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## **Ivanhoe Estate, Macquarie Park**

## **Stage 1 DA Acoustic Assessment**

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# 1 INTRODUCTION

This report supports a Development Application for Stage 1 of the Ivanhoe Estate redevelopment, a State Significant Development (SSD) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It has been prepared for Aspire Consortium on behalf of NSW Land and Housing Corporation.

This document addresses noise impacts associated with the following:

- Traffic noise intrusion into project site from Herring Road and Epping Road, Macquarie Park.
- External noise emission from operation of project site including Child Care Centre, Mechanical Plant and Loading Dock.
- Noise and vibration emissions from the construction of project site.

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

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline*';
- 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*';
- NSW Planning Noise Policy for Industry 2017;
- Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013;
- Australian Standards AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites; and
- NSW Environmental Protection Agency Interim Construction Noise Guideline German Standard DIN 4150.

This assessment has been conducted using the Bates Smart Architects Pty Ltd and Candalepas Associates architectural drawings for D.A Submission, see details below.

**Table 1 – Architectural Drawing List**

Architect	Building	Drawing Number	Drawing Title	Date	Rev
Bates Smart Architects Pty Ltd	A1	DA02.MP.102	Masterplan Envelope Control Plan	30/10/2017	A
		DA01.A1.001	Site Plan	21/12/2017	X
		DA03.A1.000L	Lower Ground Plan		
		DA03.A1.000U	Upper Ground Plan		
		DA03.A1.001	Level 01 Plan	20/12/2017	
		DA03.A1.002	Level 02 Plan		
		DA03.A1.003	Level 03, 05 & 07 Plan		
		DA03.A1.004	Level 04 & 06 Plan		
		DA03.A1.008	Level 08, 10, 12 & 14		
		DA03.A1.009	Level 09, 11, 13 & 15		
		DA03.A1.016	Level 16, 18 & 20 Plan		
		DA03.A1.017	Level 17, 19 & 21 Plan		
		DA03.A1.022	Level 22 Plan		
		DA03.A1.023	Level 23 Plan		
		DA03.A1.024	Roof Plan		
		DA03.A1.B1	Basement 01: Loading Dock/Childcare Parking		
		DA03.A1.B2	Basement 02 – Typical Carpark		
		DA.03.A1.B3	Basement 03 - Carpark		
		DA.03.A1.B4	Basement 04 - Carpark		
		DA08.A1.001	Section AA		
		DA08.A1.002	Section BB		
CANDALEPAS ASSOCIATES	C1	DA 1050	Site Plan	25/09/2018	P7
		DA 1102	Basement 3 Floor Plan		
		DA 1103	Basement 2 Floor Plan		
		DA 1104	Basement 1 Floor Plan		
		DA 1105	Lower Ground Floor Plan		
		DA 1106	Upper Ground Floor Plan		
		DA 1107	Level 1 Floor Plan		
		DA 1108	Level 2 Floor Plan		
		DA 1109	Level 3 – 4 Floor Plan		
		DA 1110	Level 5 – 12 Floor Plan		

**Table 2 – Architectural Drawing List (Cont.)**

<b>Architect</b>	<b>Building</b>	<b>Drawing Number</b>	<b>Drawing Title</b>	<b>Date</b>	<b>Rev</b>
CANDALEPAS ASSOCIATES	C1	DA 1111	Level 13 Floor Plan	25/09/2018	P7
		DA 1112	Level 14 – 19 Floor Plan		
		DA 1113	Roof Plan		
		DA 1150	Adaptable Unit Floor Plans		
		DA1200	Section A		
		DA 1201	Section B		
		DA 1202	Section C		
		DA 1300	North East Elevation		
		DA 1301	North West Elevation		
		DA 1302	North West Internal Elevation		
		DA 1303	South East Elevation		
		DA 1304	South East Internal Elevation		
		DA 1305	South West Elevation		



## 2 SITE DESCRIPTION

The Ivanhoe Estate site is located in Macquarie Park near the corner of Epping Road and Herring Road within the Ryde Local Government Area (LGA). The site is approximately 8.2 hectares and currently accommodates 259 social housing dwellings, comprising a mix of townhouse and four storey apartment buildings set around a cul-de-sac street layout. An aerial photo of the site is provided at **Figure 1** below.

Immediately to the north of the site are a series of four storey residential apartment buildings. On the north-western boundary, the site fronts Herring Road and a lot that is currently occupied by four former student accommodation buildings and is likely to be subject to redevelopment. Epping Road runs along the south-western boundary of the site and Shrimptons Creek, an area of public open space, runs along the south-eastern boundary. Vehicle access to the site is via Herring Road.

Ivanhoe Estate comprised of 17 individual lots owned and managed by the NSW Land and Housing Corporation. The Masterplan site also incorporates adjoining land, being a portion of Shrimptons Creek and part of the commercial site at 2-4 Lyon park Road. This land is included to facilitate a bridge crossing and road connection to Lyon park Road.



**Figure 1: Ivanhoe Estate Site**



The proposed Stage 1 Development Application seeks consent for the first stage of detailed works within the Ivanhoe Estate, pursuant to the Ivanhoe Estate Masterplan under Section 4.22 of the EP&A Act. The Masterplan establishes the planning and development framework against which this Stage 1 Development Application will be assessed.

The Stage 1 Development Application seeks approval for:

- Site preparation works, including tree removal, demolition of roads, services, and earthworks across the Ivanhoe Estate;
- The provision and augmentation of utilities and services infrastructure across the Ivanhoe Estate;
- The construction of all internal roads including public domain within the road reserves, and the bridge crossing and road connection to Lyonpark Road;
- The consolidation of existing lots and subdivision of the Ivanhoe Estate to reflect the revised road layout, open space, and provide superblocks corresponding to the Masterplan;
- The construction and use of Buildings A1 and C1 comprising residential uses (including social housing), a childcare centre, and retail / community spaces.

An image of the Masterplan, identifying Buildings A1 and C1 and illustrating the road network, is provided at **Figure 2** below.

Acoustic investigation has been carried out by this office in regards to the developments surrounding the Stage 1 Ivanhoe Estate development, which has been detailed below:

- Western facade faces Herring Road which is the six lane road with heavy traffic volume including buses at certain time of a day;
- Southern facade faces future residential development;
- Northern facade faces the existing multi storey residential buildings;
- Remaining facades will be bounded by the future development of whole project site.
- The proposed childcare centre will be located on ground floor of Building A1 which will care 75 kids and operation hours are 7am to 6pm.

The nearest residential noise receivers around the project site include:

- Receiver 1 - Residential buildings located at 112 – 120 Herring Road situated to the North, residential receivers are multi storey;
- Receiver 2 - Residential buildings located at 155 – 159 Herring Road and 5-11 Windsor Drive situated to the North-East, residential receivers are multi storey.
- Receiver 3- Residential apartments within project site.

A site map with noise measurement locations and surrounding receivers is presented in Figure 3 below.





Figure 2: Site Map of Ivanhoe Estate



Proposed A1 & C1 Buildings



-  Unattended Noise Monitor
-  Attended Noise Measurements

**Figure 3: Site Survey and Monitoring Positions**  
Sourced from Six Maps NSW

 Residential Receiver

### 3 EXISTING ACOUSTIC ENVIRONMENT

The acoustic environment is categorised by High background noise levels during the day and evening due to traffic movements along Herring Road and Epping Road. Medium background noise levels during the night as most of the volume of traffic has finished for the day.

Acoustic monitoring was conducted at the site to establish the background noise levels which will be used as basis for this assessment.

#### 3.1 ENVIRONMENTAL 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 15-20 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.



## **3.2 BACKGROUND NOISE LEVELS**

Background noise levels which will be used as a basis for this assessment are detailed in the following sections.

### **3.2.1 Measurement Equipment**

Unattended noise monitoring was conducting using one 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.

### **3.2.2 Measurement Location**

A few unattended background noise monitors have been installed around master plan of project site and the noise data of monitor at middle of Ivanhoe Place has been adopted to setup noise emission criteria. For a detailed location refer to Figure 1.

### **3.2.3 Measurement Period**

Unattended noise monitoring was conducted from Wednesday, 25<sup>th</sup> October, 2017 to Wednesday, 1<sup>st</sup> November, 2017.

### **3.2.4 Measured Background Noise Levels**

The background noise levels established from the unattended noise monitoring are detailed in the table below.

### **3.2.5 Unattended Noise Measurements**

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

Appendix 1 provides the results of the unattended noise monitoring. Weather affected data was excluded from the assessment. The processed Rating Background Noise Levels (lowest 10<sup>th</sup> percentile noise levels during operation time period) are presented in Tables below.

**Table 3 – Unattended Noise Monitor – Rating Background Noise Level**

Date	Measured Rating Background Noise Level dB(A)L <sub>90</sub>		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Wednesday, 25 <sup>th</sup> October, 2017	-	39	-
Thursday, 26 <sup>th</sup> October, 2017	41	43	36
Friday, 27 <sup>th</sup> October, 2017	45	38	35
Saturday, 28 <sup>th</sup> October, 2017	46	39	34
Sunday, 29 <sup>th</sup> October, 2017	42	38	34
Monday, 30 <sup>th</sup> October, 2017	40	41	33
Tuesday, 31 <sup>st</sup> October, 2017	38	38	34
Wednesday, 1 <sup>st</sup> November, 2017	42	39	35
<b>Median</b>	<b>42</b>	<b>39</b>	<b>34</b>

**3.2.6 Summarised Rating Background Noise Levels**

Summarised rating background noise levels for each receiver are presented below.

**Table 4 -Summarised Rating Background Noise Level**

Location	Time of day	Rating Background Noise Level dB(A)L <sub>90</sub>
Project Site	Day	42
	Evening	39
	Night	34



## 4 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigation indicates that the major external noise sources around project site are below:

- Traffic noise impacts from Herring Road, Macquarie Park;
- Traffic noise impacts from Epping Road, Macquarie Park and;

### 4.1 INTERNAL NOISE CRITERIA

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

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – *'Developments near Rail Corridors or Busy Roads – Interim Guideline'*;
- NSW Department of Planning and Environment's document – *'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007'*;
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'* and;
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*.

#### 4.1.1 City of Ryde Development Control Plan 2014 (Traffic Noise Intrusion)

The City of Ryde Development Control Plan 2014 does not state traffic noise criteria, therefore; the following documents and their criteria are recommended.

#### 4.1.2 NSW Department of Planning and Environment's Document – *'Developments near Rail Corridors or Busy Roads – Interim Guideline'*

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

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

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

#### 4.1.3 NSW Department of Planning and Environment's document – 'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007' (Traffic Noise Intrusion)

RTA Map No. 11 of the traffic volume maps referenced by the SEPP (INFRASTRUCTURE) on the RTA website (see below), classifies the section of Epping Road where the development is located adjacent to as a road where a noise intrusion assessment is mandatory under clause 102 of the SEPP Infrastructure 2007. See RTA average annual daily road traffic volume map number 11 and the approximate location of the site below.

