

## MARSDEN PARK PRECINCT

# ENVIRONMENTAL NOISE & VIBRATION IMPACT ASSESSMENT

TF497-01F02 (REV 4) NOISE & VIBRATION ASSESSMENT.DOC

12 JULY 2012

Prepared for:

Woorong Park Pty Ltd  
Level 10, 61 Lavender Street  
Milsons Point NSW 2061

Attention: MR BILL SARKIS



## DOCUMENT CONTROL

<b>Date</b>	<b>Revision History</b>	<b>Non-Issued Revision</b>	<b>Issued Revision</b>	<b>Prepared By (initials)</b>	<b>Instructed By (initials)</b>	<b>Reviewed &amp; Authorised by (initials)</b>
12/03/2012	Generation of draft report	0	1	WC	MCH	MCH
04/05/2012	Revise draft report	-	2	WC	MCH	MCH
17/05/2012	Revise for comments	-	3	WC	-	-
12/07/2012	Final for exhibition	-	4	WC	-	MCH

*The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.*

*This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.*

*This document is prepared for our Client's particular requirements which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.*

*The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.*

## CONTENTS

1	INTRODUCTION	5
2	PROJECT DESCRIPTION	6
2.1	BACKGROUND INFORMATION	6
2.2	SITE DESCRIPTION	6
2.3	NOISE ISSUES	6
3	EXISTING ACOUSTIC ENVIRONMENT	8
3.1	NOISE MONITORING LOCATIONS	8
3.2	EXISTING BACKGROUND & AMBIENT NOISE LEVELS	9
3.3	MEASURED TRAFFIC NOISE LEVELS	10
4	INDUSTRIAL NOISE ASSESSMENT	12
4.1	INDUSTRIAL NOISE CRITERIA	12
4.1.1	Intrusive Noise Impacts	12
4.1.2	Protecting Noise Amenity	12
4.1.3	PEO (Noise Control) Regulation 2000	13
4.2	INDUSTRIAL NOISE SOURCES	14
4.3	RECOMMENDATIONS	14
5	ROAD TRAFFIC NOISE ASSESSMENT	16
5.1	ROAD TRAFFIC NOISE CRITERIA	16
5.2	ISEPP NOISE LIMITS	16
5.2.1	ISEPP Guideline	17
	<u>Clarification of ISEPP Noise Limits</u>	17
5.3	ROAD TRAFFIC NOISE SOURCES	18
5.4	PREDICTED ROAD TRAFFIC NOISE	20
5.5	ROAD TRAFFIC NOISE ASSESSMENT	21
5.5.1	Predicted Traffic Noise Levels	21
5.5.2	Assessment of Impacts	22
5.6	RECOMMENDATIONS	27
5.6.1	Noise Barriers	27
5.6.2	Building Treatment	28
5.6.3	Building Design	30
6	AIRCRAFT NOISE	31
6.1	AIRCRAFT NOISE CRITERIA	31
6.2	ANEF ZONING	32
7	CONSTRUCTION NOISE AND VIBRATION CRITERIA	34
7.1	CONSTRUCTION NOISE GUIDELINES	34

7.1.1	Management Levels	35
7.2	CONSTRUCTION VIBRATION GUIDELINES	37
	<u>Disturbance to Buildings Occupants</u>	37
	<u>Structural Damage to Buildings</u>	39
8	CONCLUSION	41
	APPENDIX A - GLOSSARY OF ACOUSTIC TERMS	42
	APPENDIX B - NOISE MONITORING METHODOLOGY	45
	B.1 NOISE MONITORING EQUIPMENT	45
	B.2 METEOROLOGY DURING MONITORING	45
	B.3 NOISE VS TIME GRAPHS	45
	APPENDIX C - LONG TERM NOISE MONITORING RESULTS	46

### List of Tables

Table 3.1	– Measured Existing Background ( $L_{90}$ ) & Ambient ( $L_{eq}$ ) Noise Levels, dB(A)	9
Table 3.2	– Measured $L_{eq}$ Road Traffic Noise Levels	10
Table 4.1	– Intrusiveness Criteria at Assessment Location	12
Table 4.2	– Amenity Criteria for Various Land Uses	13
Table 5.1	– ISEPP Internal Road Traffic Noise Criteria, dB(A)	18
Table 5.2	– Equivalent External ISEPP Road Traffic Noise Criteria, dB(A)	18
Table 5.3	– Future Traffic Volume & Composition Data	19
Table 5.4	– Summary of Modelling Inputs	21
Table 5.5	– Recommended Internal Sound Levels Based on AS2107:2000	29
Table 6.1	– Building Site Acceptability Based on ANEF Zones (Table 2.1 – AS2021)	31
Table 6.2	– Internal Design Sound Levels, dB(A)	32
Table 6.3	– Location of Site Relative to ANEF Contour Charts	32
Table 7.1	– Noise at Residences Using Quantitative Assessment	35
Table 7.2	– Noise at Other Sensitive Land Uses Using Quantitative Assessment	36
Table 7.3	– Noise Management Levels for Industrial and Commercial Premises	37
Table 7.4	– Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration ( $m/s^2$ ) 1-80Hz	38
Table 7.5	– Acceptable vibration dose values for intermittent vibration ( $m/s^{1.75}$ )	38
Table 7.6	– BS 7385 Structural Damage Criteria	39
Table 7.7	– DIN 4150-3 Structural Damage Criteria	40

# 1 INTRODUCTION

---

Renzo Tonin & Associates were engaged to conduct an environmental noise assessment of the proposed land uses for the Marsden Park Precinct land release area. This report quantifies the road traffic noise and aircraft noise, and assesses the potential impact upon the Marsden Park Precinct land release area. Furthermore, traffic noise and future site operation noise associated with the Marsden Park Precinct impacting on existing residential premises located nearby are also assessed.

Noise and vibration issues are assessed against the relevant noise criteria set out in the NSW Office of Environment and Heritage's (OEH) 'Industrial Noise Policy' (INP), 'Interim Construction Noise Guidelines' (ICNG) and 'Road Noise Policy' (RNP); the NSW State Environmental Planning Policy (Infrastructure) 2007 (ISEPP), the Growth Centres Commission's 'Growth Centres Development Code', the Protection of the Environmental Operations Act 1997 and Australian Standard AS2021-2000 for aircraft noise impacts.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

## **2 PROJECT DESCRIPTION**

---

### **2.1 Background Information**

This acoustic study report has been prepared to assess noise impacts to and from the proposed Marsden Park Precinct. The land release area is proposed to be rezoned for residential, employment and community uses. A strategy map has been prepared and provides an indication of the various land uses and their locations, proposed for the Marsden Park Precinct.

Noise impact to and from the proposed development was assessed and compared to the noise guidelines set by the NSW Office of Environment and Heritage (OEH), Blacktown City Council, state legislation and relevant Australian Standards.

### **2.2 Site Description**

The proposed Marsden Park Precinct (the Precinct) land release area is located within the North West Growth Centre in the Blacktown Local Government Area. The Precinct is bounded by the Hawkesbury River to the North, Richmond Road to the East, the proposed Marsden Park Industrial Precinct (MPIP) and St Mary's subdivision to the South and Stony Creek Road to the West. The current main land use of the Precinct is for agriculture with a variety of mixed businesses located along Richmond Road. The total area of the Precinct is approximately 1,800 hectares and is expected to accommodate up to 10,000 dwellings. The Precinct also includes approximately 600 hectares of the Air Services Australia Site in the south, which is intended to be set aside for conservation and open space.

The types of industry to be located within the employment areas of the precinct are not yet known at this early stage of the project. However, it is envisaged that various commercial uses could be accommodated.

Furthermore, the types of community and local centre facilities are also not finalised. It is envisaged that business premises, childcare centres, community facilities, educational establishments, function centres, information and education facilities, office premises, passenger transport facilities, indoor and outdoor recreation facilities, retail premises and/or a branch library could be accommodated in the community and local centre areas of the precinct.

### **2.3 Noise Issues**

Noise potentially impacting future developments within the Precinct includes:

- Industrial noise from the future commercial employment developments within the Precinct impacting future residential properties and sensitive land uses in the Precinct.
- Aircraft noise due to the operation of the RAAF Richmond Airbase impacting land uses within the Precinct.
- Industrial noise from the proposed Marsden Park Industrial Precinct.

It is noted that based on site visits and review of aerial photos, the Penrith Local Government Area adjacent to the proposed Marsden Park Precinct (i.e Berkshire Park and Llandillo) has no industrial noise sources which will potentially impact future developments within the Precinct.

Furthermore, the existing quarry within the future MPIP site would be decommissioned as part of the MPIP development and therefore noise impacts from the existing quarry would not be an issue when the Precinct is developed.

- Road traffic noise from Richmond Road and South Street upgrade impacting land uses within the Marsden Park Precinct

In terms of potential rail noise impacts, the NSW Government has identified potential rail transport corridors west of Cudgegong Road to support future growth in the North West Growth Centre. One of the proposed options – “Option A – Cudgegong Road to Schofields and Marsden Park” – results in the proposed rail line extension running from the future North West Rail Link heading west to Schofields Railway Station then further on to Marsden Park. This option could potentially affect the southern area of the Marsden Park Precinct. However, as the options will be decided pending the completion of the North West Rail Link, there is insufficient information at this early stage to assess potential noise impacts from the proposed transport corridor. Furthermore, when the options are finalised it is expected that acoustic assessments will be required at the detailed design stage of the proposed transport corridor.

Noise potentially impacting existing properties as a result of the Precinct includes:

- Industrial noise from the future commercial employment developments within the Precinct impacting existing residential properties and sensitive land uses in Marsden Park.
- Road traffic noise on public roads as a result of additional traffic from the Precinct impacting on existing land uses within Marsden Park.

### 3 EXISTING ACOUSTIC ENVIRONMENT

---

Site investigations found that the existing acoustic environment of the site is dominated by natural sounds, with some influence (depending on location) from traffic noise generated by nearby roads, namely Richmond Road. Long term, unattended noise monitoring was undertaken to measure the existing acoustic environment at various areas of the site.

#### 3.1 Noise Monitoring Locations

To determine existing background and ambient noise levels at the Precinct, long term unattended noise monitoring was carried out at the locations summarised below. To quantify the existing ambient noise environment, long-term (unattended) noise monitoring was conducted at each location over nine days, between Tuesday 8<sup>th</sup> November and Thursday 17<sup>th</sup> November 2011.

- **Location M1 – Lot 9 / DP 1078187 Stoney Creek Road, Shanes Park**

Noise monitor located in the free field on the northern side of the access driveway and approximately 50m east of Stoney Creek Road. Noise environment dominated by natural sounds and occasional traffic noise along Stoney Creek Road and is considered representative of the area on the western side of the Precinct.

- **Location M2 – 46 Glengarrie Road, Marsden Park**

Noise monitor located in the free field on the south eastern corner of the property. Noise environment dominated by natural sounds, distant traffic noise from Richmond Road and South Street and occasional distant industrial noise from the Waste Services Depot. Measured noise levels representative of the area in the centre of the Precinct and near the proposed Marsden Park Industrial Precinct.

- **Location M3 – 990 Richmond Road, Marsden Park**

Noise monitor located on the south eastern corner of the property and approximately 20m west of Richmond Road. Noise environment dominated by traffic noise on Richmond Road and considered representative of the area on the southern side of the Precinct, west of Richmond Road.

- **Location M4 – Lot 1 / DP1078187 Richmond Road, Marsden Park**

Noise monitor located on the north eastern corner of the property, adjacent to the access driveway and approximately 40m west of Richmond Road. Noise environment dominated by traffic noise on Richmond Road and considered representative of the area on the northern side of the Precinct, west of Richmond Road.



- **Location M5 – 1029 Richmond Road, Marsden Park**

Noise monitor located in the front yard of the property and approximately 16m east of Richmond Road. Noise environment dominated by traffic noise on Richmond Road and considered representative of the area on the eastern side of the Precinct, east of Richmond Road.

Figure 1 shows the site, surrounds and monitoring locations.

Weather information for the area was obtained from the Bureau of Meteorology for the monitoring period and any data adversely affected by rain, wind or extraneous noise was discarded.

Appendix A of this report presents a description of acoustic terms. Appendix B details the noise monitoring methodology. The graphical recorded output from long term noise monitoring is included in Appendix C to this report. The graphs in Appendix C were analysed to determine an assessment background level (ABL) for each day, evening and night period in each 24 hour period of noise monitoring, and based on the median of individual ABLs an overall single Rating Background Level (RBL) for the day, evening and night period is determined over the entire monitoring period in accordance with the NSW 'Industrial Noise Policy' (INP).

### 3.2 Existing Background & Ambient Noise Levels

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NSW 'Industrial Noise Policy' (INP) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The INP defines these periods as follows:

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Existing background and ambient noise levels are presented in Table 3.1 below.

**Table 3.1 – Measured Existing Background (L<sub>90</sub>) & Ambient (L<sub>eq</sub>) Noise Levels, dB(A)**

Noise Monitoring Location	L <sub>90</sub> Background Noise Levels			L <sub>eq</sub> Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
M1 – Lot 9 / DP1078187 Stoney Creek Rd	38	35	30	56	53	52
M2 – 46 Glengarrie Rd	38	38	36	49	49	52
M3 – 990 Richmond Rd	55	48	41	67	64	65

Noise Monitoring Location	L <sub>90</sub> Background Noise Levels			L <sub>eq</sub> Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
M4 – Lot 1 / DP1078187 Richmond Rd	54	47	36	69	65	66
M5 – 1029 Richmond Rd	51	48	35	63	62	60

### 3.3 Measured Traffic Noise Levels

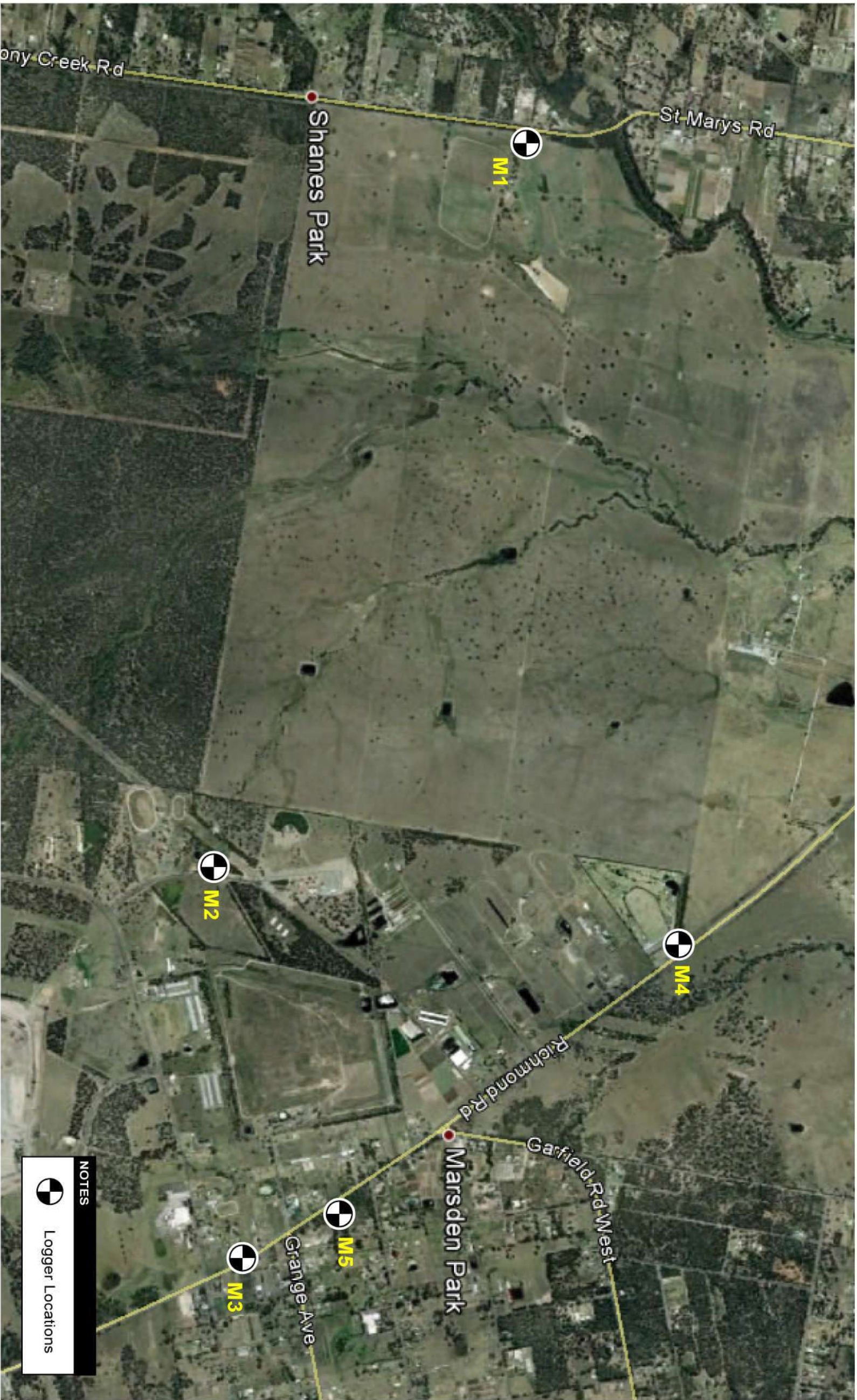
Traffic noise measurements were conducted to determine traffic noise levels from Richmond Road at noise monitoring locations M3, M4 and M5. Traffic noise levels are assessed separately for daytime and night time periods, defined by the RNP as follows:

- **Day** is defined as 7:00am to 10:00pm;
- **Night** is defined as 10:00pm to 7:00am.

