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**Operational Noise Assessment -
Proposed Warehouse and Logistics Estate**

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DOCUMENT CONTROL REGISTER

Project Number	20151211.4
Project Name	585-649 Mamre Road, Orchard Hills (SSD 7173)
Document Title	Operational Noise Assessment
Document Reference	20151211.4/0924A/R7/TT
Issue Type	Email
Attention To	Stephen O'Conner

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	9/02/2016	20151211.4/0209A/R0/TT	TT	TT	TT
1	9/02/2016	20151211.4/0209A/R1/TT	TT	TT	TT
2	20/03/2016	20151211.4/0209A/R2/TT	TT	TT	TT
3	23/03/2016	20151211.4/0209A/R3/TT	TT	TT	TT
4	23/03/2016	20151211.4/0209A/R4/TT	TT	TT	TT
5	31/03/2016	20151211.4/0209A/R5/TT	TT	TT	TT
6	31/03/2016	20151211.4/0209A/R6/TT	TT	TT	TT
7	5/04/2016	20151211.4/0209A/R7/TT	TT	TT	TT

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1 INTRODUCTION

Acoustic Logic Consultancy has been engaged to undertake an assessment of a proposed new Warehouse and Logistics Hub at 585-649 Mamre Road, Orchard Hills.

The assessment includes:

- An assessment of noise generated by the operational activities created by Lots 7, 8A and 8B.
- An assessment of construction noise, being:
 - Noise from earthworks and infrastructure in the Estate generally and
 - Noise from the construction of built form in lots 7, 8A and 8B.

In this report, we will:

- Identify nearby noise sensitive receivers and operational noise sources with the potential to adversely impact nearby development.
- Identify relevant Penrith City Council and Environmental Protection Agency (EPA) acoustic criteria applicable to the development (as required by Secretary Environmental Assessment Requirements).
- Identify operational and construction noise sources and predict operational noise emissions and assess them against acoustic criteria.
- If necessary, determine building and/or management controls necessary to ensure ongoing compliance with noise emission goals.

This report has been prepared in order to address potential noise and vibration impacts, raised as a “key issue” in the Secretary Environmental Assessment Requirements, dated 11 September 2015.

2 SITE DESCRIPTION AND PROPOSED WORKS

The site is located on Mamre Road, Orchard Hills.

The Estate is an industrial development comprising 9 lots which will be created by the rezoning of existing rural residential land (see serial photo below, and site plan in Appendix 3).

Lots 7, 8A and 8B are lots within the Estate. Development approval for the construction of warehouses on these lots is also sought as part of this application.

Lots 7, 8A and 8B are located centrally within the Estate and will comprise three warehouses:

- Lot 7:
 - Warehouse area: 36,000m².
 - Office: 1,695m².

- Dock Office: 147m².
- Lot 8A (use not yet determined).
 - Warehouse house area 18,170m².
 - Office: 1,000m².
- Lot 8B (use not yet determined).
 - Warehouse house area 19,120m².
 - Office: 1,000m².

Permission is sought for the use of the site to operate twenty four hours per day.

The use of the remaining lots has not been determined, and will be the subject of future development applications.

Vehicular access to the Estate is via driveways from Mamre Road. As part of the development of the Estate, construction of a number of internal roadways is proposed (refer to site plan, Appendix 3).

The Estate is bounded as follows:

- To the east by Mamre Road. Further to the east (on the far side of Mamre Road) lies industrial/commercial development.
- To the north, west and south by residential/rural development.
 - The nearest residential development lies immediately to the north of the site, approximately 250m from Lots 7, 8A and 8B. While it is anticipated that this site will be acquired by the RMS for infrastructure works, the precise timing of acquisition is not known, and so noise emissions from the proposed development will be assessed on the assumption that this property remains residential (Rural Residences A).
 - Residences to the west, further to the north (on Mandalong Close) are located further away (Rural Residences B and C - at least 400m away).
- We also note that primary access to the site will be via Mamre Road. There are residences on Mamre Road located to the north of the site with setbacks of approximately 25m from the edge of the road. These are the residences most potentially impacted by road traffic generated by the site (Residences D – as per aerial photo).

The primary noise source in the vicinity of the site is road traffic from Mamre Road.

See aerial photograph below.

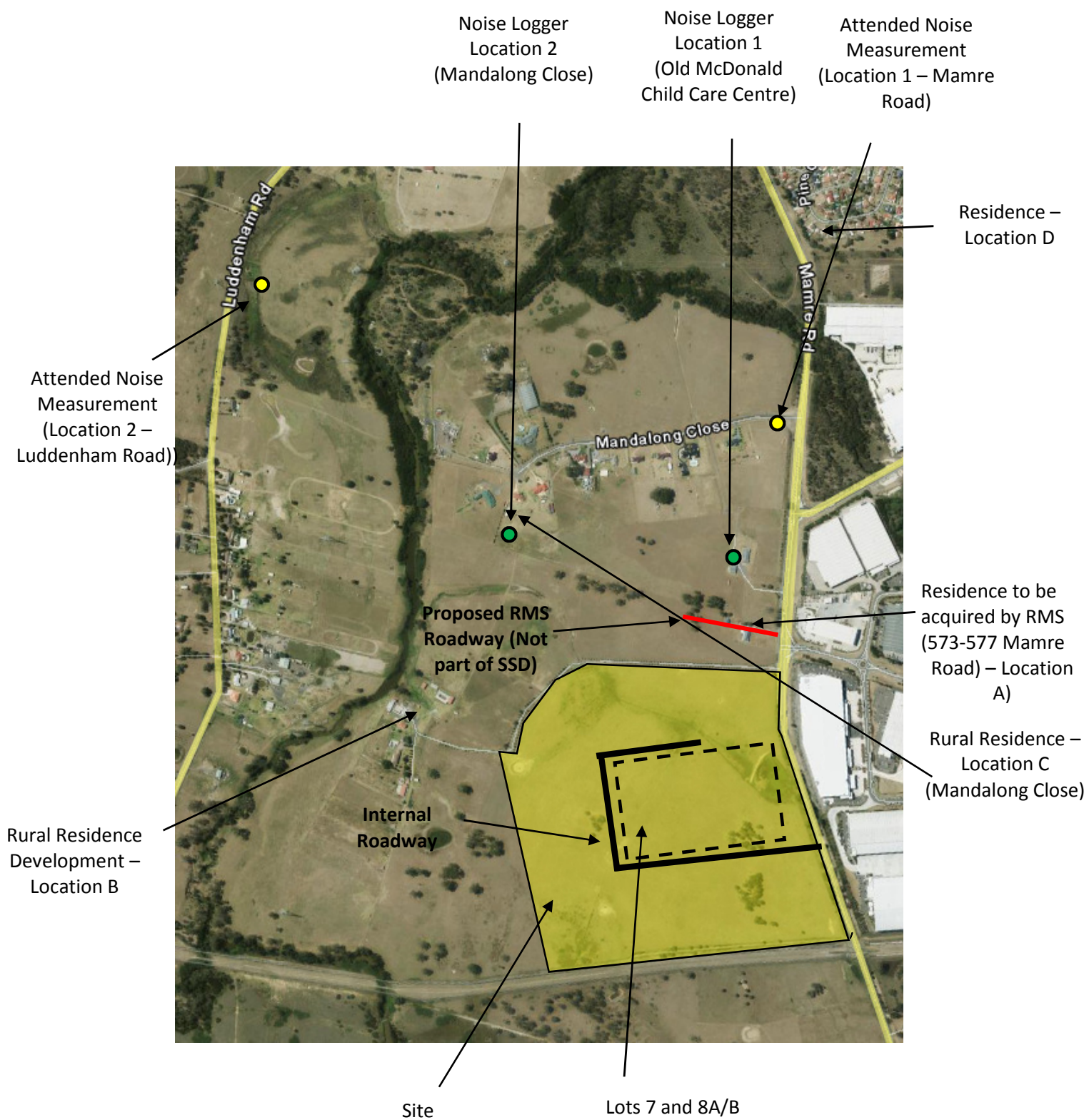


Figure 1: Site Photo

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 15-20 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 traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

L_1 levels represent is the loudest 1% noise event during a measurement period.

4 SURVEY OF AMBIENT NOISE

Both long term unattended noise logging, and attended noise measurements were conducted to quantify the existing acoustic environment at the site.

Unattended noise monitoring was conducted between 4 to 11 September 2015. Monitoring was conducted using two Acoustic Research Laboratories monitors set on A-weighted fast response mode. The monitors were calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded. The monitoring location is shown in section 2.

In addition, an attended measurement was made on 11 September 2015 to measure existing noise levels generated by traffic on Mamre and Luddenham Roads. This measurement was made using a Norsonic 118 Type 1 Sound Analyser set on A-weighted, fast response mode.

All measurement locations are marked in the aerial photograph in Section 2.

Periods of adverse weather have been eliminated when determining the rating background noise level at the site, which is presented below. Weather monitoring data has been taken from the Badgery's Creek weather station.

Measured noise levels (both the average/ L_{eq} and rating background noise level) are presented below. Average/ L_{eq} noise levels at the site are dominated by road traffic noise.

Table 1 – Long Term Noise Logging Data

Location	Time of Day		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
Noise Logger Location 1 (applicable to 573-577 Mamre Road – Resident A)	50dB(A) $L_{eq(Period)}$ 38dB(A) L_{90}	50dB(A) $L_{eq(Period)}$ 38dB(A) L_{90}	46dB(A) $L_{eq(Period)}$ 33dB(A) L_{90}
Noise Logger Location 2 (applicable to Residents B and C)*	50dB(A) $L_{eq(Period)}$ 38dB(A) L_{90}	50dB(A) $L_{eq(Period)}$ 34dB(A) L_{90}	46dB(A) $L_{eq(Period)}$ 34dB(A) L_{90}

*See aerial photo, section 2.

Table 2 – Attended Noise Measurement (Road Traffic Noise)

Location	Measured Noise Level - Daytime
Attended Measurement – Location 1 (40m from Mamre Road)	64dB(A) $L_{eq(15hr)}$
Attended Measurement – Location 2 (10m from Luddenham Road)	68dB(A) $L_{eq(15hr)}$

5 NOISE EMISSION CRITERIA

The Secretary Environmental Assessment Requirements (dated 11 September 2015) require (with respect to acoustics):

- *A quantitative noise and vibration assessment for construction and operation, including impacts on nearby sensitive receivers such as the new child care centre in the vicinity of the site and adjoining rural residential properties.*
- *Cumulative Impacts of other developments and*
- *Details of the proposed noise management/mitigation and monitoring measures.*

To address the issues raised, the following noise controls and guidelines will be used in the acoustic assessment of the site:

- Mamre West DCP.
- The Penrith DCP.
- The EPA Industrial Noise Policy
- The EPA Road Noise Policy
- EPA guidelines for sleep arousal (Application Notes to the Industrial Noise Policy).
- The EPA document –Assessing Vibration, A Technical Guideline.
- The EPA Interim Construction Noise Guidelines.

5.1 THE MAMRE WEST DCP

Section 6.5 of the Mamre West DCP addresses noise and vibration from the site. It is an objective of the DCP to “avoid significant environmental impacts arising from industrial development”.

The DCP, however, does not state any specific numerical noise emission goals. In the absence of this, the noise emission criteria of the EPA Industrial Noise Policy will be adopted, as this is the most commonly used guideline for the assessment of industrial noise. The noise emission requirements of the Industrial Noise Policy are set out in section 5.3 of this report.

We note that the “Controls” section of part 6.5 requires that where feasible, building form be used to provide noise screening, and the, amongst other things, any acoustic assessment should address vehicle movements, noise external activities (such as use of forklifts or similar) and to recommend any necessary noise attenuation treatments or management controls. Assessment of typical noise sources is set out in section 6 of this report, and the necessary building./management controls set out in section 7.