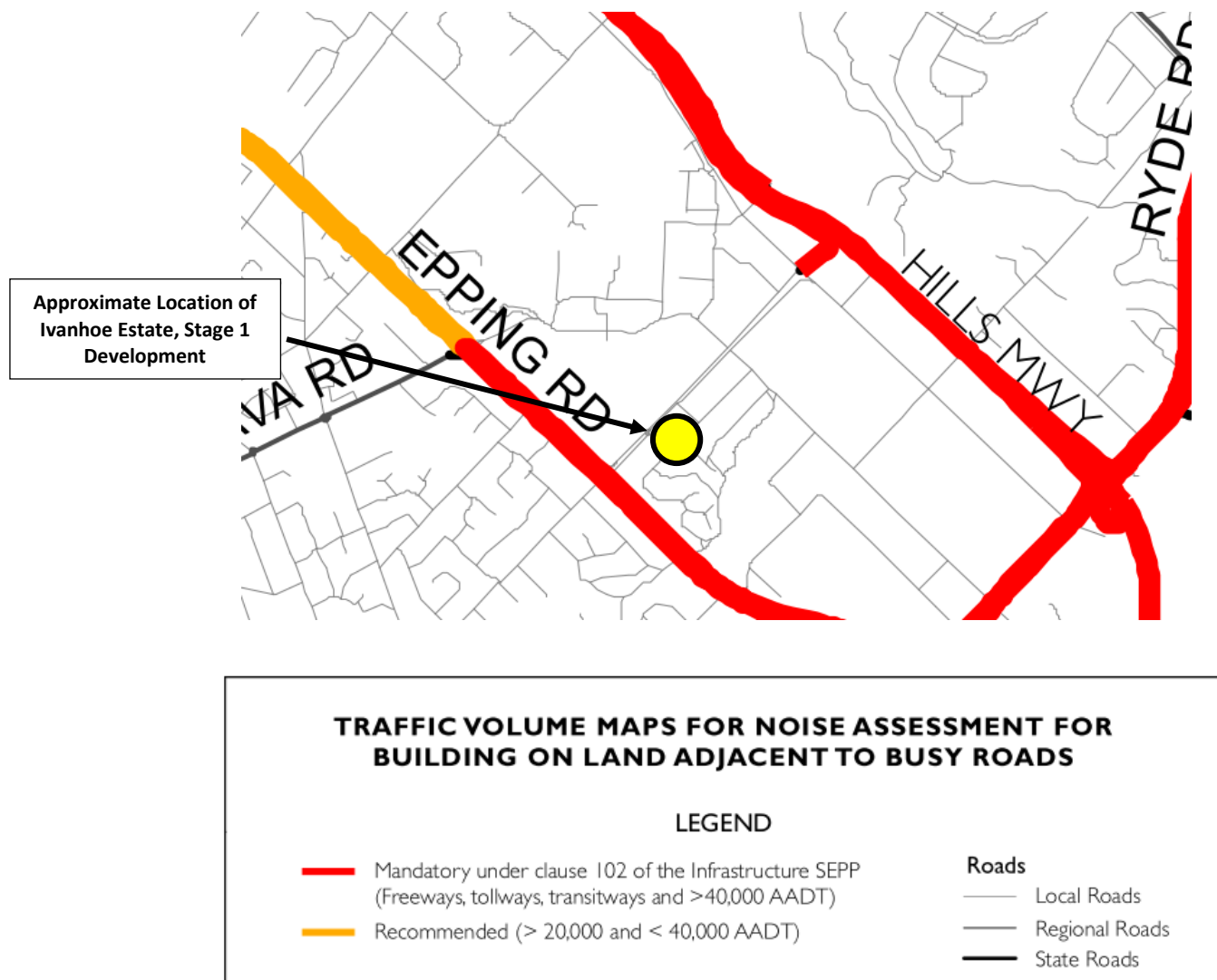


Figure 2 – RTA Map No. 11 and Approximate Location of Proposed Development

### *Clause 87 - Impact of rail noise or vibration on non-rail development*

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

- (a) a building for residential use,
- (b) a place of public worship,
- (c) a hospital,
- (d) an educational establishment or child care centre.

(3) If the development is for the purposes of a building for residential use, 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  $L_{Aeq}$  levels are not exceeded:

- (a) in any bedroom in the building--35 dB(A) at any time between 10.00 pm and 7.00 am,
- (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)--40 dB(A) at any time.

### *Clause 102*

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

#### **4.1.4 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 the relevant standard.
- Australian Standard AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors', is the industry adopted standard.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the  $L_{eq}$  descriptor, ALC shall also use this descriptor.
- AS3671 does not specifically recommend a time interval. On this basis, ALC 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).

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

#### 4.1.5 Australian and New Zealand AS/NZS 2107:2016 ‘Recommended design sound levels and reverberation times for building interiors’

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table 1, in Section 5 of AS 2107-2016, gives the following maximum internal noise levels for commercial buildings and residential buildings near major roads.

**Table 5 – Recommended Design Sound Level**

Space /Activity Type	Recommended Maximum Design Sound Level dB(A) $L_{eq}$
Living Areas	30-40 dB(A) $L_{eq}$ , 24 hours
Sleeping Areas	30-35 dB(A) $L_{eq}$ (night time)
Bathrooms, Ensuites, Laundry	45 dB(A) $L_{eq}$

#### 4.1.6 To Child Care Centre

##### 4.1.6.1 Indoor Play Area Noise Levels

The internal noise levels of the childcare centre shall comply with the requirements of Association of Australian Acoustical Consultants “Technical Guideline Child Care Centre Noise Assessment” 2013 which has been detailed below.

**Table 6 – Childcare Centre- Internal Noise Criteria**

Space	Internal Noise
Sleeping Rooms	40 dB(A) $L_{eq}$ , 1 hour
Other rooms	40 dB(A) $L_{eq}$ , 1 hour

##### 4.1.6.2 Outdoor Play Area Noise Levels

External ambient noise levels shall comply with the requirements of Association of Australian Acoustical Consultants “Technical Guideline Child Care Centre Noise Assessment” 2013 which has been detailed below.

**Table 7 - Childcare Centre- Outdoor Noise Criteria**

Space	External Noise
Outdoor Playgrounds and Activity Areas	55 dB(A) $L_{eq}$ , 1 hour

#### 4.1.7 Summary of Criteria

The governing project criteria is presented in the Table below.

**Table 8 - Summary of Internal Noise Level Criteria**

Space	Internal Traffic Noise Criteria dB(A) $L_{eq}$
Bedroom	35dB(A) $L_{eq(9hour)}$ ; 40dB(A) $L_{eq(15hour)}$
Living Space	40dB(A) $L_{eq(24hour)}$
Bathroom	45dB(A) $L_{eq(When\ in\ use)}$
Child Care Indoor Area	40 dB(A) $L_{eq, 1\ hour}$
Child Care Outdoor Area	55 dB(A) $L_{eq, 1\ hour}$

## 4.2 EXTERNAL NOISE MEASUREMENTS

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

### 4.2.1 Noise Measurements

### 4.2.2 Measurement Equipment

Attended short term measurements of traffic noise which 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.

Unattended noise monitoring was conducting using one 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.

### 4.2.3 Measurement Location

Attended Traffic Noise Measurements: These were conducted along Epping Road and Herring Road, See Figure 1 for measurement location. All noise measurements had a 180° view of the road.

### 4.2.4 Measurement Period

Unattended noise monitoring was conducted from Wednesday, 25<sup>th</sup> October, 2017 to Wednesday, 1<sup>st</sup> November, 2017.

Attended noise measurements were undertaken between the hours of 3:30pm and 5:30pm on Wednesday, 25<sup>th</sup> October 2017.

#### 4.2.5 Measured Traffic Noise Levels

##### 4.2.5.1 Attended Noise Measurement Results

**Table 9 – Manned Traffic Noise Measurement Results**

Location	Measured Noise Level dB(A) $L_{eq}$
Epping Road- at 7m distance from kerb (Figure 1)	69
Herring Road- at 5m distance from kerb (Figure 1)	71

##### 4.2.5.2 Unattended Noise Measurement Results

**Table 10 -Unattended Noise Measurement Results**

Location	Measured Noise Level Day	
	Day dB(A) $L_{eq, T}$	Night dB(A) $L_{eq, T}$
13m distance from kerb of Epping Rd	69	66
18m distance from kerb of Herring Rd	63	56

#### 4.2.6 Summarised External Noise Levels

The existing traffic noise levels listed in the table below were determined based on the unattended noise monitoring and attended noise measurements.

**Table 11 – Measured Existing Traffic Noise Levels**

Location	Summary of Measured Existing Traffic Noise Levels*	
	Daytime (7am-10pm) dB(A) $L_{Aeq}$	Night time (10pm-7am) dB(A) $L_{Aeq}$
Herring Road 5m from kerb 180° view of the road	72dB(A)	65dB(A)
Epping Road 7m from kerb 180° view of the road	69dB(A)	62dB(A)

\*Adjusted based off unattended noise monitoring

#### 4.3 NOISE INTRUSION ANALYSIS

Traffic noise intrusion into the proposed development was assessed using the measured and predicted noise levels above.

Calculations were undertaken taking into account the 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 NOISE EMISSION ASSESSMENT

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

- City of Ryde Development Control Plan 2014 and;
- NSW Planning Noise Policy for Industry 2017.

### 5.1 NOISE EMISSION CRITERIA

#### 5.1.1 City of Ryde Development Control Plan 2014

3.10 Acoustic Privacy Controls

f. *“The operating noise level of air conditioners, swimming pool pumps and other mechanical services must not exceed the background noise level by more than 5dB(A).”*

#### 5.1.2 Requirements by EPA

The Industrial Noise Policy has been superseded by Noise Policy for Industry 2017.

The NPfI 2017 provides guidelines for assessing noise impacts from industrial 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 both have to be complied with, namely project amenity criterion and an intrusiveness criterion.

##### 5.1.2.1 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).

Intrusive criteria based on the minimum RBL recommended by EPA for project site are detailed in table below.

**Table 12 – INP Intrusiveness Criteria**

Time of day	Background Noise Level dB(A) $L_{90}$	Intrusiveness Criteria (Background+5dB(A)) dB(A) $L_{eq}$
Day	42	47
Evening	39	44
Night	34	39

### 5.1.2.2 Project 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.

The NPfI requires Project Amenity Noise Levels to be calculated below:

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

Pursuant to the NPfI, the residential receivers in the vicinity would be considered Urban. Corresponding Project Amenity Criteria noise emission goals are presented below.

**Table 13 –NPfI Project Amenity Criteria**

Type of Receiver	Time of day	Recommended Amenity Noise Level dB(A) $L_{eq}$	Project Amenity Noise Level dB(A) $L_{eq, 15 \text{ min}}$
Residential (Urban)*	Day	60	58
	Evening	50	48
	Night	45	43

### 5.1.2.3 Sleep Arousal Criteria

Section 2.5 of NPfI 2017 recommended the following noise limit to mitigate sleeping disturbance:

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

- $L_{Aeq, 15 \text{ min}}$  40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- $L_{AFmax}$  52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

*A detailed maximum noise level even assessment should be undertaken.*

**Table 14 - Sleep Arousal Emergence Criteria (Night)**

Location	Rating Background Noise Level (Night) - dB(A) $L_{90}$	Emergence Level
All Potentially Affected Residential Properties	34	39 dB(A) $L_{eq, 15 \text{ min}}$ ; 49 dB(A) $L_{max, F}$

#### 5.1.2.4 Summary of Noise Emission Criteria

The noise emission criteria for the proposed Stage 1 have been summarised below.

**Table 15 – Summary of External Noise Emission Criteria**

Location	Time	Noise Emission Criteria
All potentially affected residential boundaries	Day	47 dB(A) $L_{eq}$ , 15 min
	Evening	44 dB(A) $L_{eq}$ , 15 min
	Night	39 dB(A) $L_{eq}$ , 15 min 49 dB(A) $L_{max}$ , F

## 5.2 NOISE EMISSION ASSESSMENT

The major noise sources generated by the proposed development are below:

- Plant service project buildings.
- Loading dock operation
- Child Care Centre.

### 5.2.1 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 to the closest residential receiver should comply with the requirements of section 5.1.

### 5.2.2 Noise generated by loading dock and carpark

Loading dock and carpark are fully enclosed therefore the noise emissions shall not have any adverse impact to the noise receivers around the project site.

### 5.2.3 Proposed Child Care Centre

#### 5.2.3.1 Noise Emission Criteria

Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013 states:

**Up to 2 hours (total) per day-** The  $L_{eq}$ , 15min noise level emitted from outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location;

**More than 2 hours per day-** The  $L_{eq}$ , 15min noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.

The noise emission criteria have been summarised below base on the requirements above and measured rating background noise data on site.