The measured daytime and night time traffic noise levels are presented in the table below.

**Table 3.2 – Measured L<sub>eq</sub> Road Traffic Noise Levels**

Noise Monitoring Location	Distance from Richmond Road	L <sub>Aeq,15hr</sub> Day	L <sub>Aeq,9hr</sub> Night
M3 – 990 Richmond Rd	22m	70	69
M4 – Lot 1 / DP1078187 Richmond Rd	41m	66	63
M5 – 1029 Richmond Rd	16m	71	68



**RENZO TONIN  
& ASSOCIATES**  
*Inspired to achieve*  
Consultants in Acoustics, Vibration and Structural Dynamics  
Email: [acoustics@rtagroup.com.au](mailto:acoustics@rtagroup.com.au) [www.renzotonin.com.au](http://www.renzotonin.com.au)

**RAAG** Member of the Association of Australian Acoustical Consultants

Sydney  
Ph: (02) 8218 9500 Fax: (02) 8218 0501  
Melbourne  
Ph: (03) 9506 0041 Fax: (03) 9506 0042  
Brisbane  
Ph: (07) 3211 9155 Fax: (07) 3211 9188  
Gold Coast  
Ph: (07) 5593 5633 Fax: (07) 5593 5635  
Kuwait  
Ph: +0011 965 653 1520

**Title :**  
Figure 1 - Site, Surrounds & Logger Locations

**Project :**  
Marsden Park Precinct

**Date:** 12/03/12

**Scale:** NTS

**Ref:** TF497-01P01 (rev 0

## 4 INDUSTRIAL NOISE ASSESSMENT

### 4.1 Industrial Noise Criteria

The assessment procedure in terms of the OEH's 'Industrial Noise Policy' (INP), applied by Blacktown City Council, has two components:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for particular land uses for residences and other land uses.

#### 4.1.1 Intrusive Noise Impacts

According to the INP, the intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the  $L_{Aeq}$  descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5dB(A).

The intrusiveness criterion is summarised as follows:

$$L_{Aeq, 15 \text{ minute}} \leq L_{A90} \text{ background noise level plus 5dB(A)}$$

It is noted that the intrusiveness criterion is only applicable for residential receivers. The table below presents the intrusiveness criteria based on the noise monitoring. The representative area of Marsden Park Precinct for each noise monitoring location is discussed in Section 3.1.

**Table 4.1 – Intrusiveness Criteria at Assessment Location**

Assessment Location	Day	Evening	Night
M1 – Lot 9 / DP1078187 Stoney Creek Rd	$\leq 38 + 5 = 43$	$\leq 35 + 5 = 40$	$\leq 30 + 5 = 35$
M2 – 46 Glengarrie Rd	$\leq 38 + 5 = 43$	$\leq 38 + 5 = 43$	$\leq 36 + 5 = 41$
M3 – 990 Richmond Rd	$\leq 55 + 5 = 60$	$\leq 48 + 5 = 53$	$\leq 41 + 5 = 46$
M4 – Lot 1 / DP1078187 Richmond Rd	$\leq 54 + 5 = 59$	$\leq 47 + 5 = 52$	$\leq 36 + 5 = 41$
M5 – 1029 Richmond Rd	$\leq 51 + 5 = 56$	$\leq 48 + 5 = 53$	$\leq 35 + 5 = 40$

Notes: 1. Day refers to 7am to 6pm, Monday to Saturday; and 8am to 6pm, Sundays and Public Holidays

2. Evening refers to 6pm to 10pm

3. Night refers to 10pm to 7am, Monday to Saturday; and 10pm to 8am, Sundays and Public Holidays

Further to the above, for existing residences surrounding the proposed Precinct, the intrusiveness criteria for Locations M1 and M5 would be applicable to existing residences on the western side of Stoney Creek Road and the eastern side of Richmond Road, respectively.

#### 4.1.2 Protecting Noise Amenity

The Amenity Criteria are determined in accordance with Chapter 2 of the NSW INP. The INP recommends base acceptable noise levels for various receivers, including residential, commercial, industrial receivers and sensitive receivers such as schools, hospitals, churches and parks. These base noise criteria are then lowered by up to 10dB depending on the extent

of existing industrial noise impact upon the receiver. Higher levels of existing industrial noise therefore result in stricter Amenity Criteria applied to any new industrial development. In this way the cumulative impacts of existing and known future industrial noise sources are minimised.

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the policy, the applicable parts of which are reproduced below. Given that proposed uses for the Marsden Park Precinct may consist of childcare and educational centres, active and passive recreation areas, commercial premises and industrial premises, the applicable amenity criteria for these proposed uses are presented in Table 4.2 below. For noise from the proposed Precinct and the proposed MPIP impacting on future residential properties within the Precinct, the amenity criteria for residential land uses are categorised as 'Suburban'. While for existing rural residential properties in Marsden Park potentially impacted upon by the proposed Precinct, the residential land uses are categorised as 'Rural'.

**Table 4.2 – Amenity Criteria for Various Land Uses**

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L <sub>Aeq</sub> Noise Level, dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Notes: 1. Criteria based on internal noise levels

#### 4.1.3 PEO (Noise Control) Regulation 2000

Although not an industrial noise source, the noise assessment of domestic air conditioners that may be installed within dwellings as part of future residential developments within the precinct should consider the requirements of the 'Protection of the Environment Operations (PEO) (Noise Control) Regulation 2000', which stipulates noise limits required for the use of domestic air conditioners.

Noise generated by domestic air conditioners is limited by Part 52 'Air conditioners' of the Regulation. The Regulation states that:

*'A person must not cause or permit an air conditioner to be used on residential premises in such a manner that it emits noise that can be heard within a habitable room in any other residential premises (regardless of whether any door or window to that room is open):'*

- (a) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or
- (b) before 7 am or after 10 pm on any other day.'

Under the Regulation, a 'domestic air conditioner' means:

*'a split or packaged mechanical system:*

*(a) that is capable of controlling air temperature and distribution and that may also control the humidity and cleanliness of the air, and*

*(b) whose nominal cooling capacity does not exceed 12 kilowatts when measured in accordance with AS 1861,*

*but does not include a device of the kind that is commonly known as an evaporative system, and does not include a device that is designed exclusively for heating.'*

## **4.2 Industrial Noise Sources**

At this stage of development the employment uses of the Marsden Park Precinct are yet to be finalised. However, it is envisaged that the Precinct will only accommodate commercial type developments in the employment areas and no industrial (light) type developments will be located within the Precinct. It is recommended that once employment uses are determined and finalised, a detailed acoustic assessment of noise impacts to future sensitive land uses within the proposed Precinct and existing sensitive land uses surrounding the Precinct should be undertaken.

Industrial type developments including heavy industries are expected to be located at the adjacent Marsden Park Industrial Precinct (MPIP). As part of its development submissions and approvals to Blacktown City Council, the MPIP is expected to provide its own noise emission targets / criteria and therefore noise impacts from the MPIP on the Precinct are not assessed from herein.

## **4.3 Recommendations**

The following recommendations provide general in-principle noise control solutions that may be considered during the detailed design stage of the project to reduce potential noise impacts from employment areas to sensitive receivers within the proposed Precinct and within the existing areas surrounding the Precinct. The recommendations take into consideration and address the requirements nominated in the Growth Centres Development Code. This information is presented for the purpose of the decision making and cost planning process. More detailed noise control solutions should be determined during the detailed design stage of the project when zone boundaries and types of uses are confirmed and finalised.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

- Noise screens / walls should be considered in the design phase of any commercial premises to be located within the Precinct. The noise screens / walls can form part of boundary fences and should be designed to and located so that the screen / wall provides sufficient noise attenuation to reduce noise impacts to neighbouring noise sensitive areas.
- Consideration should be given to building layout design at the design stage of any commercial development to ensure that noisy activities are located away from noise sensitive areas. For example, buildings should be sited so that they are located between the noisy activities (eg. loading docks and driveways) and the noise sensitive areas, providing noise shielding of the noisy activities to the affected sensitive areas.
- Providing buffer zones between noise sources and noise sensitive areas, where space allows, which would include:
  - dense vegetation/ foliage across a wide area of the buffer zone. Studies have shown that areas heavily planted with shrubs and trees can achieve noticeable noise reductions where the buffer zones are large. Furthermore, the visual obstruction to the noise source could also reduce the perceived noise impacts; and/or
  - earth mounds or noise walls. Earth mounding or noise walls may be used in combination with vegetation screening to further reduce potential impacts.

It is noted that noise mitigation options such as dense vegetation / foliage or earth mounding should be cognisant of any other issues that might impact on their overall design and effectiveness, including visual impact, bushfire hazard, and ease and cost of maintaining effective mitigation.

- Should restrictions on the hours of operation of the proposed employment areas within the Precinct be considered, then the criteria used for the assessment of noise impacts will be less stringent. For example, if hours of operation are changed from 24 hours to between 7.00am and 10.00pm, then the applicable noise criteria would be based on the evening period, which is less stringent than the night period that would be used for a 24 hour operation noise assessment. This may result in reduced exceedances of the applicable noise criteria, which in turn may reduce the noise control measures required. This may be a consideration during the detailed design phase of the project.

## 5 ROAD TRAFFIC NOISE ASSESSMENT

---

### 5.1 Road Traffic Noise Criteria

Since the replacement of the 'Environmental Criteria for Road Traffic Noise' (ECRTN) with the 'Road Noise Policy' (RNP) by The NSW Office of Environment & Heritage (OEH) in July 2011, noise criteria for new residential developments impacted by road traffic noise are now based on the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP). The ISEPP sets out internal noise criteria for new residential developments adjacent to roads having an Annual Average Daily Traffic (AADT) volume greater than 40,000.

In regards to the RNP, the change in policy resulted in the removal of noise criteria for new residential developments. The effect of removing the criteria is that there is no requirement to assess noise for new residential developments unless they are exposed to noise from roads with an AADT volume of 40,000 cars or more.

Furthermore, it should be noted that there are **no** external noise requirements (eg. backyards, outdoor courtyards, etc) for new residential developments, nor are there external noise requirements for new sensitive land uses such as passive and active open spaces (eg. sports fields), school classrooms, hospitals, places of worships, childcare facilities or aged care facilities.

Richmond Road has been identified as the main source of potential road traffic noise impact onto the proposed Precinct. Based on the forecasted traffic volumes, Richmond Road has an AADT volume of more than 40,000 cars; therefore, compliance with the ISEPP would be required.

### 5.2 ISEPP Noise Limits

In NSW the State Environmental Planning Policy (Infrastructure) 2007 (known as the 'Infrastructure SEPP') commenced on 1 January 2008 to facilitate the effective delivery of infrastructure across the State.

Clause 102 of the ISEPP states the following:

**"102 Impact of road noise or vibration on non-road development**

1. *This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road 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.
2. Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.
  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 LAeq levels are not exceeded:
    - (a) in any bedroom in the building – 35dB(A) at any time between 10pm and 7am,
    - (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.
  4. In this clause, **freeway**, **tollway** and **transitway** have the same meanings as they have in the Roads Act 1993.”

#### 5.2.1 ISEPP Guideline

To support the Infrastructure SEPP, the NSW Department of Planning released the *Development in Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. Whilst the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

##### Clarification of ISEPP Noise Limits

The Guideline clarifies the time period of measurement and assessment. As stated in Section 3.4 of the Guideline and Table 3.1 of Section 3.6.1, noise measurements are determined over the following relevant time periods:

- Daytime            7am-10pm            L<sub>Aeq(15hr)</sub>
- Night-time        10pm-7am            L<sub>Aeq(9hr)</sub>

The noise criteria nominated in the ISEPP are internal noise levels with windows and doors closed and the requirements are stated in the following table.

**Table 5.1 – ISEPP Internal Road Traffic Noise Criteria, dB(A)**

Internal Space	Time Period	Noise Metric	Internal Criteria <sup>1</sup>
Bedrooms	7am – 10pm	L <sub>Aeq(15hr)</sub>	40 <sup>2</sup>
	10pm to 7am	L <sub>Aeq(9hr)</sub>	35
Other Habitable Rooms	Any Time	L <sub>Aeq(15hr)</sub> and L <sub>Aeq(9hr)</sub>	40

Notes: 1. Based on windows and doors closed

2. Whilst not specified in the ISEPP, daytime criteria for bedrooms set to 40dB(A), as per other habitable rooms.

Section 3.6.1 of the Guideline states the following for airborne noise:

*"If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, 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."*

As noise modelling is undertaken for external locations, the above criteria and guidelines have been used to establish equivalent external noise criteria. These external noise criteria are used to determine which building façades may require specific acoustic treatment to meet the requirements of the ISEPP. External criteria have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position, where windows are opened to 5% of the floor area in accordance with the requirements of BCA 2011.

**Table 5.2 – Equivalent External ISEPP Road Traffic Noise Criteria, dB(A)**

Internal Space	Location	L <sub>Aeq(15hr)</sub> Day	L <sub>Aeq(9hr)</sub> Night
Bedrooms	External Free-Field Location <sup>1</sup>	60	55
Other Habitable Rooms		60	60

Notes: 1. Equivalent external noise criteria based on nominal 10dB(A) reduction through an open window to an external free-field position.

2. Day represents the period from 7am to 10pm; Night represents the period from 10pm to 7am

### 5.3 Road Traffic Noise Sources

The proposed development will potentially be affected by traffic along Richmond Road. AADT data has been obtained from the 'Traffic Volume Data for the NSW Southern Region 2006' document published by the NSW Roads and Maritime Services (RMS). Furthermore, on-site peak hour traffic counting was conducted by AECOM, the traffic consultants for the Project. Forecast peak hour traffic volumes for the years 2021 and 2036, were also provided by AECOM.

In addition, RMS plans to upgrade South Street as part of the Schofields Road corridor project. Schofields Road is planned to be extended to Richmond Road and transformed into a transit boulevard, providing a major east-west connection between Richmond Road and Windsor Road. Therefore, the proposed Precinct would potentially be affected by traffic along the upgraded South Street and the Schofields Road extension. As per Richmond Road, the forecast peak hour traffic volumes for years 2021 and 2036 were provided by AECOM

The traffic composition data used for noise modelling purposes are summarised in the table below.

**Table 5.3 – Future Traffic Volume & Composition Data**

Section of Road	Year	Direction	Day (7am-10pm)		Night (10pm-7am)		Speed
			Volume	%HV	Volume	%HV	
<b>Richmond Road</b>							
1. Sanctuary Drive to St Marys Rd	2021	Two way	23,564 <sup>1</sup>	5.4	4,117 <sup>1</sup>	5.4	80 km/hr
2. St Marys Rd to 1270 Richmond Rd	2021	Two way	22,271 <sup>1</sup>	5.4	3,899 <sup>1</sup>	5.4	80 km/hr
3. 1270 Richmond Rd to 1148 Richmond Rd	2021	Two way	24,267 <sup>1</sup>	5.5	4,182 <sup>1</sup>	5.5	80 km/hr
4. 1138 Richmond Rd to Garfield Rd West	2021	Two way	26,753 <sup>1</sup>	7.7	4,563 <sup>1</sup>	7.7	80 km/hr
5. Garfield Rd West to Vine St West	2021	Two way	34,472 <sup>1</sup>	7.7	5,878 <sup>1</sup>	7.7	80 km/hr
6. Vine St West to Grange Ave	2021	Two way	34,995 <sup>1</sup>	7.7	5,962 <sup>1</sup>	7.7	80 km/hr
7. Grange Ave to South St	2021	Two way	35,717 <sup>1</sup>	7.7	6,109 <sup>1</sup>	7.7	80 km/hr
8. South St to 920 Richmond Rd	2021	Two way	36,904 <sup>1</sup>	8.4	6,327 <sup>1</sup>	8.4	80 km/hr
9. 920 Richmond Rd to Townson Rd	2021	Two way	42,612 <sup>1</sup>	8.3	7,472 <sup>1</sup>	8.3	80 km/hr
10. Townson Rd to M7 Motorway	2021	Two way	54,357 <sup>1</sup>	8.2	9,592 <sup>1</sup>	8.2	80 km/hr
11. Sanctuary Drive to St Marys Rd	2036	Two way	25,132 <sup>1</sup>	5.3	4,441 <sup>1</sup>	5.3	80 km/hr
12. St Marys Rd to 1270 Richmond Rd	2036	Two way	24,730 <sup>1</sup>	5.3	4,383 <sup>1</sup>	5.3	80 km/hr
13. 1270 Richmond Rd to 1148 Richmond Rd	2036	Two way	26,983 <sup>1</sup>	5.3	4,702 <sup>1</sup>	5.3	80 km/hr
14. 1138 Richmond Rd to Garfield Rd West	2036	Two way	33,526 <sup>1</sup>	7.3	5,788 <sup>1</sup>	7.3	80 km/hr
15. Garfield Rd West to Vine St West	2036	Two way	42,523 <sup>1</sup>	7.3	7,384 <sup>1</sup>	7.3	80 km/hr
16. Vine St West to Grange Ave	2036	Two way	44,348 <sup>1</sup>	7.4	7,656 <sup>1</sup>	7.4	80 km/hr
17. Grange Ave to South St	2036	Two way	43,334 <sup>1</sup>	7.3	7,427 <sup>1</sup>	7.3	80 km/hr
18. South St to 920 Richmond Rd	2036	Two way	54,874 <sup>1</sup>	8.2	9,262 <sup>1</sup>	8.2	80 km/hr
19. 920 Richmond Rd to Townson Rd	2036	Two way	61,983 <sup>1</sup>	8.1	10,735 <sup>1</sup>	8.1	80 km/hr
20. Townson Rd to M7 Motorway	2036	Two way	75,925 <sup>1</sup>	8.0	13,059 <sup>1</sup>	8.0	80 km/hr