5.2 THE PENRITH DCP

Sections 12.1 and 12.4 of the Penrith DCP address noise impacts associated with industrial development.

Both sections of DCP note the importance of maintaining residential amenity.

Section 12.4 refers to the EPA Industrial Noise Policy in the assessment of plant and equipment noise generated by the site. This is discussed in detail below.

Section 12.1 deals with noise from traffic associated with a site, and refers to the guidelines of relevant state government authorities. In this case, this will be the EPA Road Noise Policy (also discussed below).

5.3 EPA INDUSTRIAL NOISE POLICY

Noise sources covered by this code will include vehicle noise (generated on the site) and mechanical services noise. Both the Intrusiveness and the Amenity criteria (as set out below) must be complied with.

5.3.1 INP - Intrusiveness Assessment

Intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels. The criteria are as follows:

Table 3 – EPA Intrusiveness Criteria (Residential Receiver A – 573-577 Mamre Road)

Location	Time of Day	Background noise Level - dB(A) _{L₉₀}	Intrusiveness Noise Objective dB(A) _{L_{eq}(15min)} (Background + 5dB)
All Potentially Affected Residential Properties	Day Time (7am - 6pm)	38	43
	Evening (6pm - 10pm)	38	43
	Night (10pm - 7am)	33	38

Table 4 – EPA Intrusiveness Criteria (Residential Receivers B and C)

Location	Time of Day	Background noise Level - dB(A) _{L₉₀}	Intrusiveness Noise Objective dB(A) _{L_{eq}(15min)} (Background + 5dB)
All Potentially Affected Residential Properties	Day Time (7am - 6pm)	38	43
	Evening (6pm - 10pm)	34	39
	Night (10pm - 7am)	34	39

5.3.2 INP - Amenity Assessment

The Amenity criteria set additional criteria based on the land use of the noise sensitive receivers.

Amenity criteria are as follows:

Table 5 – EPA Amenity Criteria

Receiver Location	Land Type	Time of Day	Amenity Noise Objective dB(A) _{Leq(Period)}
All Potentially Affected Residential Properties	Rural Residential	Day Time (7am – 6pm)	50
		Evening (6pm – 10pm)	45
		Night (10pm-7am)	40
Commercial	All	When in use	65
Industrial	All	When in use	70

5.4 SLEEP AROUSAL ASSESSMENT

Potential sleep arousal impacts should be considered for noise generated before 7am or after 10pm.

Short duration, intermittent noise events (typically trucks starting and the noise from the pneumatic break release valve, which engages when a truck leaves a stationary position) are typically assessed for potential sleep disturbance.

Potential impacts are assessed using the recommended procedure in the Application Notes to the EPA Industrial Noise Policy. As recommended in the Application Notes, when assessing potential sleep arousal impacts, a two stage test is carried out:

- Step 1 - An “emergence” test is first carried out. That is, the L_1 noise level of any specific noise source should not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident’s bedroom window between the hours of 10pm and 7am. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The guideline level is set out below.

Table 6 – Sleep Arousal (Emergence Criteria)

Location	Background Noise Level (10pm-7am) dB(A) _{L90}	Emergence Level dB(A) $L_{1(1min)}$
Residential Receiver A (573-577 Mamre Road)	33	48
Residential Receivers – B and C	34	49

- Step 2 - If there are noise events that could exceed the emergence level, 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 test takes into account the noise level and number of occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA Industrial Noise Policy, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

From 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.*

The internal noise level guidelines have also been adopted in this assessment.

5.5 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA Road Noise Policy.

Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby building facade.

Table 7 – Criteria for Traffic Noise Generated By New Developments

Road Type	Time of day	Permissible Noise Generation
Sub-Arterial (Mamre Road)	Day (7am to 10pm)	60dB(A) _{Leq(15hr)}
	Night (10pm to 7am)	55dB(A) _{Leq(9hr)}

However, if existing noise levels exceed those in the table above, section 3.4 of the Road Noise Policy is applicable, which requires noise impacts are 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.

5.6 CONSTRUCTION NOISE AND VIBRATION IMPACTS

5.6.1 EPA Interim Construction Noise Guidelines

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 effected” level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the “noise effected level”. For residential properties, the “noise effected” level occurs when construction noise exceeds ambient levels by more than:
 - 10dB(A) $L_{eq(15min)}$ for work during standard construction hours (7am-6pm Monday to Friday and 8am to 1pm on Saturdays) and
 - 5dB(A) $L_{eq(15min)}$ for work outside of standard construction hours.
- *“Highly noise affected level”.* Where noise emissions are such that nearby properties are “highly noise effected”, noise controls such as respite periods should be considered. For residential properties, the “highly noise effected” level occurs when construction noise exceeds 75dB(A) $L_{eq(15min)}$ at nearby residences.

A summary of noise emission goals for both standard hours of construction and outside standard hours are presented.

Table 8 – Construction Noise Emission Goals

Location	“Noise Affected” Level - dB(A) $L_{eq(15min)}$	“Highly Noise Affected” Level - dB(A) $L_{eq(15min)}$
Residences	48 (Standard Construction Hours)	75
Commercial	70	N/A
Industrial	75	N/A

5.6.2 Construction Vibration

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 9 – Construction Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
Commercial/Industrial	When in use	0.56	1.12
Impulsive Vibration			
Residences	Daytime	8.6	17
Commercial/Industrial	When in use	18	36

6 NOISE EMISSION ASSESSMENT

An assessment of operational and construction noise is presented below. The following noise sources are assessed:

- Operational noise from Lots 7, 8A and 8B, being:
 - Trucks driving on internal roadways and noise from use of forklifts.
 - Noise created on public roads as a result of traffic generated by the Lots 7, 8A and 8B.
 - A preliminary assessment of noise from mechanical plant.
- An assessment of construction noise and vibration from civil works/excavation/infrastructure within the Estate.

6.1 OPERATIONAL NOISE – LOTS 7, 8A AND 8B

6.1.1 On-site vehicle noise (trucks driving on site, noise from forklifts).

Noise generated by vehicles manoeuvring on the site is assessed with reference to the EPA Industrial Noise Policy.

In predicting operational noise emissions, the following assumptions have been made:

- That there is an articulated truck movement to/from Lots 7, 8A and 8B:
 - Up to five times in any fifteen minute period (at night time) and
 - Up to eighteen times in any fifteen minute (during the daytime/evening).
- Articulated trucks are assumed to have a sound power level of 105dB(A)_{Leq}, inclusive of a 5dB(A) penalty for a tonal reversing beacon when driving on the site or on internal roadways within the development.
- That there are up to 4 forklift continuously in operation in the hardstand area on the Lots. Forklifts are assumed to have a sound power level of 90dB(A)_{Leq}.

Predicted noise levels are set out below.

Noise emissions are predicted on the assumption that there is no noise screening provided by any future warehouses on the northern or western boundaries of the Estate (which will ultimately provide some noise screening).

As is consistent with EPA guidelines when assessing rural development, the noise emissions are assessed at point on the residential properties which is 30m from the location of the house.

Table 10 – Vehicle Noise Impact Assessment (Daytime/Evening)

Noise Source	Noise Receiver Location	Predicted Noise Level – dB(A) _{Leq(15min)}	Compliance
Articulated trucks driving to/from site, forklift operating on site.	Residential Receiver A (573-577 Mamre Road)	39dB(A) _{Leq(15min)}	Complies – Night time criteria (43dB(A) _{Leq(15min)} , table 3)
	Residential Receiver B (West of Site)	39dB(A) _{Leq(15min)}	Complies – Night time criteria (39dB(A) _{Leq(15min)} , table 4)
	Residential Receiver C (Mandalong Close)	36dB(A) _{Leq(15min)}	Complies – Night time criteria (39dB(A) _{Leq(15min)} , table 4)

Table 11 – Vehicle Noise Impact Assessment (Night Time)

Noise Source	Noise Receiver Location	Predicted Noise Level – dB(A) _{Leq(15min)}	Compliance
Articulated trucks driving to/from site, forklift operating on site.	Residential Receiver A (573-577 Mamre Road)	34dB(A) _{Leq(15min)}	Complies – Night time criteria (38dB(A) _{Leq(15min)} , table 3)
	Residential Receiver B (West of Site)	38dB(A) _{Leq(15min)} *	Complies – Night time criteria (39dB(A) _{Leq(15min)} , table 4)
	Residential Receiver C (Mandalong Close)	34dB(A) _{Leq(15min)} *	Complies – Night time criteria (39dB(A) _{Leq(15min)} , table 4)

* Predictions takes into account air absorption and adverse weather conditions (wind or temperature inversion). Calculation done as per table 5.10 *Engineering Noise Control* Beis and Hansen 1988. For Receiver A, effect of temperature inversion is less than 3dB(A), and therefore no further analysis required as per section 5.2 of the Industrial Noise Policy.

We note that noise emissions from Stage 1 (from trucks and use of forklifts) indicates that even night time use of the site can be conducted and noise levels compliant with EPA guidelines is achieved.

In addition, we note:

- Noise emissions have been predicted on the assumption that there are no warehouses around the perimeter of Stage 1 and therefore there is a line of sight between the internal roadways/external hardstand areas and the residences to the north and west. This is a conservative analysis.
- As other industrial units in Stage 1 are developed, warehouses along the northern and western boundaries of the site will provide noise screening from vehicle noise and from use of outdoor, hard stand areas (provided that the future warehouse sits between the vehicle and the residences to the north or west). This noise screening will reduce noise emissions by approximately 10dB(A).

- This noise screening will then in turn allow for a higher level of activity within the Estate (as the future industrial units are developed) while still complying with EPA guidelines.
- Obviously as the individual units are developed, it would be expected that there will be individual noise emission assessments made for the proposed use. The individual assessments would be expected to take into account:
 - The number and type of vehicle movements proposed.
 - The noise screening (if any) provided by the built form of any proposed warehouse.

Analysis indicates that the site is capable of complying with EPA guidelines both initially (when Lots 7, 8A and 8B are the only development in the Estate) and in the future (as the remaining lots within the Estate are developed).

6.1.2 Noise Generated by Additional Traffic on Public Roads

Noise created as a result of an increase in traffic on public roads is assessed with reference to the EPA Road Noise Policy (which supersedes the previous EPA guideline, the *Environmental Criteria for Road Traffic Noise*).

It is truck movement on Mamre Road which brings vehicles closest to residential development, being 573-577 Mamre Road (in the event it is not acquired prior to the development of the site) and Location D (as per aerial photo in section 2).

We note that Stage 1 is predicted to generate a total of 2,139 vehicle movements per day, with up to 20% predicted to be heavy vehicles on regional roads (as per Ason Group traffic projections for the site).

On reviewing a peak AM/PM period (with the PM period being the most critical), the site will generate a total of 66 vehicle movements on Mamre Road. On applying a 20% heavy vehicle split, this will equate to 13 heavy vehicle movements per hour which will run past the residences in a peak period (and 53 standard vehicles).

Assuming a typical sound power for vehicles driving at 60km/h of 105dB(A) for trucks and 94dB(A) for passenger vehicles (typical in Acoustic Logic experience) and adopting the traffic generation referred to above, the road traffic noise attributed to the development can be calculated, and assessed with reference to EPA Road Noise Policy Guidelines.

Predicted noise levels are as follows. As a conservative assessment, the peak daytime traffic generation is assessed with reference to the more stringent night time acoustic criteria.