**Table 16 –Noise Emission Criteria for the Child Care Centre**

<b>Total Outdoor Play Hours</b>	<b>Noise Receiver</b>	<b>Criteria dB(A) L<sub>eq</sub> 15min</b>
≤ 2 hours	1m from the receiver façade	52

## **5.2.4 Noise Source Data**

### **5.2.4.1 Outdoor Play Area Noise Measurements**

Outdoor play area noise measurements were undertaken at Child Care Centre, 8 Central Avenue Mosman by this office. Details of the measurements are presented below. Noise measurements were taken of the 3 to 6 year age group (8 kids) at play. This group represents the most active of the age groups and hence are likely to generate the maximum noise levels. Although noise measurements have not been conducted for the 0-2 year age group, it would be expected that they would be likely to generate lower levels of sound than the older age group

### **5.2.4.2 Measurement Location**

Measurements were taken during the morning play session within the outdoor play area with 8 children present.

The measurements were taken at noted distances to the children playing with the measured levels presented below.

### **5.2.4.3 Measurement Equipment**

Noise measurements were obtained using a CEL-593 Type 1 Sound Level Analyser, set to A-weighted fast response. The sound level meter was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

### **5.2.4.4 Measured Noise Levels**

The measured activity noise levels from the 8 children playing are listed below in table below.

**Table 17 - Measured Children Activity Noise Levels dB(A) LA<sub>10</sub>**

<b>Location</b>	<b>Activity</b>	<b>Distance</b>	<b>Noise Level</b>
Outdoor Play Area	Bikes + Sandpit play	3m	66
	Blocks + Sandpit play	4m	64
	Stepping Blocks + Sandpit play	4m	57
	Play gym + Sand pit play	3m	65

### 5.2.5 Predicted Noise Levels

The noise level at the nearest residents was predicted using the above data and by taking into account any expected noise reduction provided by the building fabric, distance losses, directivity, barrier effects, number of children playing etc. The EPA INP now uses the  $L_{eq}$  descriptor in place of  $L_{10}$ . An approximate relationship would be a difference of 2dB less for the  $L_{eq}$  descriptor. Table below shows the predicted noise levels from the children with the recommended acoustic fence. It is noted that analysis was based on a maximum of 40 children use the afternoon outplay area at any one time. The recommended noise controls in Section 8 has been taken account in the noise prediction.

Table below presents the predicted noise levels dB(A)  $L_{eq}$  at the subject sensitive receivers.

#### 5.2.5.1 To the Nearest Noise Receiver - Single Storey Residential Dwelling Across Caroline St

The noise emission calculations detailed below to the noise receiver at 1m distance from front boundary fence.

**Table 18 –Predicted Outdoor Play Area to front yard of Receiver - dB(A)  $L_{eq}$**

Noise Source	8 Kids Sound Power Level: 82.8 dB(A)
Adjust the Number of Kids	40 Kids playing outdoor areas: +7 dB
Result	52dB(A)
Criteria	$\leq 52$ dB(A) $L_{eq}$ 1 hour
Comply	Yes

## 6 CONSTRUCTION NOISE AND VIBRATION IMPACT

### 6.1 SENSITIVE RECEIVERS

The nearest sensitive receivers in the vicinity of the site are as follows:

- Receiver 1 - Residential buildings located at 112 – 120 Herring Road situated to the North, residential receivers are multi storey;
- Receiver 2 - Residential buildings located at 155 – 159 Herring Road and 5-11 Windsor Drive situated to the North-East, residential receivers are multi storey.

### 6.2 NOISE MANAGEMENT LEVEL

Establishment of criteria for construction noise requirements will be in accordance with the following documents.

- Ryde Council Development Control Plan 2014
- Australian Standards AS2436:2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*
- NSW Environmental Protection Agency Interim Construction Noise Guideline

## **6.2.1 Ryde Council Development Control Plan 2014**

### **6.2.1.1 Part 8.1 – Construction Activities**

Section 2.6.1 a) of the Ryde DCP 2014 states:

*All works shall be carried out in accordance with the requirements of AS2601 – 1991 The Demolition of Structures.*

Section 1.7.2.3 – Noise Control of AS2601 states:

*Noise shall be minimised, as far as practicable, by the selection of appropriate methods and equipment, and by the use of silencing devices. Attention is drawn to the recommendations contained in AS2436*

#### **6.2.1.1.1 Section 4.6 – Hours of Operation**

Section 4.6 a) of the Ryde DCP 2014 states:

*All demolition and/or construction and associated work is to be restricted to between the hours of 7am and 7pm Mondays to Fridays and between 8am and 4pm on Saturday. No work is to be carried out on Sundays or public holidays*

## **6.2.2 Australian Standard AS2436:2010 “Guide to noise control on construction, maintenance and demolition sites**

Australian Standard AS2436 provides guidance on noise and vibration control in respect to construction and demolition sites, and the preparation of noise and vibration management plans, work method statements and impact studies. The Standard states that:

- “Some construction and demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration.”
- Construction, demolition and maintenance works pose different problems of noise and vibration control when compared with most other types of industrial activity, since
  - (a) they are mainly carried on in the open;
  - (b) they are often temporary in nature although they may cause considerable disturbance whilst they last;
  - (c) the noise and vibration arise from many different activities and kinds of plant, and their intensity and character may vary greatly during different phases of the work, and;
  - (d) the sites cannot be separated by planning control, from areas that are sensitive to noise and vibration.

The Standard provides advice and guidelines for the prediction of impacts and the methods available to manage impacts. It guideline promulgates feasible and reasonable mitigation strategies and controls, and stakeholder liaison, in the effort to reach a realistic compromise between site activities and impacts on neighbouring properties.



Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Develop a suitable noise criterion based on the NSW Environmental Protection Agencies Interim Construction Noise Guideline.
- Adopt management conditions as per AS 2436 in the event of a non-compliance.

### 6.2.3 NSW EPA Interim Construction Noise Guideline

Given the scale of the proposed works, the “quantitative” assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used (as opposed to the more simple “qualitative” assessment method outlined in the guidelines). The quantitative assessment method requires:

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

#### 6.2.3.1 At Residential Receivers

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

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

#### 6.2.3.2 Construction Noise Management Levels

Construction noise management levels applicable to the development have been determined based on the minimum background noise level recorded and the construction noise management level detailed in of this report. Noise management Level for the construction period of the site are detailed in table below.

**Table 19 – Construction Noise Management Levels**

Receiver	Category	Time of Day	Background Noise Level dB(A) L <sub>90</sub>	Construction Noise Management Level dB(A) L <sub>eq(15min)</sub>	"Highly Noise Affected" Level dB(A) L <sub>eq(15min)</sub>
R1 & R2	Monday to Friday	0700 - 1800	42	52	75

### 6.3 NOISE EMISSION ASSESSMENT

Detailed demolition, excavation and construction methodology are not available at this stage, acoustic analysis will be carried out at CC stage based on requirements above to work out noise mitigation solutions.

## 7 CONSTRUCTION VIBRATION CRITERIA

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For amenity criterion, the NSW Environmental Protection Authorities document *Assessing Vibration: A technical guideline*
- For structure borne damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*

The criteria and the application of these standards are discussed in separate sections below.

### 7.1.1 Amenity

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels are presented below:

**Table 20 –Vibration Goals**

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences (R1-R2)	Daytime	0.28	0.56
Impulsive Vibration			
Residences (R1-R2)	Daytime	8.6	17

### 7.1.2 Structure Borne Vibration (Damage Criteria)

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

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

**Table 21 - DIN 4150-3 (1999-02) Safe Limits for Building Vibration**

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms <sup>-1</sup> )			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

### 7.1.3 Recommended Vibration Limits

The table below presents the recommended vibration limit at the nearest vibration sensitive receivers.

**Table 22 – Recommended Vibration Limit**

Vibration Receiver	Recommended Vibration Limits PPV (mm/s)
Residential Receivers R1 to R2	≤ 5mm/s PPV

## 7.2 VIBRATION MONITORING AND SAFEGUARD SYSTEM

Vibration monitoring system shall be determined at CC stage once the detailed piling /excavation methodology available. The buildings adjacent to the project site shall be vibration safeguarded by monitors and ensure that the construction of project site will not result any adverse vibration impact on neighbouring buildings.

## 8 RECOMMENDATIONS

The following acoustic treatments are recommended for the proposed redevelopment.

### 8.1 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-Ion type acoustic seals. **(Mohair Seals are unacceptable)**.

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 the table below.

**Table 23 – Recommended Glazing Construction**

Building	Level	Façade	Room	Glazing Thickness	Acoustic Seals
A1	Level 1- Level 12	Herring Road	Bedroom (total glazed area of room $\leq 8\text{m}^2$ )	12.38mm Laminated	Yes
			Living Room (total glazed area of room $\leq 10\text{m}^2$ )	10.38mm Laminated	
		Remaining Façades	Bedroom (total glazed area of room $< 8\text{m}^2$ )	10.38mm Laminated	
			Living Room (total glazed area of room $< 10\text{m}^2$ )	10.38mm Laminated	
		Child Care Centre	All	10.38mm Laminated	

**Table 24 – Recommended Glazing Construction (Cont.)**

Building	Level	Façade	Room	Glazing Thickness	Acoustic Seals
A1	Level 12 And Up	Herring Road	Bedroom (total glazed area of room $\leq 8\text{m}^2$ )	10.38mm Laminated	
			Living Room (total glazed area of room $\leq 10\text{m}^2$ )	10.38mm Laminated	
		Remaining Façades	Bedroom (total glazed area of room $< 8\text{m}^2$ )	10.38mm Laminated	
			Living Room (total glazed area of room $< 10\text{m}^2$ )	10.38mm Laminated	
C1.1 to C1.5		All	Bedroom	6.38mm Laminated	
			Living Room	6.38mm Laminated	

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 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 25 - Minimum  $R_w$  of Glazing (with Acoustic Seals)**

Glazing Assembly	Minimum $R_w$ of Installed Window	Acoustic Seals
6.38mm Laminated	31	Yes
10.38mm Laminate	35	Yes
12.38mm Laminated	37	Yes

## 8.2 EXTERNAL ROOF/CEILING

External roof construction will be constructed from concrete or masonry elements, this proposed structure will not require any further acoustic upgrading. In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

### 8.3 EXTERNAL WALLS

External wall construction will be constructed from concrete and masonry elements, this proposed structure will not require any further acoustic upgrading. In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

### 8.4 ENTRY DOORS

External opening entry doors shall have glazing thicknesses equal to those recommended in section 4.4.1 Recommended Glazing Construction, and are to have Raven RP10 to the top and sides, and Raven RP38 to the underside of the door.

### 8.5 MECHANICAL VENTILATION

With respect to natural ventilation of the dwelling, the NSW Department of Planning document "Development near Busy Roads and Rail Corridors - Interim Guideline" dictates that:

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

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

The northern facade and western facade of Building A1 cannot achieve the noise criteria above with doors/ windows open. The ventilation for those rooms shall be provided to make sure that occupants can leave windows / doors closed.

Remaining facades will satisfy the requirements above with windows / doors open.

### 8.6 LOADING DOCK

- Loading dock - truck movements shall be day time only: 7am to 10pm Monday to Saturday; 8am to 10pm Sunday and public holidays.

### 8.7 PLANT

- Plant noise emission criteria has been setup in this report, detailed mechanical noise assessment shall be carried out at CC stage.

### 8.8 CHILD CARE CENTRE

Recommendations subject to future Development Application by Child Care Operator:

- Consider no more than 2 hours total outdoor play time per childcare ages group every day. The exact amount of time allowance will be subject to a future DA by the childcare operator.
- Consider maximum number of children outside at one time are below



**Table 26 – Number of Children Outside Once a Time**

Location	Number of Children
Morning play space	20
Afternoon play space	40

- Consider external doors /windows to remain closed except people in/out.
- Consider installation of 1Kg/m<sup>2</sup> acoustic treatment to cover the outdoor play area, or other equivalent acoustic treatments, or engineered solutions.

**Note:** Detailed acoustic treatment design is subject to a future Development Application by the childcare operator.



## 9 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with the proposed residential development to be constructed at Stage 1 Ivanhoe Estate, Macquarie Park.

