-6:00pm)	37
	Evening (6:00pm-10:00pm)	40 (Adjusted to 37)[(1)]
	Night (10:00pm-7:00am)	33
Receiver 4	Day (7:00am-6:00pm)	38
	Evening (6:00pm-10:00pm)	38
	Night (10:00pm-7:00am)	35

* The NPfI recognises that the RBL obtained from long-term monitoring for the evening or night periods can sometimes be higher than the RBL for the daytime period. This can be caused by increased noise from insects or frogs, or temperature inversion conditions during winter.

The NPfI generally recommends that the project intrusiveness level for evening be set at no greater than the project intrusiveness level for daytime, and the project intrusiveness level for night be set at no greater than the project intrusiveness level for day or evening.

Therefore, the background noise level which will be adopted during the evening period (i.e. 6:00pm-10:00pm) will be adjusted to match the measured background noise level during the day period (7:00am-6:00pm).

5 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigation indicates that the main external noise sources around project site is traffic noise from Burdett Street. Noise intrusion from this source will be assessed in accordance with criteria nominated in section 4.1 below.

5.1 NOISE INTRUSION CRITERIA

A noise intrusion assessment has been conducted based off the requirements of the following acoustic noise criteria/standards;

- Hornsby Shire Council – '*Hornsby Development Control Plan 2013';*
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*; and

5.2 HORNSBY DEVELOPMENT CONTROL PLAN 2013

Hornsby Development Control Plan 2013 notes that "Seniors Housing should comply with the planning controls in *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004*". There is no noise intrusion requirement stipulated in the DCP nor the SEPP guideline for aged care developments, as such, Australian Standards will be used in light of this.

5.2.1 Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*

Australian Standard AS 3671-1989 notes the following in relation to traffic noise:

- Internal noise levels should be determined in accordance with AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors'.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the L_{eq} descriptor, Acoustic Logic shall also use this descriptor.
- AS3671 does not specifically recommend a time interval. On this basis, Acoustic Logic have adopted the interval used by the EPA Road Noise Policy for main/arterial roads, that being:
    - Day – 7am to 10pm (15 hour); and
    - Night – 10pm to 7am (9 hour).
- Acoustic Logic have applied the daytime interval to the living/dining areas and the night time interval to the bedrooms of residential spaces.

Internal noise levels have been selected in accordance with AS 2107:2016.

5.2.2 Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*

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. As the standard does not present a design criteria for aged-care facilities, the design criteria for houses and apartments near minor roads will be used instead.

Table 5-1 – Recommended Design Sound Level

Occupancy/Activity Type Houses and Apartments near Minor Roads	Recommended Design Sound Level
Sleeping Areas (Night Time)	30-35 dB(A)L_{eq}
Living Areas	30-40 dB(A)L_{eq}

5.2.3 Summarised Internal Noise Criteria

The following maximum internal noise criteria is summarised below.

Table 5-2 – Summarised Maximum Internal Noise Criteria

Space /Activity Type	Maximum Internal Noise Criteria
Sleeping Areas	35 dB(A)$L_{eq(9hour)}$
Living Areas	40 dB(A)$L_{eq(15hour)}$

5.3 EXTERNAL NOISE MEASUREMENTS

This section of the report details noise measurements conducted at the site to establish road traffic environmental noise levels impacting the development.

5.3.1 Measurement Equipment

Attended short term measurements of train noise were undertaken by this office to supplement the unattended noise monitoring. Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

An additional unattended noise monitor was installed onsite using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

5.3.2 Measurement Location

The unattended noise monitor was installed at 71 Burdett Street, as indicated in Figure 1. The monitor was installed approximately 17m from Burdett Street and had a 180° view of the road.

Attended noise measurements were also conducted at 71 Burdett Street, approximately 4m from Burdett Street and had a 180° view of the road. Weather conditions were sunny and dry with little to no wind.

5.3.3 Measurement Period

Unattended noise monitoring was conducted from Wednesday 2nd to Thursday 10th of October 2019.

Attended noise measurements were undertaken between the hours of 3:30pm and 4:00pm on Wednesday 2nd of October 2019.

5.3.4 Measured Traffic Noise Measurements

Results of the attended and unattended noise measurements have been summarised below for all locations.

5.3.4.1 Unattended Noise Monitoring

Results of the unattended noise monitoring conducted inside the project site has been summarised below. Further detailed results can be found in Appendix A of this report.

Table 5-3 - Unattended Noise Monitor – Traffic Noise Measurements

Date	Daytime (7am-10pm) $dB(A)L_{eq\ (15hour)}$	Night time (10pm-7am) $dB(A)L_{eq\ (9hour)}$
02 October, 2019	-	48
03 October, 2019	55	46
04 October, 2019	53	49
05 October, 2019	54	43
06 October, 2019	49	46
07 October, 2019	50	46
08 October, 2019	51	49
09 October, 2019	52	50
10 October, 2019	-	-
Logarithmic Average	**52**	**47**

Table 5-4 – Attended Traffic Noise Measurements

Location	Time of Measurement	Measured Noise Level $dB(A)L_{eq}$
Burdett Street 4m from kerb 180° view of the road	3:30pm – 4:00pm Wednesday, 2nd October, 2019	56 $dB(A)_{(15min)}$

5.3.5 Summarised External Noise Levels

The existing traffic noise levels listed in the table below were determined based on the unattended logging data and attended noise measurements presented above.

Table 5-5 – Measured Existing Traffic Nosie Levels

Location	Summary of Measured Existing Traffic Noise Level	
	Daytime	Night Time
Burdett Street 17m from kerb 180° view of the road	52 dB(A)$L_{eq\ (15hour)}$	47 dB(A)$L_{eq\ (9hour)}$
	56 dB(A)$L_{eq\ (1hour)}$	52 dB(A)$L_{eq\ (1hour)}$

5.4 NOISE INTRUSION ANALYSIS

Train noise intrusion into the proposed development was assessed using the measured noise levels presented above.

Calculations were undertaken taking into account the location of measurements, orientation of windows, barrier effects *(where applicable)*, the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way the likely interior noise levels can be predicted.

5.5 RECOMMENDED CONSTRUCTIONS

5.5.1 Glazed Windows and Doors

The following constructions are recommended to comply with the project noise objectives. 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 acoustic seals. (Note: Mohair Seals are not considered acoustic seals).

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

The recommended constructions are listed in Table 6 below.

Table 5-6 - Glazing Thickness Requirements

Façade	Level	Space	Glazing Construction	Acoustic Seals
All	All	Bedroom/Living	6mm Float	Yes
All	All	Wet Area	4mm Float	Yes

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 7 for all rooms. Where nominated, 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 5-7 - Minimum RW of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum R_W of Installed Window
6mm Float	29
4mm Float	27

5.5.2 Roof/Ceiling Construction

Proposed roof constructions of masonry system (e.g. concrete slab) which will be acoustically acceptable without additional treatment.

If any penetrations are required through any of the external lining of any of the systems above for other building services, all gaps should be filled with acoustic sealant to ensure compliance with internal noise level requirements.

5.5.3 External Wall Construction

Proposed external wall constructions of masonry system (e.g. brick) which will be acoustically acceptable without additional treatment.

If any penetrations are required through any of the external lining of any of the systems above for other building services, all gaps should be filled with acoustic sealant to ensure compliance with internal noise level requirements.

6 NOISE EMISSION CRITERIA

Noise emissions from the project site will be assessed against the requirements of the following:

- Hornsby Shire Council – '*Hornsby Development Control Plan 2013';*
- NSW Environmental Protection Authority (EPA) document – *'Noise Policy for Industry (NPfI) 2017'*.

Detailed requirements from the documents above have been discussed below.

6.1 HORNSBY DEVELOPMENT CONTROL PLAN 2013

Hornsby Development Control Plan 2013 notes that "Seniors Housing should comply with the planning controls in *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004*". There is no noise emission requirement stipulated in the DCP nor the SEPP guideline for aged care developments, as such, the *NPfI* will be used in this assessment.

6.2 EPA NOISE POLICY FOR INDUSTRY (NPFI)

The EPA NPfI provides guidelines for assessing noise impacts from developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPfI has two requirements which must both be complied with, namely an amenity criterion and an intrusiveness criterion.

6.2.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A).

Table 6-1 - NPfI Project Intrusiveness Criteria

Receiver	Time of Day	Background Noise Level dB(A)$L_{90(Period)}$	Project Intrusiveness Criteria dB(A)$L_{eq(15minute)}$
Receiver 1, 2 and 3	Day (7:00am-6:00pm)	37	42
	Evening (6:00pm-10:00pm)	37	42
	Night (10:00pm-7:00am)	33	38
Receiver 4	Day (7:00am-6:00pm)	38	43
	Evening (6:00pm-10:00pm)	38	43
	Night (10:00pm-7:00am)	35	40

6.2.2 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment (e.g. cumulative noise from project site and other developments).

The EPA's NPI sets out acceptable noise levels for different residential areas, being rural, suburban and urban. When determining types of residential receiver, the NPI considers the land zoning, existing noise levels and environmental noise characteristics of the area being assessed. Based on the measured noise levels and environmental noise characteristics, the 'Suburban' classification is most appropriate and has been selected.

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

Project Amenity Noise Level dB(A)$L_{eq(15min)}$ = Recommended Amenity Noise Level – 5 dB(A) + 3 dB(A)

Table 6-2 - NPfI Project Amenity Criteria

Receiver	Time of Day	Recommended Amenity Noise Level dB(A)$L_{eq(15minute)}$	Project Amenity Criteria dB(A)$L_{eq(15minute)}$
Receiver 1 to 4	Day (7:00am-6:00pm)	55	53
	Evening (6:00pm-10:00pm)	45	43
	Night (10:00pm-7:00am)	40	38

6.2.3 Sleep Disturbance Criterion

The NPfI recommends the following noise limits to mitigate sleeping disturbance:

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

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

a detailed maximum noise level even assessment should be undertaken.

The following sleep emergence noise objectives then apply.

Table 6-3 - Sleep Disturbance Criteria for Residential Receivers

Residential Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
Receiver 1, 2 and 3	33	40 dB(A) $L_{eq, 15min}$; 52 dB(A) L_{Fmax}
Receiver 4	35	

If there are noise events that could exceed the emergence levels detailed in the table above, then an assessment of sleep arousal impact is required to be carried out, taking into account the level and frequency of noise events during the night, existing noise sources, etc. This more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

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

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

6.2.4 Summarised Noise Emission Criteria (Mechanical Plant)

Table 6-4 - Summary of Noise Emission Criteria

Receiver	Time of Day	Project Intrusiveness dB(A)$L_{eq(15minute)}$	Project Amenity dB(A)$L_{eq(15minute)}$	Sleep Disturbance
Receiver 1, 2 and 3	Day (7:00am-6:00pm)	**42**	53	N/A
	Evening (6:00pm-10:00pm)	**42**	43	N/A
	Night (10:00pm-7:00am)	**38**	**38**	40 dB(A)$L_{eq, 15min}$; 52 dB(A) L_{Fmax}
Receiver 4	Day (7:00am-6:00pm)	**43**	53	N/A
	Evening (6:00pm-10:00pm)	**43**	**43**	N/A
	Night (10:00pm-7:00am)	40	**38**	40 dB(A)$L_{eq, 15min}$; 52 dB(A)L_{Fmax}

The project noise trigger levels have been selected (and bolded above) as the most stringent between the intrusiveness and amenity criteria.