Table 11 – Noise Generated by Additional Road Traffic Assessment

Receiver Location	Predicted Noise Level – dB(A) L_{eq}	Compliance
Existing residences Fronting Mamre Road (Location A – 573-577 Mamre Road)	53dB(A) $L_{eq(9hr)}$	Complies with Night time criteria (55dB(A) $L_{eq(9hr)}$)
Existing residences Fronting Mamre Road (Location D)	55dB(A) $L_{eq(9hr)}$	Complies with Night time criteria (55dB(A) $L_{eq(9hr)}$)

Noise from traffic on public roads generated by the site is expected to comply with EPA Road Noise Policy guidelines.

6.1.3 Transient Noise Events (Sleep Arousal)

Noise events occurring between 10pm and 7am should be assessed for potential sleep disturbance impacts on nearby residents.

The primary potential noise source will be the use of the pneumatic valve which engages when a truck moves from a stationary position. Based on measurements conducted by this office, the sound power of this noise event is 113dB(A) $L_{1(1min)}$.

The noise emissions at the window of the nearest residences are presented below. Predictions take into account distance correction and air absorption.

Table 12 – Sleep Arousal Assessment

Receiver Location	Noise Source	Predicted Noise Level	Emergence Test Level	Compliance
Residential Receiver A (573-577 Mamre Road)	Truck Brake	48dB(A) $L_{1(1min)}$	48dB(A) $L_{1(1min)}$	Complies with BG+15 test.
Residential Receiver B (West of Site)	Truck Brake	47dB(A) $L_{1(1min)}$	49dB(A) $L_{1(1min)}$	Complies with BG+15 test.
Residential Receiver C (Mandalong Close)	Truck Brake	45dB(A) $L_{1(1min)}$	49dB(A) $L_{1(1min)}$	Complies with BG+15 test.

* Prediction takes into account air absorption and adverse weather conditions (wind or temperature inversion). Calculation done as per table 5.10 *Engineering Noise Control* Beis and Hansen 1988. For Receiver A, effect of temperature inversion is less than 3dB(A), and therefore no further analysis required as per section 5.2 of the Industrial Noise Policy.

Noise emissions from the truck brake are predicted to be less than 15dB(A) above the night time background noise level, and therefore compliant with the EPA sleep disturbance “emergence” test. Given that compliance with the emergence test is achieved, no further detailed analysis is typically required.

In addition, we note:

- Assuming that the bedroom/living room window of a residence is left *open*, the noise level within the nearest residence (573-577 Mamre Road) is predicted to be 38dB(A)_{L1} (as there is typically a 10dB(A) reduction between outside to inside through an open window).
- In this regard we note that the EPA Road Noise Policy states that “*maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep*”. The predicted noise level of 38dB(A) is well this 50-55dB(A) target for the noise level inside the residence. EPA sleep disturbance probability tables predict the chance of sleep disturbance as a result to be 0%.

On this basis, use of the site between 10pm and 7am to allow for vehicles to enter/leave the site) is compliant with EPA sleep disturbance guidelines.

Further, following the development of remaining lots at the site, the line of sight between any vehicle and a resident will be broken by new warehouses. This would further reduce noise emission by at least 7dB(A).

6.1.4 Mechanical plant

Detailed review of all external mechanical plant should be undertaken at construction certificate stage (once plant selections and locations are finalised). Acoustic treatments should be determined in order to control plant noise emissions to the required levels set out in section 5 of this report.

Compliance with noise emission requirements will be achievable with appropriate acoustic treatment. However, it is likely that any large roof top equipment which operates 24 hours per day (such as refrigeration plant) will require a noise screens to provide a line of sight break between the equipment and the residence at 573-577 Mamre Road.

6.2 CONSTRUCTION IMPACTS - CIVIL WORKS WITHIN THE ESTATE

6.2.1 Construction Noise

With respect to construction noise, the impact on nearby development will be dependent on the activity in question and where on the site the activity is undertaken. Excavation and piling works tend to be the loudest typical construction activity. Work close to the northern and western boundaries of the Estate will have greatest potential impact on residential dwellings.

Primary noise emissions will occur during excavation/site levelling. Equipment items will typically have sound power levels of approximately 110-115dB(A)_{L_{eq}(15min)}. Predicted noise levels at nearby development are:

- Up to 47dB(A)_{L_{eq}}, at the nearest residence to the north (573-577 Mamre Road) during construction of the Lots 7, 8A and 8B. This is compliant with the EPA “Background+10dB(A)” noise emission goal for construction noise (during the daytime)

- We note that civil works and construction along the northern site boundary of the Estate will be much closer to 573-577 Mamre Road (as close as 70m away). At this time, construction noise will be louder (up to 60dB(A)_{L_{eq}}). However:
 - Although this is technically an exceedance of EPA construction noise guidelines, we note that at 60dB(A), the construction noise will still be quieter than the daytime traffic noise level from Mamre Road.
 - The construction noise will also be well below the EPA “Highly Noise Effectuated” level of 75dB(A).
- Noise levels at all other residences (to the west, and further to the north on Mandalong Close) will also be compliant with EPA construction noise guidelines.

Provided that construction works are limited to standard construction hours (7am-6pm), and are suitably managed, excessive construction noise impact will be avoided.

In light of the above, we recommend:

- For Lots 7, 8A and 8B, construction noise management is not likely to be required, given the distance from the site to the nearest residences.
- For civil works within the Estate and during construction on the lots along the northern boundary of the Estate, acoustic review of proposed construction activities and plant/methods should be undertaken to identify the extent and duration of potential exceedances of EPA Noise Effectuated levels (ie – “background+10dB(A)”). Noise emissions may intermittently exceed the EPA “Noise Management Level”, however will not exceed the “Highly Noise Effectuated Level”. A suitable Construction Noise Management Plan will be satisfactory to ensure noise impacts on 573-577 Mamre Road are achieved. The management plan would address selection of plant, use of screens around static plant, scheduling of noisy works, notification of adjoining land users.
- However, in the event that 573-577 Mamre Road is acquired prior to work commencing, construction noise management is not required given the distance to the remaining residences.

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

6.2.2 Construction Vibration

Excavation, earth retention and civil works are the primary vibration generating activities.

Given the distance between the Estate and the nearest residential buildings, it is unlikely that construction vibration will exceed EPA guidelines (for amenity) and *highly* unlikely to approach vibration levels with the potential to cause building damage. Construction vibration mitigation is not warranted.

7 RECOMMENDATIONS

7.1 DISCUSSION

Acoustic analysis indicates that:

- Noise from Lot 7, 8A and 8B will comply with relevant EPA noise emission requirements provided that the recommendations set out in section 7.2 are adopted.
- Noise from remaining lots (Lots 8A, 8B and remaining lots within the Estate) is capable of complying with EPA guidelines. As detailed in section 6, even assuming high levels of traffic generation and on site activity within the Estate, compliant noise levels can be achieved, indicating the cumulative noise impacts for multiple users of the Estate is still capable of meeting EPA guidelines.
- Noise from civil works in Estate will comply with EPA construction noise guidelines in the event that 573-577 Mamre Road is acquired prior to commencement of works. In the event that civil works commence prior to acquisition of 573-577 Mamre Road, we recommend that a Construction Noise Management Plan be developed to minimise construction impacts in accordance with EPA Interim Construction Noise Guidelines.

7.2 RECOMMENDATIONS

Noise screen:

- Construct a noise screen along the northern boundary of the Estate. The screen is to be positioned such that it breaks any line of sight between any internal roadway and the residence at 573-577 Mamre Road (see markup – appendix 2). Screen to be minimum 2.4m high and constructed of lapped and capped timber, Colorbond or masonry.
- In the event that there is any significant outdoor activity on lots on the northern boundary of the Estate, those lots will potentially also require a noise screen. The need for this would be determined in any development application for that lot.
- In the event that 573-577 Mamre Road is acquired prior to commencement of operation of the site, the screen will not be required.

To ensure ongoing compliance with EPA requirements:

- For use of the proposed Lots 7, 8A and 8B (prior to the construction of any other warehouses in Stage 1):
 - At night time - there should be no more than five truck movements to or from the site in any 15 minute period. Up to 18 per 15 minutes are permitted during the day and evening periods.
 - In the event that these lots become operational before the acquisition of 573-577 Mamre Road - there should be no more than 4 forklifts in continuous operation at any one time in each of the hard stand area of Lot 7 and 8B. This restriction need not apply once 573-577 Mamre Road is acquired.

- Forklifts are to be electric or gas powered (not diesel) and should have non-tonal reversing beacons. If a diesel forklift is proposed, this should be the subject of acoustic assessment by the proposed tenant.
- Detailed acoustic review of any external mechanical plant (or plant ducted to external louvres) is to be conducted at CC stage, once plant and equipment selections are finalised).
- An acoustic assessment should be submitted with any development application for use of the other industrial units in Stage 1. The acoustic assessment should specifically identify:
 - Proposed numbers of vehicles movements associated with the lot.
 - Any noisy activities to be conducted in external areas (such as use of forklifts, truck washes or similar).
 - Detailed acoustic review of any external mechanical plant (or plant ducted to external louvres) is to be conducted at CC stage, once plant and equipment selections are finalised).

The existing contribution of any pre-existing mechanical noise should be taken into account when setting noise emission goals, with adjustments to EPA Amenity noise emission goals made as necessary (to avoid “background” creep).

In the event that civil works commence prior to acquisition of 573-577 Mamre Road, we recommend that a Construction Noise Management Plan be developed to minimise construction impacts in accordance with EPA Interim Construction Noise Guidelines.

8 CONCLUSION

Noise emissions associated with the operation of three proposed warehouses on Lots 7, 8A and 8B at 585-649 Mamre Road, Orchard Hills have been assessed with reference to relevant EPA and Penrith Council acoustic guidelines in order to address Secretary Environmental Assessment Requirements.

An analysis of typical operational noise (vehicle, mechanical equipment equipment) indicates that:

- The proposed use of Lots 7, 8A and 8B will be compliant with noise emission requirements provided that the recommendations in section 7 of this report are adopted.
- For the remaining units in the Estate - the site is capable of complying with relevant noise emission criteria, even when considering the cumulative impact of multiple potential users of the Estate.

Acoustic treatments for control of noise emissions have been presented in Section 7 of this report. Provided that these recommendations are followed, compliant noise levels will be achieved, both for Lots 7, 8A and 8B and in the event of future approvals for remaining units.

With respect to construction noise:

- An assessment of noise generated by the construction of the built form of the proposed warehouses for Lots 7, 8A and 8B has been undertaken. Construction noise is expected to be compliant with EPA Construction Noise Guidelines.
- Noise as a result of civil works in the Estate generally has also been conducted. In the event that civil works are commenced prior to the acquisition of 573-577 Mamre Road, we recommend that a Construction Noise and Vibration Management plan be prepared to ensure the construction noise impacts are minimised.

Please contact us if you have any queries.