Provided that the treatments set out in section 8 of this report are employed, internal noise levels shall comply with the requirements below:

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline*';
- NSW Department of Planning and Environment's document – '*State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*';
- Australian and New Zealand AS/NZS 3671:1989 '*Acoustics—Road traffic noise intrusion—Building siting and construction*'; and
- Australian and New Zealand AS/NZS 2107:2016 '*Recommended design sound levels and reverberation times for building interiors*'.

External noise emissions criteria have been setup in this report to satisfy the requirements from the following documents;

- City of Ryde Development Control Plan 2014;
- NSW Planning Noise Policy for Industry 2017; and
- Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013.

Construction noise emission management level have been setup based on requirements of NSW Interim Construction Noise Guideline and detailed noise controls will be determined at CC stage.

Construction vibration limit has been setup in in Section 10 based on requirements of DIN 4150 and EPA document Assessing Vibration: A technical guideline. Detailed vibration safeguard system will be determined at CC of each stage.

Please contact us should you have any further queries.

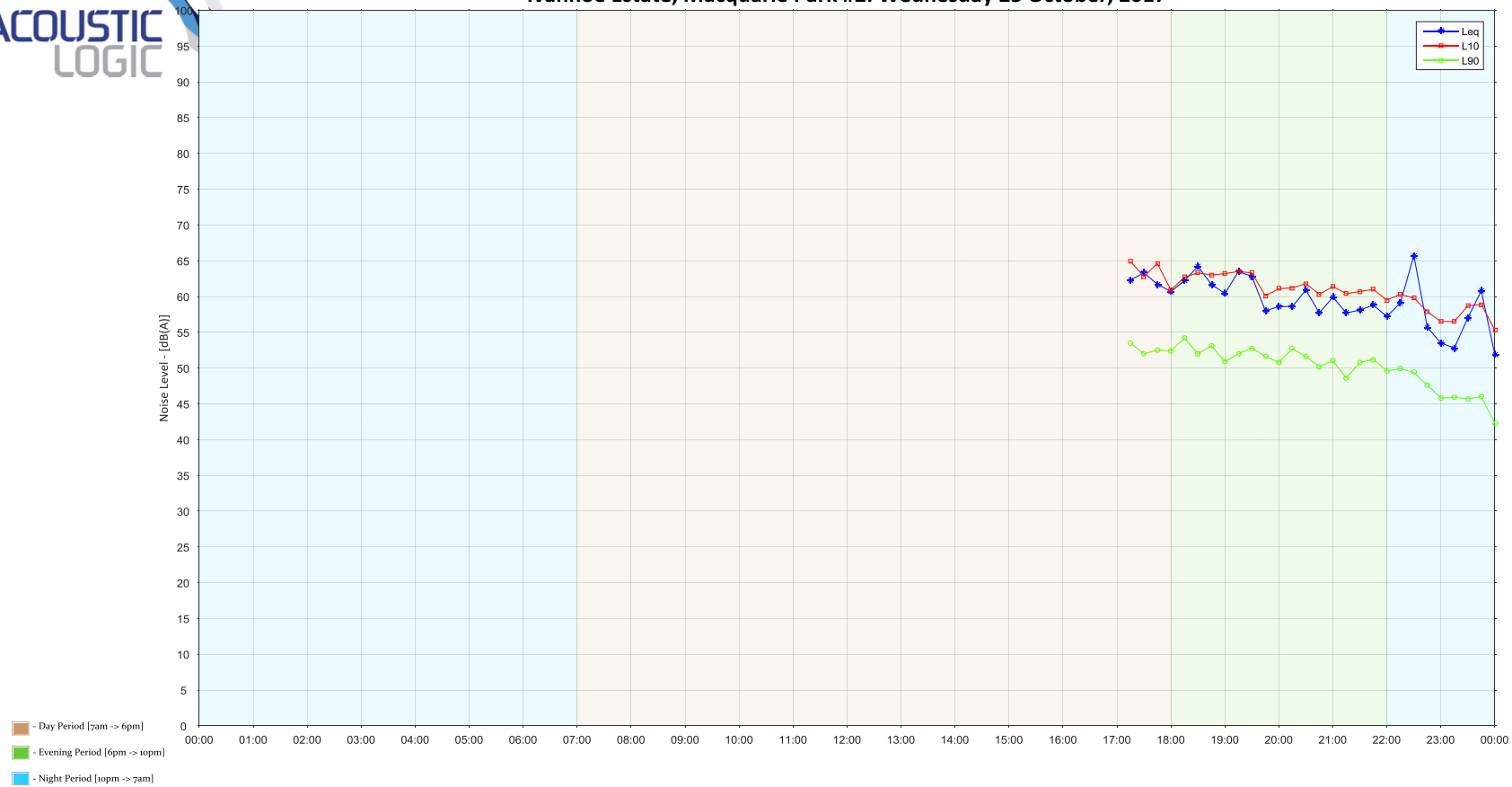
Yours faithfully,



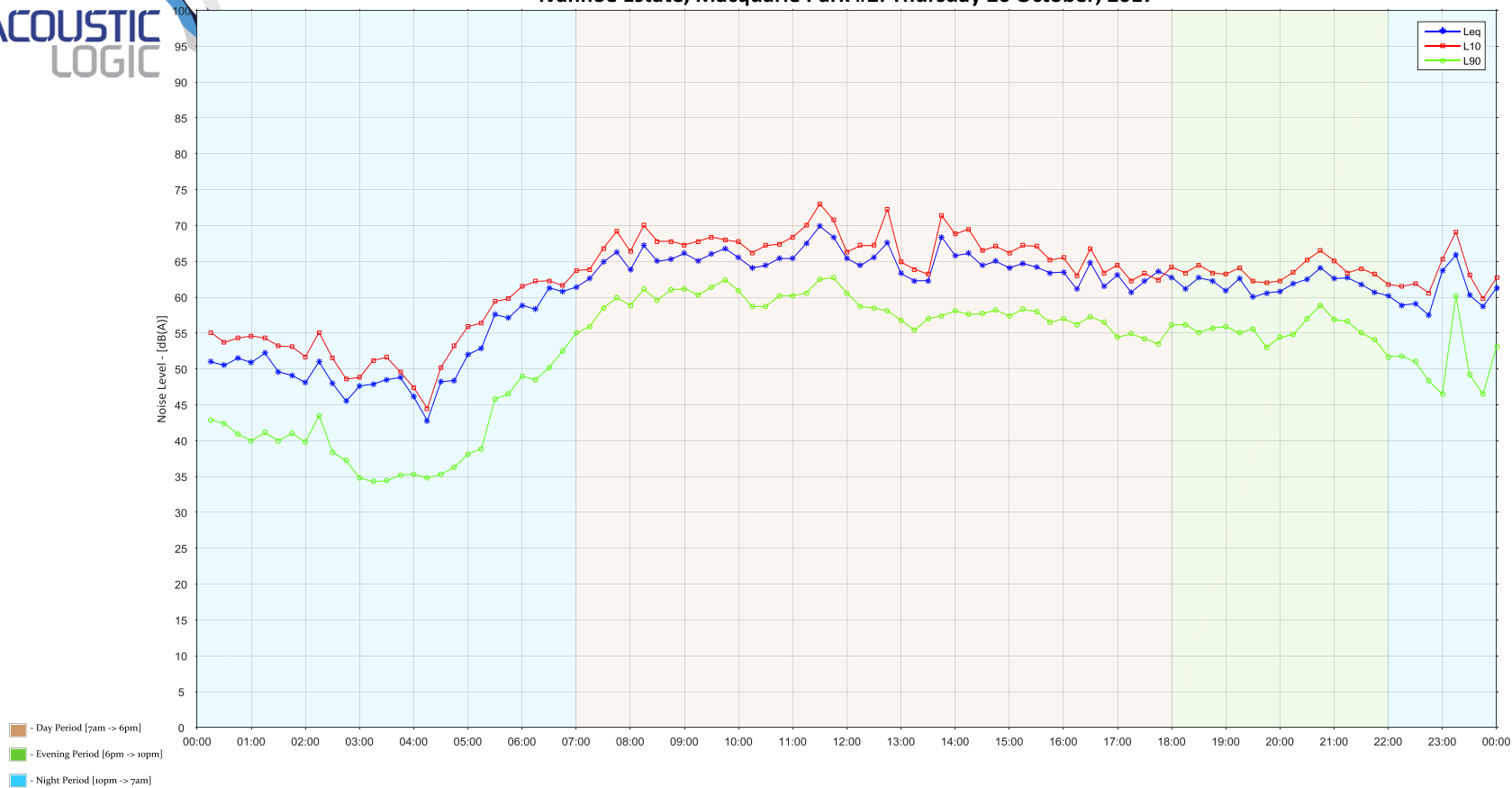
Acoustic Logic Consultancy Pty Ltd  
Shane Nichols