7 NOISE EMISSION ASSESSMENT

7.1 MECHANICAL PLANT NOISE

Detailed plant selection has not been undertaken at this stage, as plant selections have not been determined. Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels. Satisfactory levels will be achievable through appropriate plant selection and location and, if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Noise emissions from all mechanical services plant to the closest receivers are to comply with the noise emission criteria stipulated above.

7.2 OUTDOOR COMMUNAL AREAS

7.2.1 Assumptions and Noise Levels

Noise emission predictions will be based on the following assumptions.

- The average sound power level per resident has been assumed to be 75 dB(A) L_{eq} (raised voice)
- Only 1 in 2 people will be talking at any one time, which is representative of normal conversations.
- Up to the following number of residents per area (with residents evenly distributed throughout the area) at any given time:
    - 6 people in the outdoor area along the eastern boundary, located on Lower Ground Floor
    - 24 people in Courtyard 3, located on the Lower Ground Floor
    - 8 people in the both outdoor areas above Courtyard 3, located on Ground Floor
    - 8 people in the outdoor area facing Burdett Street, located on Ground Floor
    - 4 people in the outdoor area along the eastern boundary, located on Level 1
- Outdoor areas are not used during the night time period (10pm to 7am).
- No music is played in outdoor areas.
- Recommendations in Section 7.5 of this report are implemented

The following spectrums have been used in this assessment.

Table 7-1 - Spectrum for Raised Voice Conversation (Sound Power Level)

63	125	250	500	1000	2000	4000	8000	A-Wt
60	68	68	74	71	66	57	45	75

7.2.2 Predicted Noise Levels

The NPfI applies only to activities detailed in Schedule 1 of the Protection of the Environment Operations Act, of which aged care facility communal areas are not listed. Notwithstanding the above, noise impacts from communal areas has been assessed to the project noise trigger levels established in Section 6.2.4 to maintain the amenity of neighbouring residents.

The NPfI requires that noise levels are assessed at the closest façade of a habitable space, e.g. a bedroom or living area. The predicted levels take into account any expected noise reduction provided by distance losses, barrier effects and the recommendations set out in Section 7.5.

Table 7-2 – Predicted Noise Levels at Receivers from Outdoor Communal Areas

Receiver	Time of Day	Predicted Noise Level dB(A)$L_{eq(15min)}$	Noise Emission Criteria dB(A)$L_{eq(15min)}$	Complies
Receiver 1	Evening (6pm to 10pm)	42	42	Yes
Receiver 2		42	42	Yes
Receiver 3		42	42	Yes
Receiver 4		43	43	Yes

7.3 DELIVERIES

The 'Traffic and Parking Assessment Report' prepared by Varga Traffic Planning notes that

"Loading/servicing for the proposed development is expected to be undertaken by a variety of commercial vehicles up to and including 8.8m long MRV trucks. The service area is to be located at the bottom of the basement access ramp, with vehicular access to the loading dock provided via the abovementioned two-way basement access driveway located at the western end of the Burdett Street site frontage".

7.3.1 Assumptions and Noise Levels

The following is assumed for the purpose of this assessment:

- Up to 1 truck movement in any given 1-hour period.
- Deliveries do not occur during the night time period (10pm to 7am).
- Recommendations in Section 7.5 of this report are implemented

The following sound power levels have been used in this assessment and are based on measurements conducted by this office of similar studies.

Table 7-3 - Average (L_{eq}) Noise Levels Associated with Delivery Vehicles

Noise Source	Sound Power Level, dB(A)
Large Delivery Truck (MRV Travelling at 10 km/h	100 dB(A) L_{eq}
Car / Van Travelling at 10 km/h	84 dB(A) L_{eq}

7.3.2 Predicted Noise Levels

Noise impacts from MRV deliveries has been assessed to the project noise trigger levels established in Section 6.2.4 to maintain the amenity of neighbouring residents.

The NPfI requires that noise levels are assessed at the closest façade of a habitable space, e.g. a bedroom or living area. The predicted levels take into account any expected noise reduction provided by distance losses, barrier effects and the recommendations set out in Section 7.5.

Table 7-4 – Predicted Noise Levels at Receivers from Delivery Vehicles

Receiver	Time of Day	Predicted Noise Level dB(A)$L_{eq(15min)}$	Noise Emission Criteria dB(A)$L_{eq(15min)}$	Complies
Receiver 1	Evening (6pm to 10pm)	39	42	Yes
Receiver 2		42	42	Yes
Receiver 3		< 39	42	Yes
Receiver 4		< 39	43	Yes

7.4 PARKING USAGE

The 'Traffic and Parking Assessment Report' prepared by Varga Traffic Planning notes that the development comprises 102 beds with up to 40 staff on-site. As the development is a RACF and not independent living units, it can be expected that majority of traffic movement on site will be from staff shift changeovers. As the morning shift change is expected to prior to the morning network peak (typically 8am to 9am), there is a chance that some vehicles will be arriving and exiting site during the night time (e.g. 6am to 7am), thus a sleep disturbance assessment has been conducted.

7.4.1 Assumptions and Noise Levels

The following is assumed for the purpose of this assessment:

- Up to 20 staff changeovers for the morning shift
- 50% of the 20 staff arrive / exit before 7am (meaning 10 arrivals, 10 exits, totalling to 20 cars).
- Parking usage from the RACF residents is unlikely to occur during the night time, and the above assumptions already provides a reasonably conservative assessment.
- Recommendations in Section 7.5 of this report are implemented

The following sound power levels have been used in this assessment and are based on measurements conducted by this office of similar studies.

Table 7-5 - Average (L_{eq}) Noise Levels Associated with Small Vehicles

Noise Source	Sound Power Level, dB(A)
Car / Van Travelling at 10 km/h	84 dB(A) L_{eq}

7.4.2 Predicted Noise Levels

Noise impacts from small vehicles have been assessed to the sleep disturbance emergence levels established in Section 6.2.3 to maintain the amenity of neighbouring residents.

The NPfI requires that noise levels are assessed at the closest façade of a habitable space, e.g. a bedroom or living area. The predicted levels take into account any expected noise reduction provided by distance losses, barrier effects and the recommendations set out in Section 7.5.

Table 7-6 – Predicted Noise Levels at Receivers from Parking Usage

Receiver	Time of Day	Predicted Noise Level dB(A)$L_{eq(15min)}$	Sleep Disturbance Criteria dB(A)$L_{eq(15min)}$	Complies
Receiver 1	Evening (6pm to 10pm)	< 30	40	Yes
Receiver 2		< 30		Yes
Receiver 3		< 30		Yes
Receiver 4		40		Yes

Instantaneous maximum noise levels from activities, such as door slams, are expected to readily comply with the 52 dB(A)L_{Fmax} sleep disturbance criterion as all allocated car park spaces are in the enclosed basement carpark.

7.5 RECOMMENDATION & MANAGEMENT CONTROLS

It is recommended that the following recommendations and management physical controls be implemented into the design and operation of the proposed aged care facility to satisfy all noise criteria outlined in Section 6.

- Up to the following number of residents per area (with residents evenly distributed throughout the area) at any given time:
    - 6 people in the outdoor area along the eastern boundary, located on Lower Ground Floor
    - 24 people in Courtyard 3, located on the Lower Ground Floor
    - 8 people in the both outdoor areas above Courtyard 3, located on Ground Floor
    - 8 people in the outdoor area facing Burdett Street, located on Ground Floor
    - 4 people in the outdoor area along the eastern boundary, located on Level 1
- Outdoor areas are to not be accessible during the night time period (10pm to 7am)
- No music is played in outdoor areas at all times
- Deliveries and garbage collection will be restricted within the hours of 7am to 10pm
- Car park ramp to be a no stopping zone to prevent cars idling in this location
- Music played indoors is restricted within the hours of 7am to 10pm
- Windows and doors for indoor communal areas are to be closed while in use
- A fence of 1.8m in height from the floor, constructed of solid/imperforate material, is to be installed along the whole length of car park ramp western boundary (indicated in red below).

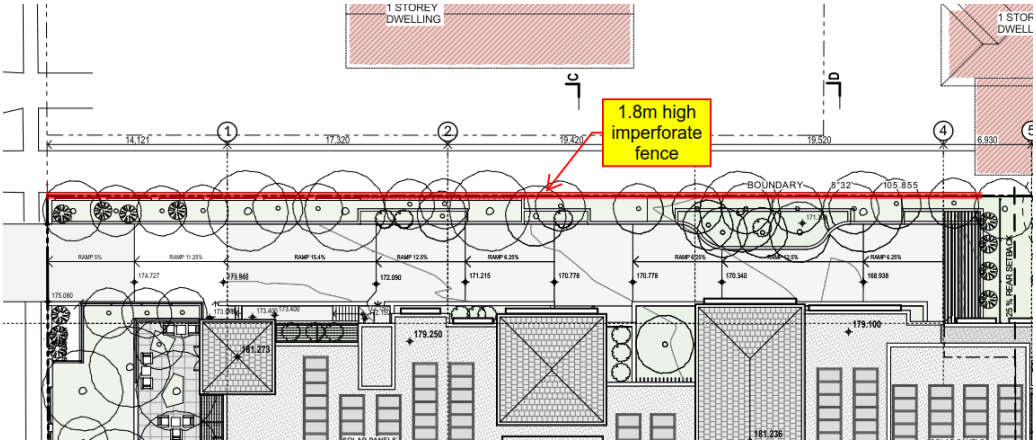


Figure 2 – 1.8m High Fence for Car Park Ramp

8 NOISE INCREASE FROM ADDITIONAL TRAFFIC

8.1 CRITERIA

For land use developments with the potential to create additional traffic the development should comply with the requirements for new developments detailed in the EPA Road Noise Policy.

The policy ensures that noise generated by additional traffic volumes associated with proposed developments does not create an unacceptable noise impact on existing land use developments.

The 'Traffic and Parking Assessment Report' prepared by Varga Traffic Planning categorises Burdett street as a "*local, unclassified road which is primarily used to provide vehicular and pedestrian access to frontage properties*".

Table 8-1 - Criteria for Traffic Noise Impact from New Developments

Road Category	Criteria for Acceptable Traffic Noise Levels	
	Daytime (7am – 10pm)	**Night Time (10pm – 7am)**
Local Road	55 dB(A) $L_{eq\ (1hour)}$	50 dB(A) $L_{eq\ (1hour)}$

Given the measured existing traffic noise levels along Burdett St is already 56 dB(A)$L_{eq\ (1hour)}$ during the day and 52 dB(A)$L_{eq\ (1hour)}$ during the night at 17m distance from kerb, Section 3.4 of the Road Noise Policy is applicable, which requires noise impacts to be reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible. This approach will be adopted in this assessment.

8.2 PREDICTED TRAFFIC NOISE INCREASE

Based on the measured peak 1-hour existing traffic noise, the corresponding traffic volume equals to approximately 120 vph based on CORTN modelling.

The 'Traffic and Parking Assessment Report' prepared by Varga Traffic Planning, notes the following:

- Existing dwelling house (1 dwelling) produces 1 vph
- Projected future traffic generation potential from aged-care facility is 40.8 vph
- From the above, the projected nett increase in peak hour traffic is approximately 40 vph.