Yours faithfully,

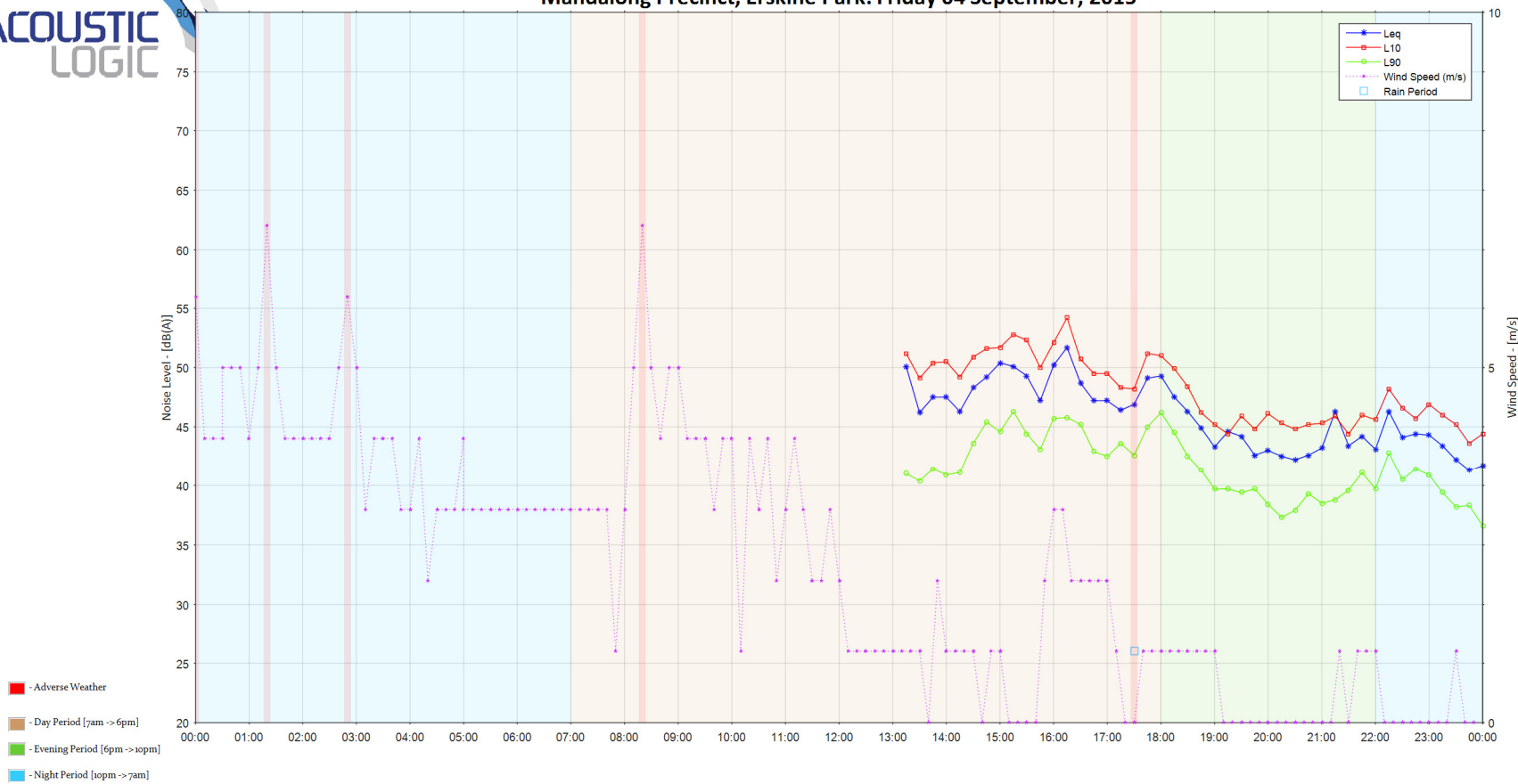


Acoustic Logic Consultancy Pty Ltd
Thomas Taylor

Appendix 1

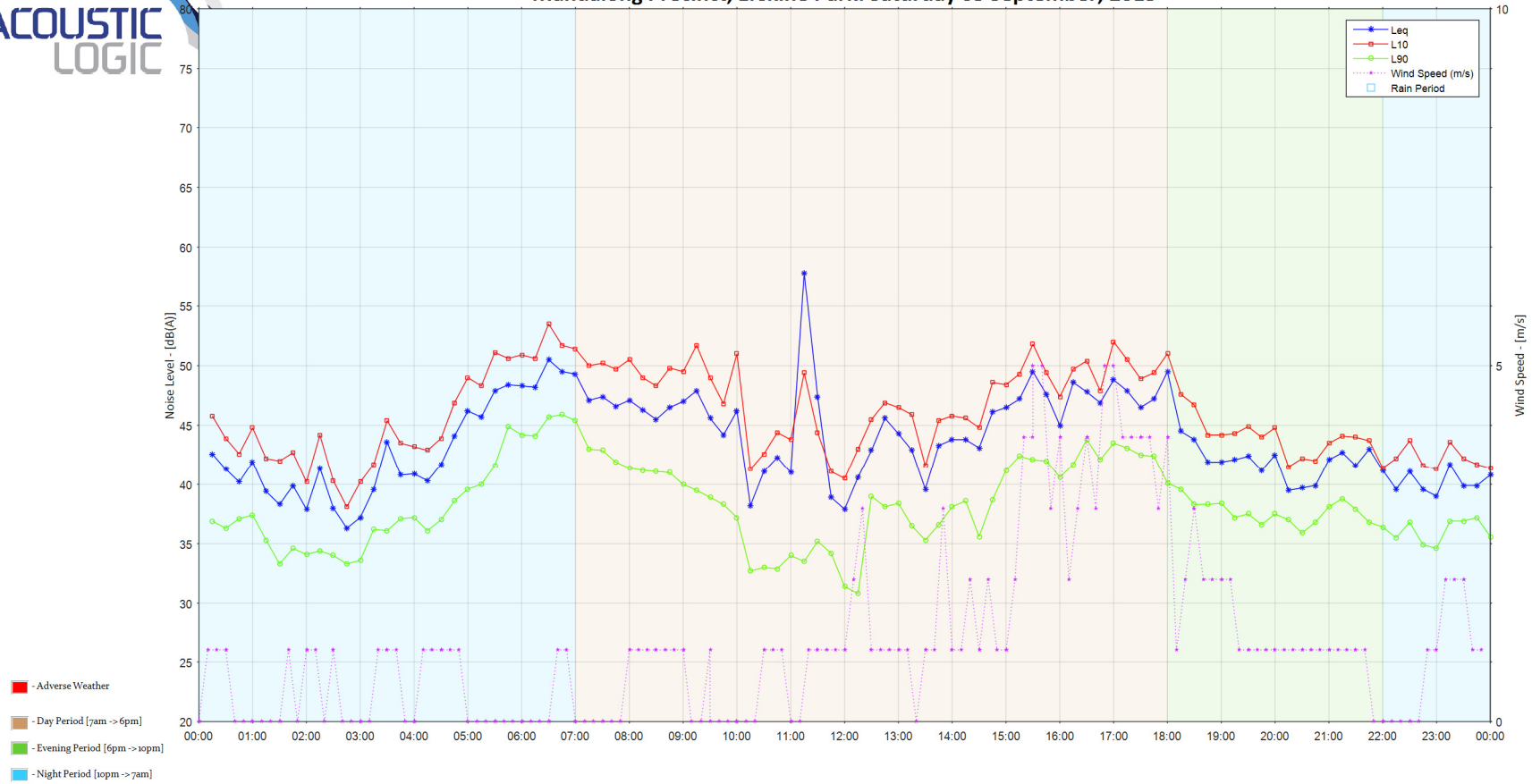
Noise Logging Data

Mandalong Precinct, Erskine Park: Friday 04 September, 2015



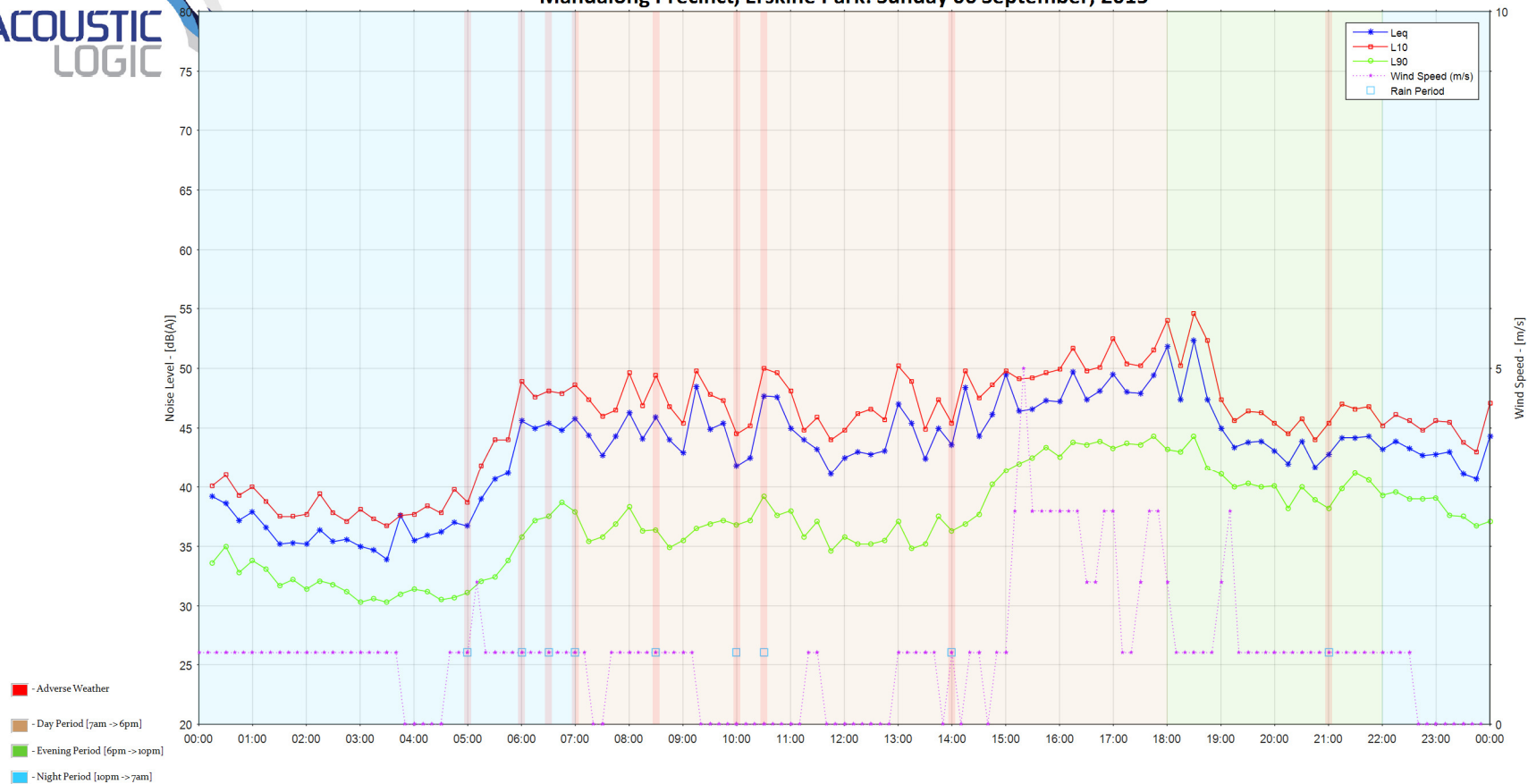


Mandalong Precinct, Erskine Park: Saturday 05 September, 2015