## **APPENDIX ONE – UNATTENDED NOISE MONITORING DATA – (HERRING ROAD) NOISE MONITOR**

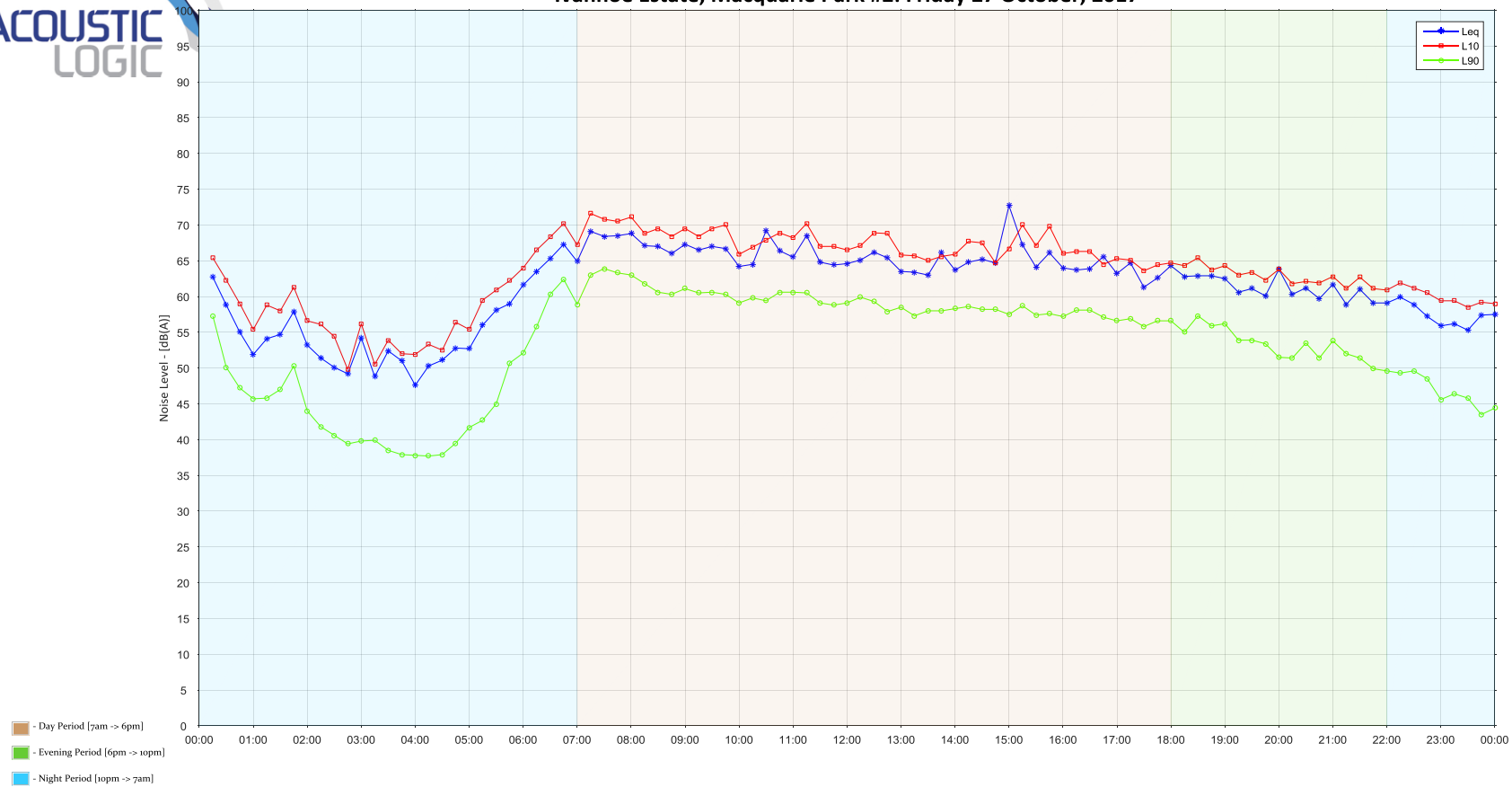
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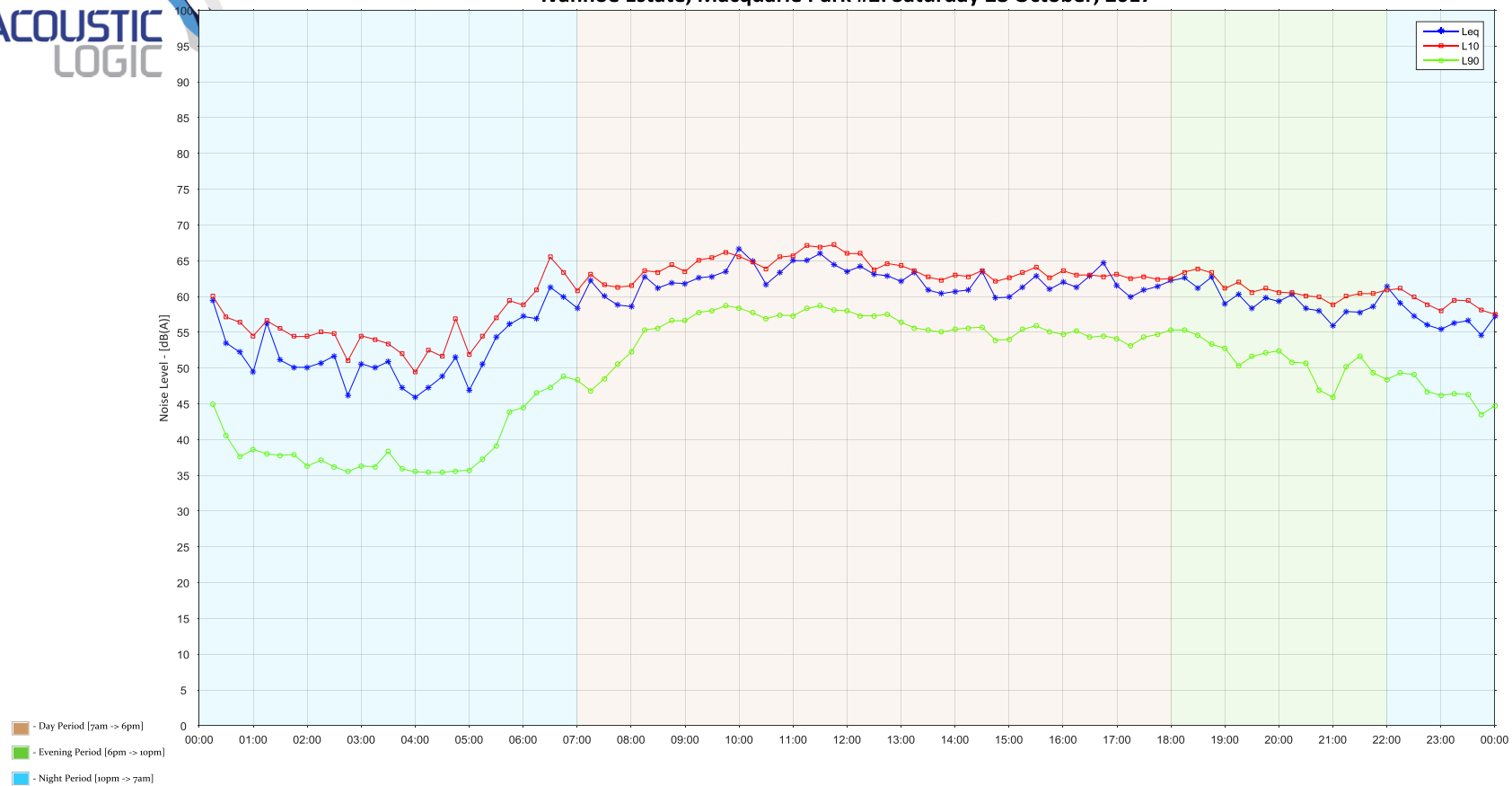
Ivanhoe Estate, Macquarie Park #2: Thursday 26 October, 2017



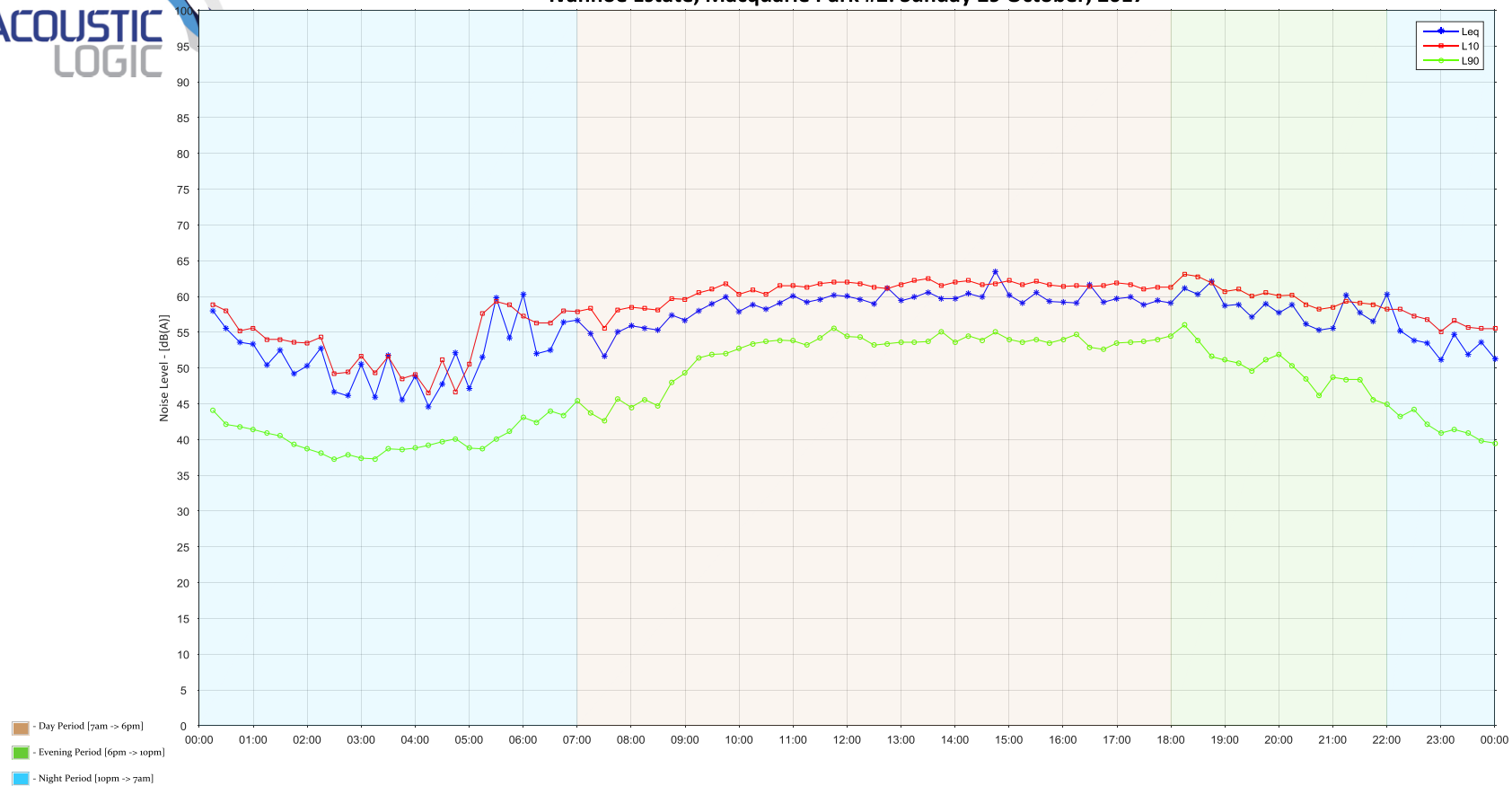
Ivanhoe Estate, Macquarie Park #2: Friday 27 October, 2017