Section of Road	Year	Direction	Day (7am-10pm)		Night (10pm-7am)		Speed
			Volume	%HV	Volume	%HV	
<b>Upgraded South Street</b>							
21. Southern boundary to Glegarrie Rd	2021	Two way	10,493 <sup>1</sup>	8.4 <sup>3</sup>	1,936 <sup>1</sup>	8.4	60 km/hr
22. Glengarrie Rd to 306 South St	2021	Two way	8,564 <sup>1</sup>	8.4 <sup>3</sup>	1,531 <sup>1</sup>	8.4	60 km/hr
23. 306 South St to 234 South St	2021	Two way	7,349 <sup>1</sup>	8.4 <sup>3</sup>	1,263 <sup>1</sup>	8.4	60 km/hr
24. 234 South St to 208 South St	2021	Two way	9,114 <sup>1</sup>	8.4 <sup>3</sup>	1,531 <sup>1</sup>	8.4	60 km/hr
25. 208 South St to Richmond Rd	2021	Two way	9,114 <sup>1</sup>	8.4 <sup>3</sup>	1,531 <sup>1</sup>	8.4	60 km/hr
26. Southern boundary to Glegarrie Rd	2036	Two way	26,576 <sup>1</sup>	8.4 <sup>3</sup>	4,313 <sup>1</sup>	8.4	60 km/hr
27. Glengarrie Rd to 306 South St	2036	Two way	27,621 <sup>1</sup>	8.4 <sup>3</sup>	4,726 <sup>1</sup>	8.4	60 km/hr
28. 306 South St to 234 South St	2036	Two way	27,577 <sup>1</sup>	8.4 <sup>3</sup>	4,644 <sup>1</sup>	8.4	60 km/hr
29. 234 South St to 208 South St	2036	Two way	32,341 <sup>1</sup>	8.4 <sup>3</sup>	5,665 <sup>1</sup>	8.4	60 km/hr
30. 208 South St to Richmond Rd	2036	Two way	39,542 <sup>1</sup>	8.4 <sup>3</sup>	6,993 <sup>1</sup>	8.4	60 km/hr
<b>Schofields Road Extension</b>							
31. Richmond Rd to 140 South St	2021	Two way	22,935 <sup>1</sup>	8.4 <sup>3</sup>	3,986 <sup>1</sup>	8.4	60 km/hr
32. 140 South St to Fermoy Rd	2021	Two way	23,282 <sup>1</sup>	8.4 <sup>3</sup>	4,074 <sup>1</sup>	8.4	60 km/hr
33. Fermoy Rd to Carnarvon Rd	2021	Two way	24,103 <sup>1</sup>	8.4 <sup>3</sup>	4,231 <sup>1</sup>	8.4	60 km/hr
34. Carnarvon Rd to Schofields Rd	2021	Two way	24,450 <sup>1</sup>	8.4 <sup>3</sup>	4,295 <sup>1</sup>	8.4	60 km/hr
35. Richmond Rd to 140 South St	2036	Two way	40,204 <sup>1</sup>	8.4 <sup>3</sup>	6,900 <sup>1</sup>	8.4	60 km/hr
36. 140 South St to Fermoy Rd	2036	Two way	40,699 <sup>1</sup>	8.4 <sup>3</sup>	7,062 <sup>1</sup>	8.4	60 km/hr
37. Fermoy Rd to Carnarvon Rd	2036	Two way	41,405 <sup>1</sup>	8.4 <sup>3</sup>	7,311 <sup>1</sup>	8.4	60 km/hr
38. Carnarvon Rd to Schofields Rd	2036	Two way	45,659 <sup>1</sup>	8.4 <sup>3</sup>	8,148 <sup>1</sup>	8.4	60 km/hr

Notes: 1. Day, night and peak traffic volume ratios determined based on hourly traffic data profiles from RMS's NSW Southern Region 2006 traffic volume data document. The volume ratios were then applied to AECOM's predicted volumes to obtain the equivalent day and night volumes

2. %HV refers to percentage of heavy vehicles

3. Based on the percentage of heavy vehicles at Richmond Road/ South Street counting station

## 5.4 Predicted Road Traffic Noise

The noise prediction model used to predict traffic noise levels for the project are contained within the calculation algorithms of the noise model developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the

CoRTN88 method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board.

The model predicts noise levels for free flowing traffic and a modified method has been developed which enables an accurate prediction of noise from high truck exhausts to be taken into account. The method predicts the  $L_{10(1hour)}$  noise levels within the daytime 15 hour (7am to 10pm) and night-time 9 hour (10pm to 7am) periods and a correction of -3dB(A) is applied to obtain the  $L_{eq(1hour)}$  noise levels for each period. The  $L_{eq(1hour)}$  noise level for the time period 7am to 10pm is then equated to the daily  $L_{eq(15hour)}$  noise level. Similarly, the  $L_{eq(1hour)}$  noise level for the time period 10pm to 7am is then equated to the night time  $L_{eq(9hour)}$  noise level.

The noise prediction model takes into account the following:

**Table 5.4 – Summary of Modelling Inputs**

Input Parameters	Data Acquired From
Traffic volumes and mix	See Table 5.3 above
Vehicle speed	See Table 5.3 above
Gradient of roadway	Estimated from Contour Plan provided by Blacktown City Council and 80% Road Design provided by AECOM
Source height	0.5m for car exhaust, 1.5m for car and truck engines and 3.6m for truck exhaust and detailed within CoRTN88
Ground topography at receiver and road	From Contour Plan provided by Blacktown City Council
Angles of view from receiver	160 degrees for all receivers
Reflections from existing barriers, structures and cuttings on opposite side of road	Determined during site inspections and review of concept design. No structures or cuttings identified.
Air and ground absorption	Detailed within CoRTN88, ground absorption varied along route. Numeric values varied between 0 (hard surface) to 1 (100% absorptive)
Receiver Heights	1.5m above ground level
Facade correction	+2.5dB(A)
Australian conditions correction	-1.7dB(A) at 1m from facade
Acoustic properties of road surfaces	Assumed dense graded asphalt
Roadside barriers	Assumes no existing noise barriers

## 5.5 Road Traffic Noise Assessment

### 5.5.1 Predicted Traffic Noise Levels

As there are numerous areas potentially affected by traffic noise from Richmond Road, the upgraded South Street and the Schofields Road extension, road traffic noise levels are predicted across the Precinct using noise contour maps. The predicted noise contour levels have been overlayed on the preliminary draft layout plan to identify areas of exceedances.

Figure 2 and Figure 3 presents the day time noise contours representing road traffic noise generated by Richmond Road, the upgraded South Street and the Schofields Road extension for the years 2021 and 2036, respectively. Figure 4 and Figure 5 presents the night time noise

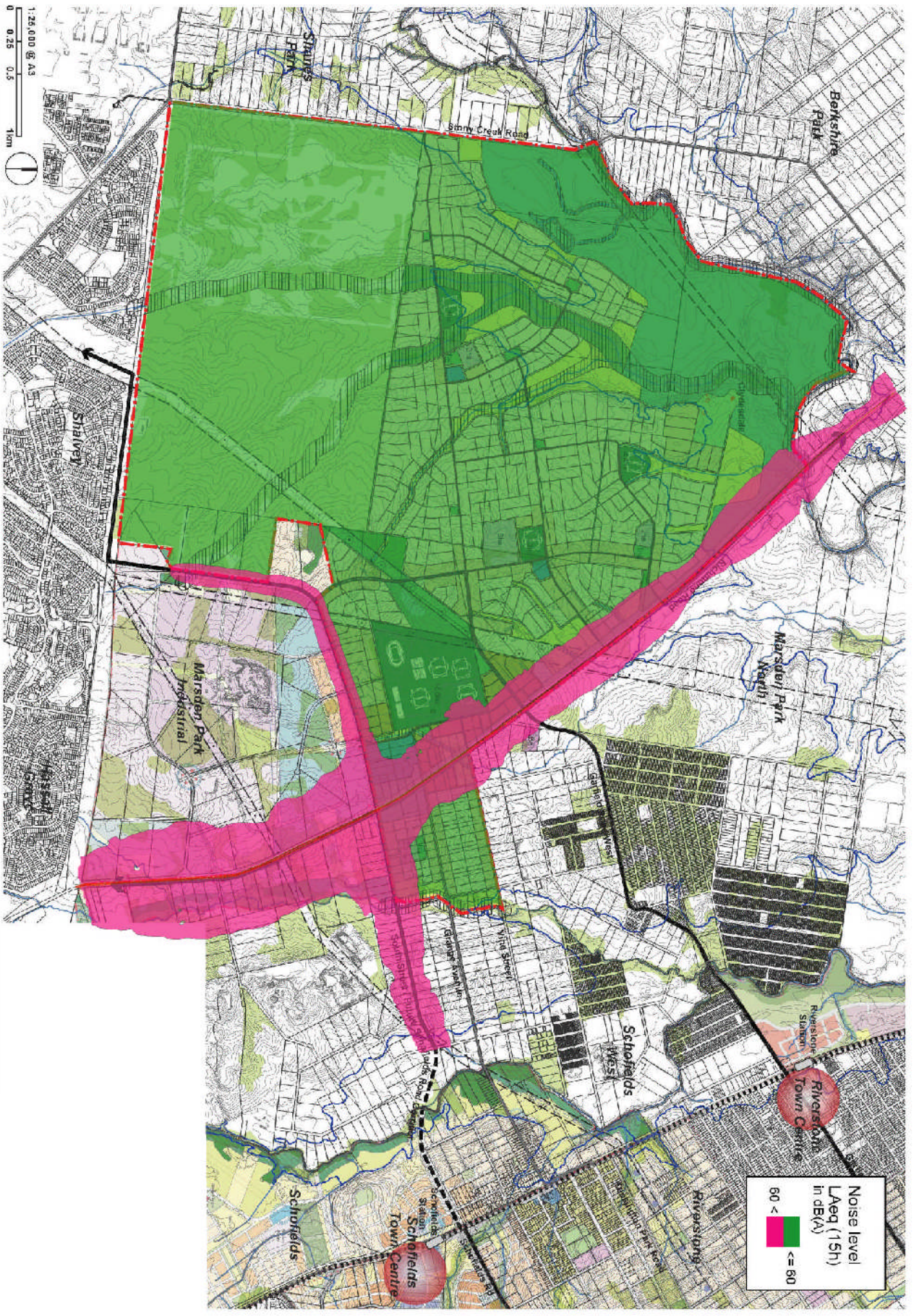
contours representing road traffic noise generated by Richmond Road, the upgraded South Street and the Schofields Road extension for the years 2021 and 2036, respectively.

### 5.5.2 Assessment of Impacts

The 60dB(A) contour shown Figure 2 and Figure 3 indicate the locations within the noise contours (ie between the noise contour and road) where road traffic noise levels from Richmond Road, the upgraded South Street and the Schofields Road extension comply with the recommendations for residential receivers during the daytime, for the relevant year. Therefore, it is recommended that residential lots should not be located between the 60dB(A) contour and Richmond Road, the upgraded South Street or the Schofields Road extension, unless appropriate acoustic mitigation measures are incorporated in the design of the residential lots (see Section 5.6 following).

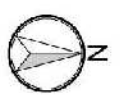
Similar the 55dB(A) contour shown in Figure 4 and Figure 5 indicate the locations within the noise contours (ie between the noise contour and road) where road traffic noise levels from Richmond Road, the upgraded South Street and the Schofields Road extension comply with the recommendations for residential receivers during the night time, for the relevant year. Therefore, it is recommended that residential lots should not be located between the 55dB(A) contour and Richmond Road, the upgraded South Street or the Schofields Road extension, unless appropriate acoustic mitigation measures are incorporated in the design of the residential lots (see Section 5.6 following).

Although there is no specific criteria for new sporting fields in the Precinct, from the NSW RNP the assessment criterion for existing open space (active use) sensitive land uses is  $L_{Aeq(15 \text{ hour})}$  60dBA when in use. Considering this assessment criterion for the new sporting fields off Garfield Road, it can be seen in Figure 2 and Figure 3 that the some portions on the western end of the sporting field will be exposed to levels greater than 60dB(A). However with the construction of high density residential and retail/commercial buildings surrounding the sporting field, it is expected that these buildings will provide shielding to reduce noise levels to below 60dB(A).



Noise level  
 LAeq (15h)  
 in dB(A)

60 <	Green
<= 60	Pink



**RENZO TONIN & ASSOCIATES**  
*inspired to achieve*

**Sydney**  
 Tel: 02 9219 0070 Fax: 02 9218 6651  
**Melbourne**  
 Tel: 03 9000 0044 Fax: 03 9000 0042  
**Brisbane**  
 Tel: 07 5500 1755 Fax: 07 5501 6188  
**Gold Coast**  
 Tel: 07 5500 9803 Fax: 07 5502 8655  
**Mumbai**  
 Tel: 022 11 666 800 1542

**Title :**  
**Figure 2 - 2021 Day-time LAeq (15h) Contours**

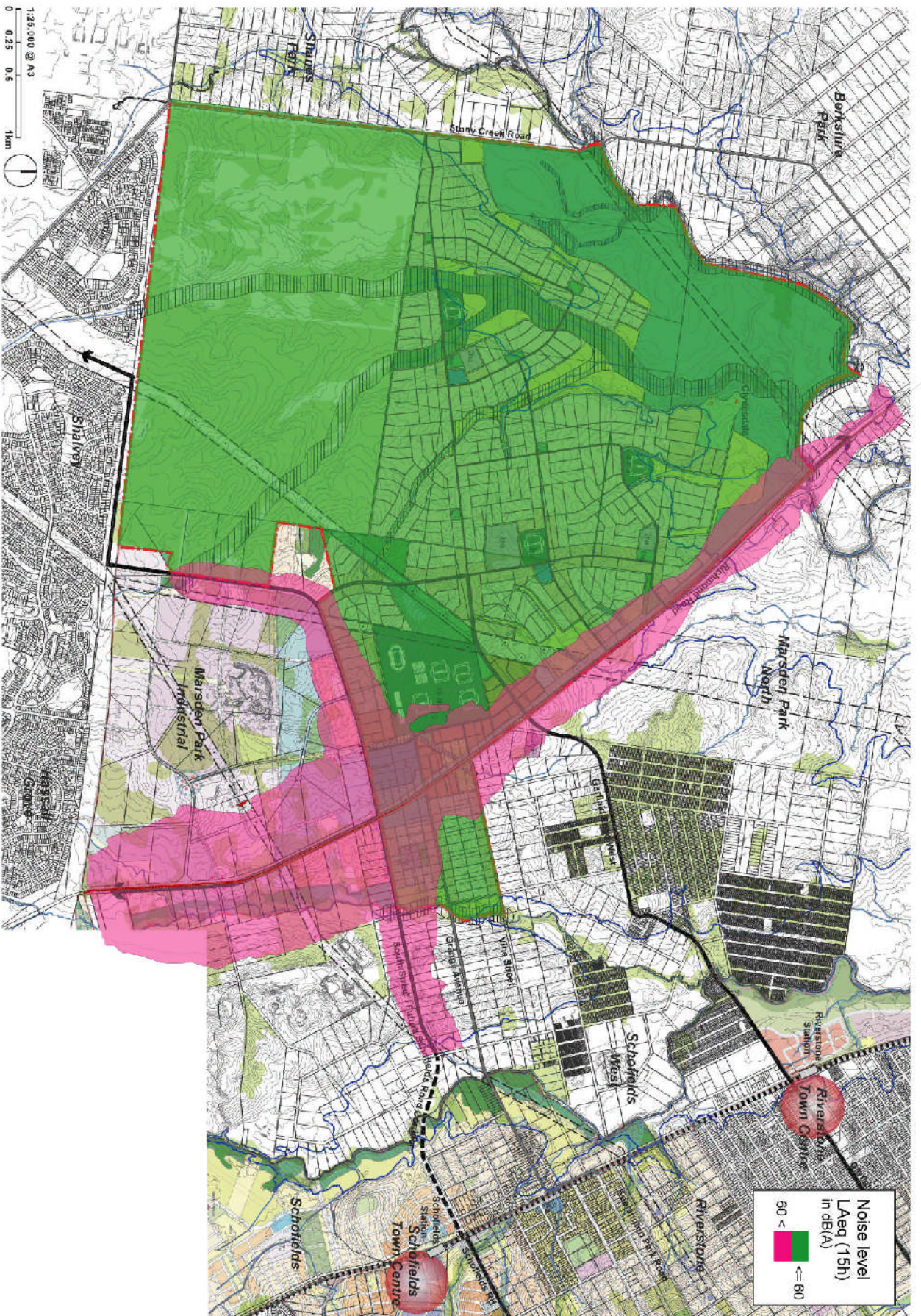
**Project :**  
**Marsden Park Precinct**