Based on CORTN modelling, the predicted increase in traffic noise levels from additional traffic is shown below.

Table 2 – Predicted Traffic Noise Increase

Predicted Traffic Noise Increase	Road Noise Policy Criteria for Local Roads	Complies
1.2 dB(A)	< 2 dB(A)	Yes

9 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with proposed aged care facility development to be constructed at 65-71 Burdett Street, Hornsby. Based on the information provided above, we conclude the following:

Provided that the recommendations set out in Section 5.5 of this report are employed, internal noise levels shall satisfy requirements outlined in:

- Hornsby Shire Council – '*Hornsby Development Control Plan 2013';*
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*; and

Provided that the recommendations set out in Section 7.5 of this report are employed, external noise emissions shall satisfy requirements outlined in:

- Hornsby Shire Council – '*Hornsby Development Control Plan 2013';*
- NSW Environmental Protection Authority (EPA) document – *'Noise Policy for Industry (NPfI) 2017'*.

Detailed acoustic control measures for the mechanical plant servicing the proposed development are to be determined later during CC stage.

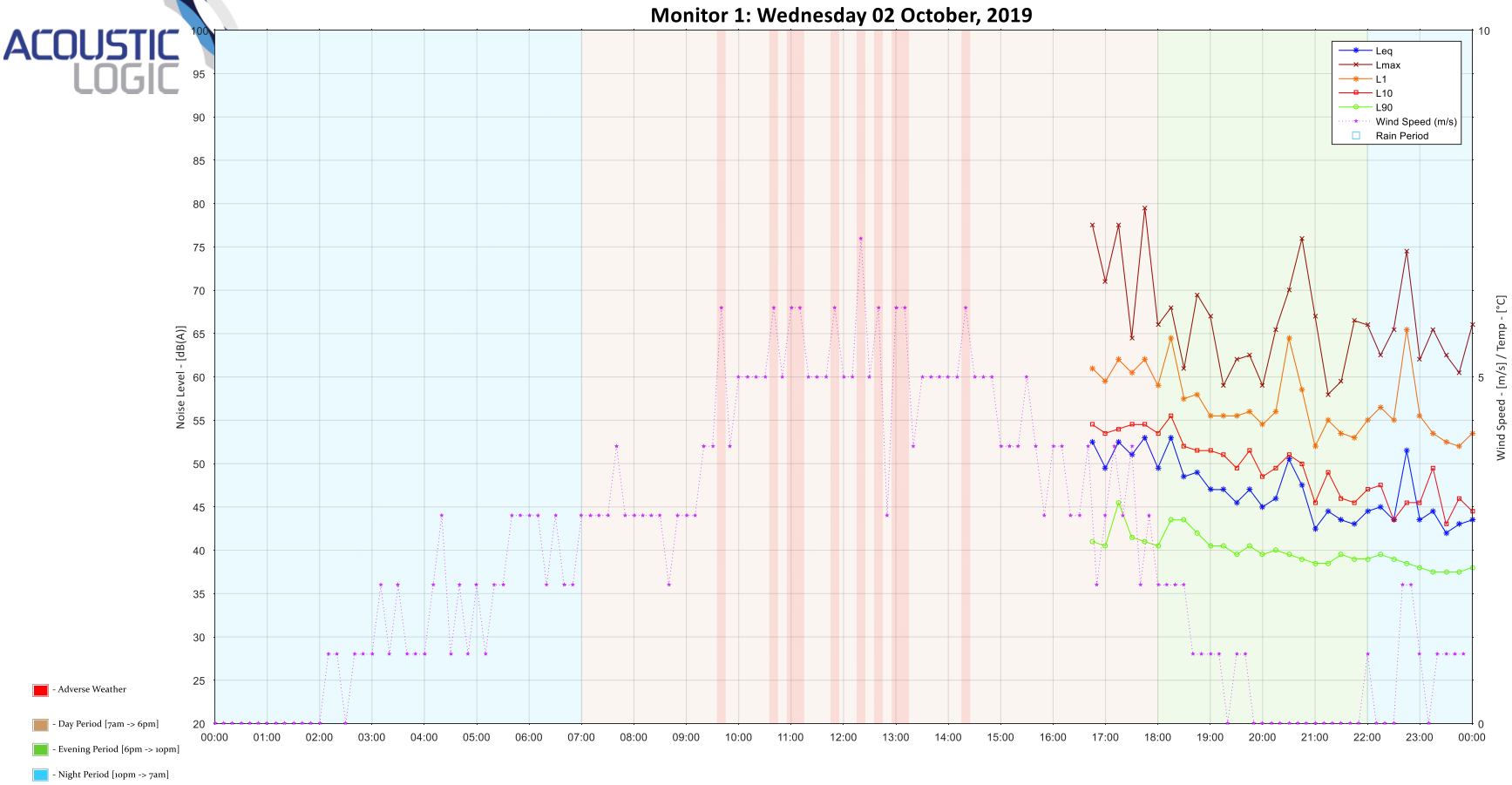
Based on measured existing traffic noise and the traffic assessment by Varga Traffic Planning, the predicted increase in noise from additional traffic satisfies Section 3.4 of the NSW Road Noise Policy.

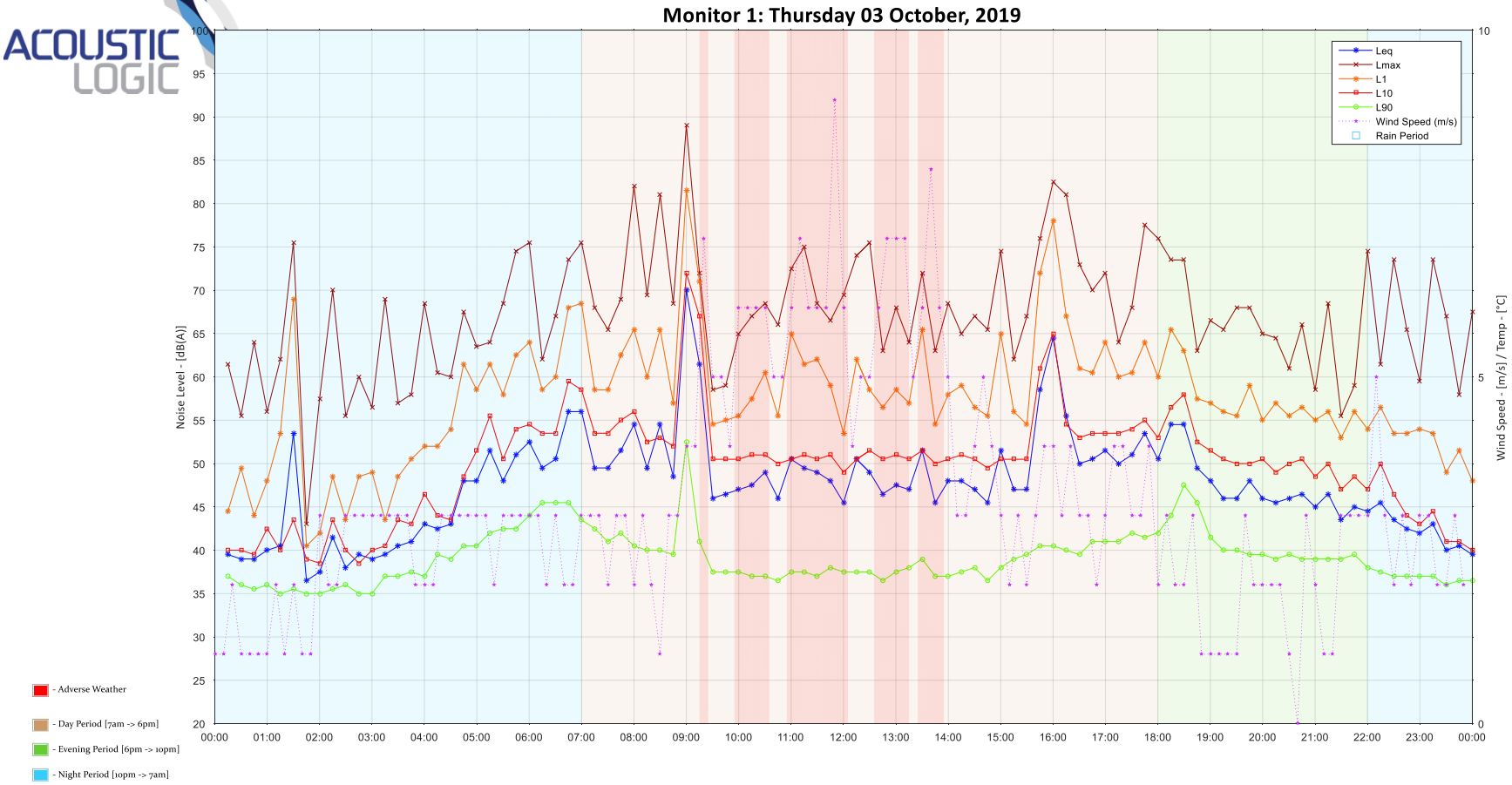
We trust this information is satisfactory. Please contact us should you have any further queries.