Ivanhoe Estate, Macquarie Park #2: Saturday 28 October, 2017

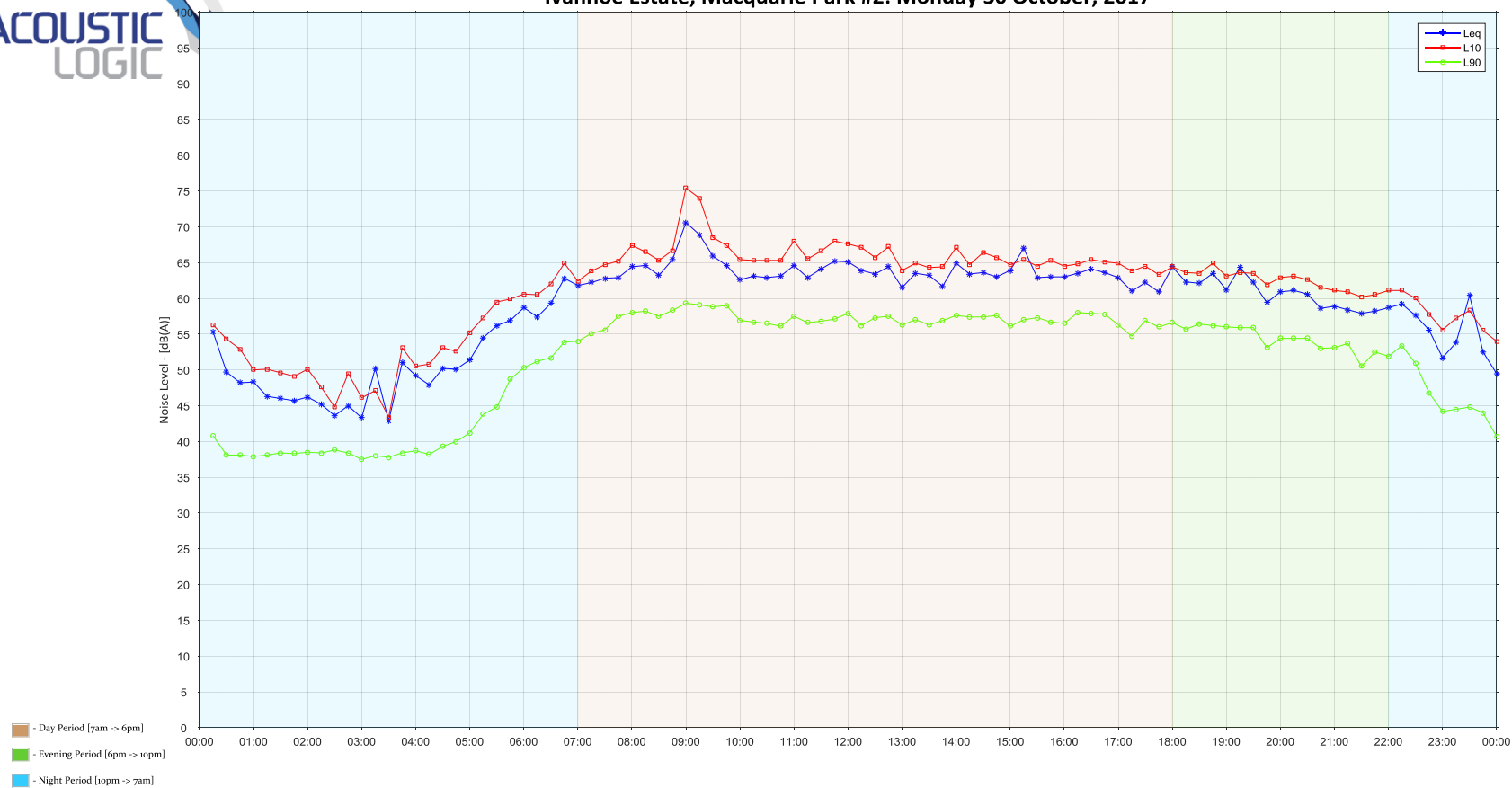


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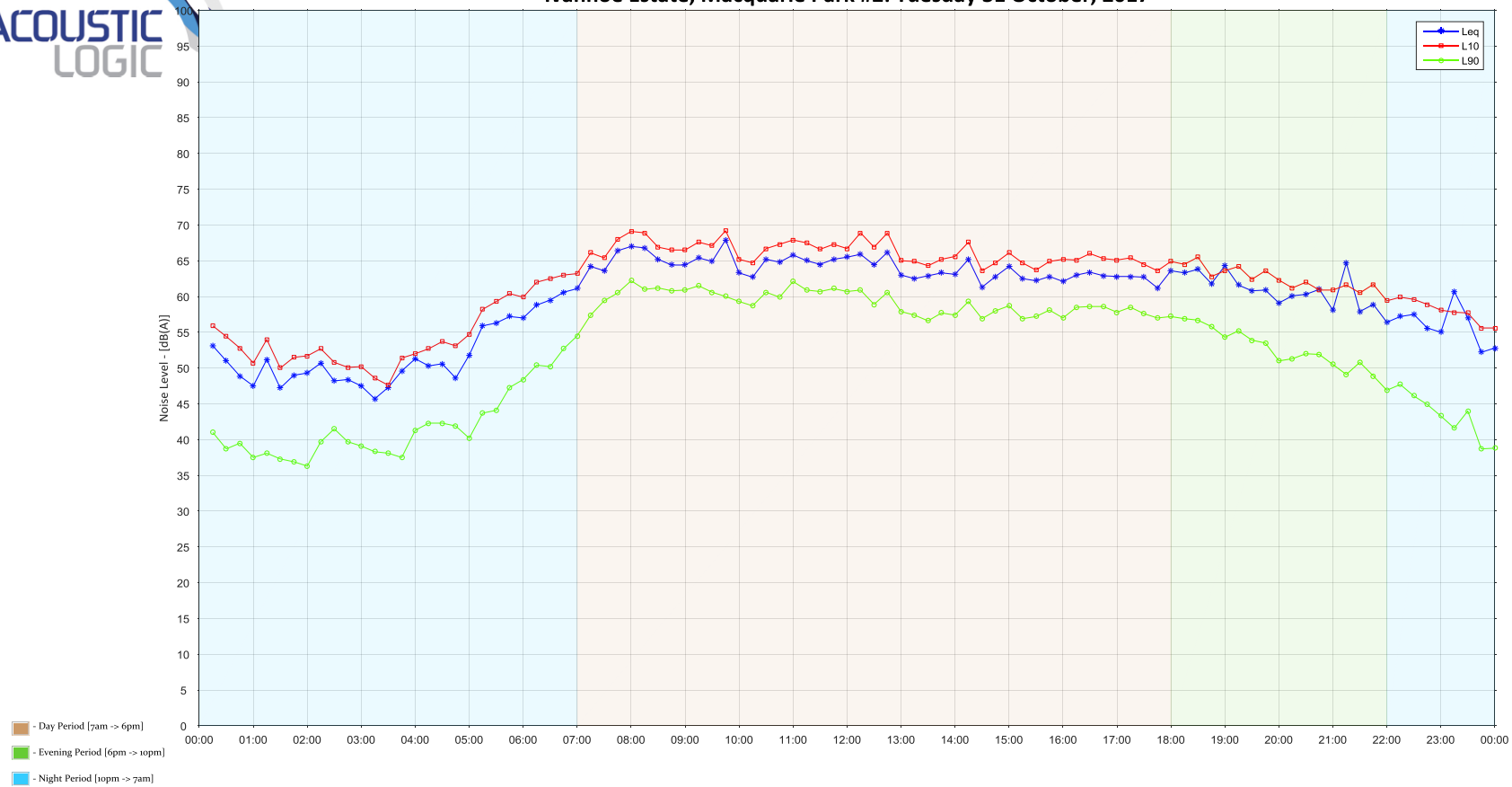




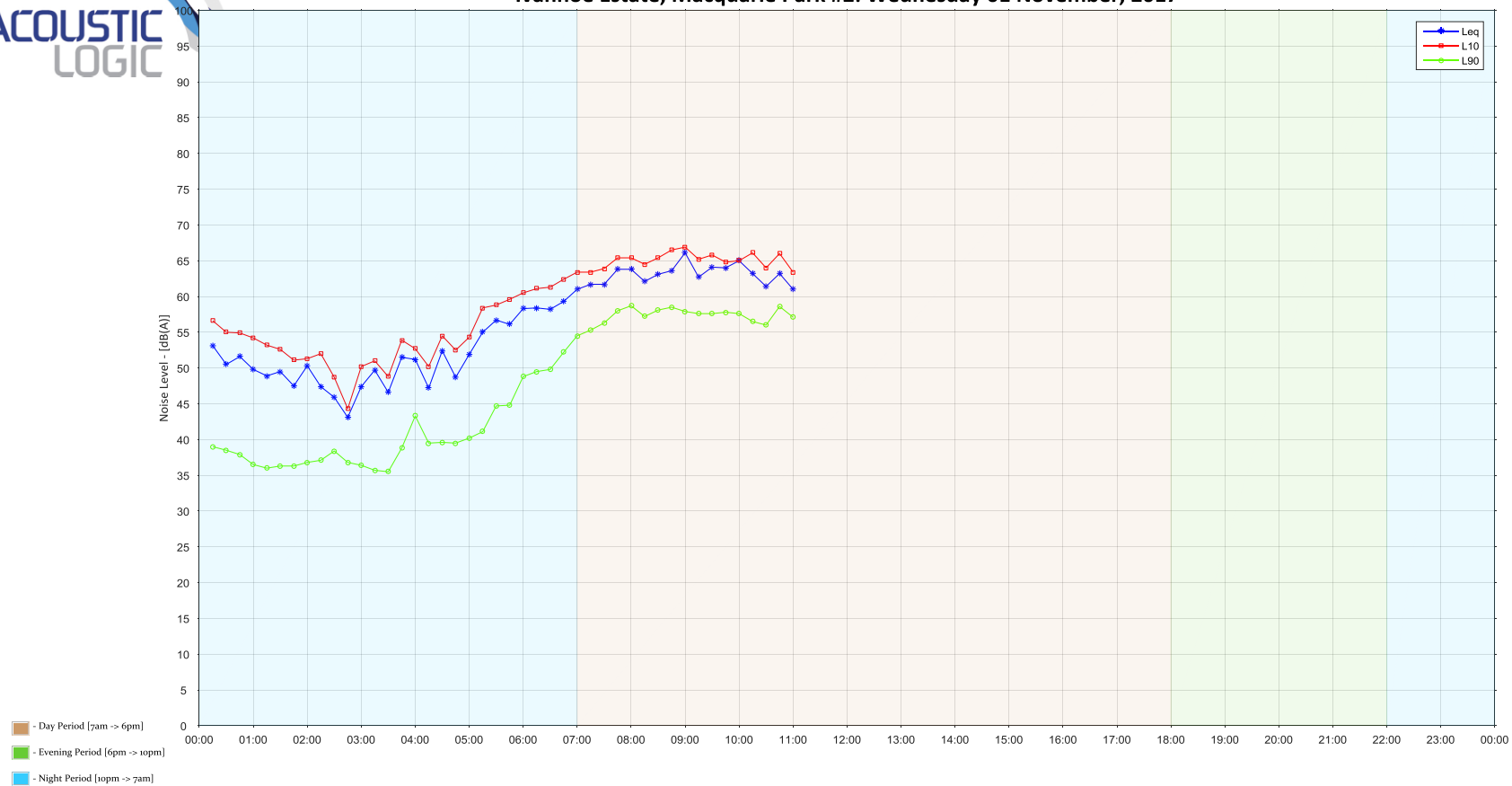
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Ivanhoe Estate, Macquarie Park #2: Tuesday 31 October, 2017