**Date:** 02/05/12

**Scale:** NTS

**Ref:** TF497-01P02 (rev 1)

Version of the Association of Architectural Contractors



**Title :**  
**Figure 3 - 2036 Day-time LAeq (15hr) Contours**

**Project :**  
**Marsden Park Precinct**

**Date:** 02/04/12

**Scale:** NTS

**Ref:** TF497-01P03 (rev 1)

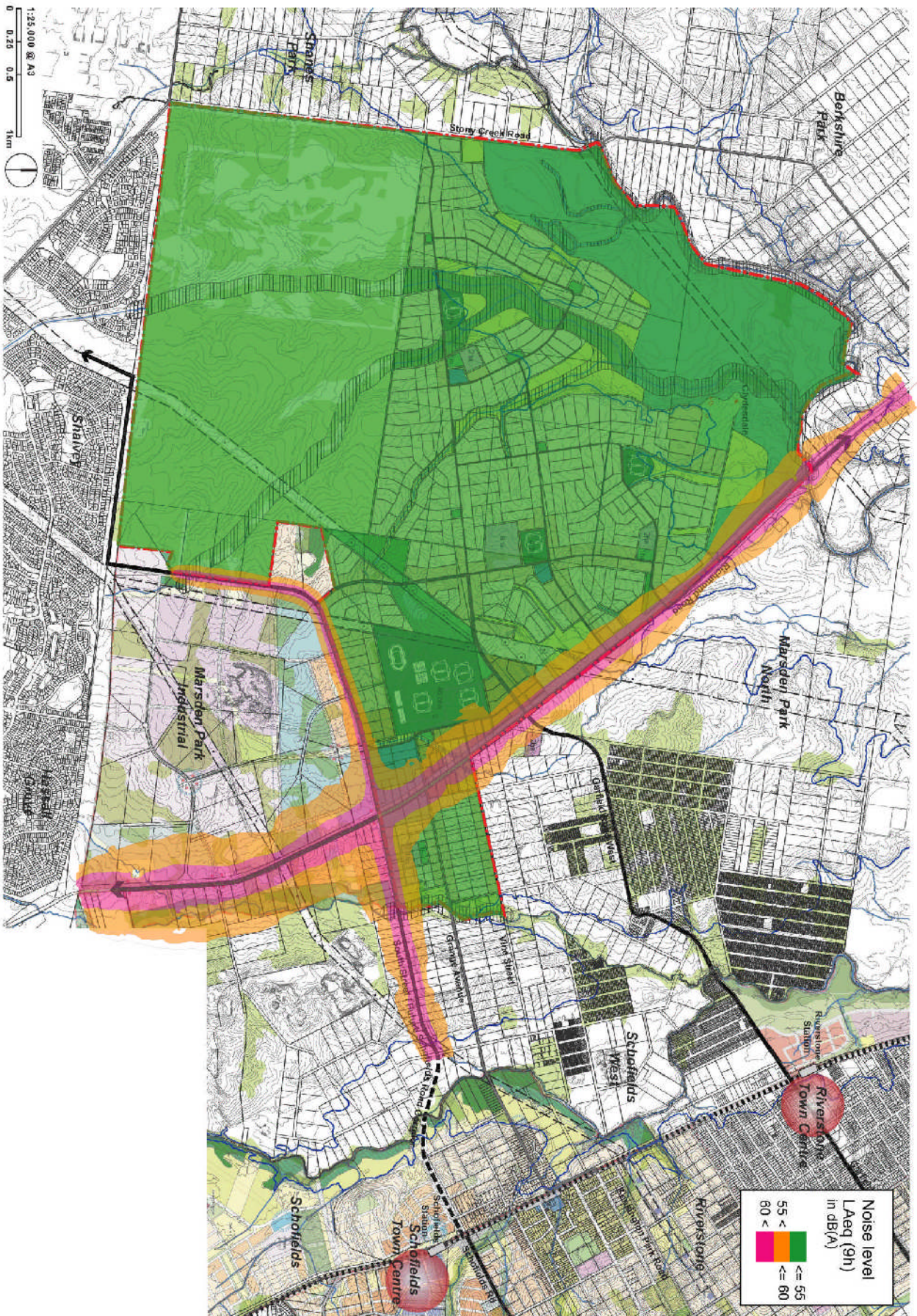


**RENZO TONIN & ASSOCIATES**  
 Inspired to achieve  
 Commercial & Residential Architecture  
 Interior Architecture  
 Urban Planning  
 Landscape Architecture  
 Project Management  
 www.renzo.com.au

**Sydney**  
 PT: (02) 85 80 0000 Fax: (02) 85 18 6561  
**Melbourne**  
 PT: (03) 9500 0041 Fax: (03) 9500 0040  
**Brisbane**  
 PT: (07) 5592 5923 Fax: (07) 5592 5925  
**Gold Coast**  
 PT: (07) 5592 5923 Fax: (07) 5592 5925  
**Mumbai**  
 PT: (0011) 555 633 1523

Member of the Association of Architects in Australia (AIA) since 1979





Noise level LAeq (9h) in dB(A)	
	<= 55
	55 < 60
	60 < 65
	65 < 70

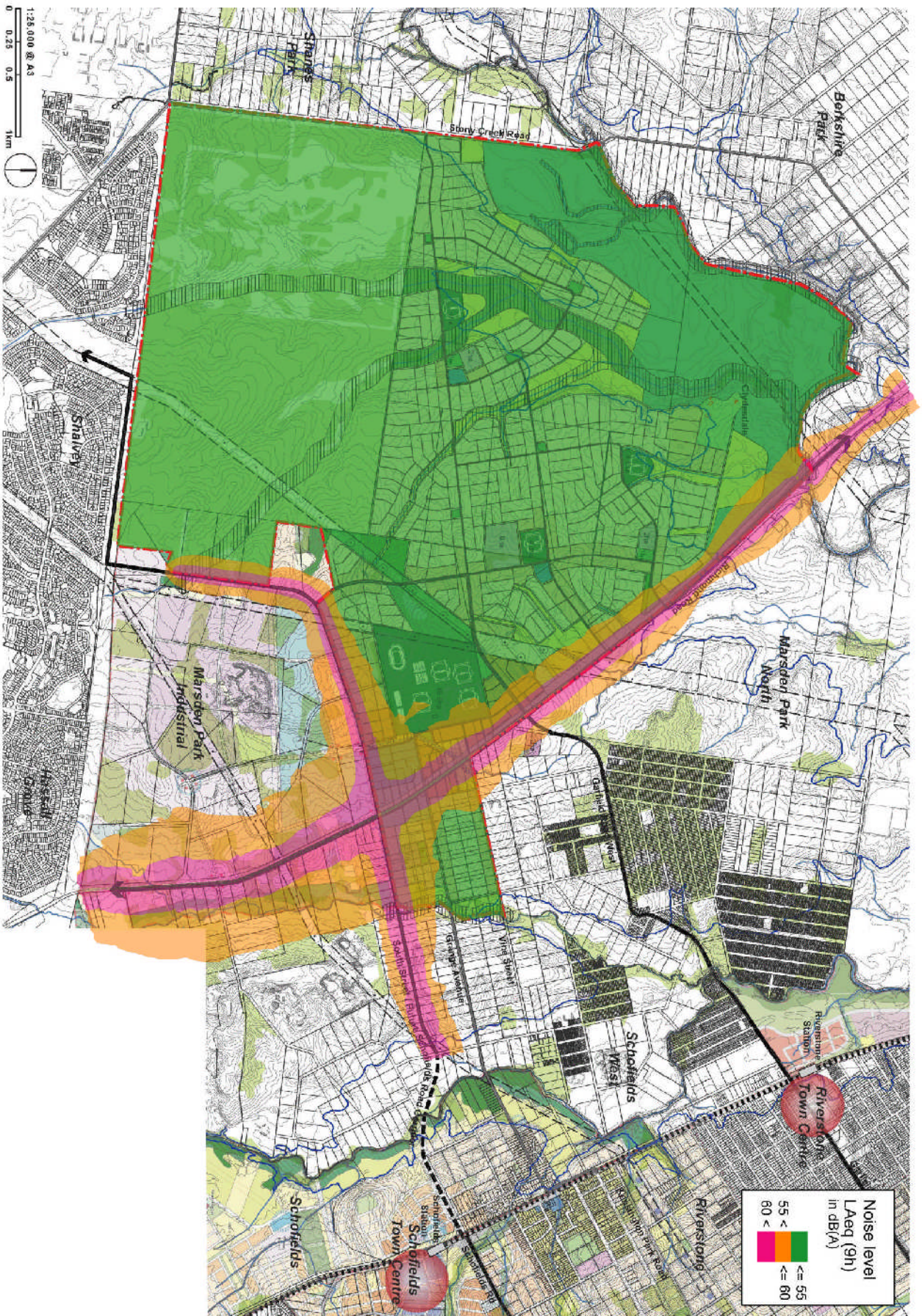
**Title :**  
Figure 4 - 2021 Night time LAeq (9hr.) Contours

**Project :**  
Marsden Park Precinct

**Date:** 02/05/12

**Scale:** NTS

**Ref:** TF497-01P04 (rev 1)



**RENZO TONIN & ASSOCIATES**  
*Inspired to achieve*

Specialists in Acoustics, Vibration and Structural Dynamics  
 Email: [renzo@renzo.com.au](mailto:renzo@renzo.com.au) www.renzo.com.au

Member of the Association of Acoustical Consultants

Sydney  
 Ph: (02) 973 9 0000 Fax: (02) 873 8 700  
 Melbourne  
 Ph: (03) 9000 0001 Fax: (03) 9000 0002  
 Brisbane  
 Ph: (07) 5533 6663 Fax: (07) 5533 6665  
 Perth  
 Ph: (08) 9437 1552

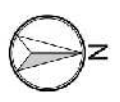
**Title :**  
**Figure 5 - 2036 Night time LAeq (9hr.) Contours**

**Project :**  
**Marsden Park Precinct**

**Date:** 09/03/12

**Scale:** NTS

**Ref:** TF497-01P05 (rev 1)



## 5.6 Recommendations

The following recommendations provide typical noise control solutions commonly used to reduce noise impacts to residential buildings that may be developed along Richmond Road and South Street within the Precinct. This information is presented for the purpose of development assessment only and shall not be used in more detailed design unless otherwise approved in writing by the acoustic consultant.

### 5.6.1 Noise Barriers

For residential properties constructed within the  $L_{Aeq(15hr)}$  60dB(A) and/or  $L_{Aeq(9hr)}$  55dB(A) contour (refer to Figure 3 and Figure 5), the use of noise barriers should be considered. Noise barriers can usually reduce noise levels by at least 5dB(A) when they are high enough to break line-of-sight and 10-15dB(A) in the acoustic 'shadow zone', with a maximum total noise reduction of 20dB(A).

Noise barriers can be very effective for mitigating traffic noise where residences are closely grouped and as long as there are no breaks in the barrier. Where the proposed dwellings are of double storey or multi-storey construction, high noise barriers (> 5m) would be required to mitigate noise to the upper levels and may not be a feasible option given the structural requirements for high barriers.

Furthermore, noise barriers are only feasible where the barriers do not cause access difficulties to properties and where they are visually acceptable. Where driveway access is required for residential properties it is preferred not to use noise barriers as the overall noise reduction provided by the barrier is compromised by the need to install an access gate.

Based on the Preliminary Draft Layout Plan, properties north of Garfield Road are proposed to generally be of low to medium density type with access from local roads; and therefore noise barriers may be a feasible option for these properties. For proposed properties generally south of Garfield Road, the layout plan shows high density or mixed use type developments. Given that high density and mixed use developments would typically include multi-storey dwellings / buildings, noise barriers may not be a feasible option given the height requirements required to mitigate upper levels of these developments, as discussed above. Therefore, other options such as building treatment should be considered for noise mitigation.

For proposed properties along South Street, noise barriers may be considered for any low to medium density developments. However, from the layout plan it is assumed that access to these properties would be from South Street; and therefore noise barriers would not be feasible due to access requirements, as discussed above.

The effectiveness and location of any noise barriers will need to be investigated during the detailed design stage when final property layout and density distribution has been determined.

## 5.6.2 Building Treatment

Residential properties constructed within the  $L_{Aeq(15hr)}$  60dB(A) and/or  $L_{Aeq(9hr)}$  55dB(A) contour (refer to Figure 3 and Figure 5) should be designed to satisfy the internal noise requirements of the ISEPP.

Examples of building treatment options that may be considered in order to achieve the ISEPP requirements may include, but not limited to, the following:

- Provide glazing with sufficient acoustic performance for windows facing the traffic noise source including the installation of acoustic seals for operable windows.
- Provide doors with sufficient acoustic performance for doors facing the traffic noise source including the installation of acoustic seals.
- Facades facing the traffic noise source be of masonry construction.
- If the ISEPP internal noise levels can only be achieved with windows and doors closed, then mechanical ventilation (eg. acoustic wall ventilators) or air conditioning should be provided to ensure fresh airflow inside the dwellings so to meet the requirements of the Building Code of Australia (BCA).

Depending on the noise reductions required in order to achieve the internal noise requirement of the ISEPP, various types of building treatment options are available to mitigate noise. The associated cost implications will depend upon the required noise controls options shown below. It is noted that cost estimates are only provided as a guide and should not be used for cost planning.

- **Option 1 Mechanical ventilation only**

*1-10 dB(A) reduction* Where external noise levels are less than 10dB(A) above the nominated external criteria, the internal noise goals may be achieved with windows closed. A light framed building with single glazed windows will provide a minimum noise reduction of up to 20dB(A) from outside to inside when windows are closed. If the ISEPP internal noise goals can only be achieved with windows closed, then mechanical ventilation or air conditioning must be provided to ensure fresh airflow inside the dwelling so to meet the requirements of the Building Code of Australia.

It is important to ensure that mechanical ventilation does not provide a new noise leakage path into the dwelling and does not create a noise nuisance to neighbouring residential premises.

- Option 2 Upgraded seals for windows and doors**  
*10-12dB(A) reduction* Where external noise levels are only slightly greater than 10dB(A) above the nominated external criteria, then additional to installing mechanical ventilation systems (Option 1), special acoustic grade seals should be installed on windows and perimeter doors exposed to road traffic noise to enable the internal noise criteria to be achieved with windows and doors shut.
- Option 3 Upgraded windows, glazing and doors**  
*>12 dB(A) reduction* Where the predicted external noise level exceeds the nominated external criteria by significantly more than 10dB(A), then upgraded windows and glazing and the provision of solid core doors will be required on the facades exposed to the road noise source, in addition to the mechanical ventilation described in Option 1. Note that these upgrades are only suitable for masonry buildings. It is unlikely that this degree of upgrade would provide significant benefits to light framed structures should there be no acoustic insulation in the walls.

Other community (eg. libraries), commercial and industrial buildings should also be constructed to achieve the recommended internal noise levels presented in Australian Standard AS2107:2000 'Acoustics – Recommended design sound levels and reverberation times for building interiors'.

The table below provides a summary of typical recommended indoor design sound levels from AS2107:2000. It is noted that this summary is for guidance only and is by no means exhaustive.

**Table 5.5 – Recommended Internal Sound Levels Based on AS2107:2000**

Type of Occupancy	Activity	Recommended Design Sound Level, $L_{Aeq}$ dB(A)	
		Satisfactory	Maximum
Child Care Centre	Teaching Areas	35	45
	Outdoor Play Areas <sup>1</sup>	$L_{Aeq(1hr)}$ 55 <sup>1</sup>	-
Libraries	Office Spaces	40	45
	Reading Areas	40	45
	Stack Areas	45	50
	Workshop Areas	45	55
Shop Building	Small retail store (general)	45	50
	Supermarkets	50	55
Office Building	Board & conference rooms	30	40
	Private offices	35	40
	General office areas	40	45

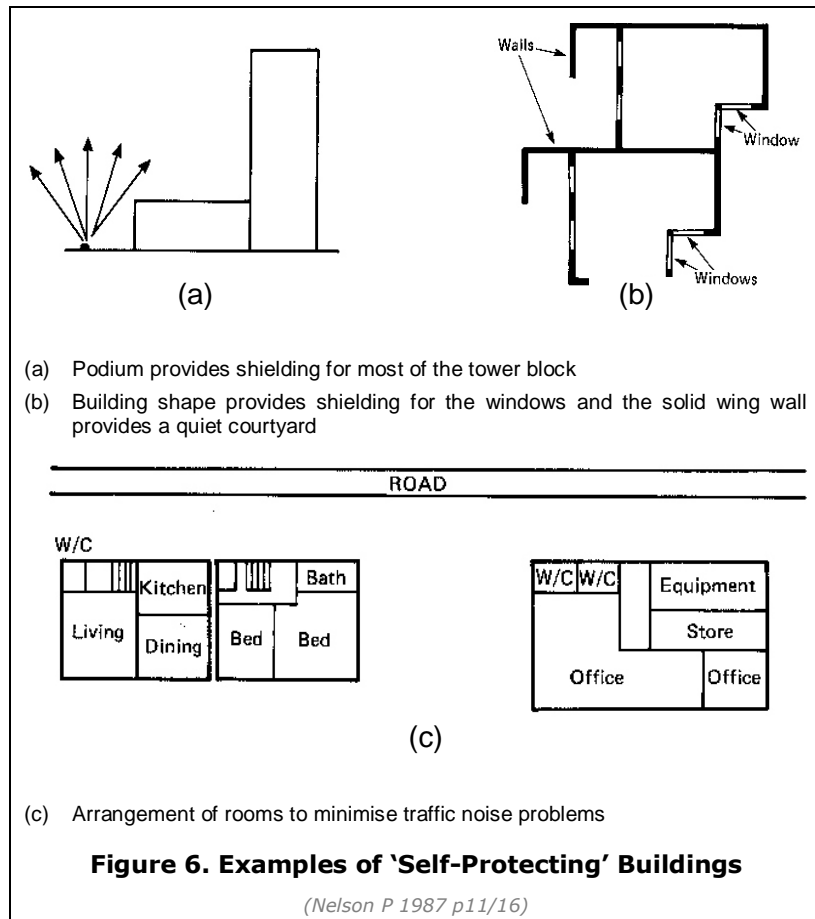
Notes: 1. External noise level, taken from RNP (p13) Table 4 – Outdoor play areas

### 5.6.3 Building Design

Buildings to be constructed in areas affected by road traffic noise, as discussed above, should consider building layout design at the design stage to ensure internal noise levels meet the ISEPP requirements.