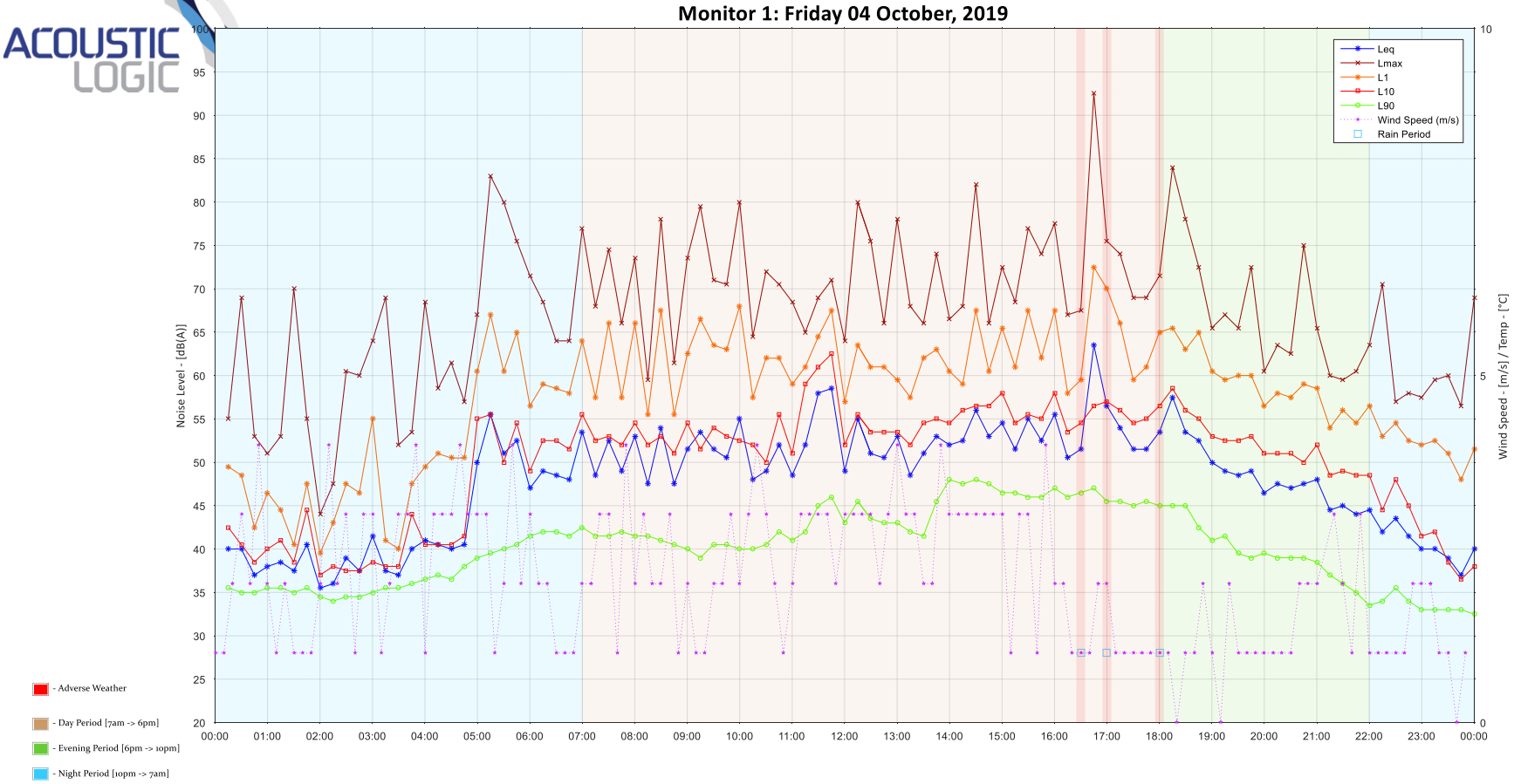
Yours faithfully,

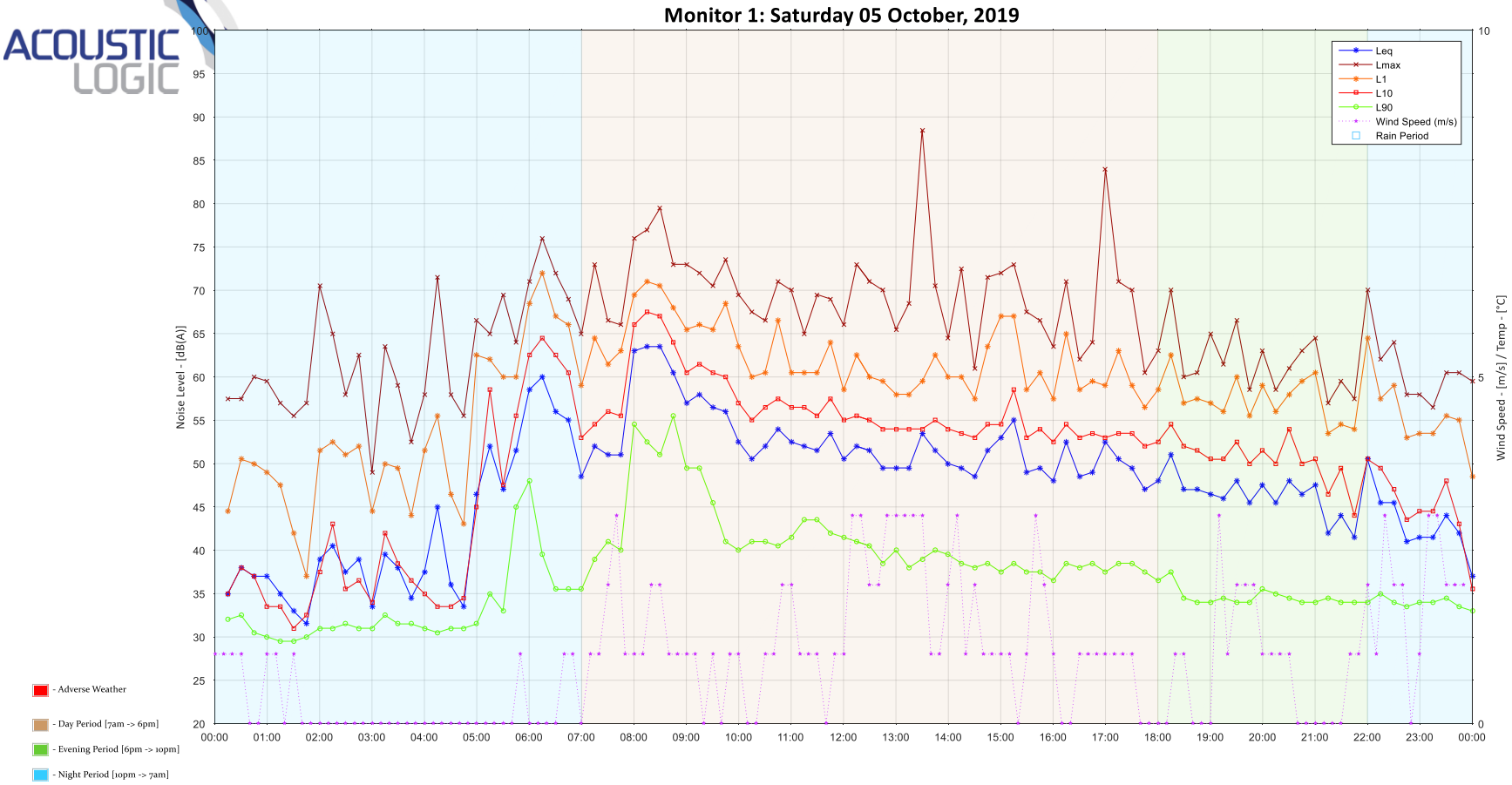
Acoustic Logic Consultancy Pty Ltd
Kanin Mungkarndee