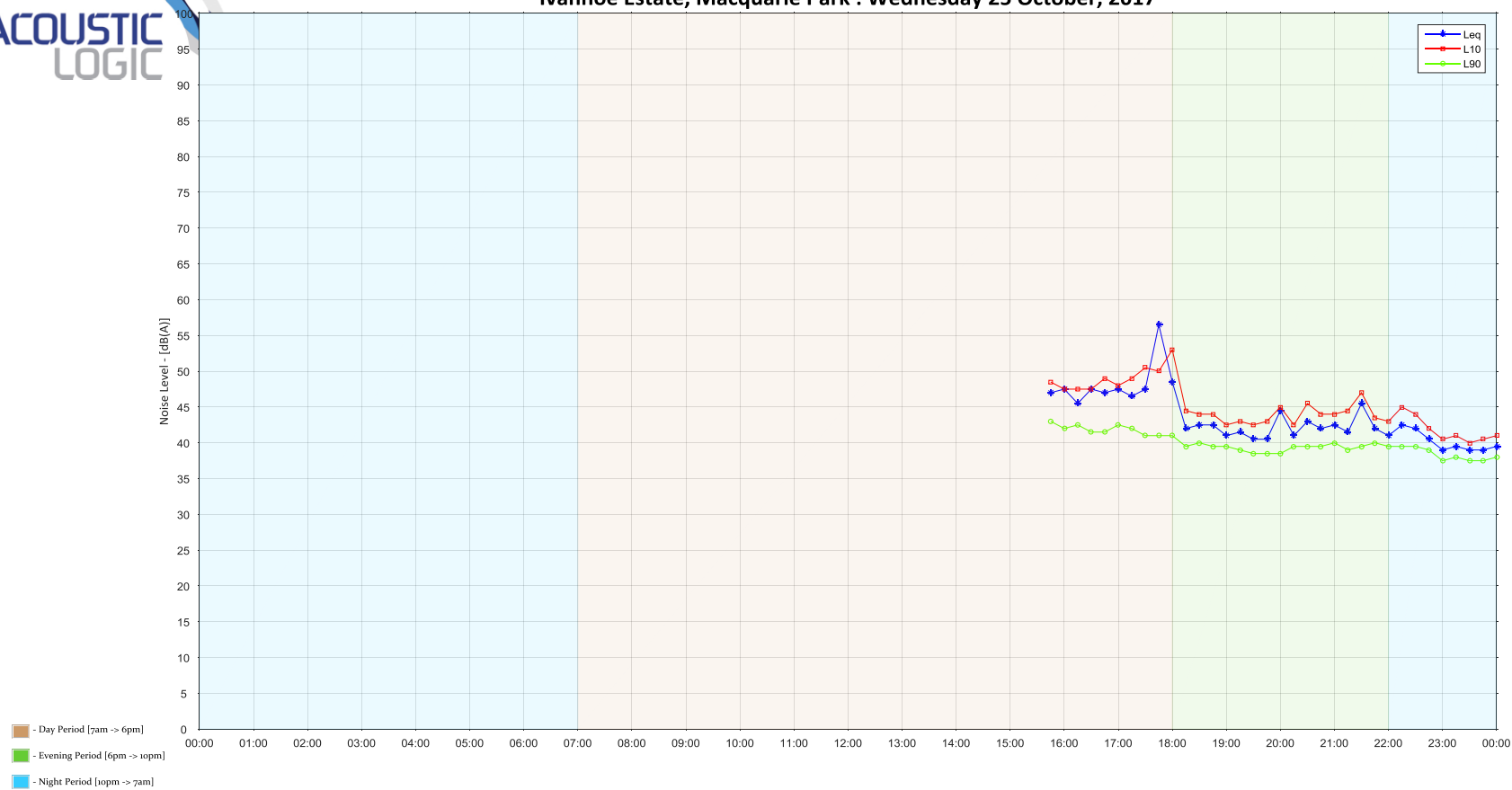


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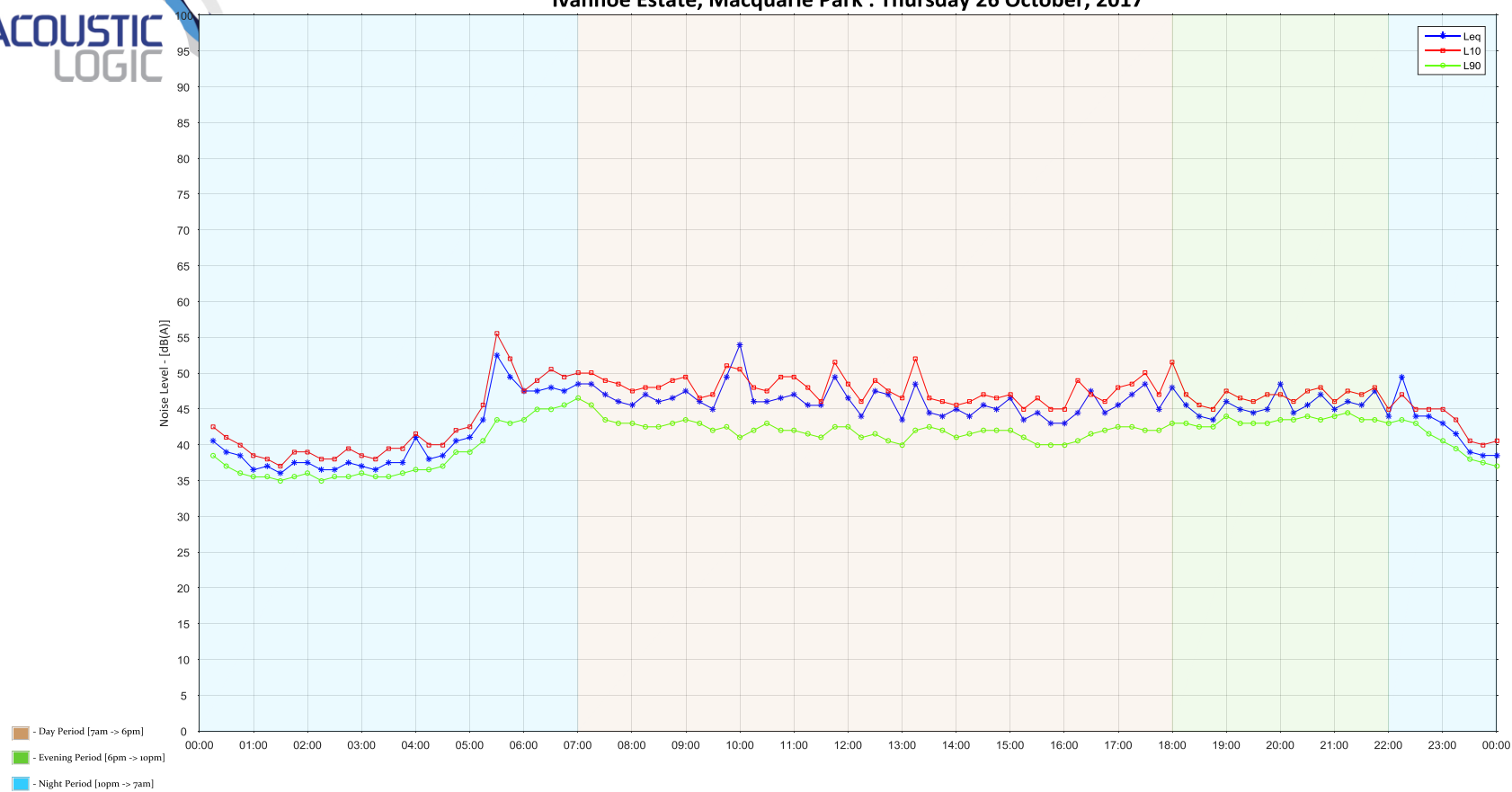


## **APPENDIX TWO – UNATTENDED NOISE MONITORING DATA – BACKGROUND NOISE MONITOR**

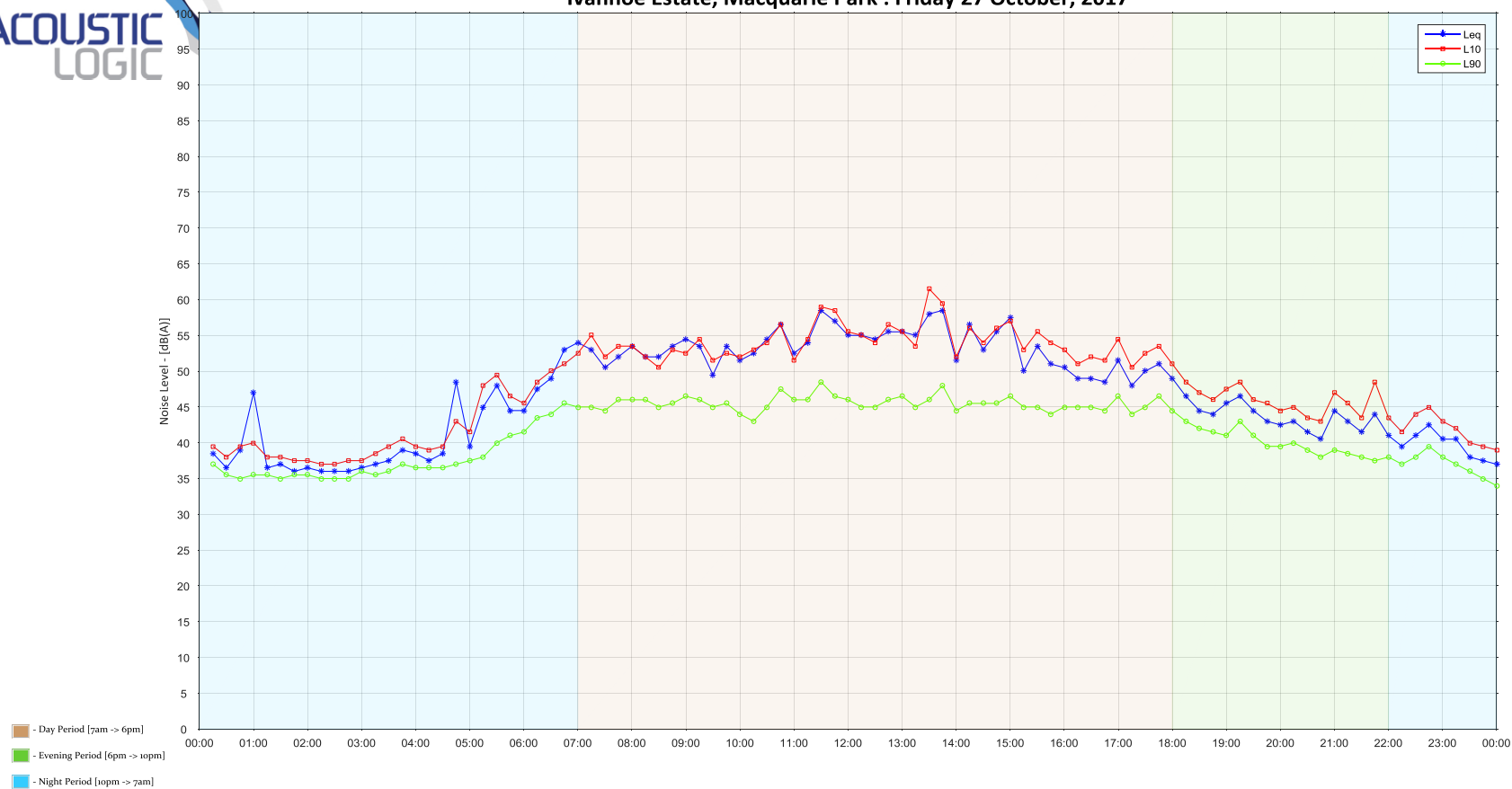
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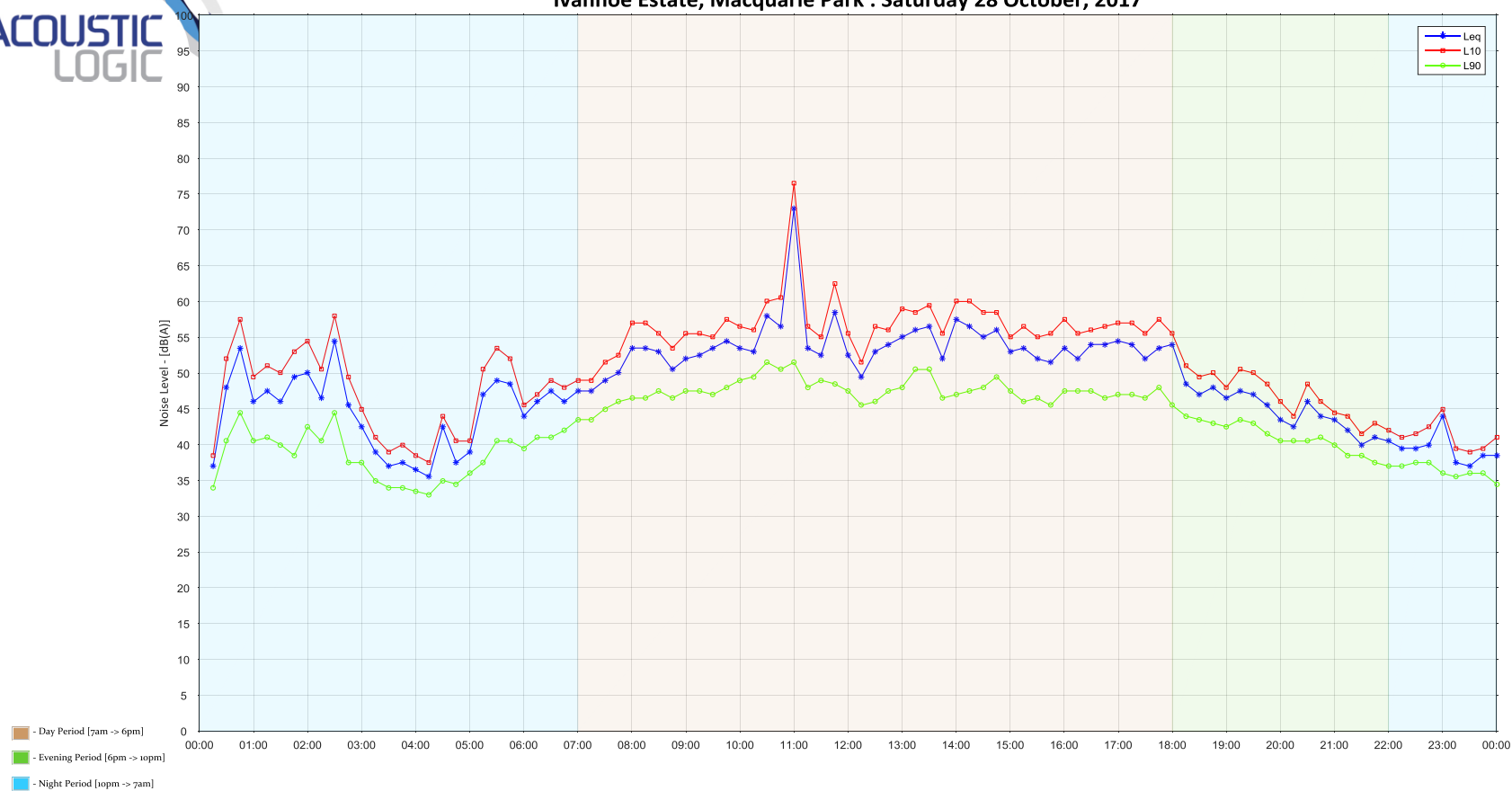
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Ivanhoe Estate, Macquarie Park : Friday 27 October, 2017