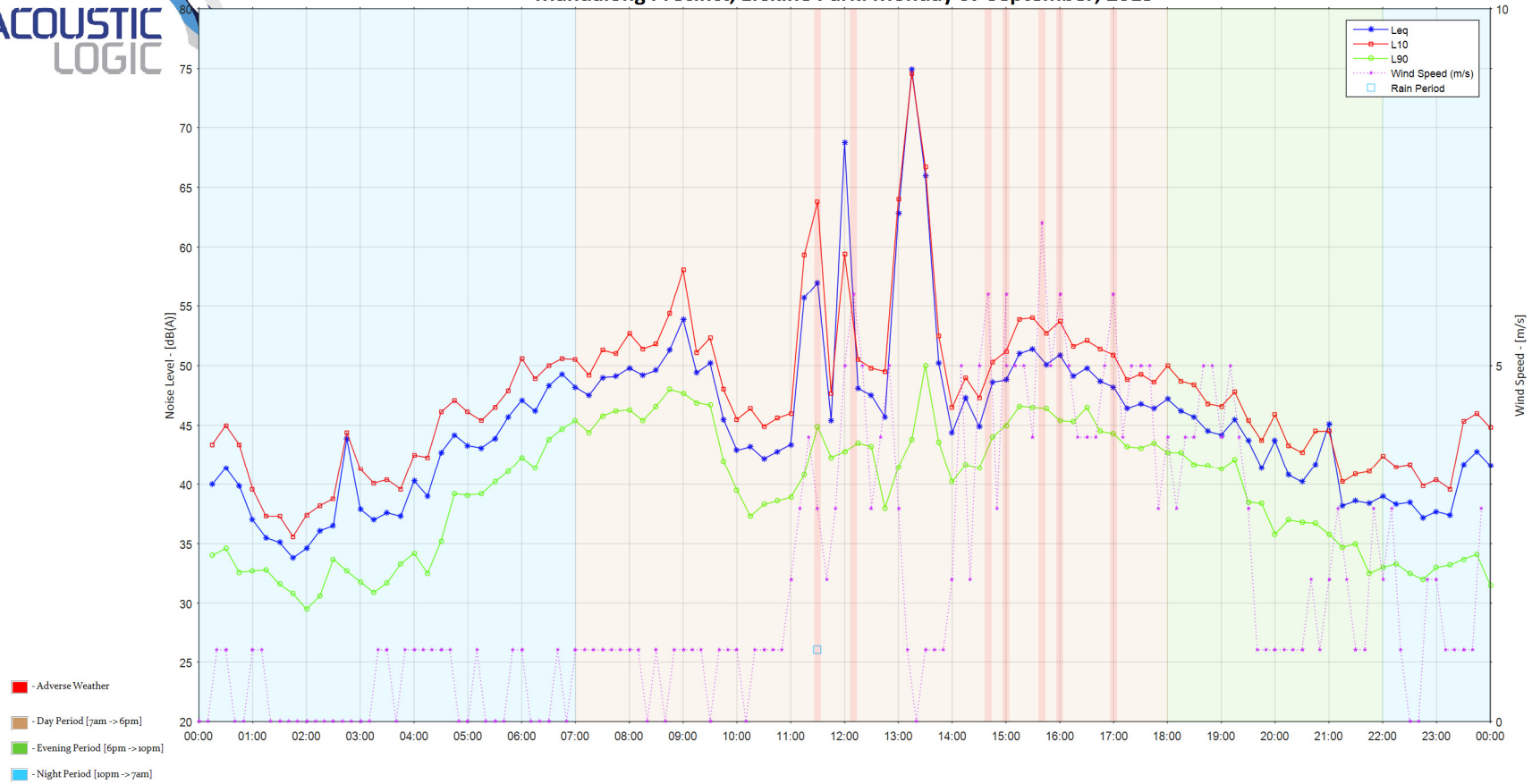




Mandalong Precinct, Erskine Park: Sunday 06 September, 2015

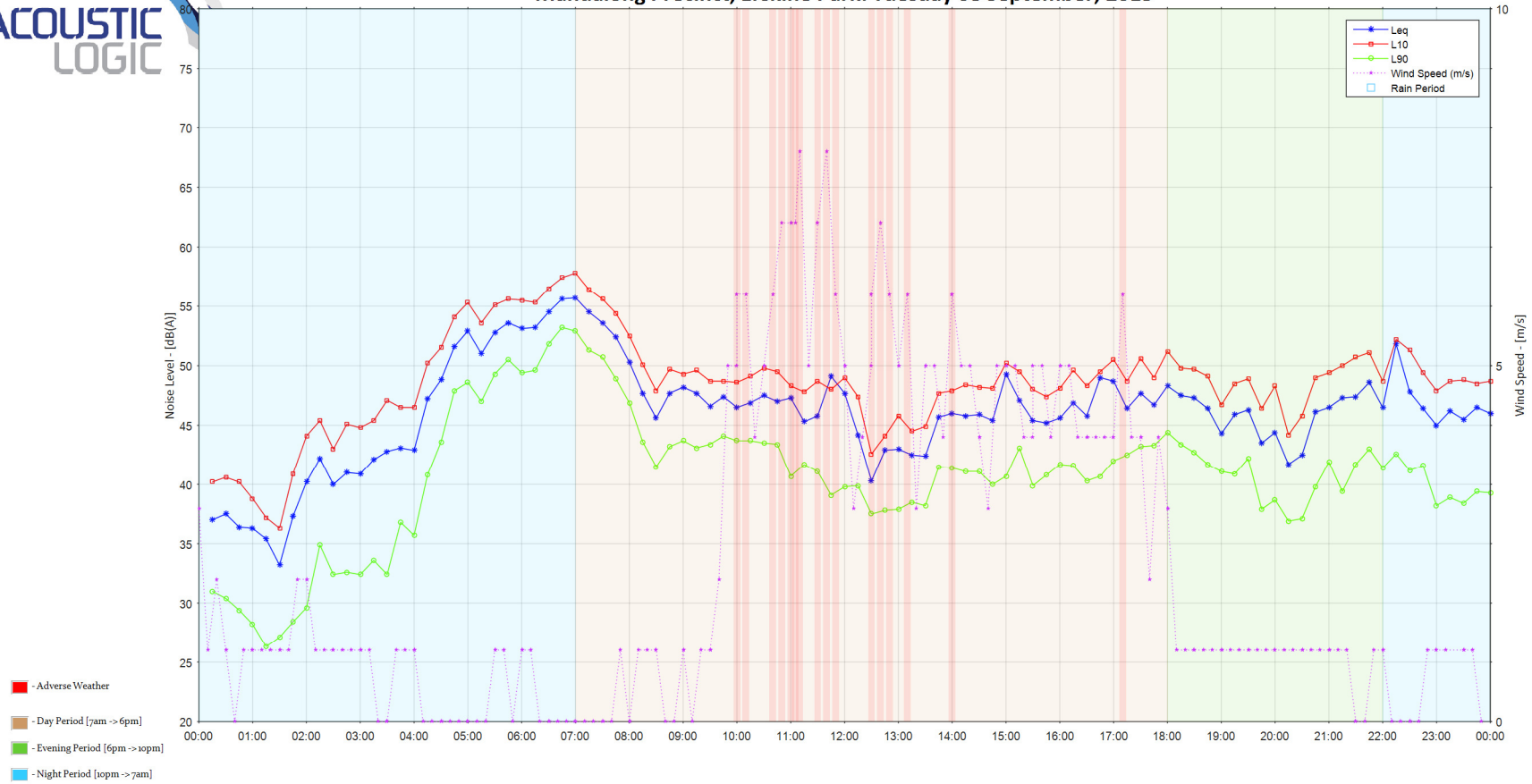


Mandalong Precinct, Erskine Park: Monday 07 September, 2015

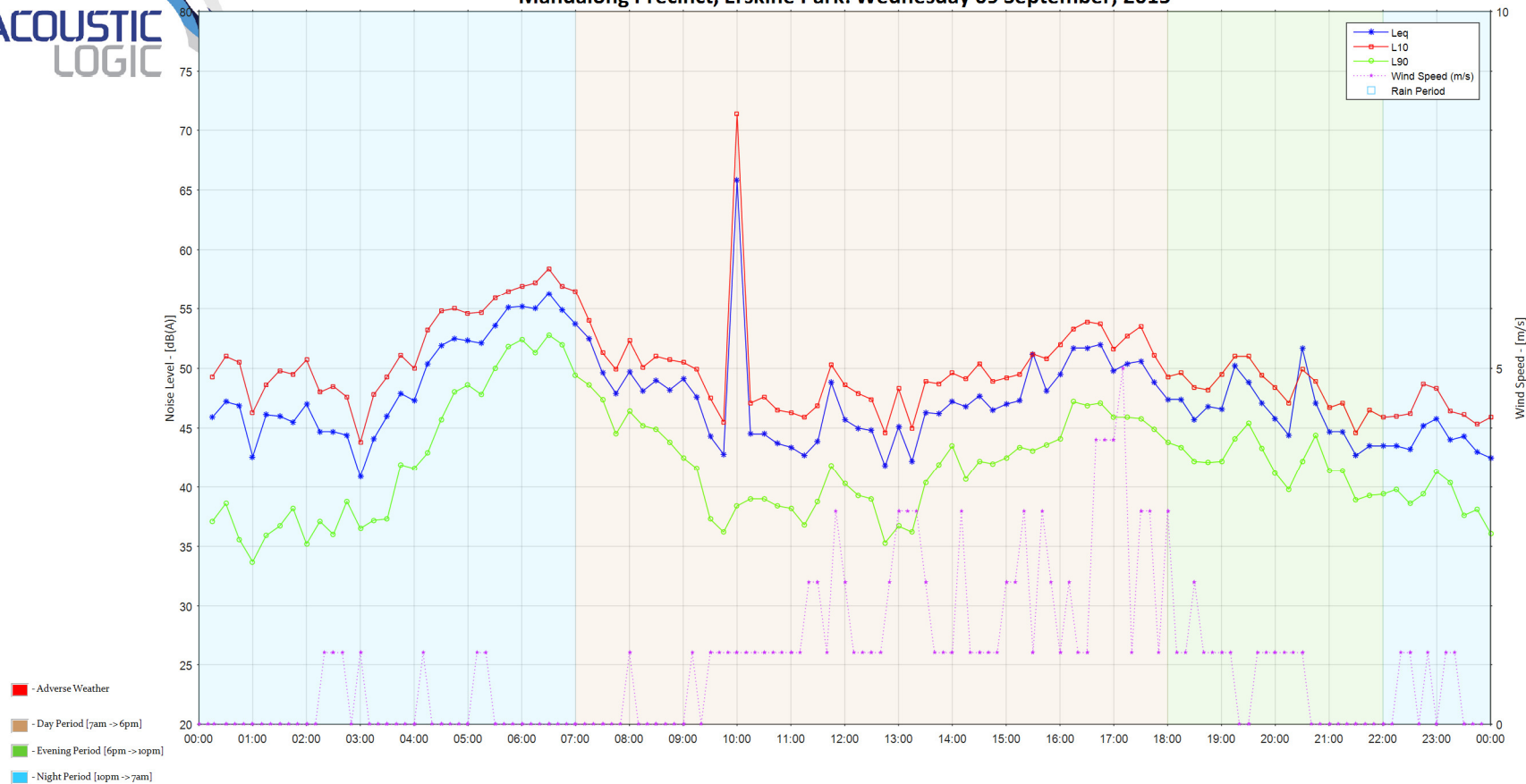




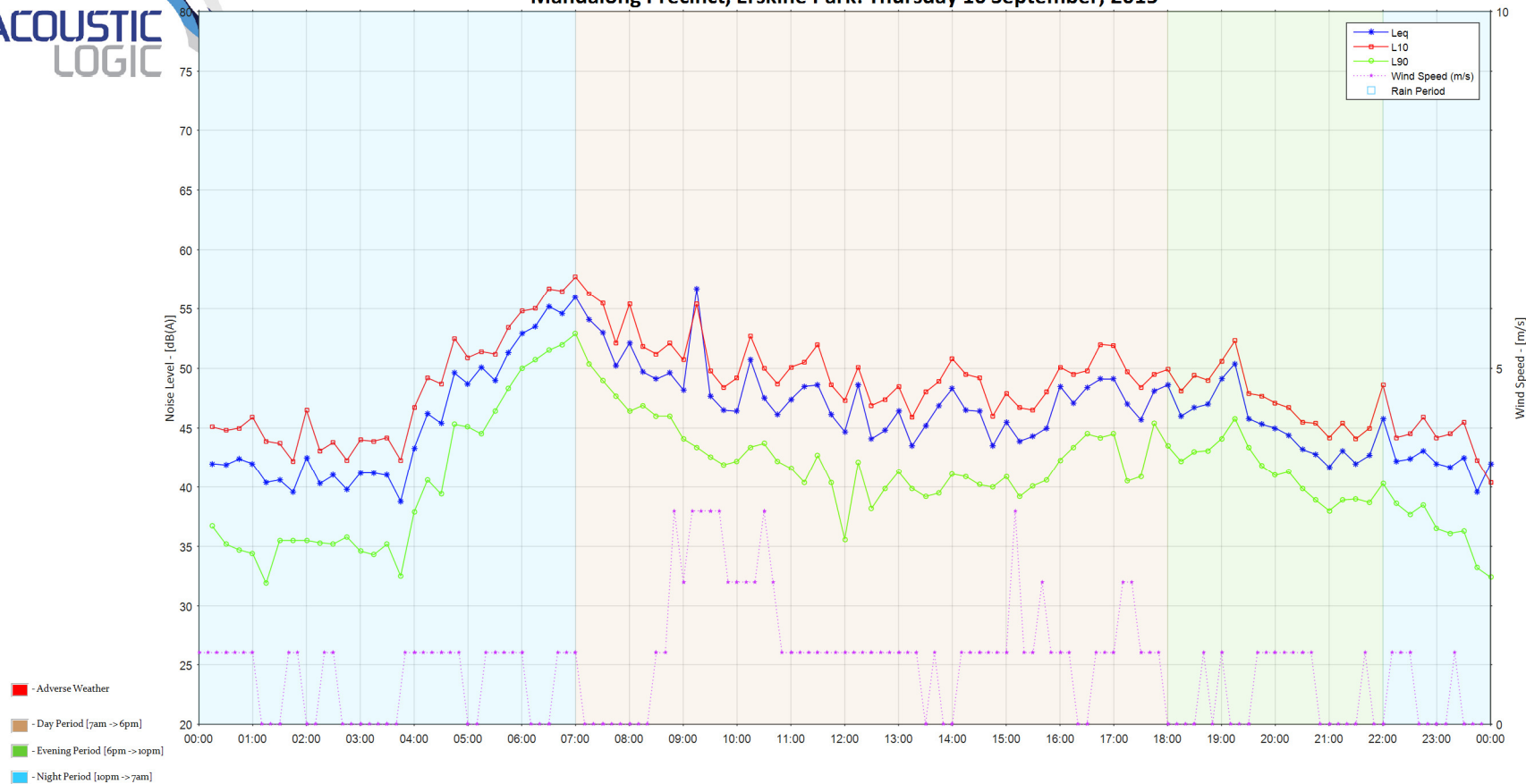