APPENDIX A – MONITOR 1 DATA

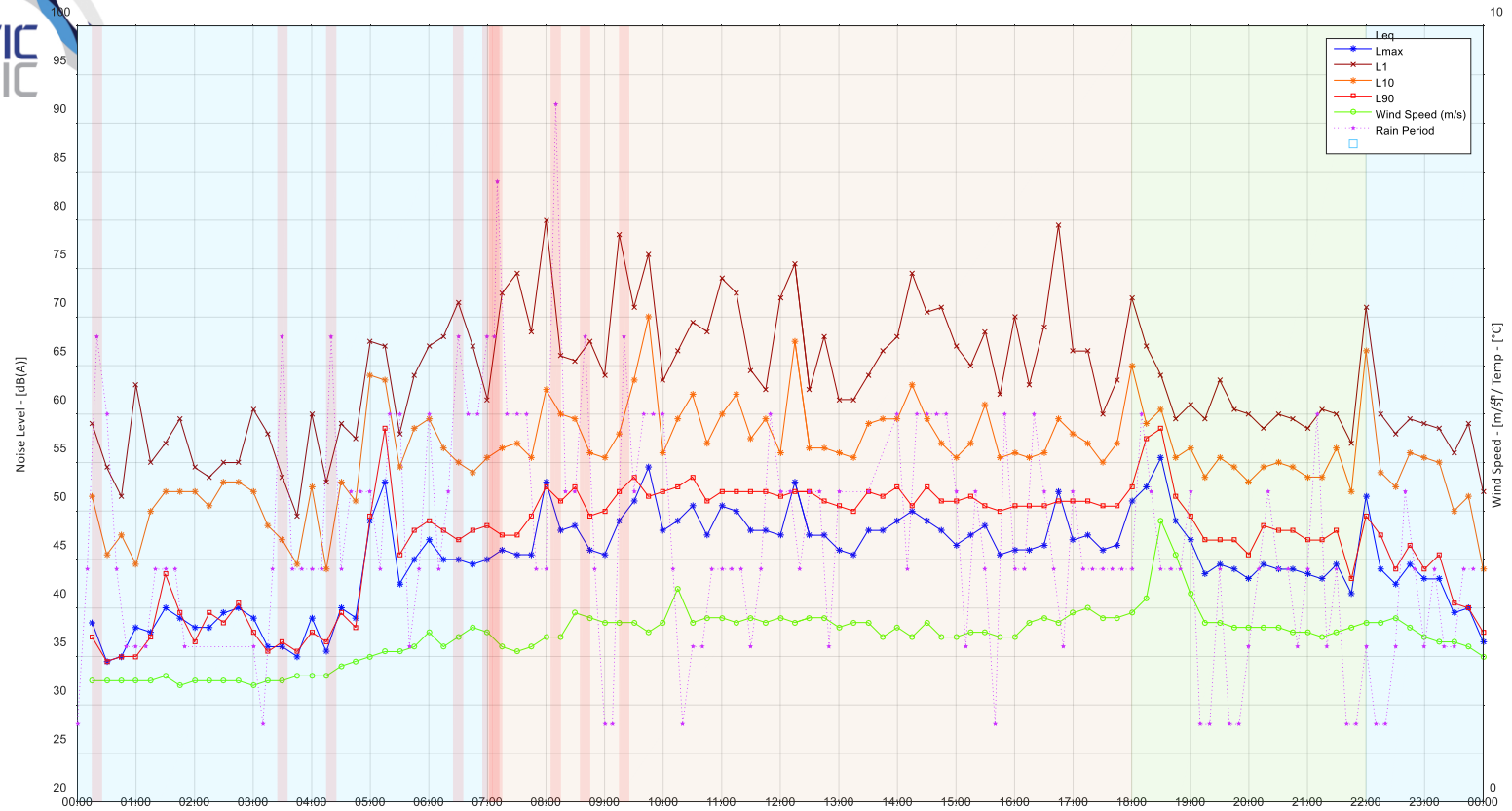

Monitor 1: Wednesday 02 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

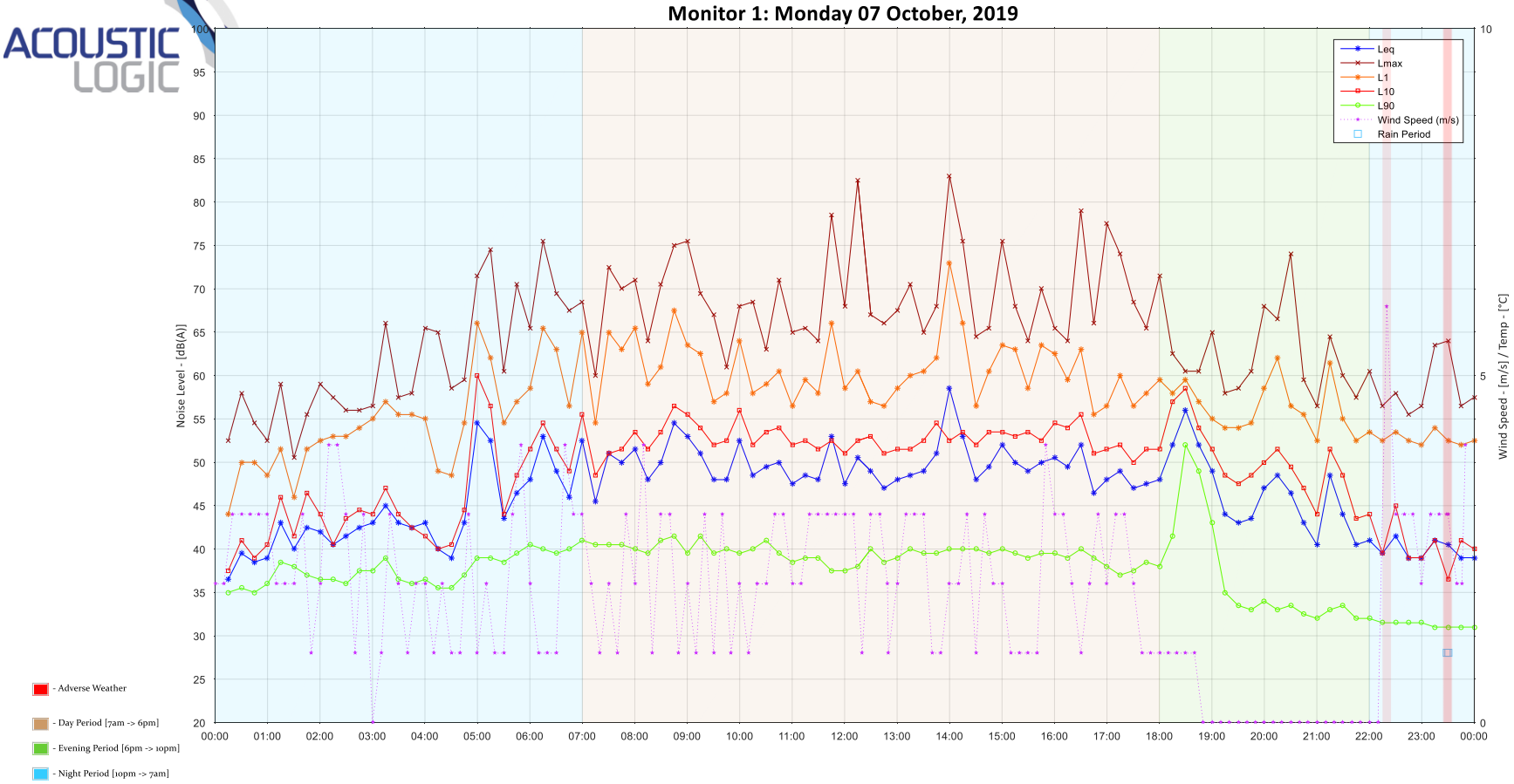

Monitor 1: Thursday 03 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

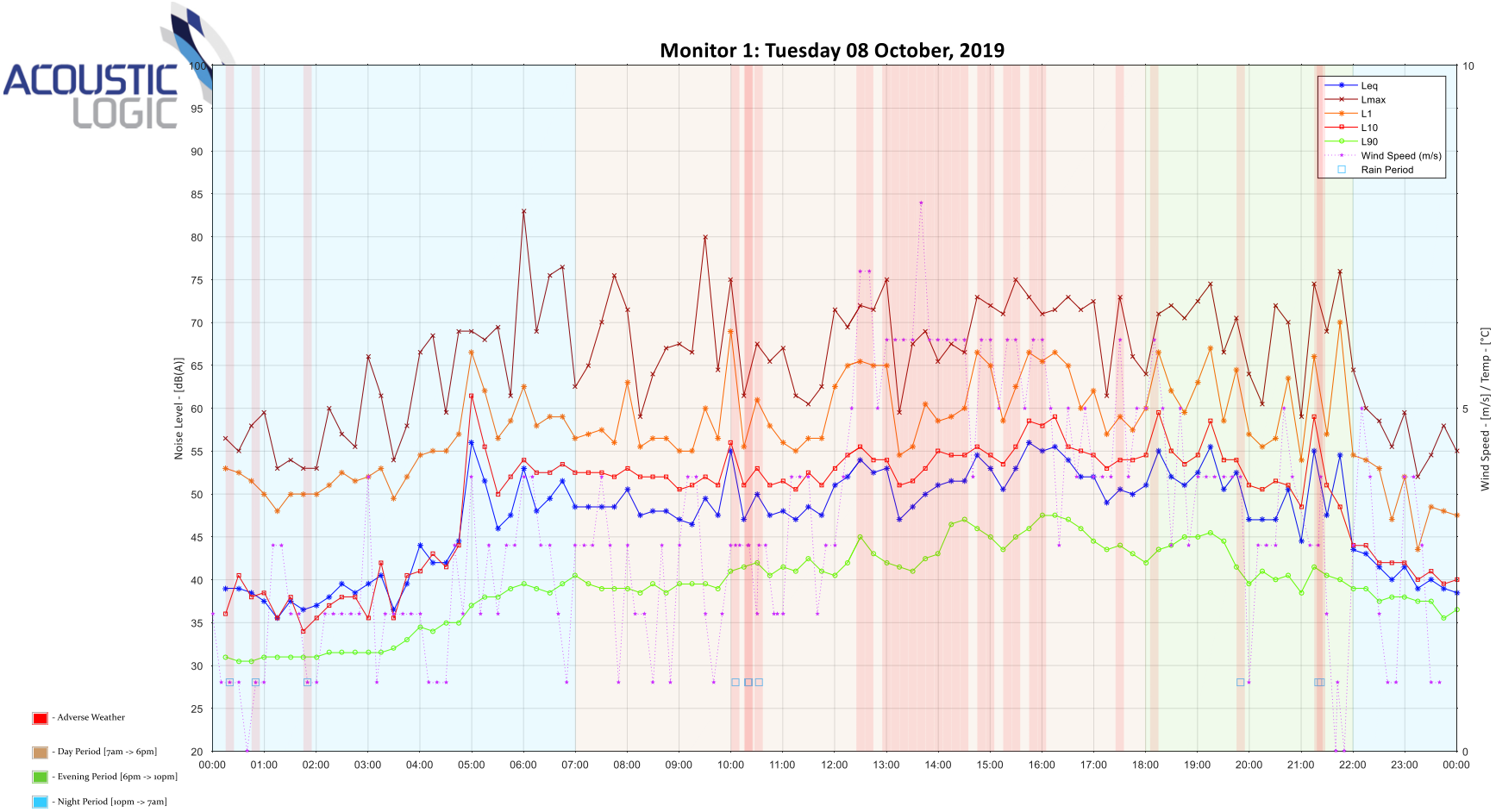

Monitor 1: Friday 04 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

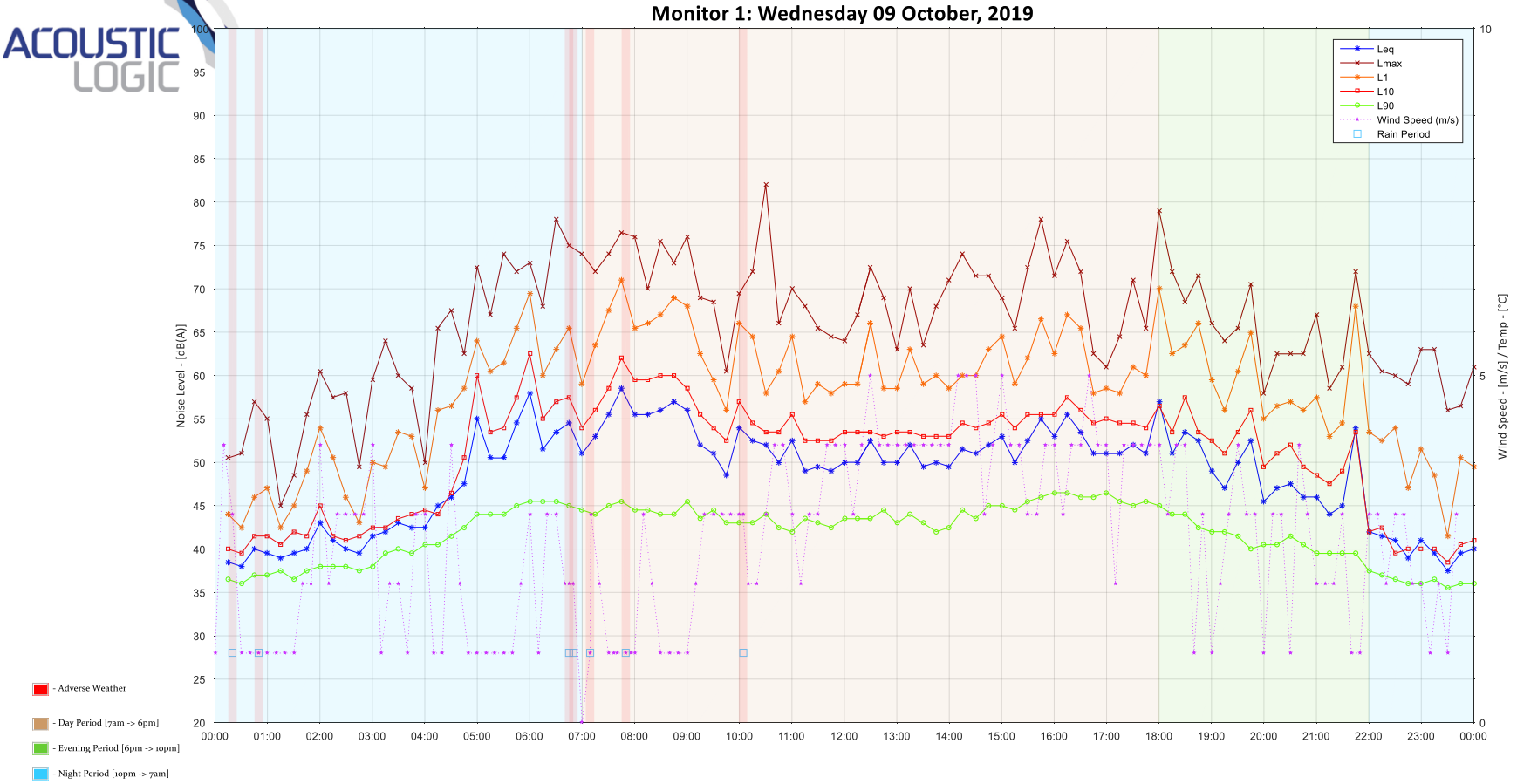