Courtyards and open space areas can be located away from the road, using the building as a buffer to obtain a quiet outdoor environment. Within the building itself, locate less sensitive rooms closest to the road, so that these essentially form a barrier between the road and noise sensitive rooms such as bedrooms. Where possible, locate the building further away from the road, thereby reducing road traffic noise at the facade.

Figure 6 below provides examples of 'self-protecting' building design.



## 6 AIRCRAFT NOISE

### 6.1 Aircraft Noise Criteria

An aircraft noise level criterion was determined using the Australian Standard AS2021-2000 – “Acoustics – Aircraft Noise Intrusion – Building Siting and Construction”. This standard provides zoning information for sites subjected to aircraft noise. Table 2.1 of AS2021 is reproduced below and presents the various building types acceptable within various noise contours.

**Table 6.1 – Building Site Acceptability Based on ANEF Zones (Table 2.1 – AS2021)**

Building Type	ANEF Zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
Home, home unit, flat, caravan park	Less than ANEF 20	20 to 25 ANEF	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

In **Acceptable** zones there is usually no need for the building construction to provide protection specifically against aircraft noise. However, it should not be inferred that aircraft noise will not be noticeable outside the ANEF20 contour.

In **Conditional** zones the maximum aircraft noise levels for the relevant aircraft and the required noise reduction should be determined from the procedures of Clause 3.1 and 3.2 of AS2021-2000, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3.

In **Unacceptable** zones – construction of the proposed development should not normally be considered. In no case should new development take place in ‘greenfield’ sites deemed unacceptable because such development may impact on airport operations.

The standard also recommends the following internal design noise levels for proposed developments.

**Table 6.2 – Internal Design Sound Levels, dB(A)**

<b>Occupancy</b>	<b>Maximum Noise Level, L<sub>max</sub> dB(A)</b>
<b><i>Houses, Home Units, Flats, Caravan Parks</i></b>	
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
<b><i>Schools, Universities</i></b>	
Libraries, study areas	50
Teaching areas, assembly areas	55
Workshops, gymnasias	75
<b><i>Public Buildings</i></b>	
Churches, religious activities	50
Theatres, cinemas, recording studios	40
Court houses, libraries, galleries	50
<b><i>Commercial Buildings, Offices and Shops</i></b>	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75
<b><i>Industrial</i></b>	
Inspection, analysis, precision work	75
Light machinery, assembly, bench work	80
Heavy machinery, warehouse, maintenance	85

The above design sound levels are the maximum noise levels [in dB(A)] that may be heard inside a building by the average listener during an aircraft flyover, and would be judged by that listener as not intrusive or annoying while carrying out the specified activity. Note that these indoor design sound levels may not be satisfactory for occupants who have particular sensitivity to aircraft noise.

## **6.2 ANEF Zoning**

The ANEF system is a scientific measure of the aircraft noise exposure levels around aerodromes. It is the only endorsed measure that is used for Land Use Planning and can also be used to give an indication of assessing average community response to aircraft noise.

Based on the 'RAAF Base Richmond 2014 ANEF Summary Report', applicable noise exposure zones within the Precinct obtained from the ANEF contours are summarised in Table 6.3.

**Table 6.3 – Location of Site Relative to ANEF Contour Charts**

<b>Development Type</b>	<b>ANEF Zone</b>
All	Less than ANEF 20



Based on the ANEF zone where the proposed Precinct falls within and the requirements of AS2021, the proposed land uses for the Precinct are considered to be within the 'acceptable' ANEF zone and will not require noise attenuation for aircraft noise.

## 7 CONSTRUCTION NOISE AND VIBRATION CRITERIA

---

As the details of the final Marsden Park Precinct plan and the types of developments proposed have not been finalised during this preliminary design stage, construction noise and vibration impacts have not been modelled and predicted. However, the appropriate construction noise and vibration requirements are provided below.

### 7.1 Construction Noise Guidelines

The NSW Office of Environment and Heritage's (OEH) 'Interim Construction Noise Guideline' 2009 (ICNG) is currently issued as an interim guideline, although it is being referred to as OEH's standard policy for assessing construction noise on new projects.

The key components of the ICNG that can be incorporated into this assessment include:

#### 1. Use of $L_{Aeq}$ as the descriptor for measuring and assessing construction noise.

In recent years NSW noise policies including OEH's NSW 'Industrial Noise Policy' (INP) and the NSW 'Environmental Criteria for Road Traffic Noise' (ECRTN) have moved to the primary use of  $L_{Aeq}$  over any other descriptor. As an energy average,  $L_{Aeq}$  provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the  $L_{A10}$  descriptor.

Consistent with the latest guideline (ICNG) the use of  $L_{Aeq}$  as the key descriptor for measuring and assessing construction noise may follow a 'best practice' approach.

#### 2. Application of feasible and reasonable noise mitigation measures

As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects, including the cost of the measure.

#### 3. Quantitative and qualitative assessment

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment.

A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria.

A qualitative assessment is recommended for small projects with a short-term duration where works are not likely to affect an individual or sensitive land use for more than

three weeks in total. It focuses on minimising noise disturbance through the implementation of feasible and reasonable work practices, and community notification.

Given the significant scale of the construction works anticipated for the Precinct, a quantitative assessment would need to be carried out, consistent with the ICNG's requirements.

### 7.1.1 Management Levels

#### Residences

Table 7.1 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

**Table 7.1 – Noise at Residences Using Quantitative Assessment**

Time of Day	Management Level $L_{Aeq(15\text{ min})}^*$	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where the predicted or measured <math>L_{Aeq(15\text{ min})}</math> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> <li>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</li> </ul>
	Highly noise affected 75dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:               <ol style="list-style-type: none"> <li>times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)</li> <li>if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ol> </li> </ul>

Time of Day	Management Level $L_{Aeq} (15 \text{ min})^*$	How to Apply
Outside recommended standard hours	Noise affected RBL + 5dB(A)	<ul style="list-style-type: none"> <li>A strong justification would typically be required for works outside the recommended standard hours.</li> <li>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> <li>Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community.</li> <li>For guidance on negotiating agreements see section 7.2.2.</li> </ul>

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

### Sensitive Land Use

Table 7.2 below (reproduced from Table 2 of the ICNG) sets out the noise management levels for various sensitive land use developments.

**Table 7.2 - Noise at Other Sensitive Land Uses Using Quantitative Assessment**

Land use	Management level, $L_{Aeq} (15 \text{ min})$ – applies when land use is being utilised
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas	External noise level 65 dB(A)
Passive recreation areas	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the 'maximum' internal levels in AS2107 for specific uses.

### Commercial and Industrial Premises

Given that existing commercial and industrial premises are located in areas surrounding the Precinct; these premises would require an assessment of construction noise impacts. Furthermore, depending on the staging of the precinct, construction noise may potentially impact future employment areas within the Precinct and/or industrial premises within the MPIP.

Therefore, noise management levels presented in the ICNG for commercial and industrial premises are reproduced in Table 7.3 below.

**Table 7.3 – Noise Management Levels for Industrial and Commercial Premises**

Type of Premises	Management level, $L_{Aeq}$ (15 min)
Industrial	External noise level = 75 dB(A)
Commercial (such as offices and retail outlets)	External noise level = 70 dB(A)

## 7.2 Construction Vibration Guidelines

### Disturbance to Buildings Occupants

For disturbance to human occupants of buildings, we refer to OEH's 'Assessing Vibration; a technical guideline', published in February 2006. This document provides criteria which are based on the British Standard BS 6472-1992, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

Vibration sources are defined as *Continuous, Impulsive or Intermittent*. Section 2 of the technical guideline defines each type of vibration as follows:

**Continuous** vibration continues uninterrupted for a defined period (usually throughout the day-time and/or night-time).

**Impulsive** vibration is a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds.

**Intermittent** vibration can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude'.

The criteria are to be applied to a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

*'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'*

Preferred and maximum values for continuous and impulsive vibration are defined in table 2.2 of the guideline and are reproduced below.

**Table 7.4 - Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration ( $m/s^2$ ) 1-80Hz**

Location	Assessment period <sup>1</sup>	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
<b>Continuous vibration</b>					
Critical areas <sup>2</sup>	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
<b>Impulsive vibration</b>					
Critical areas <sup>2</sup>	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

Intermittent vibration is to be assessed using vibration dose values (VDVs). The VDV method is a fourth power approach which is more sensitive to peaks in the acceleration waveform and makes corrections to the criteria based on the duration of the source's operation. The VDV can be calculated using the overall weighted rms acceleration of the vibrating source in each orthogonal axis and the total period during which the vibration may occur. Weighting curves are provided in each orthogonal axis in the guideline. Preferred and maximum VDV values are defined in Table 2.4 of the guideline and are reproduced below.

**Table 7.5 – Acceptable vibration dose values for intermittent vibration ( $m/s^{1.75}$ )**

Location	Daytime <sup>1</sup>		Night-time <sup>1</sup>	
	Preferred values	Maximum values	Preferred values	Maximum values
Critical areas <sup>2</sup>	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Location	Daytime <sup>1</sup>		Night-time <sup>1</sup>	
	Preferred values	Maximum values	Preferred values	Maximum values

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS 6472-1992

### Structural Damage to Buildings

Currently there exists no Australian Standard for assessment of structural building damage caused by vibrational energy. Therefore, reference is made to both the British and German standards below which are relevant to the assessment of structural damage.

### British Standard

British Standard 7385: Part 2 "Evaluation and measurement of vibration in buildings", can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

BS7385 recommends that the peak particle velocity is used to quantify vibration and specifies damage criteria for frequencies within the range 4Hz to 250Hz, which is the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The levels from the standard are given below in Table 7.6.

**Table 7.6 – BS 7385 Structural Damage Criteria**

Group	Type of Structure	Peak component particle velocity, mm/s		
		4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings		50	
2	Un-reinforced or light framed structures Residential or light commercial type buildings	15 to 20	20 to 50	50

The peak vibration limits set for minimal risk of 'cosmetic' damage are: 15mm/s for un-reinforced or light framed structures, for example residential or light commercial buildings (Group 2; increasing as the frequency content of the vibration increases) and 50mm/s for reinforced or framed structures, for example industrial and heavy commercial buildings (Group 1; constant across all frequencies). 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

These values relate to transient vibrations and to low rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50%.

The levels set by this standard are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular types of buildings. Damage comprises

minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls.

This standard states that it considers sources of vibration including blasting, demolition, piling, ground treatments, compaction, construction equipment, tunnelling, road and rail traffic and industrial machinery.

As stated in the standard, it sets guide values for building vibration based on the lowest levels above which damage has been credibly demonstrated. That is, it gives guidance on the levels of vibration above which building structures could be damaged.

#### German Standard

The German standard DIN 4150 - Part 3 - "Structural vibration in buildings - Effects on Structures", also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. This standard too, presents recommended maximum limits over a range of frequencies measured in any direction at the foundation or in the plane of the uppermost floor.

The minimum 'safe limit' of vibration at low frequencies for commercial and industrial buildings is 20mm/s. For dwellings it is 5mm/s and for particularly sensitive structures (eg historical with preservation orders, heritage items etc), it is 3mm/s. These limits increase as the frequency content of the vibration increases. These values are presented in Table 7.7 below and are generally recognised to be conservative.

**Table 7.7 – DIN 4150-3 Structural Damage Criteria**

Group	Type of Structure	Vibration Velocity, mm/s			
		At Foundation at Frequency of			Plane of Floor Uppermost Storey
		Less than 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used for 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, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

It is noted that there are some heritage listed buildings (eg. Clydesdale) that may be impacted upon by construction activities associated with the proposed Precinct. Therefore, these buildings would be assessed against Group 3 of Table 7.7 above to ensure structural damage does not occur as a result of the construction works associated with the Precinct.



## **8 CONCLUSION**

---

Renzo Tonin & Associates have completed an investigation of environmental noise impacts onto the proposed Marsden Park Precinct and noise emissions from the Precinct. Noise impacts have been quantified and compared to the noise guidelines set by the NSW OEH, ISEPP and relevant Australian and International Standards.

Industrial noise to and from the Marsden Park Precinct, noise from community and local centre areas, traffic noise impacting upon the Marsden Park Precinct and aircraft noise impacts were all assessed as part of this report.

Any noise mitigation recommendations included in this report are in-principle only. The assistance of an acoustic consultant must be sought at the detailed design phase of the project to provide more accurate design advice when there is more detailed information about building type, lot arrangement and traffic flow information available.

## APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

---

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

<i>Adverse Weather</i>	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
<i>Ambient Noise</i>	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
<i>Assessment Period</i>	The period in a day over which assessments are made.
<i>Assessment Point</i>	A point at which noise measurements are taken or estimated.
<i>Background Noise</i>	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the <b>L<sub>90</sub></b> noise level (see below).
<i>Decibel [dB]</i>	<p>The units that sound is measured in. The following are examples of the decibel readings of every day sounds:</p> <p>0dB    The faintest sound we can hear</p> <p>30dB   A quiet library or in a quiet location in the country</p> <p>45dB   Typical office space. Ambience in the city at night</p> <p>60dB   Martin Place at lunch time</p> <p>70dB   The sound of a car passing on the street</p> <p>80dB   Loud music played at home</p> <p>90dB   The sound of a truck passing on the street</p>

100dB The sound of a rock band

115dB Limit of sound permitted in industry

120dB Deafening

<i>dB(A):</i>	A-weighted decibels The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
<i>Frequency</i>	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
<i>Impulsive noise</i>	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
<i>Intermittent noise</i>	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
$L_{max}$	The maximum sound pressure level measured over a given period.
$L_{min}$	The minimum sound pressure level measured over a given period.
$L_1$	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
$L_{10}$	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{90}$	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the $L_{90}$ noise level expressed in units of dB(A).
$L_{eq}$	The "equivalent noise level" is the summation of noise events and

integrated over a selected period of time.

<i>Reflection</i>	Sound wave changed in direction of propagation due to a solid object obscuring its path.
<i>SEL</i>	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
<i>Sound</i>	A fluctuation of air pressure which is propagated as a wave through air.
<i>Sound Absorption</i>	The ability of a material to absorb sound energy through its conversion into thermal energy.
<i>Sound Level Meter</i>	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
<i>Sound Pressure Level</i>	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
<i>Sound Power Level</i>	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
<i>Tonal noise</i>	Containing a prominent frequency and characterised by a definite pitch.

## APPENDIX B - NOISE MONITORING METHODOLOGY

---

### B.1 Noise Monitoring Equipment

All long term noise monitoring was conducted using RTA Technology noise loggers. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as a Type 2 instrument suitable for field use.

A noise monitor consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory. The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

### B.2 Meteorology during Monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the INP. The Bureau of Meteorology provided meteorological data, which is considered representative of the site, for the duration of the noise monitoring period.

### B.3 Noise vs Time Graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the **L<sub>10</sub>**, **L<sub>90</sub>**, and **L<sub>eq</sub>** levels. The statistical descriptors **L<sub>10</sub>** and **L<sub>90</sub>** measure the noise level exceeded for 10% and 90% of the sample measurement time. The **L<sub>eq</sub>** level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring locations in Appendix C illustrate these concepts.

Noise levels are commonly measured in units of A-weighted decibels or dB(A). The "A-weighting" refers to standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low pitch sound than it is to high pitch sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample time period. This is represented as the **L<sub>90</sub>** noise level.