Mandalong Precinct, Erskine Park: Tuesday 08 September, 2015



Mandalong Precinct, Erskine Park: Wednesday 09 September, 2015



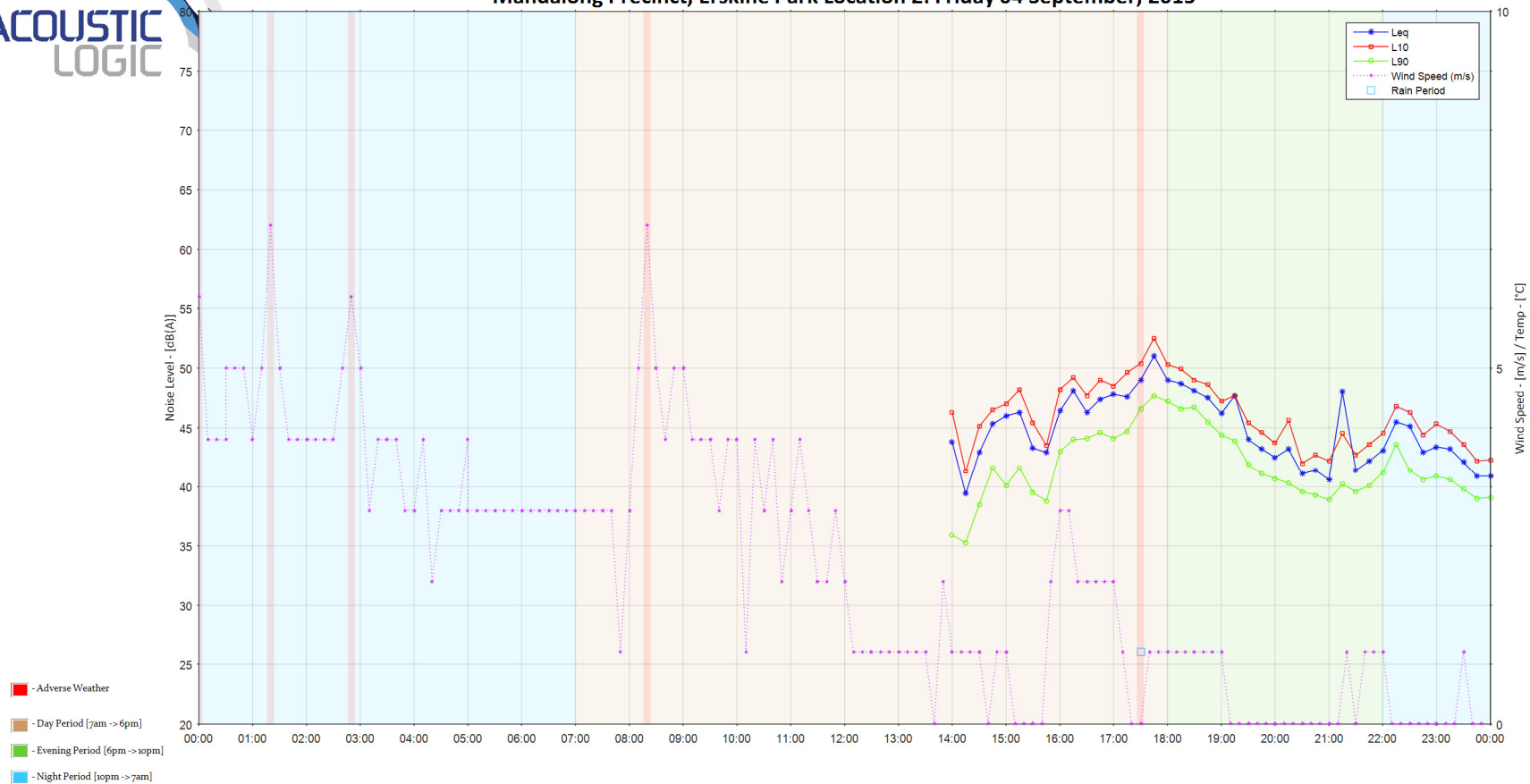
Mandalong Precinct, Erskine Park: Thursday 10 September, 2015



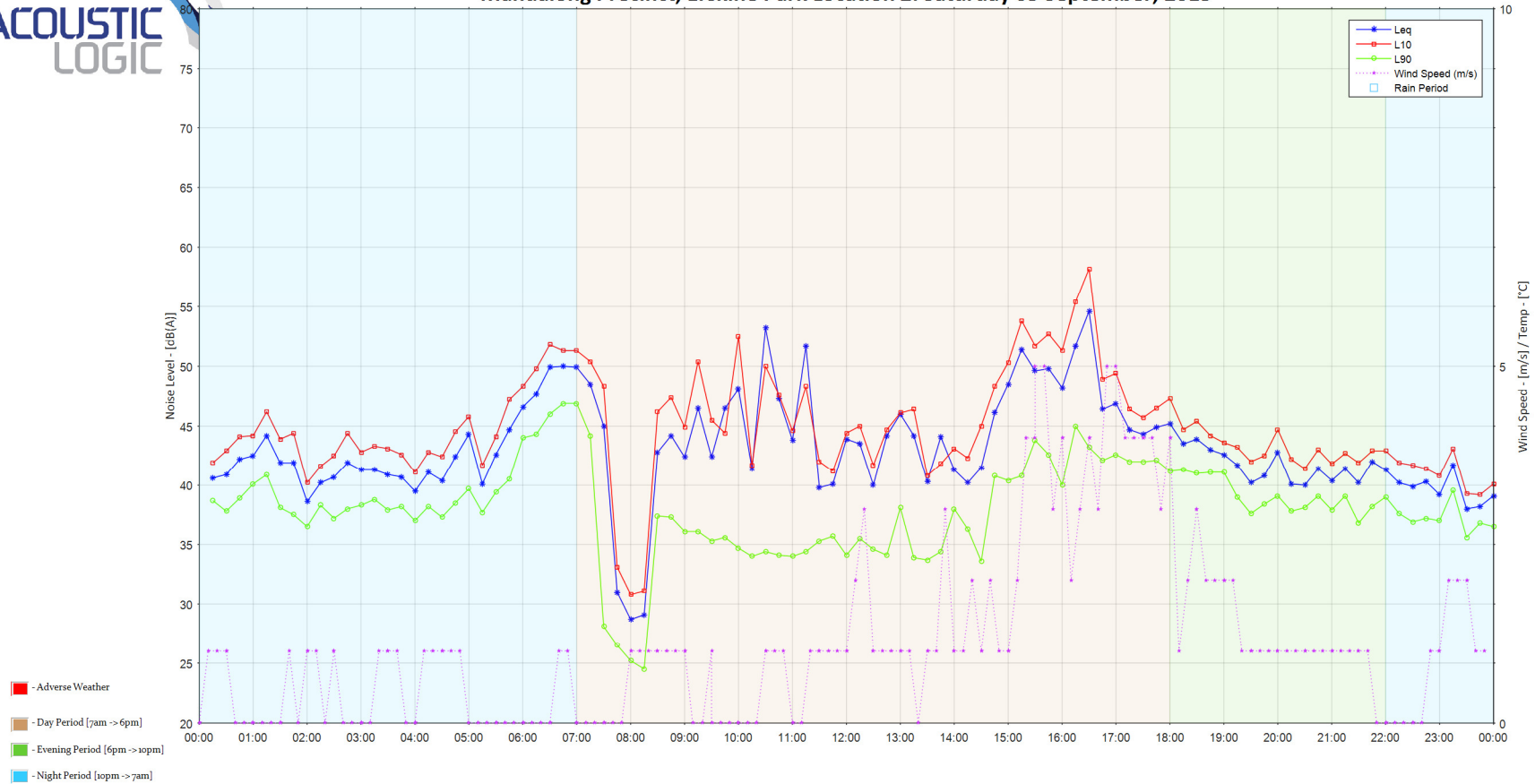
Mandalong Precinct, Erskine Park: Friday 11 September, 2015