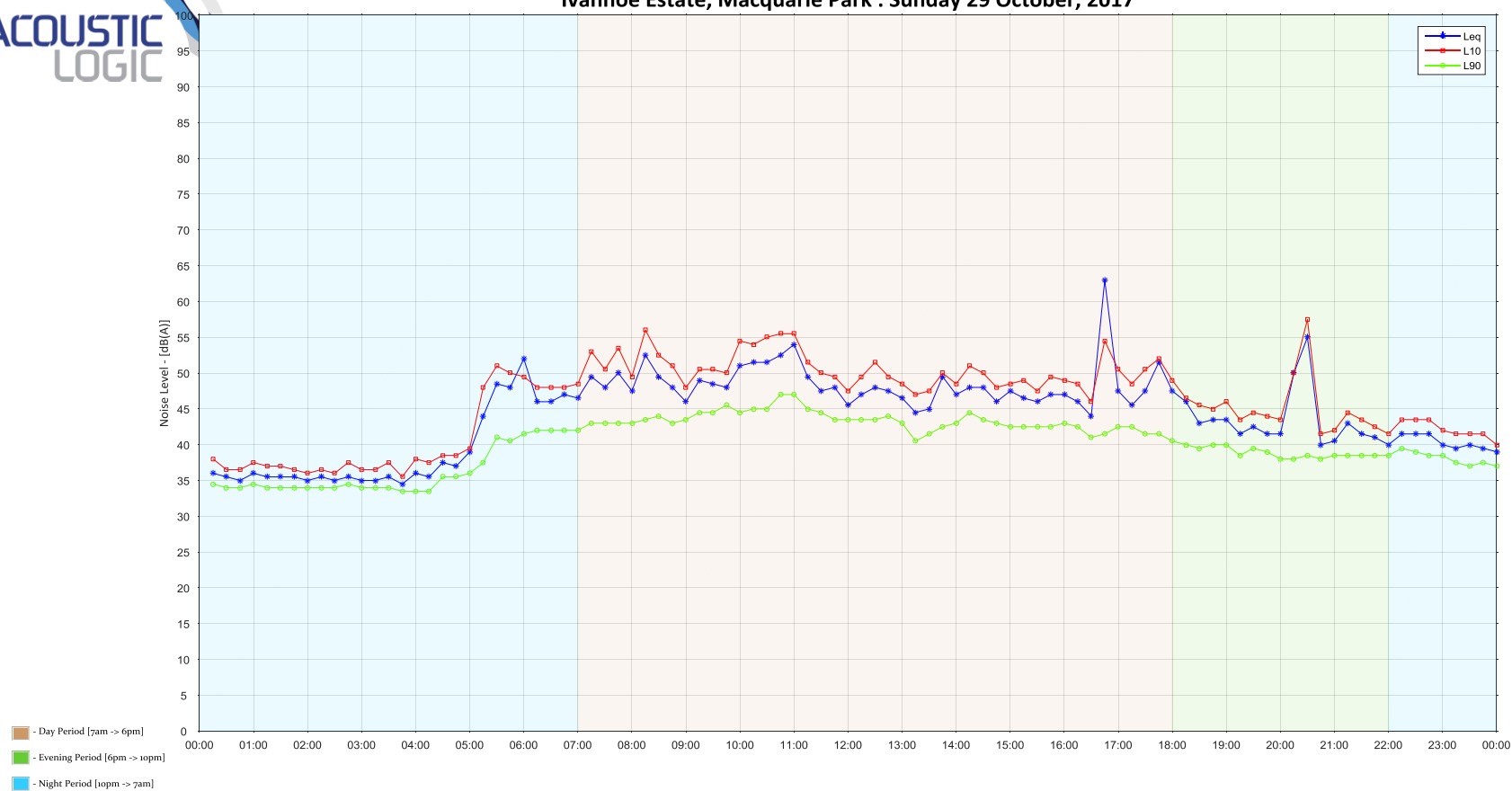


Ivanhoe Estate, Macquarie Park : Saturday 28 October, 2017

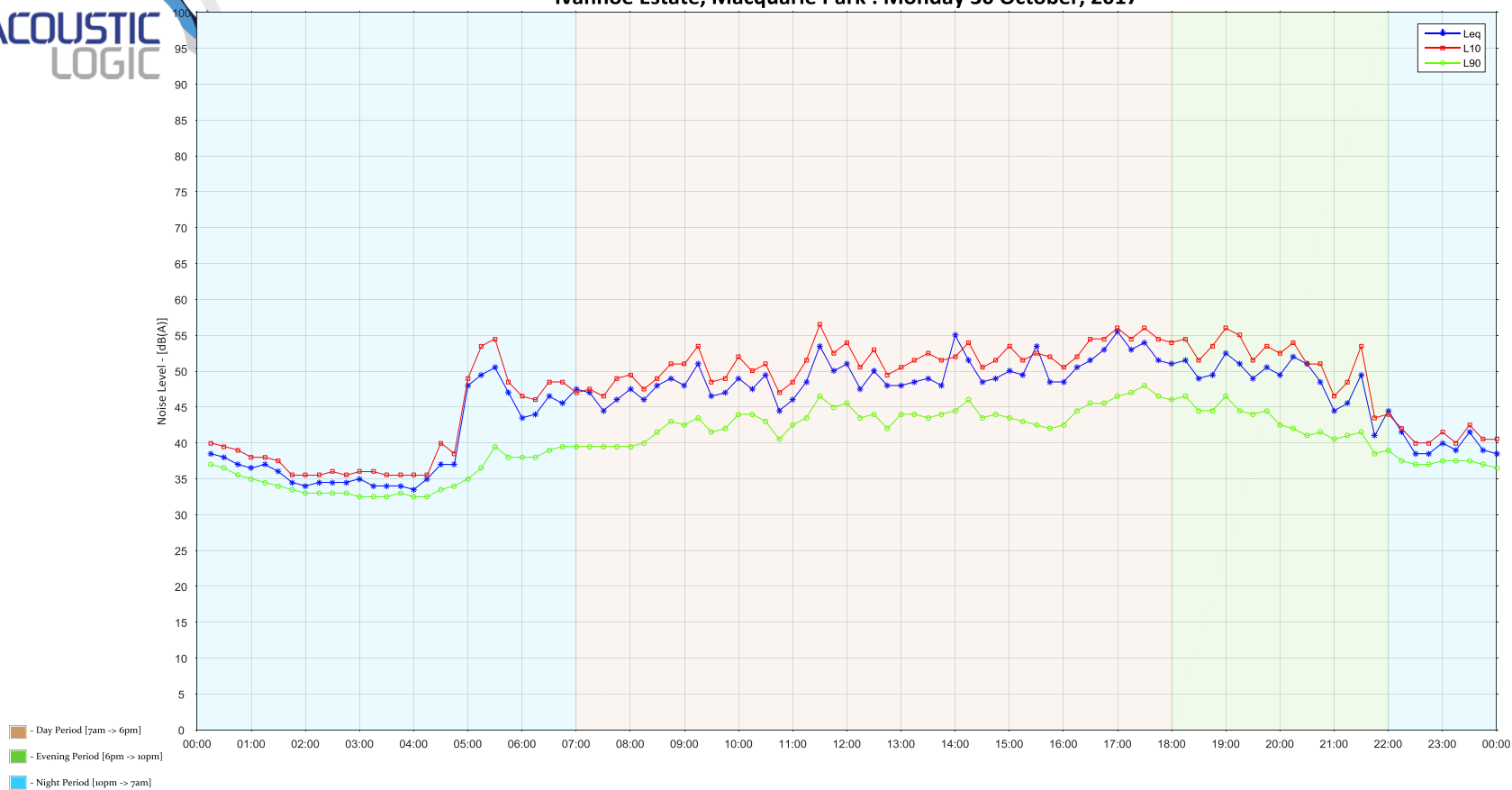




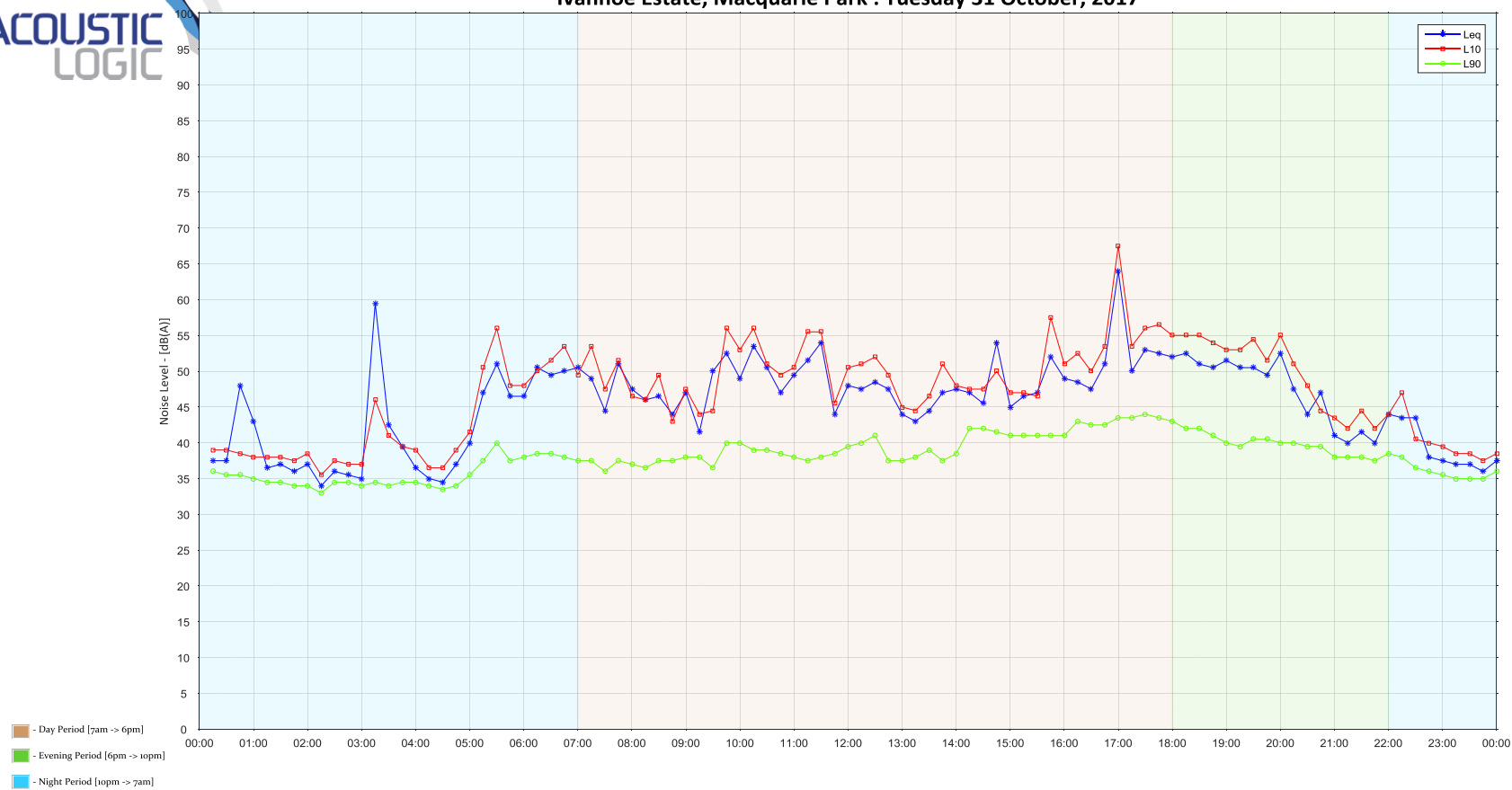
Ivanhoe Estate, Macquarie Park : Sunday 29 October, 2017



Ivanhoe Estate, Macquarie Park : Monday 30 October, 2017



Ivanhoe Estate, Macquarie Park : Tuesday 31 October, 2017



Ivanhoe Estate, Macquarie Park : Wednesday 01 November, 2017