## APPENDIX C - LONG TERM NOISE MONITORING RESULTS

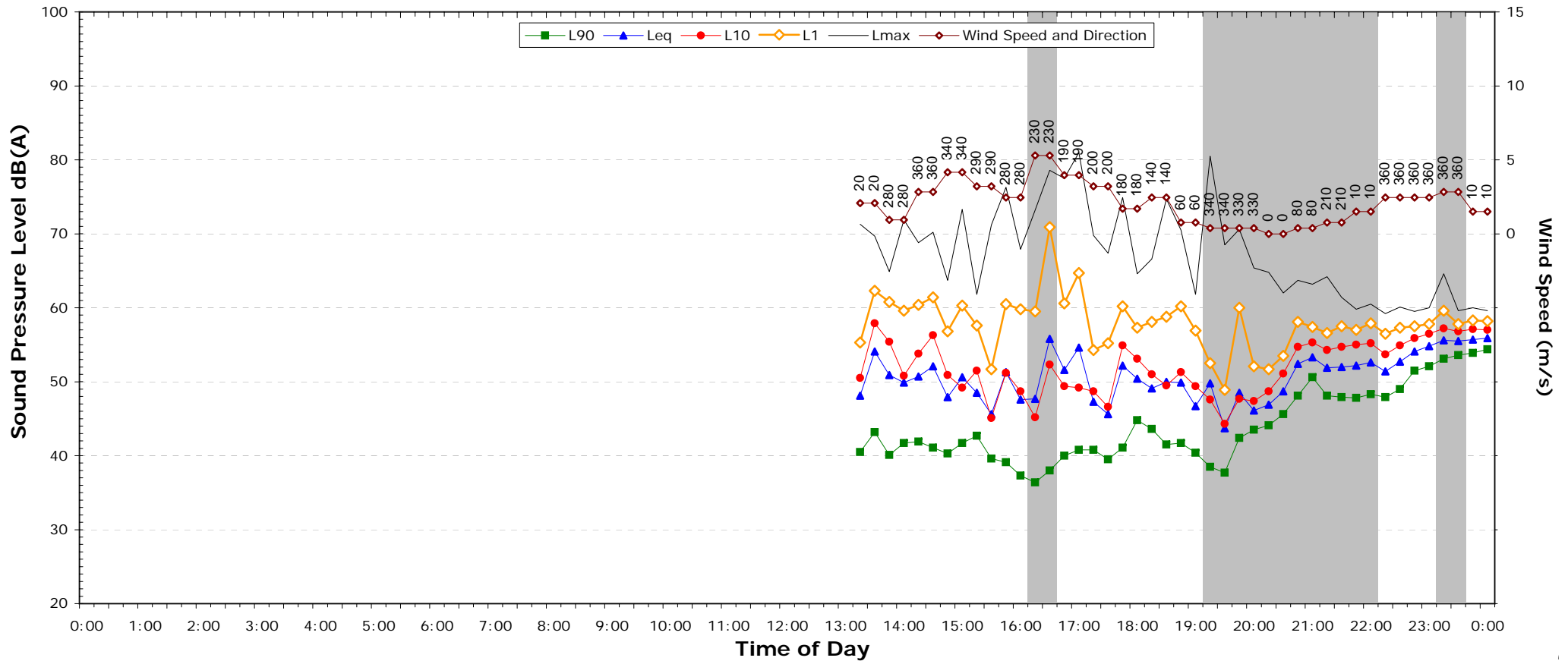
---



# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Tuesday, 8 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	40.1
Leq (see note 3)	-	-	52.8

**NOTES:**

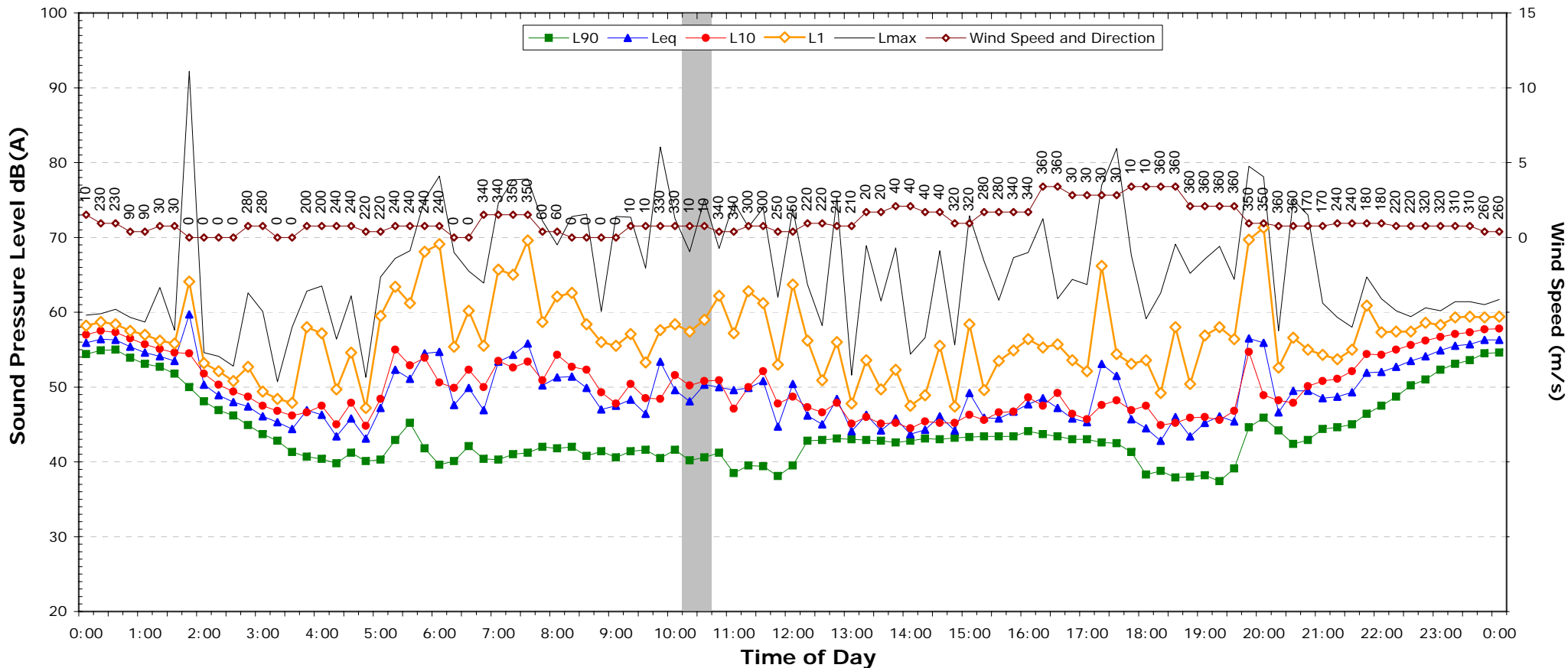
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)



# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Wednesday, 9 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	39.5	37.9	39.0
Leq (see note 3)	49.2	50.5	52.9

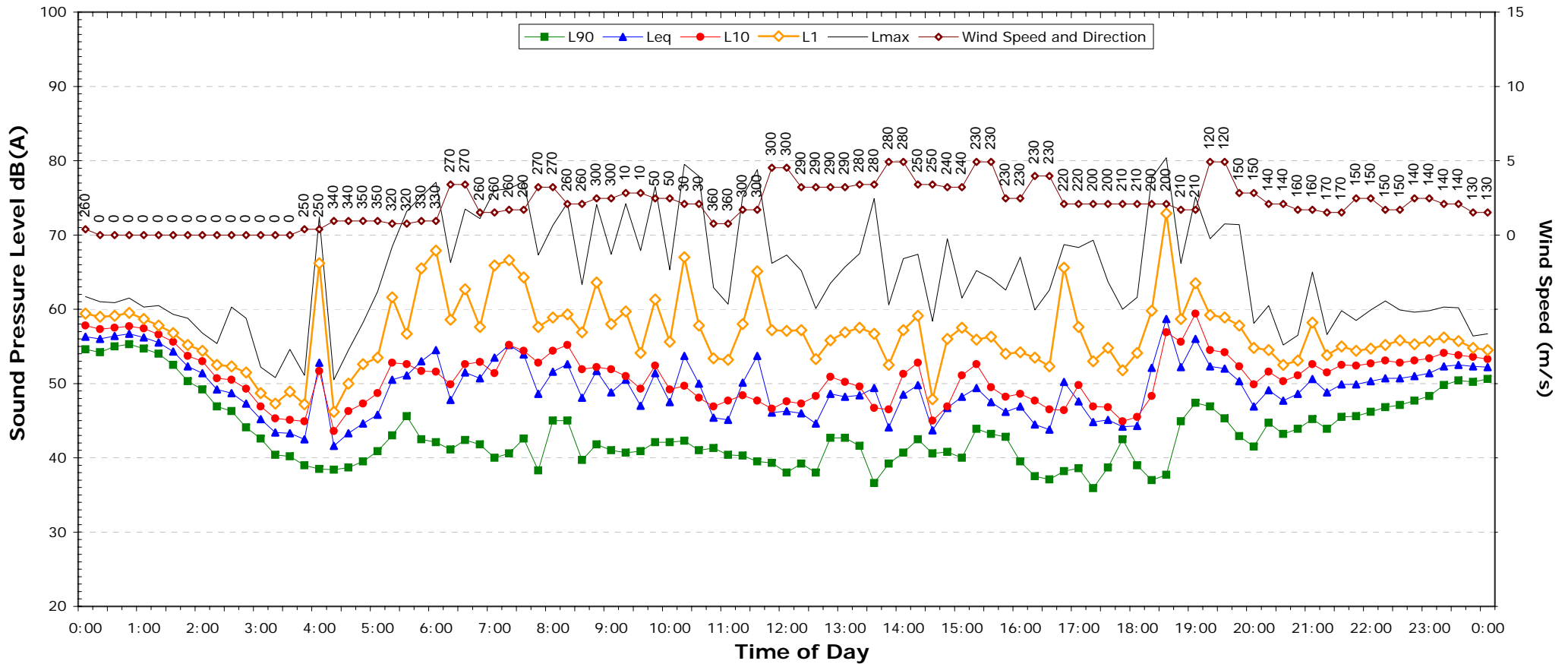
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Thursday, 10 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	38.0	37.7	34.7
Leq (see note 3)	49.2	52.2	50.4

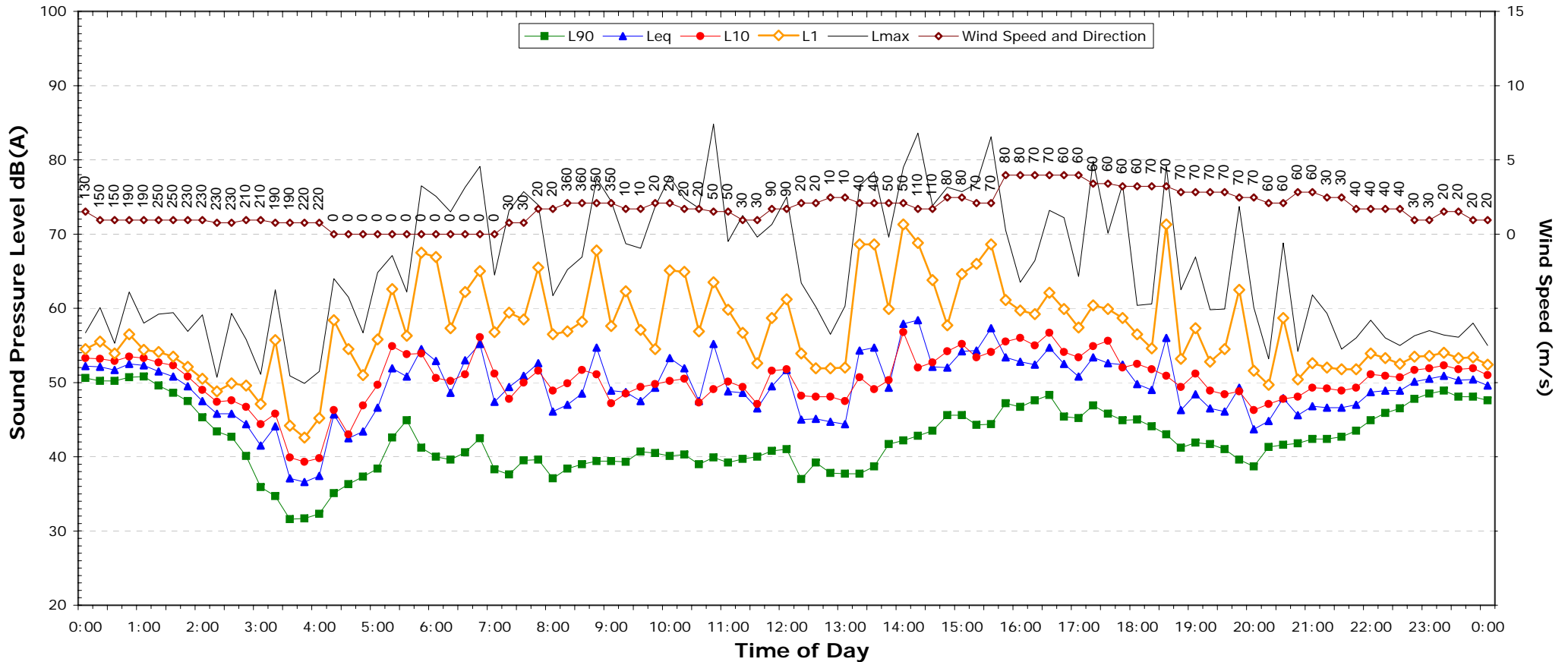
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time L<sub>max</sub> values are shown only where L<sub>max</sub> > 65dB(A) and where L<sub>max</sub>-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Friday, 11 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	37.7	39.6	33.8
Leq (see note 3)	52.4	48.7	49.4

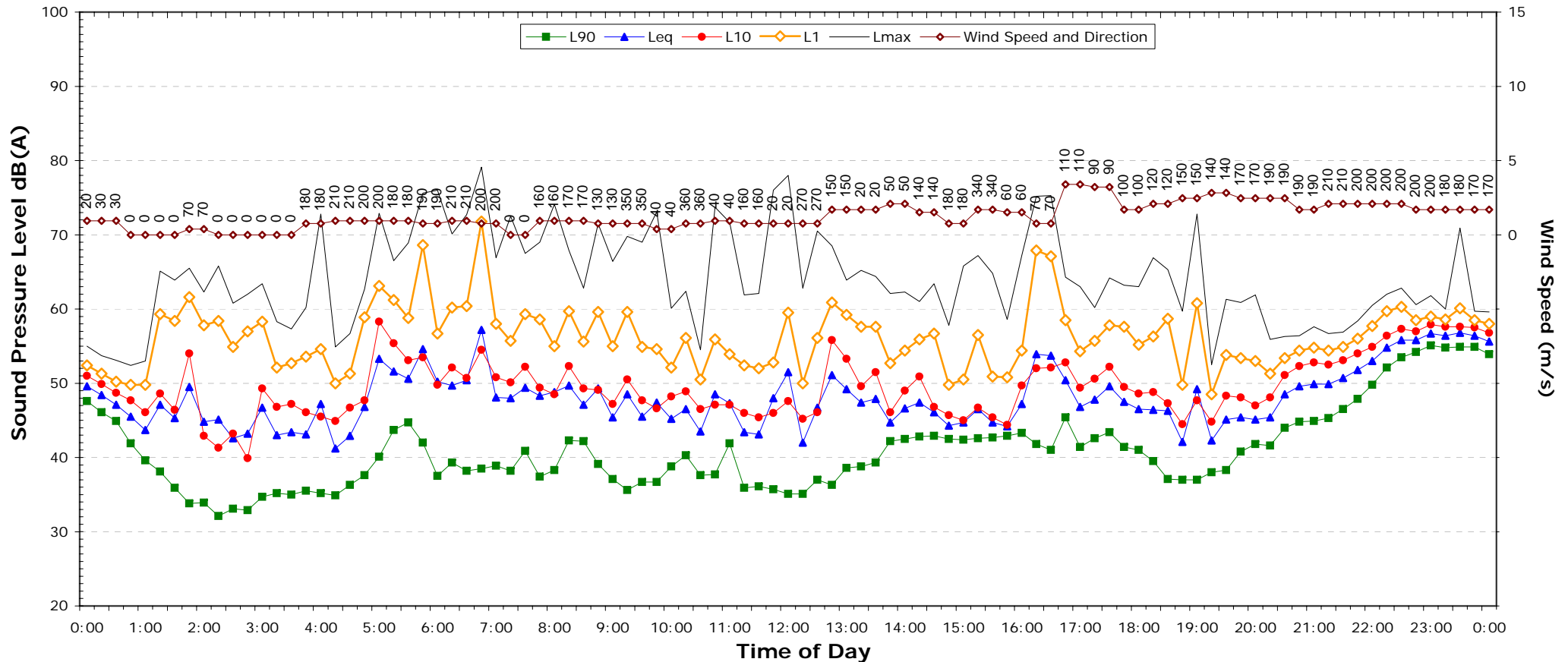
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Saturday, 12 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	35.9	37.0	34.0
Leq (see note 3)	48.1	48.6	52.8

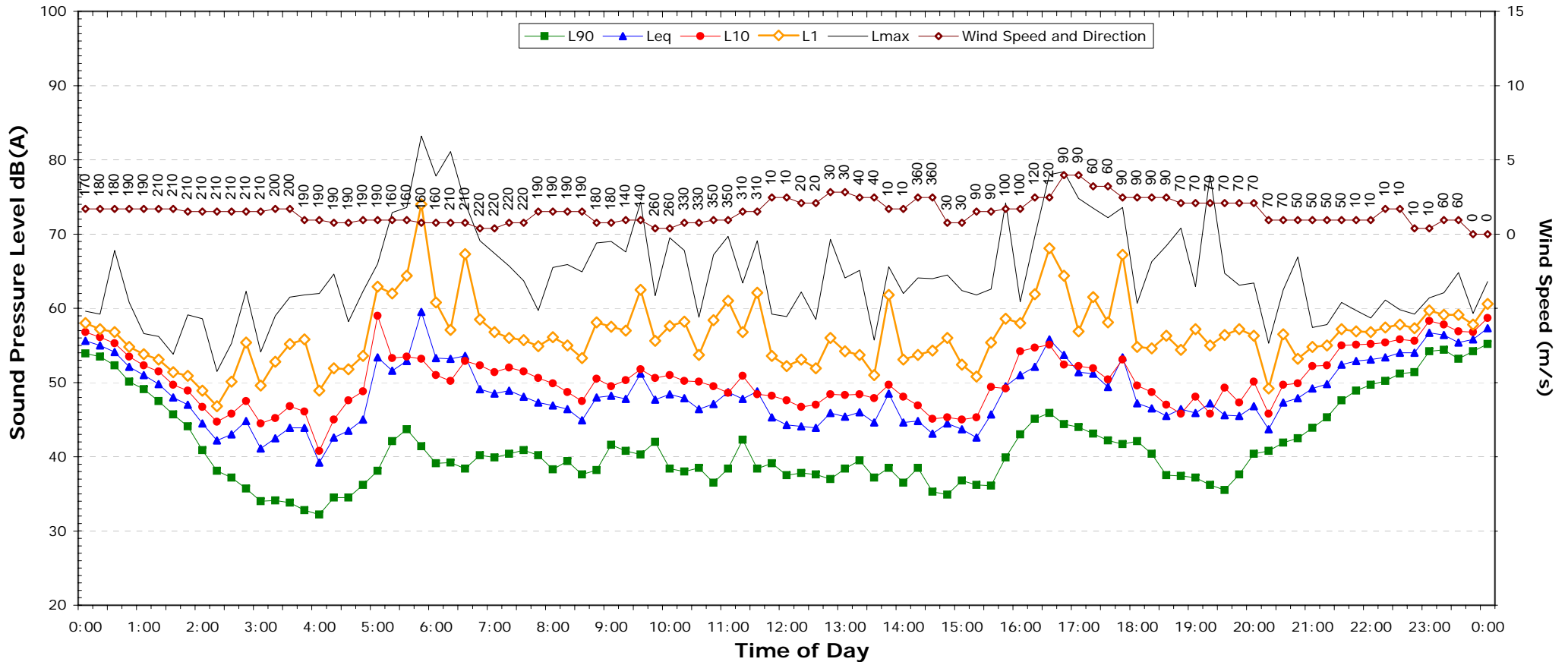
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Sunday, 13 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	36.5	36.2	34.3
Leq (see note 3)	48.7	48.8	52.4