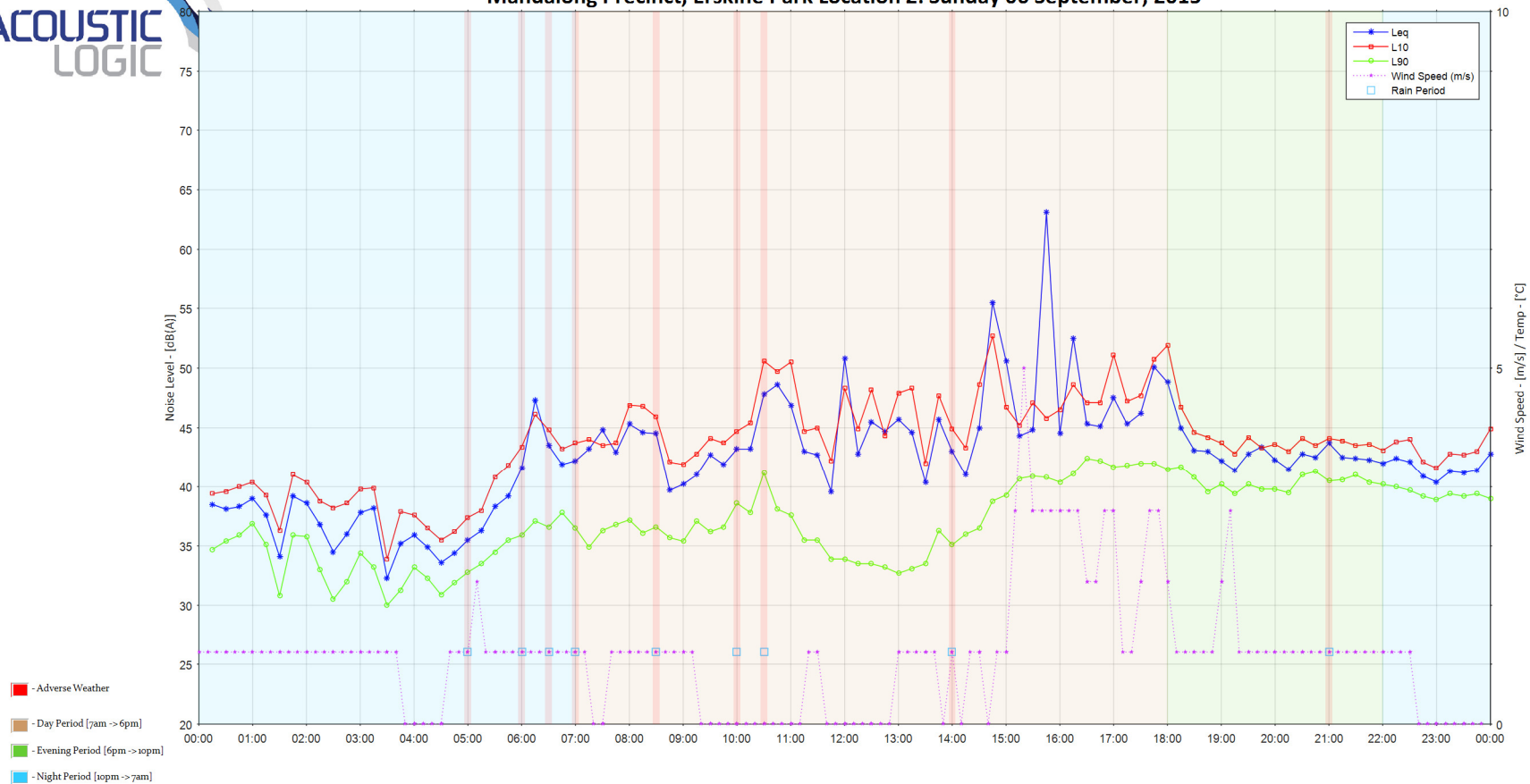
Mandalong Precinct, Erskine Park Location 2: Friday 04 September, 2015



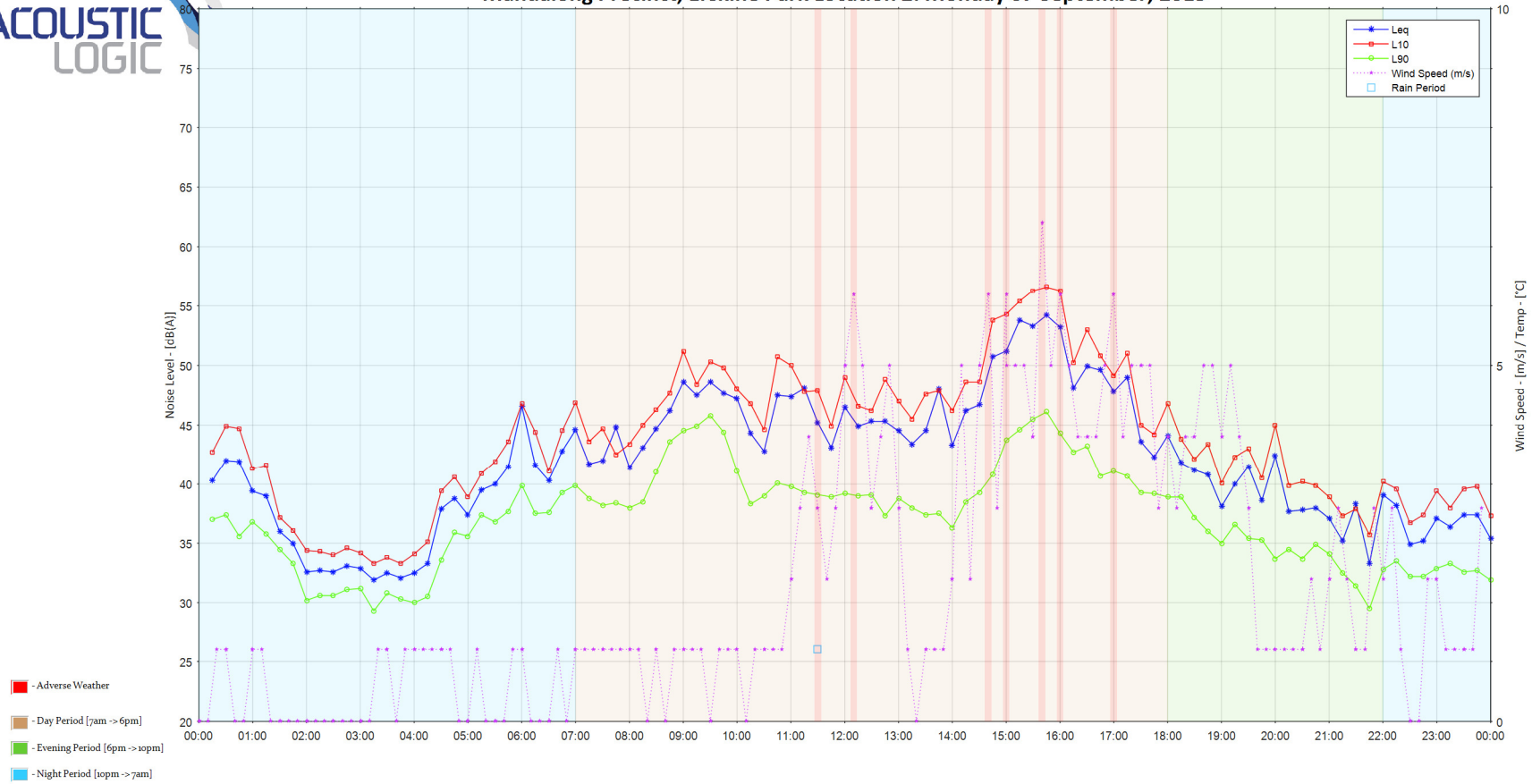
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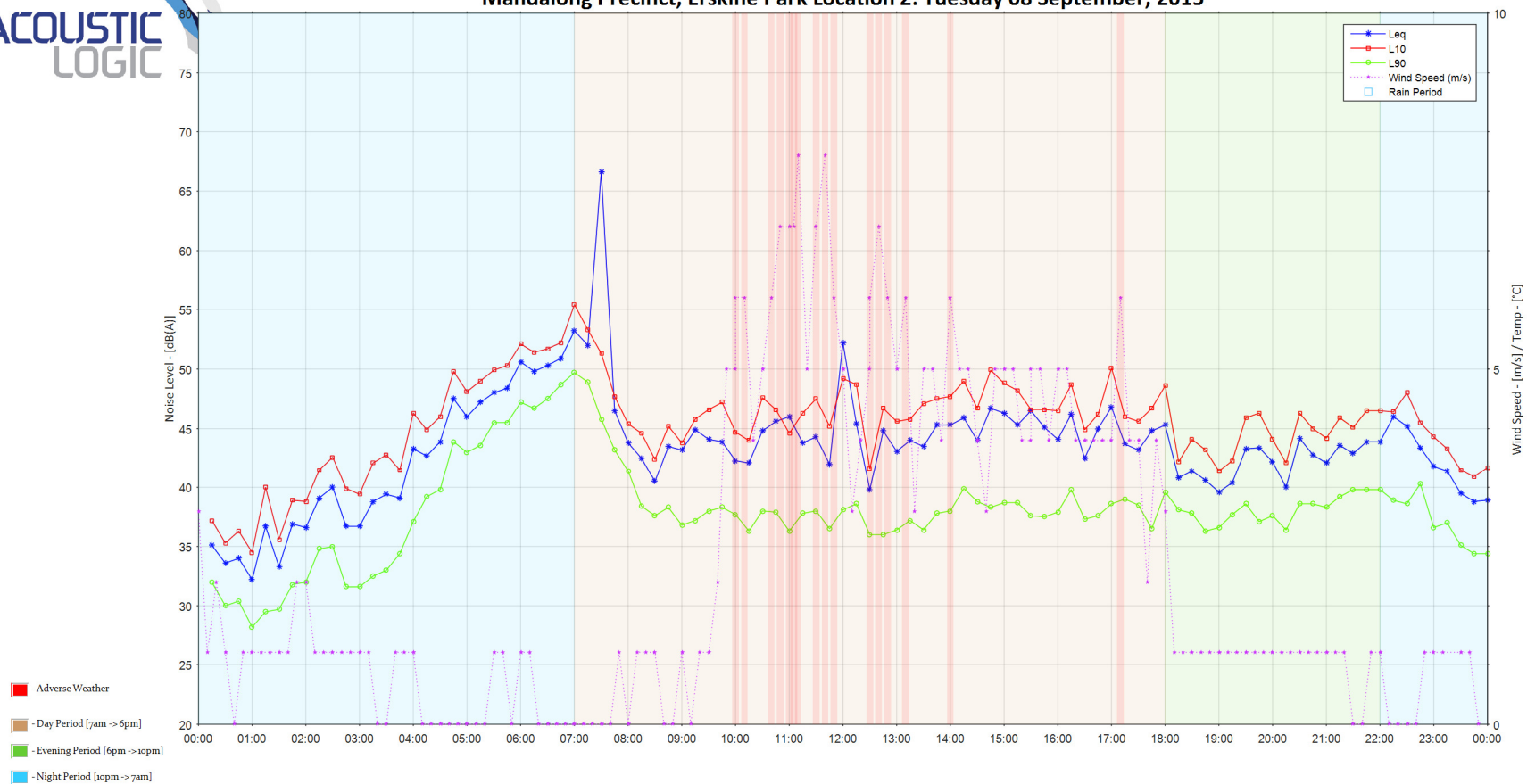
Mandalong Precinct, Erskine Park Location 2: Sunday 06 September, 2015