Monitor 1: Saturday 05 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

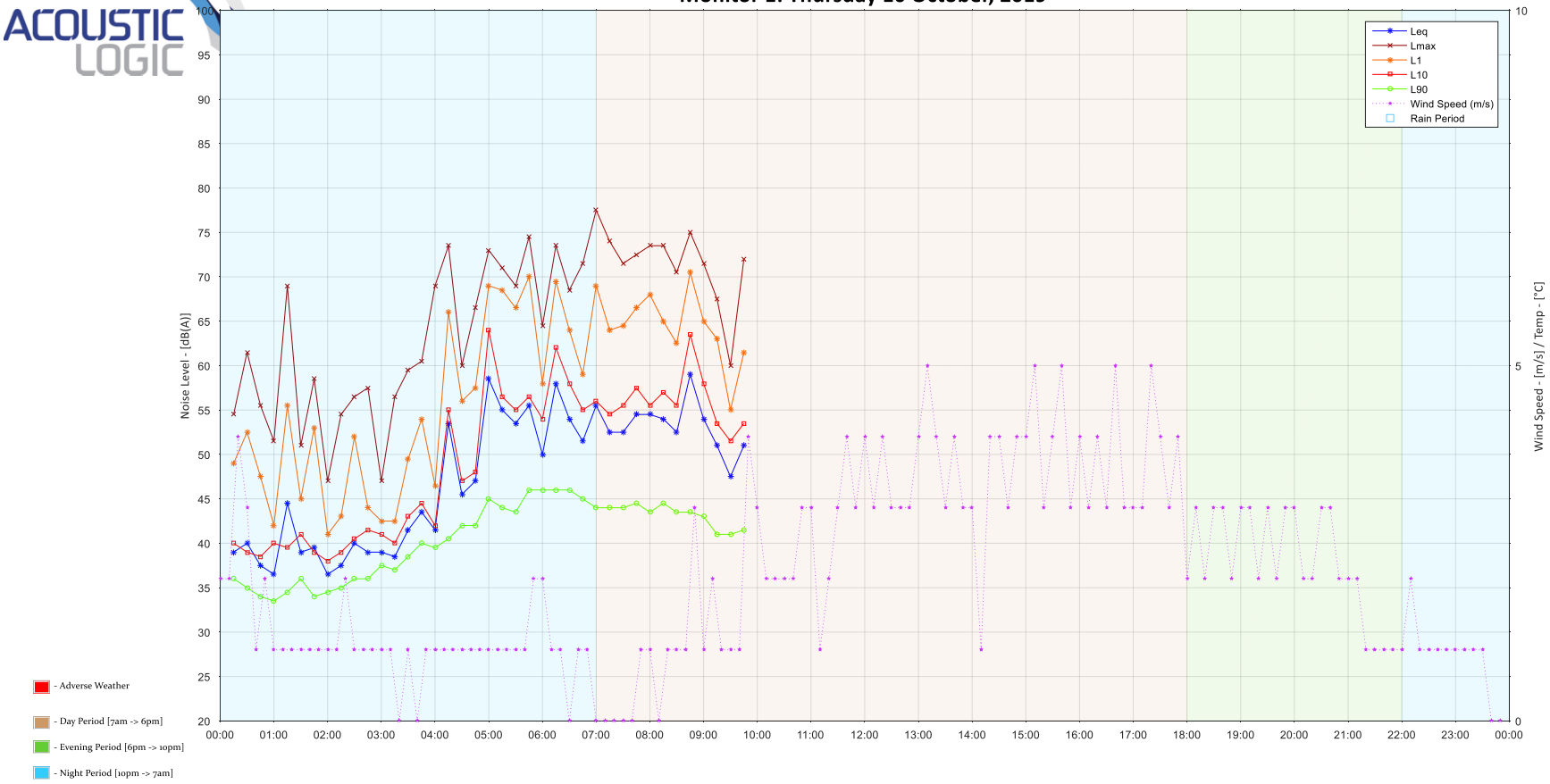
Monitor 1: Sunday 06 October, 2019



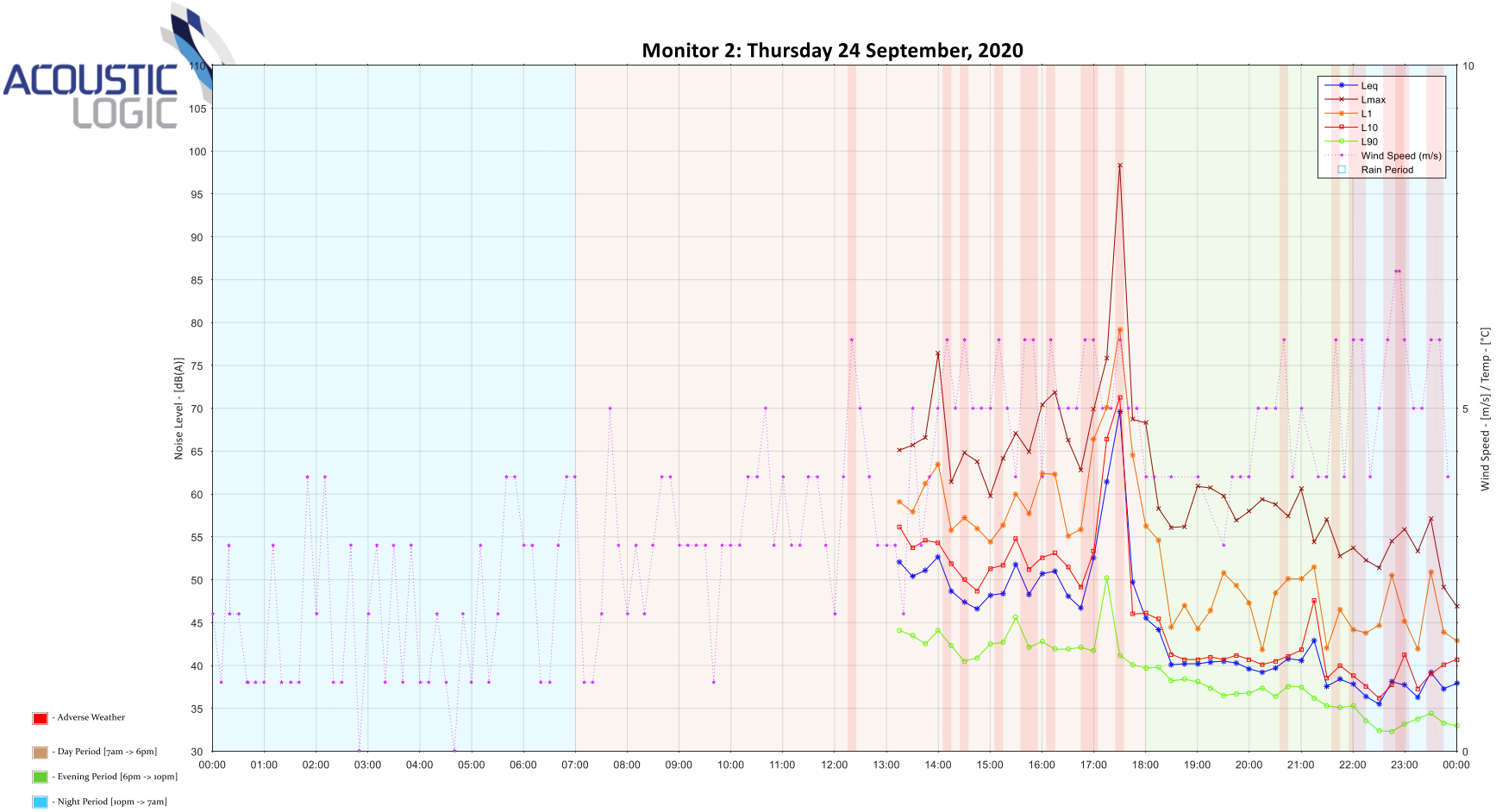

Monitor 1: Monday 07 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

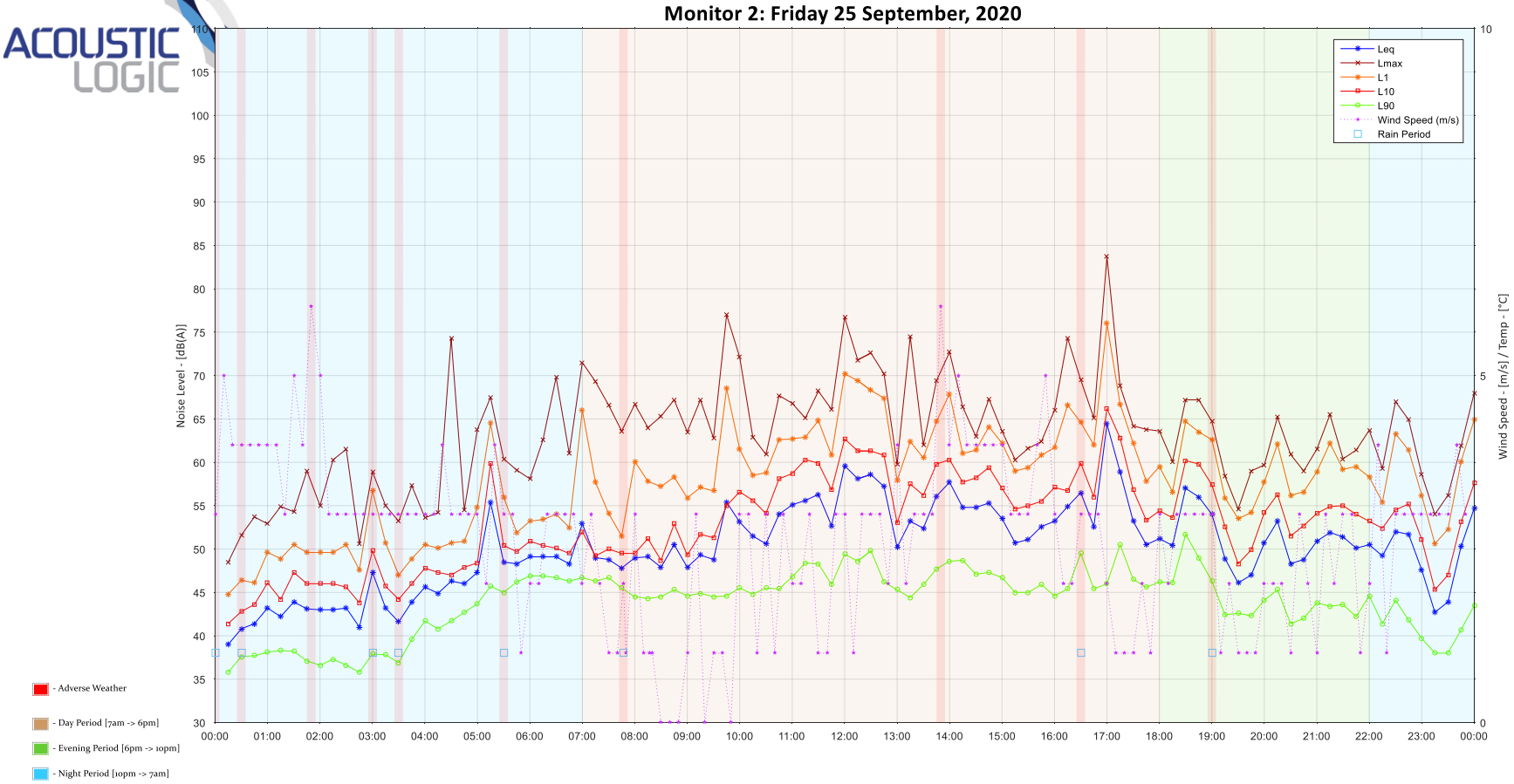

Monitor 1: Tuesday 08 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