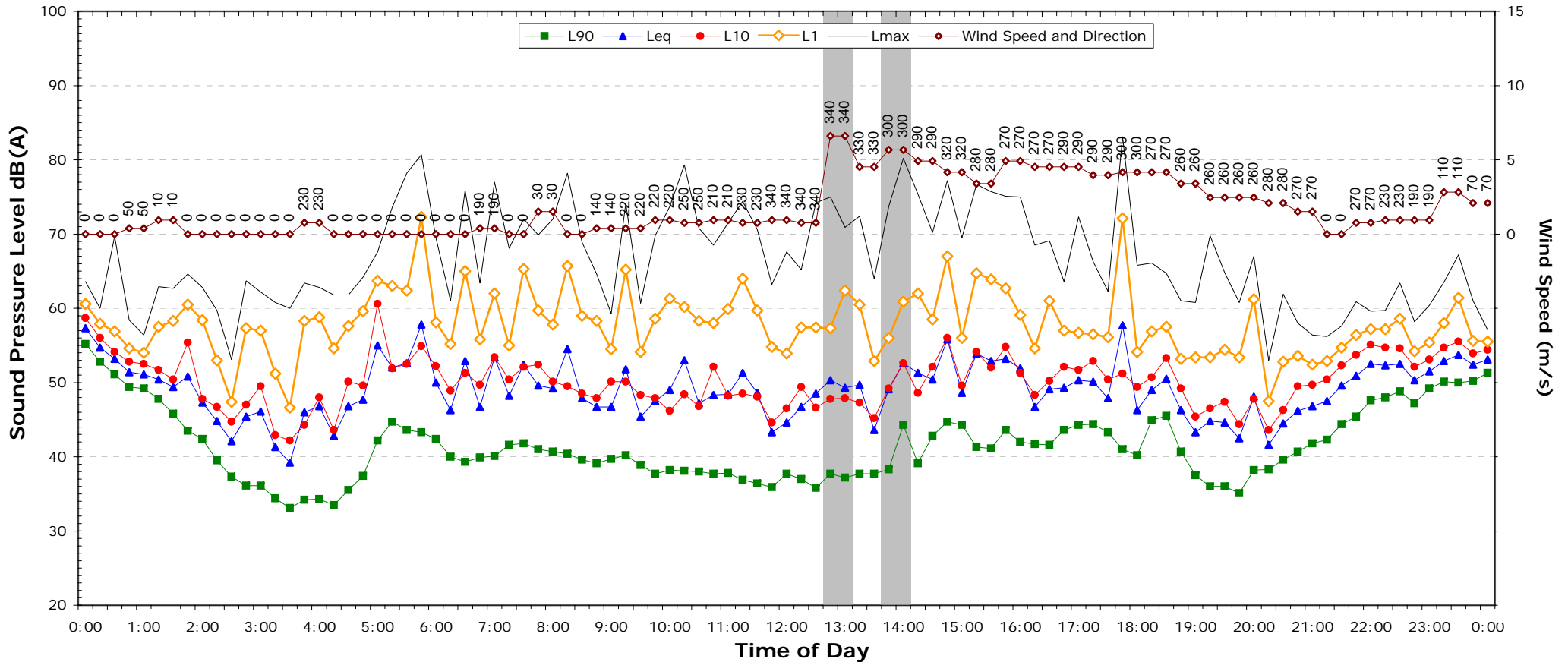
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Monday, 14 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	37.0	36.0	37.2
Leq (see note 3)	50.7	47.9	52.2

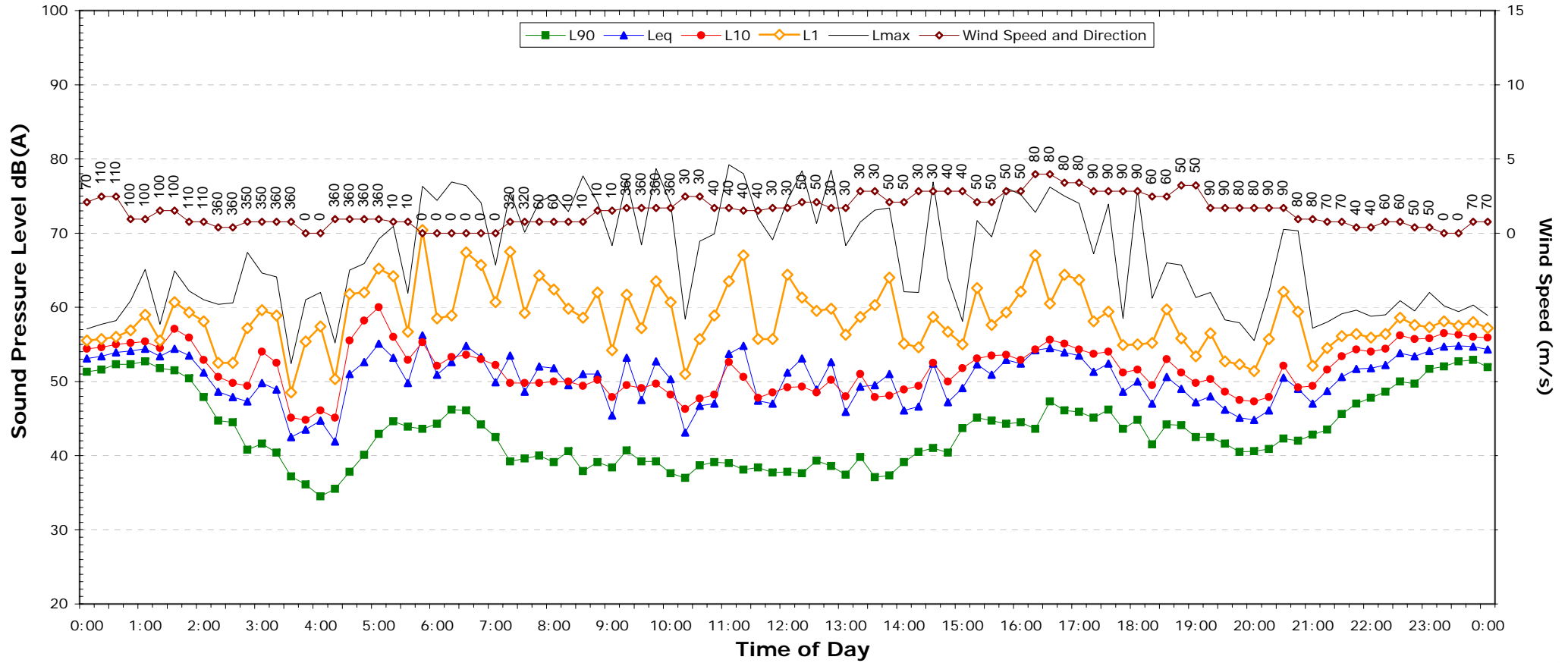
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Tuesday, 15 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	37.6	40.6	36.7
Leq (see note 3)	51.2	48.9	51.8

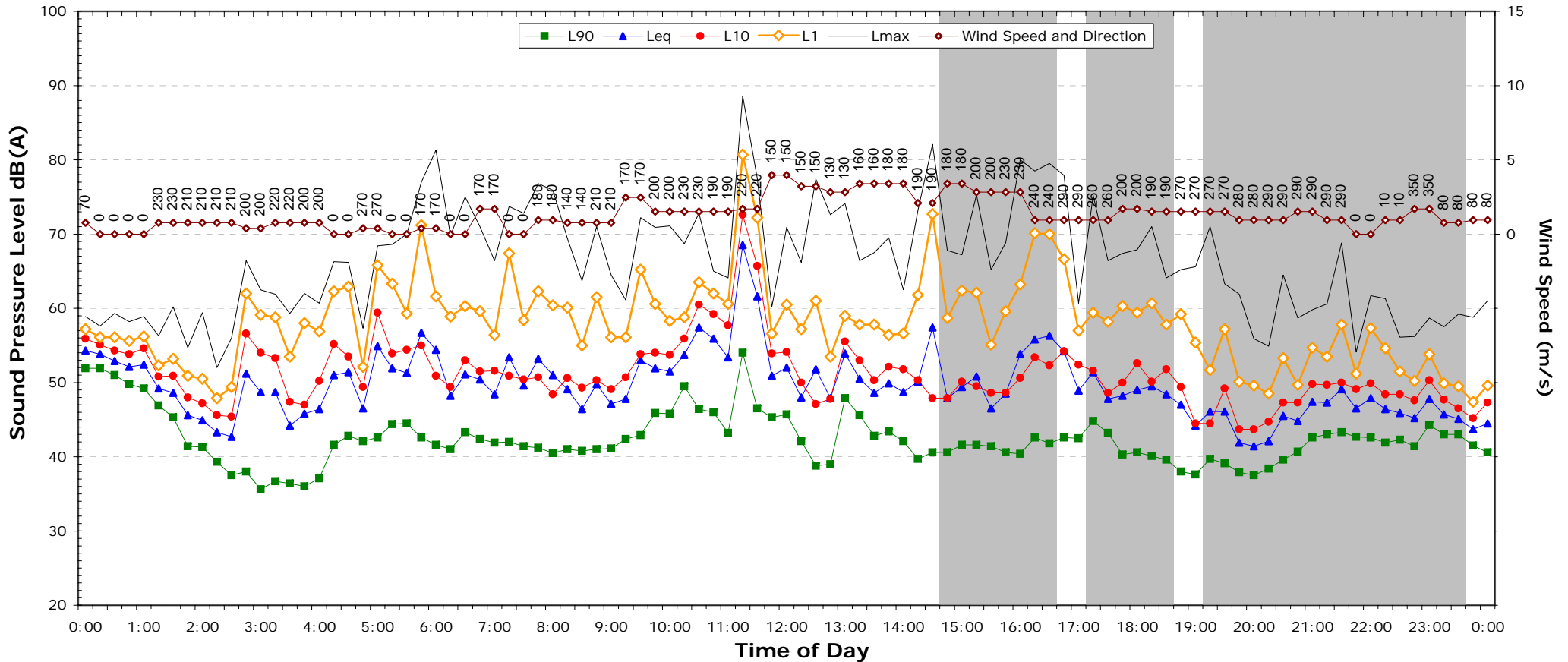
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Wednesday, 16 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

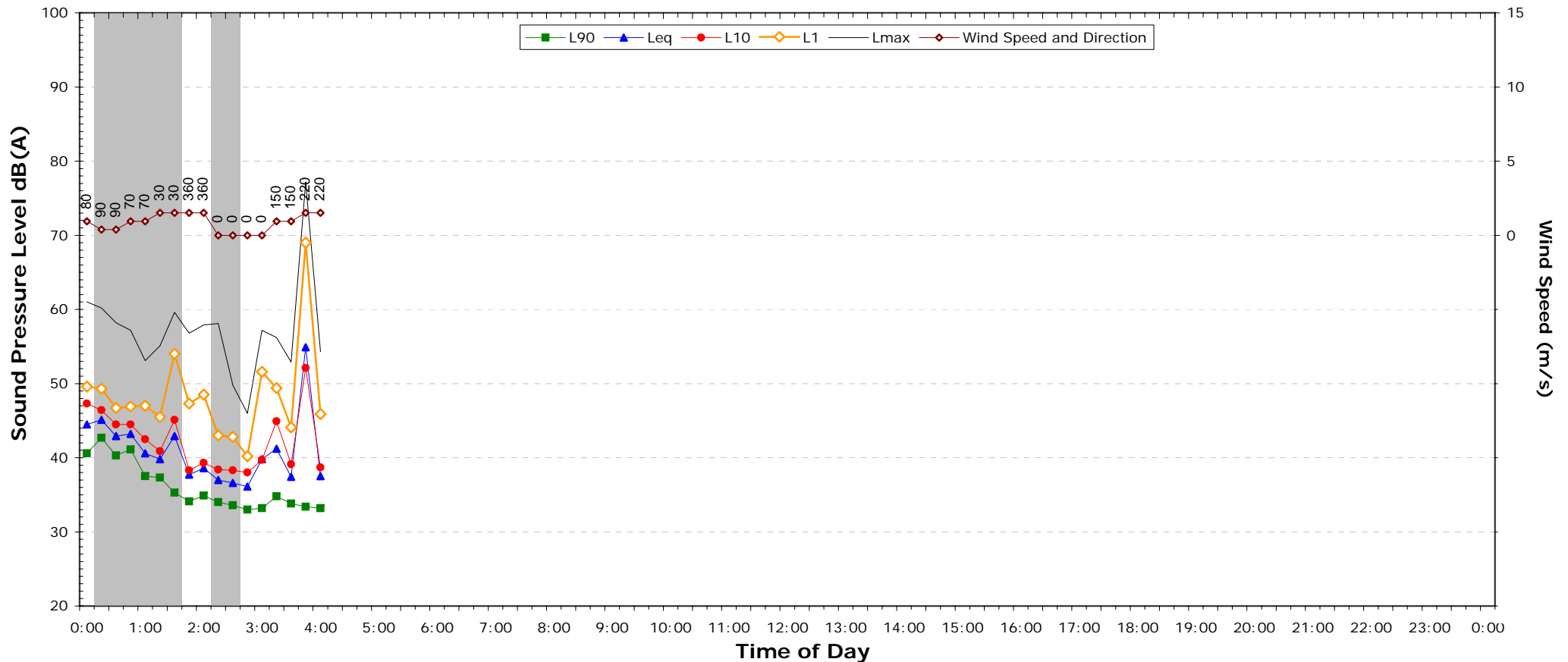
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)



# EXISTING AMBIENT NOISE LEVELS

## 46 Glengarrie Road, Marsden Park

### Thursday, 17 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

**990 Richmond Road, Marsden Park**

**BACKGROUND & AMBIENT NOISE MONITORING RESULTS  
NSW DECCW's 'INDUSTRIAL NOISE POLICY', 2000**

Day	L <sub>A90</sub> Background Noise Levels <sup>5</sup>			L <sub>Aeq</sub> Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Tuesday-08-November-2011	-	-	41	-	-	68
Wednesday-09-November-2011	56	48	41	69	64	63
Thursday-10-November-2011	58	51	40	68	66	64
Friday-11-November-2011	57	49	40	67	65	62
Saturday-12-November-2011	53	48	41	65	63	61
Sunday-13-November-2011	51	48	41	64	63	66
Monday-14-November-2011	54	47	40	68	63	64
Tuesday-15-November-2011	55	48	46	67	65	68
Wednesday-16-November-2011	-	-	-	-	-	-
Thursday-17-November-2011	-	-	-	-	-	-
<b>Representative Level</b>						
	<b>55</b>	<b>48</b>	<b>41</b>	<b>67</b>	<b>64</b>	<b>65</b>

Notes:

- Day is taken to be 7:00am to 6:00pm
- Evening is taken to be 6:00pm to 10:00pm.
- Night is taken to be the remaining periods.
- Partial day's monitoring
- Assessment Background Level (ABL)
- Rating Background Level (RBL) for L90 and logarithmic average for Leq