Mandalong Precinct, Erskine Park Location 2: Monday 07 September, 2015



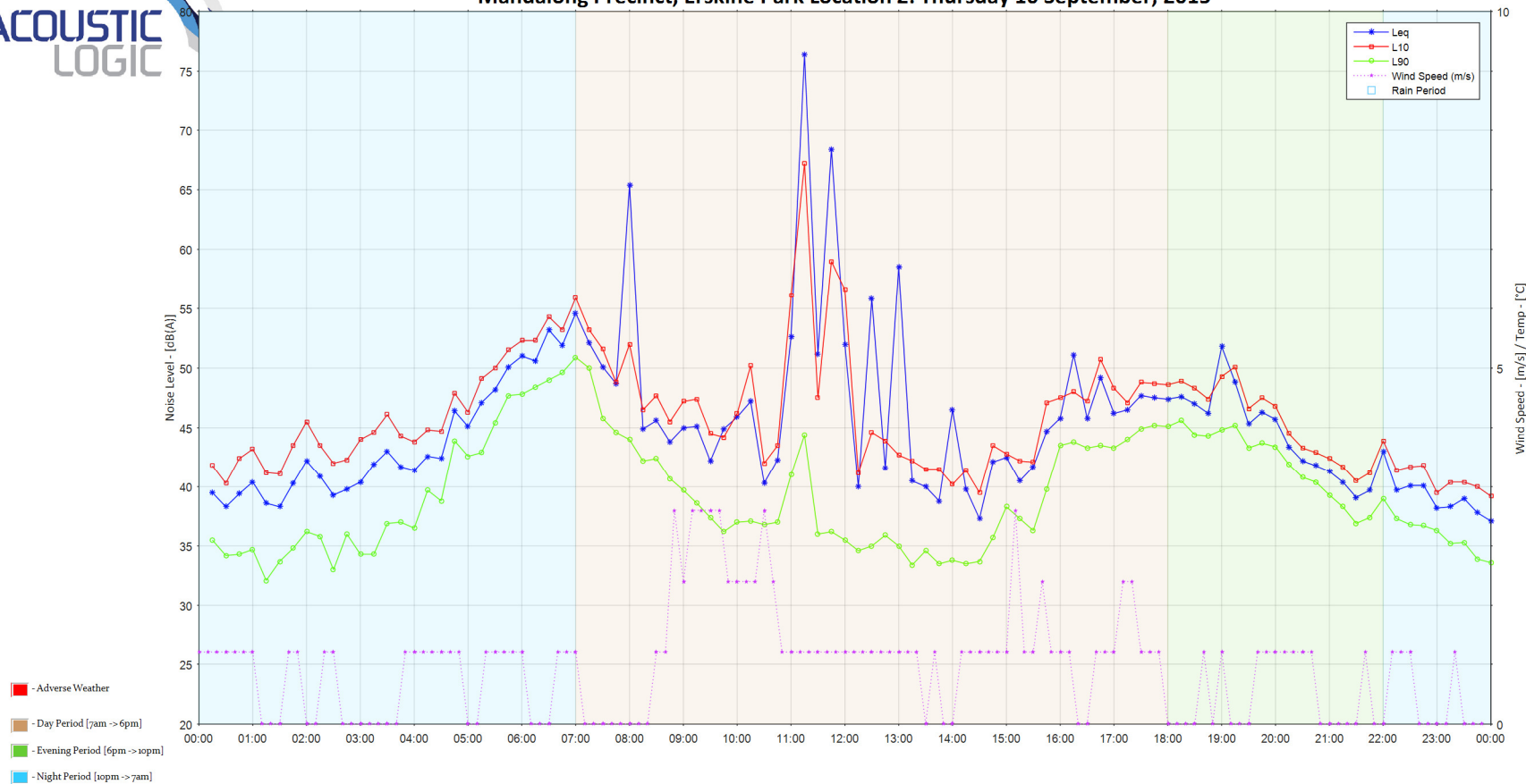
Mandalong Precinct, Erskine Park Location 2: Tuesday 08 September, 2015



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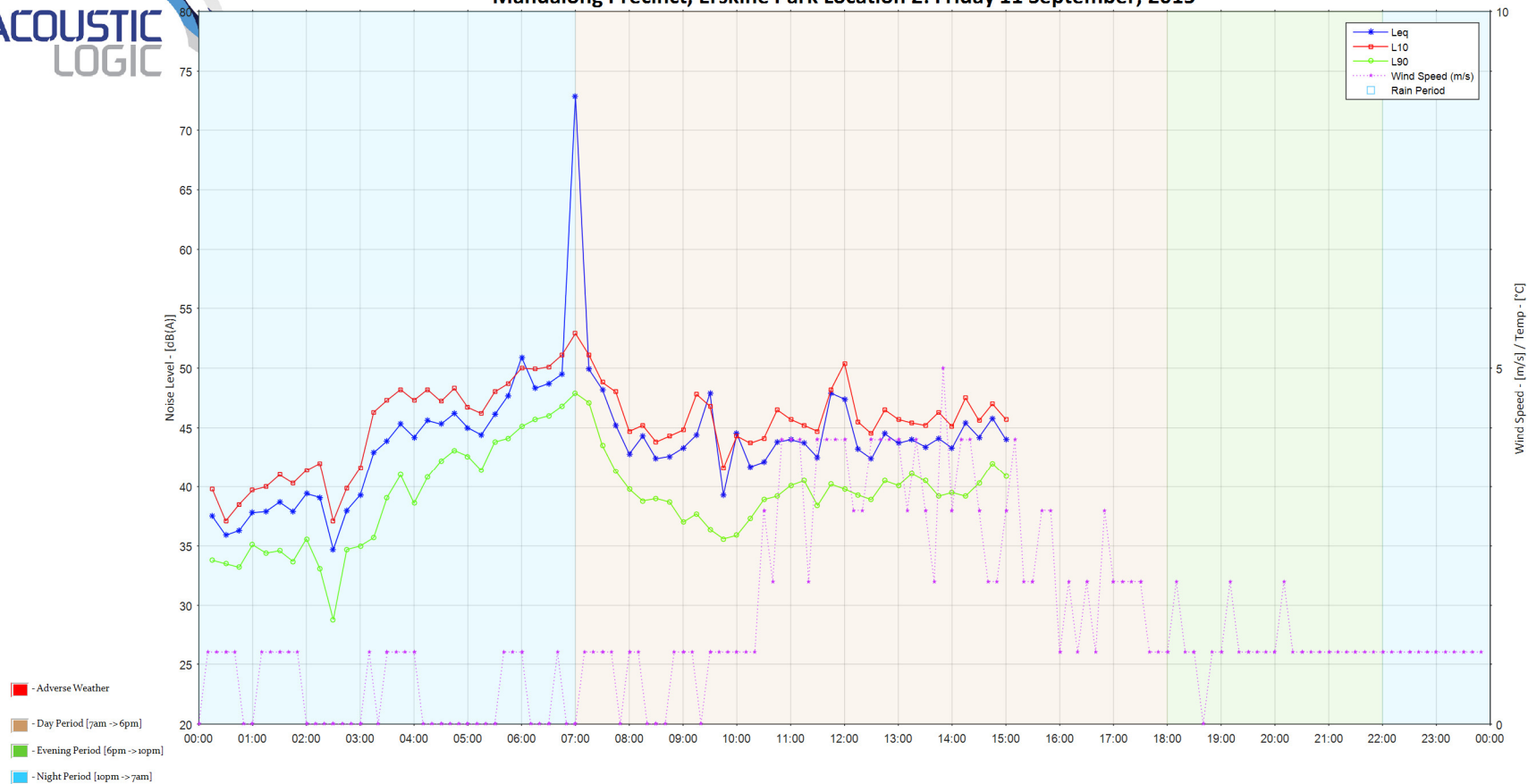


Mandalong Precinct, Erskine Park Location 2: Thursday 10 September, 2015





Mandalong Precinct, Erskine Park Location 2: Friday 11 September, 2015

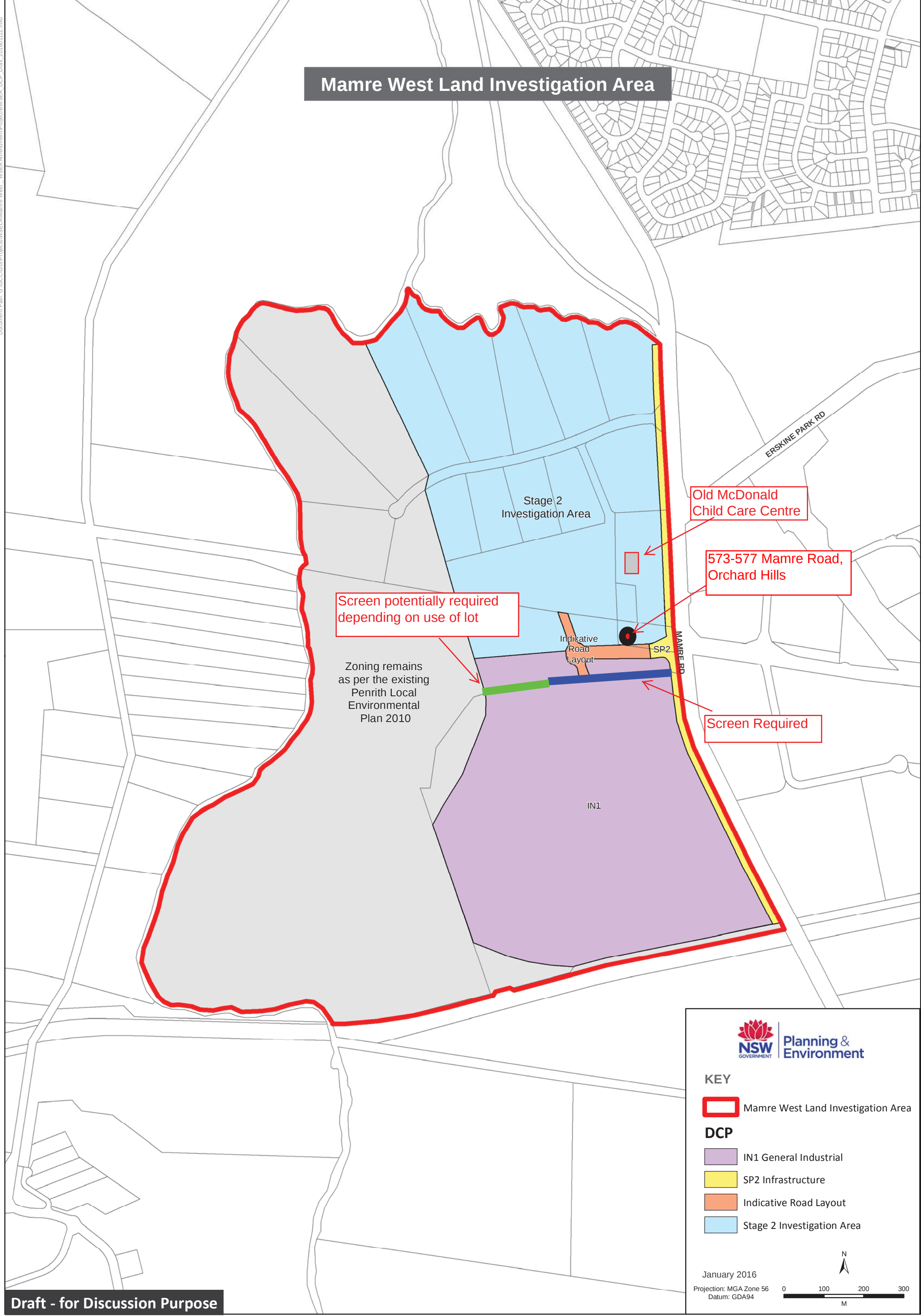


Appendix 2

Noise Screen Location

Document Path: G:\CCCGIS\Projects\WSELA\Mamre West - WSELA Amendment\Project\WSELA_DCP_Draft_20160112.mxd

Mamre West Land Investigation Area



- KEY**
- Mamre West Land Investigation Area
- DCP**
- IN1 General Industrial
 - SP2 Infrastructure
 - Indicative Road Layout
 - Stage 2 Investigation Area

January 2016

Projection: MGA Zone 56
Datum: GDA94

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Appendix 3

Site Plan

DEVELOPMENT DATA	
TOTAL SITE AREA	449,800m ²
STAGE 1 SITE AREA	135,430m ²
FUTURE DEVELOPABLE AREA	290,850m ²
WIDENING ROAD	13,670m ²
ACCESS ROAD (Excl. Road Widening)	22,795m ²
STAGES	SITE AREA
STAGE 1	
DEVELOPABLE LOTS LOT 7 & 8	135,430m ²
FUTURE STAGE	
DEVELOPABLE LOTS LOT 1, 2, 3, 4, 5 & 6	290,850m ²
TOTAL	426,280m ²



DRAFT