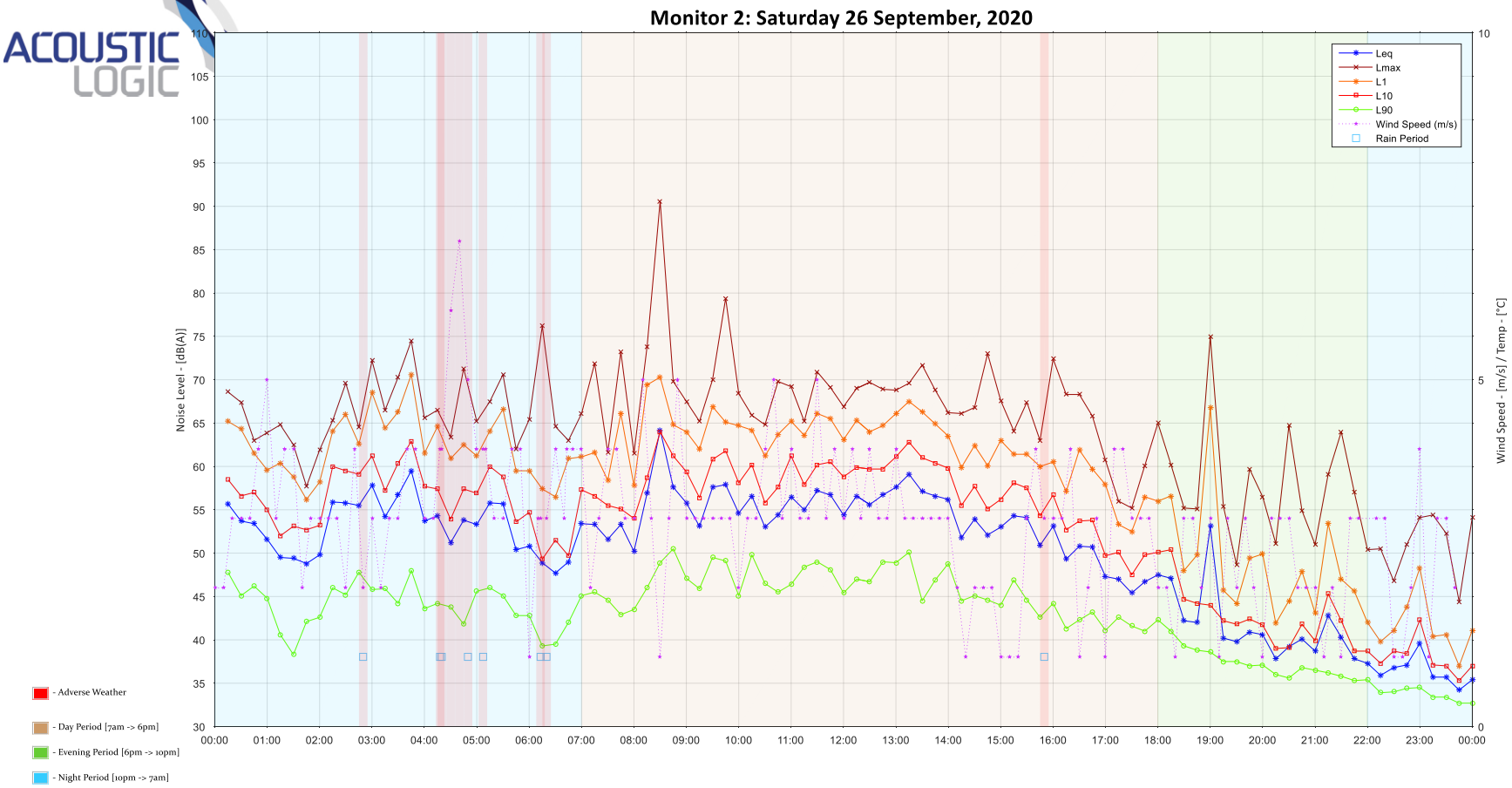

Monitor 1: Wednesday 09 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Monitor 1: Thursday 10 October, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

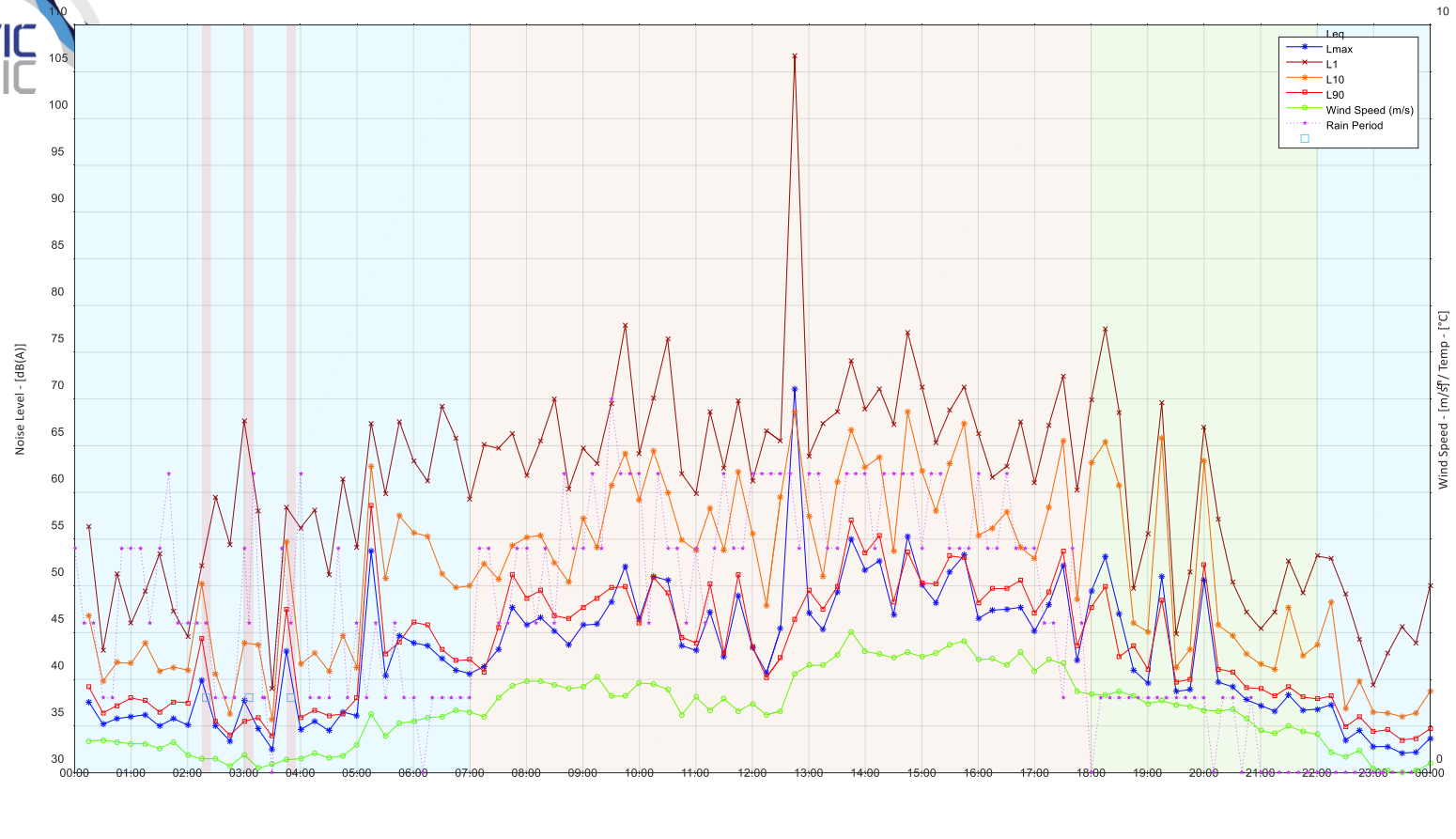
APPENDIX B – MONITOR 2 DATA

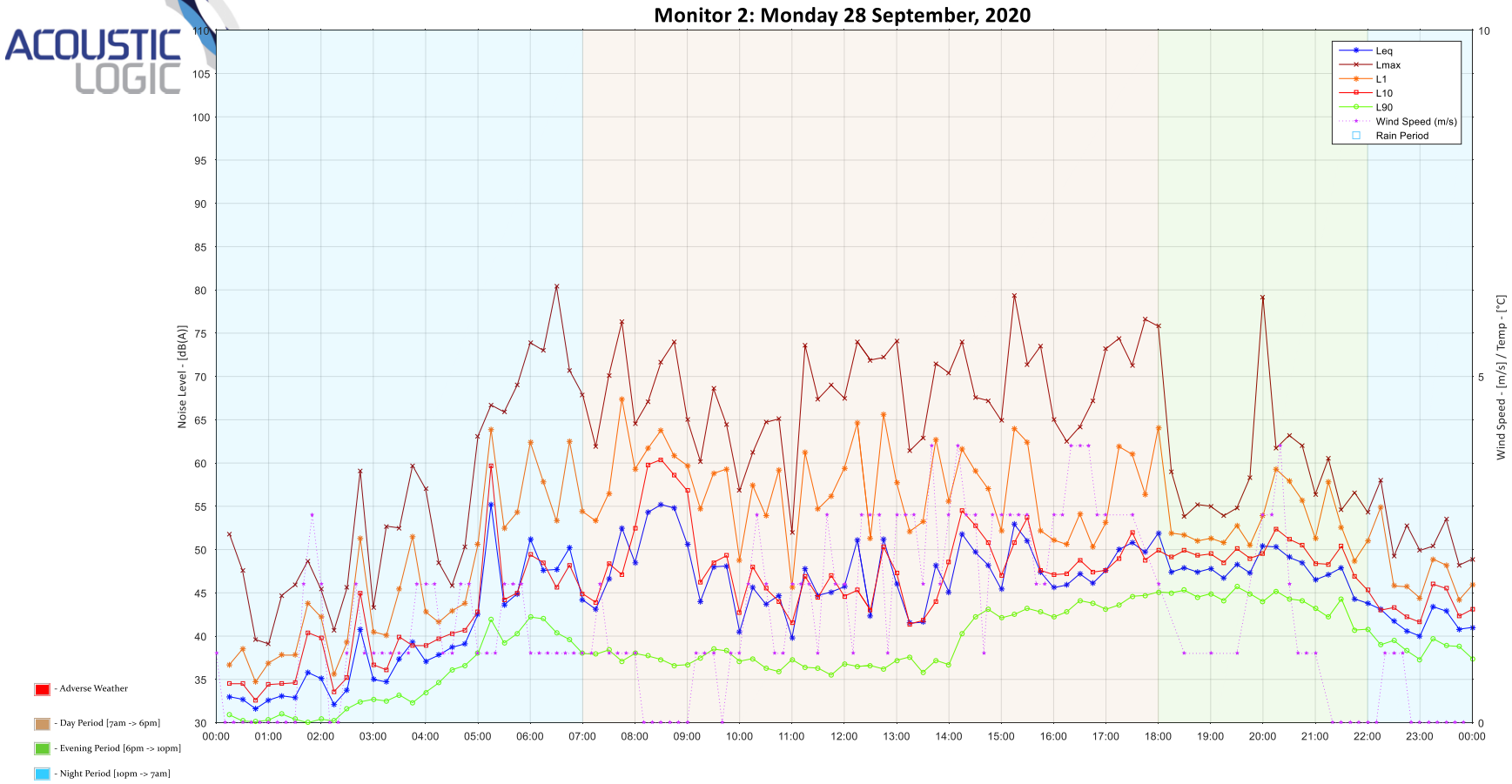

Monitor 2: Thursday 24 September, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

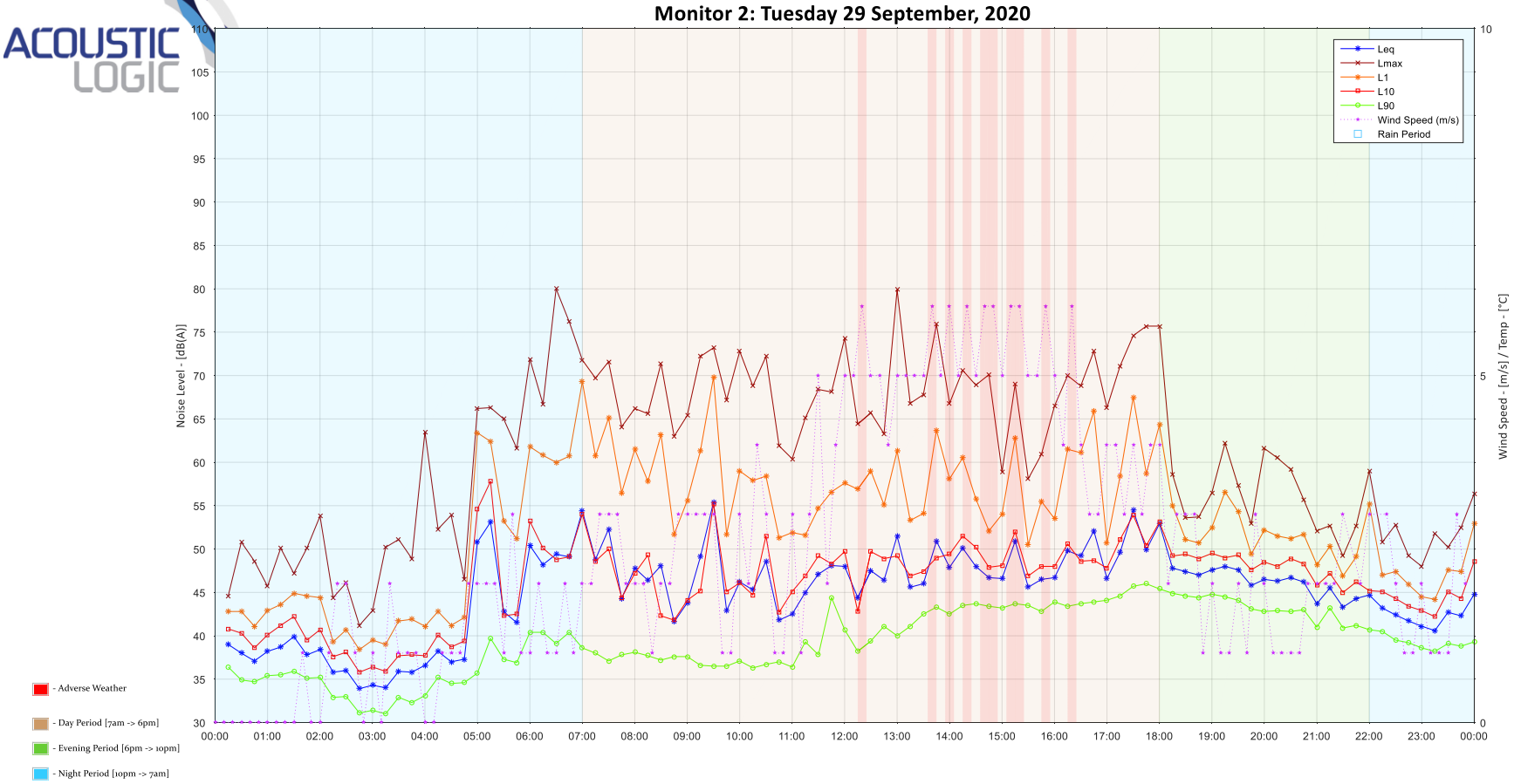

Monitor 2: Friday 25 September, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

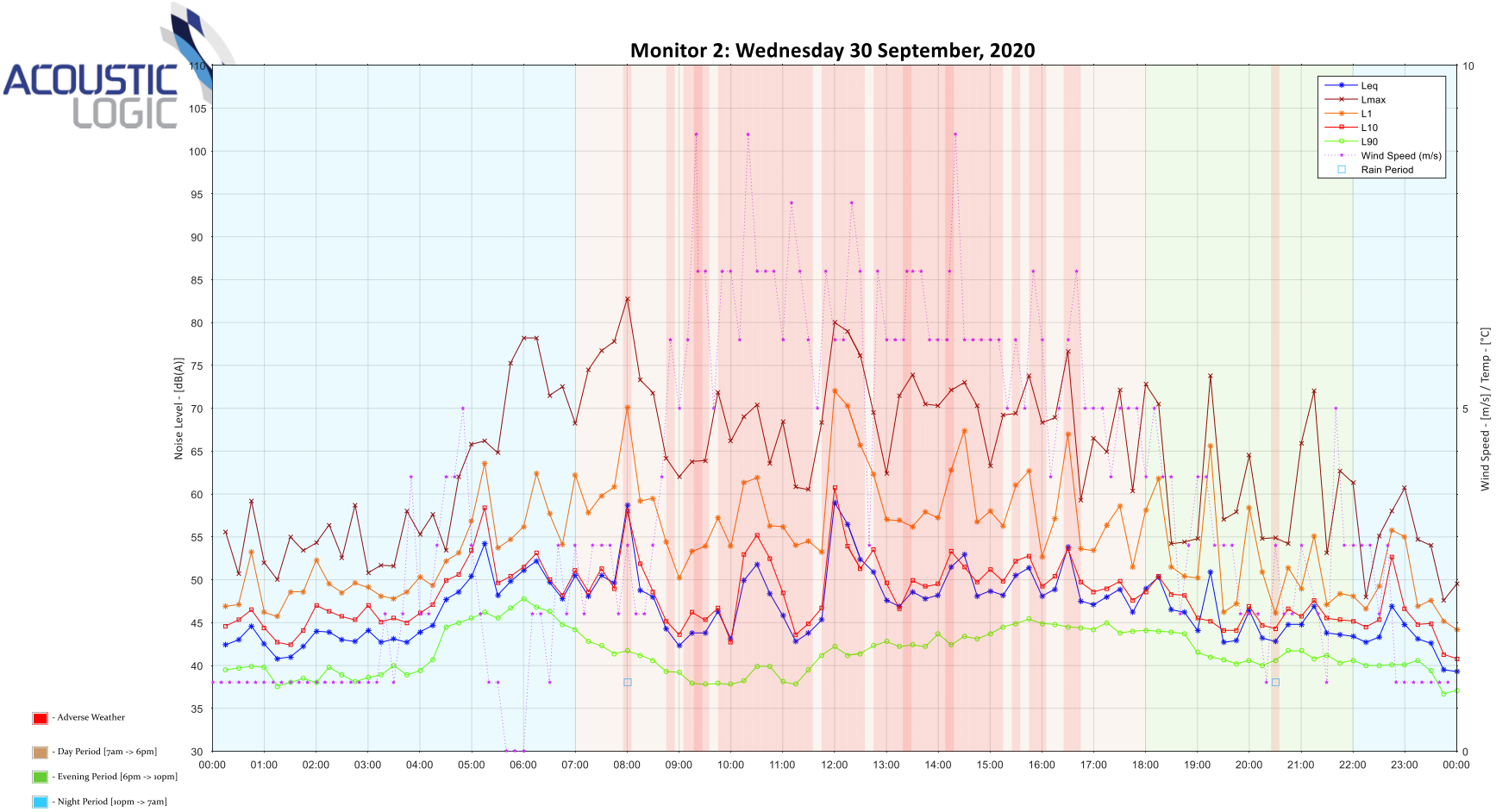

Monitor 2: Saturday 26 September, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

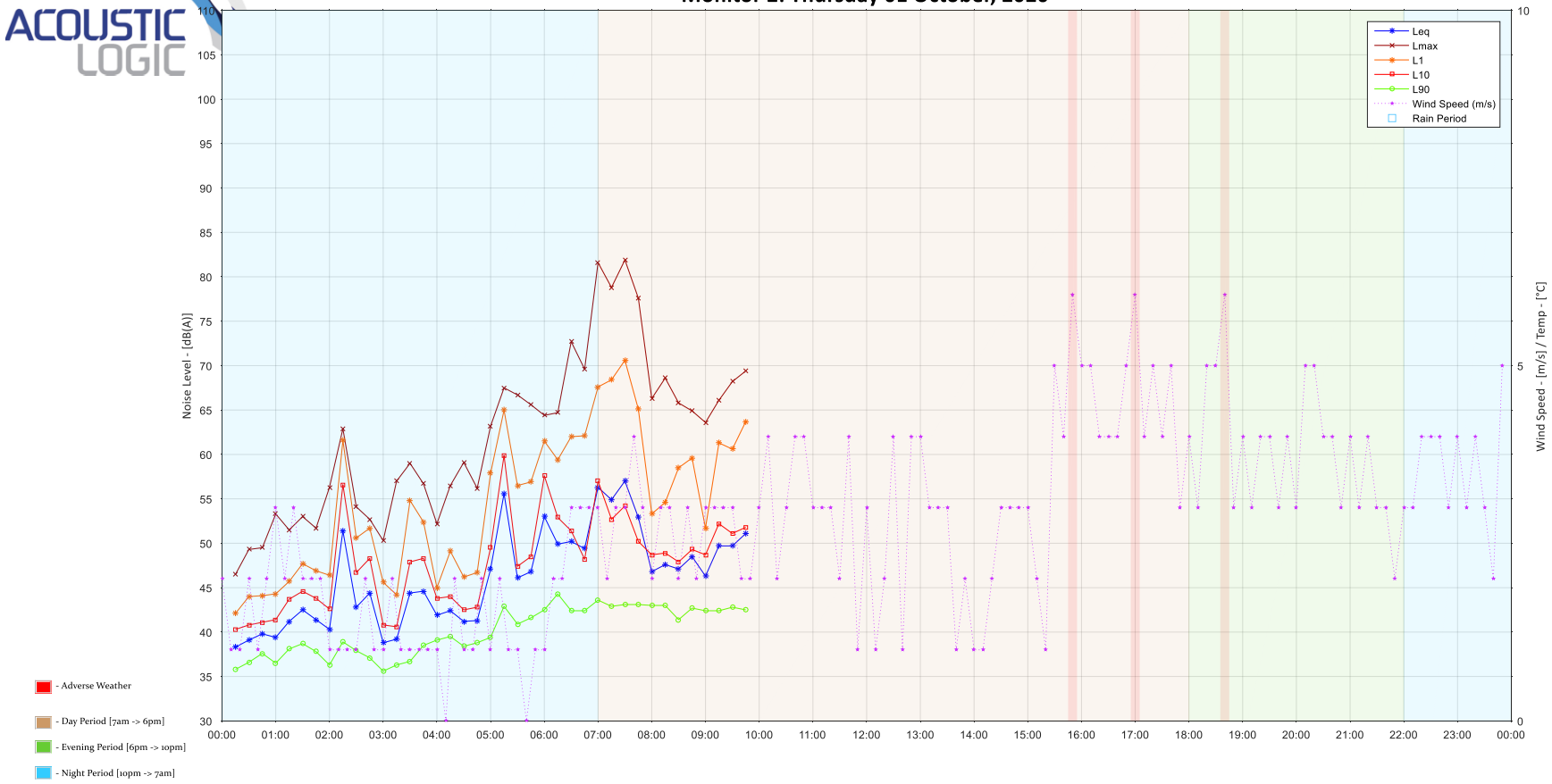
Monitor 2: Sunday 27 September, 2020




Monitor 2: Monday 28 September, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Monitor 2: Tuesday 29 September, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Monitor 2: Wednesday 30 September, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Monitor 2: Thursday 01 October, 2020
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]