**TRAFFIC NOISE MONITORING RESULTS**

**NSW DECCW 'ENVIRONMENTAL CRITERIA FOR ROAD TRAFFIC NOISE', 1999**

Day	L <sub>Aeq</sub> Noise Levels			L <sub>Aeq 1hr</sub> Noise Levels		
	Day	Night	Day - Up	Day - Low	Night - Up	Night - Low
Tuesday-08-November-2011	69	71	70	67	76	59
Wednesday-09-November-2011	70	66	75	65	70	60
Thursday-10-November-2011	70	67	73	66	71	62
Friday-11-November-2011	69	65	70	66	69	61
Saturday-12-November-2011	67	63	69	65	66	59
Sunday-13-November-2011	66	69	68	65	74	61
Monday-14-November-2011	69	67	74	65	71	60
Tuesday-15-November-2011	69	71	70	66	76	64
Wednesday-16-November-2011	71	73	73	70	76	65
Thursday-17-November-2011	75	-	75	73	-	-
<b>Representative Weekday</b>						
	<b>71</b>	<b>70</b>	<b>73</b>	<b>68</b>	<b>74</b>	<b>62</b>
<b>Representative Weekend</b>						
	<b>67</b>	<b>67</b>	<b>69</b>	<b>65</b>	<b>71</b>	<b>60</b>
<b>Representative Week</b>						
	<b>70</b>	<b>69</b>	<b>72</b>	<b>68</b>	<b>73</b>	<b>62</b>

noise logger results

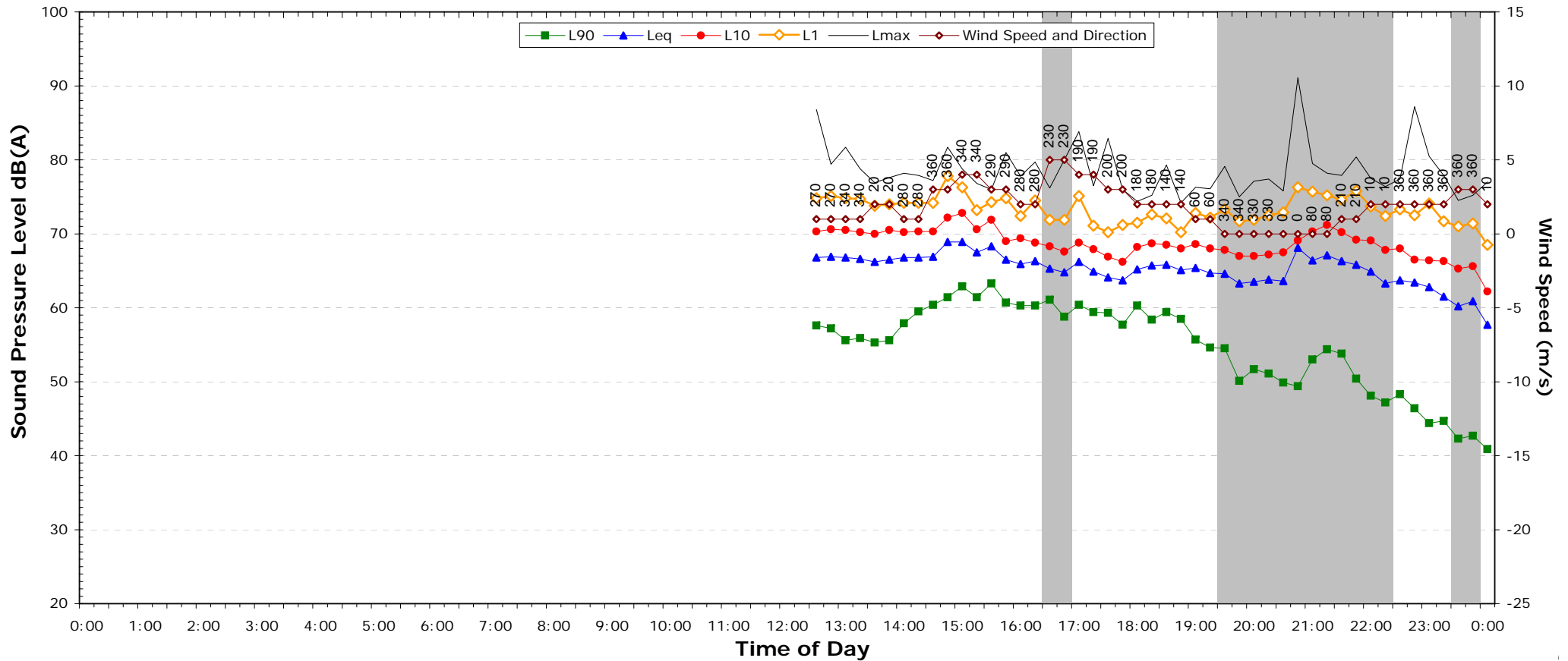
25

1982-2007  
ACOUSTIC  
ENGINEERING  
EXCELLENCE

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Tuesday, 8 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	40.9
Leq (see note 3)	-	-	68.5

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

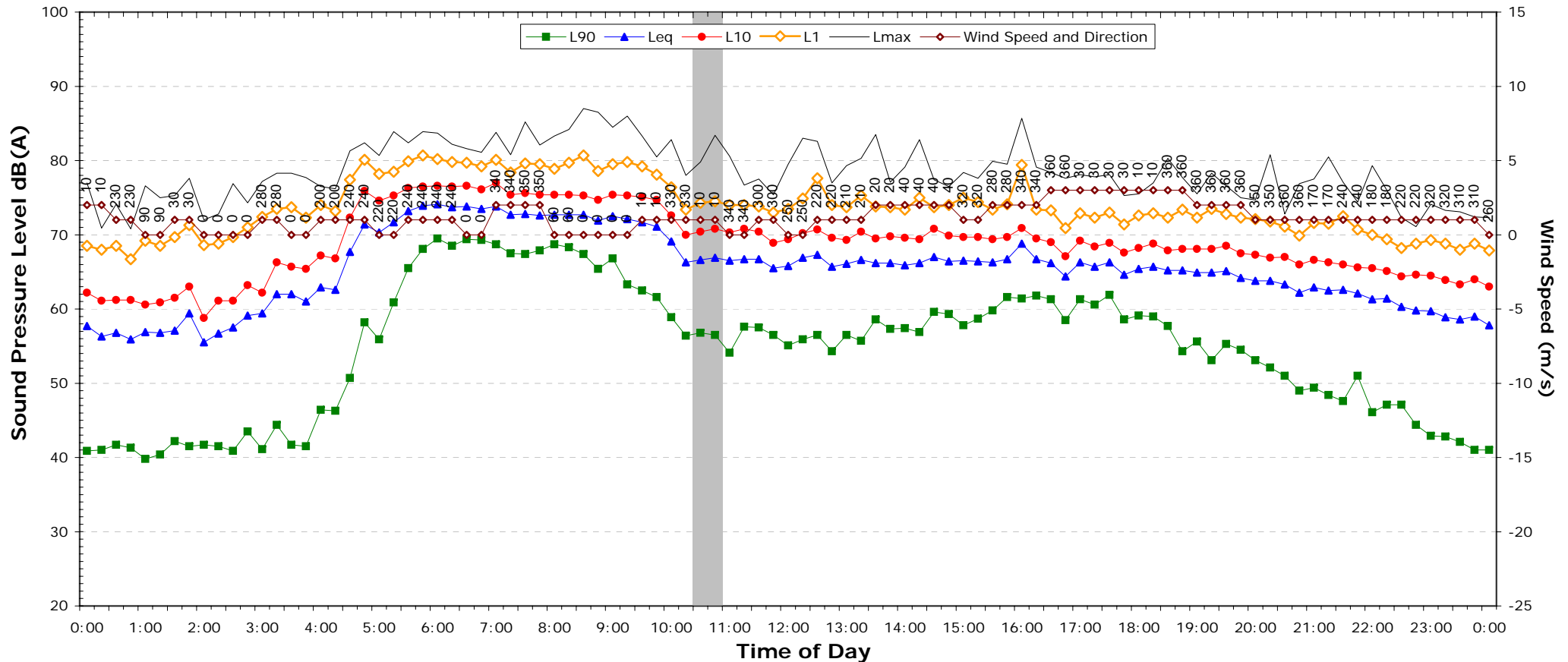
NSW ECRTN Policy (1m from facade) (see note 3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	69.0	71.0
L <sub>eq</sub> 1hr upper 10 percentile	70.5	76.2
L <sub>eq</sub> 1hr lower 10 percentile	67.0	59.0

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	76.6	to	87.2
Lmax - Leq (Range)	16.3	to	23.9

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Wednesday, 9 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	55.9	47.6	40.5
Leq (see note 3)	68.9	63.9	63.0

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

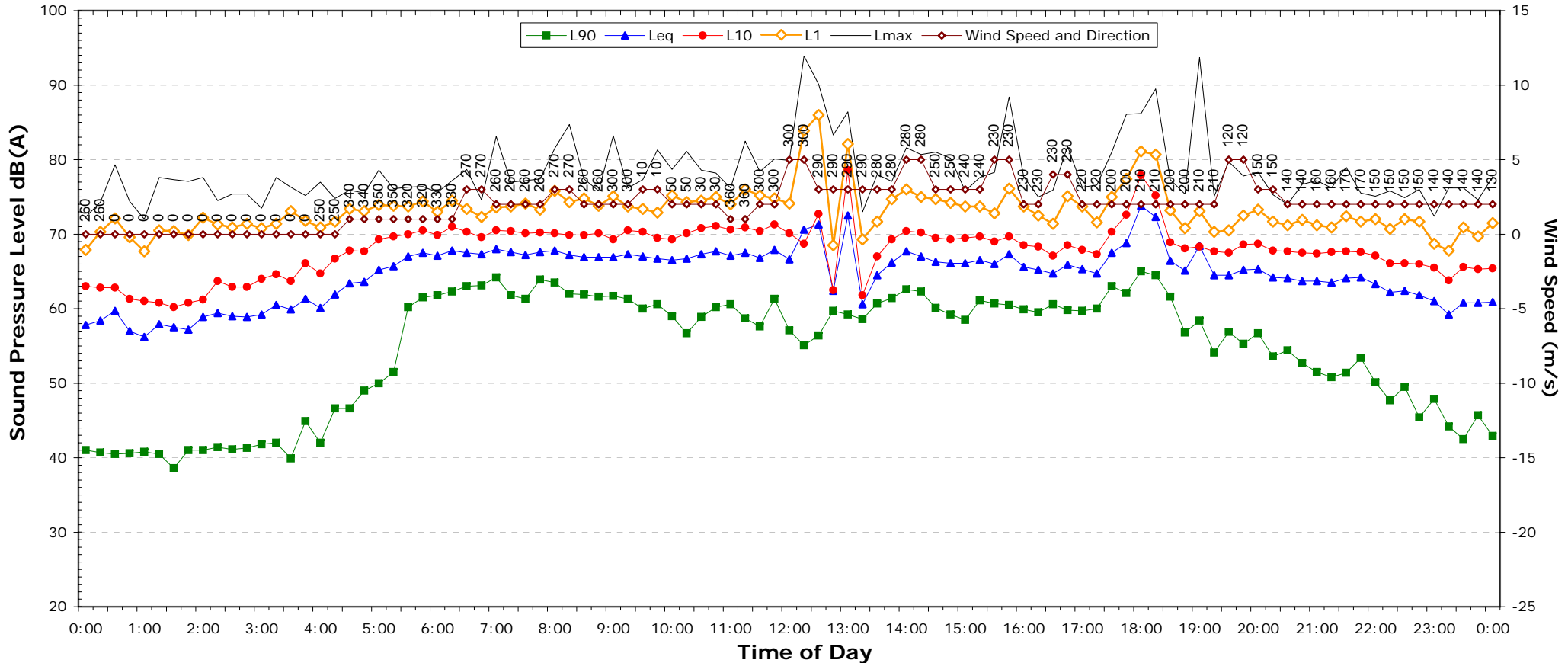
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.5	65.5
L <sub>eq</sub> 1hr upper 10 percentile	75.1	70.2
L <sub>eq</sub> 1hr lower 10 percentile	65.1	60.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	75.4	to	83.1
Lmax - Leq (Range)	15.4	to	21.3

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Thursday, 10 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	57.6	50.8	40.4
Leq (see note 3)	67.6	66.0	64.2

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

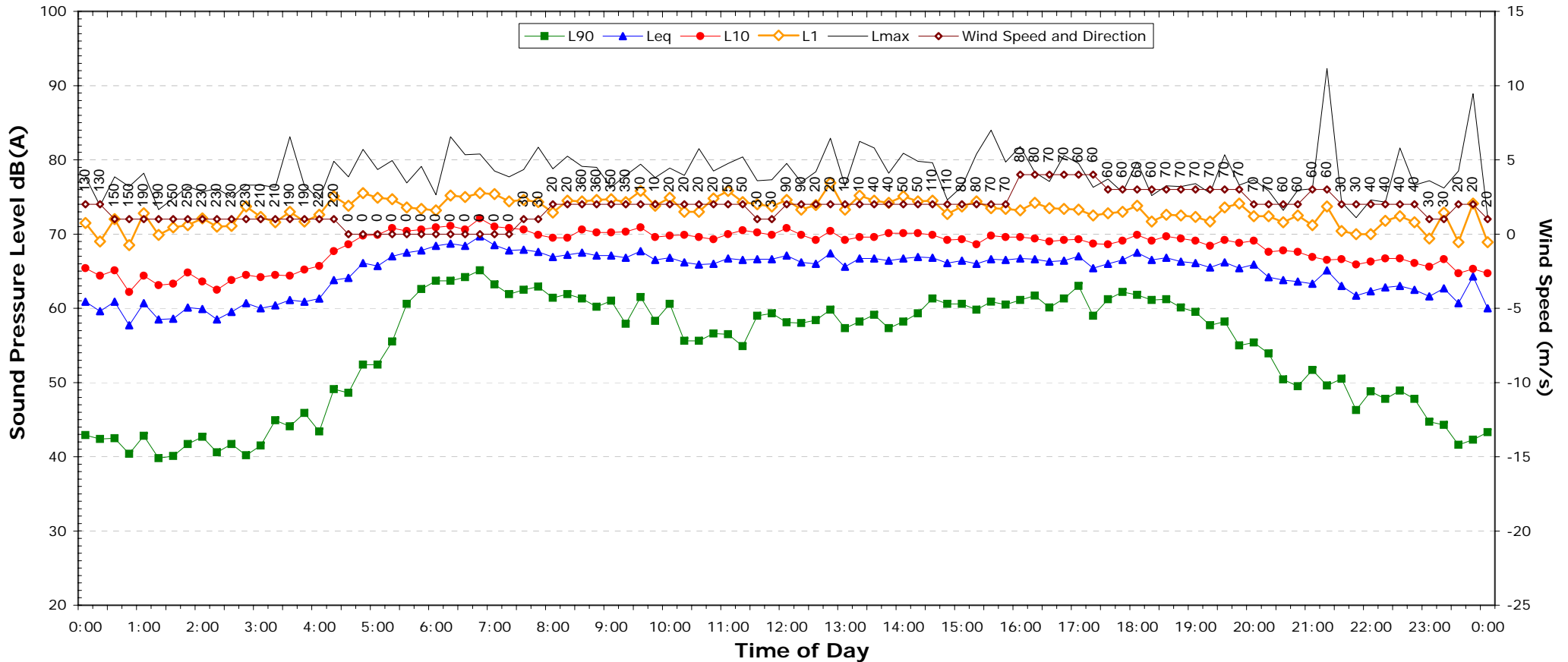
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	69.7	66.7
L <sub>eq</sub> 1hr upper 10 percentile	72.7	71.4
L <sub>eq</sub> 1hr lower 10 percentile	66.4	61.8

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	76.4	to	83.1
Lmax - Leq (Range)	16.4	to	22.2

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Friday, 11 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	56.6	48.8	39.6
Leq (see note 3)	66.7	65.0	62.5

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

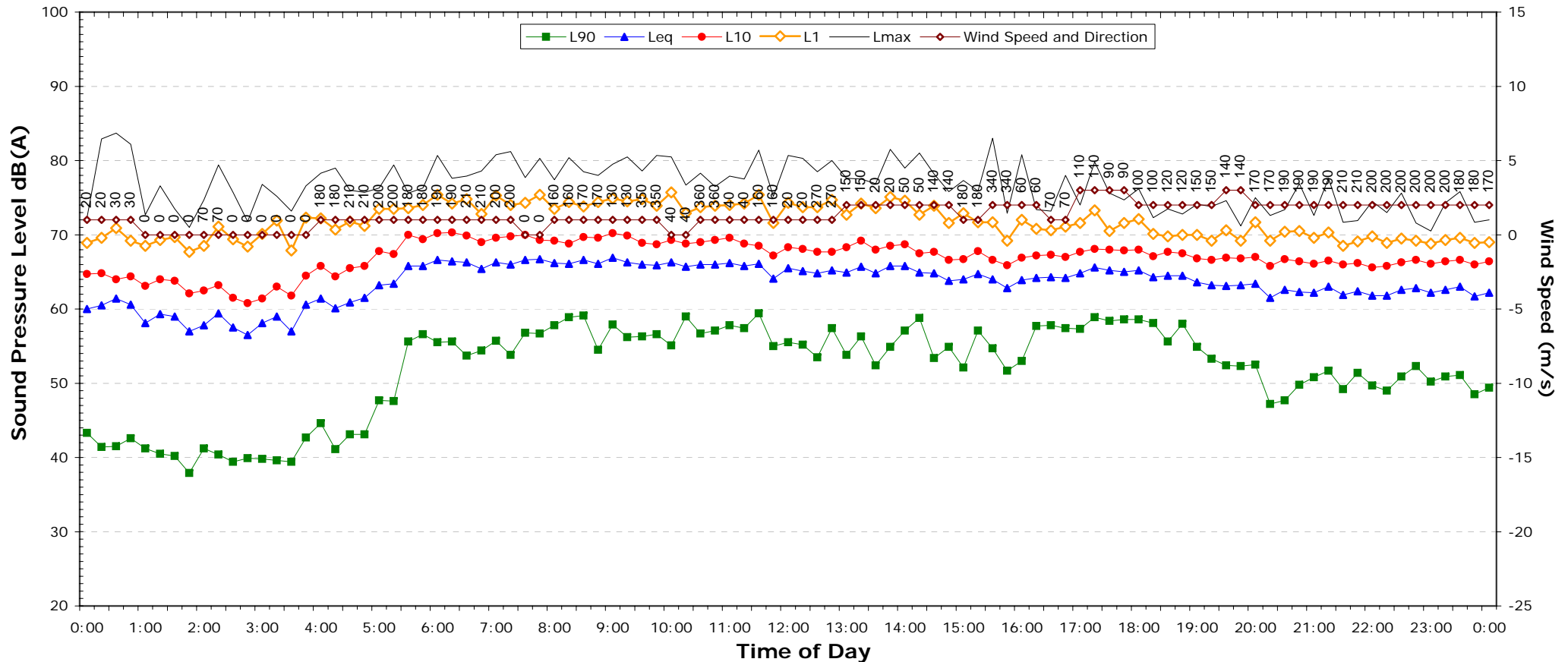
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	68.8	65.0
L <sub>eq</sub> 1hr upper 10 percentile	69.9	68.6
L <sub>eq</sub> 1hr lower 10 percentile	66.0	60.5

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	76.6	to	88.9
Lmax - Leq (Range)	15.1	to	26.6

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Saturday, 12 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	53.4	47.7	40.7
Leq (see note 3)	65.4	63.1	60.8

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

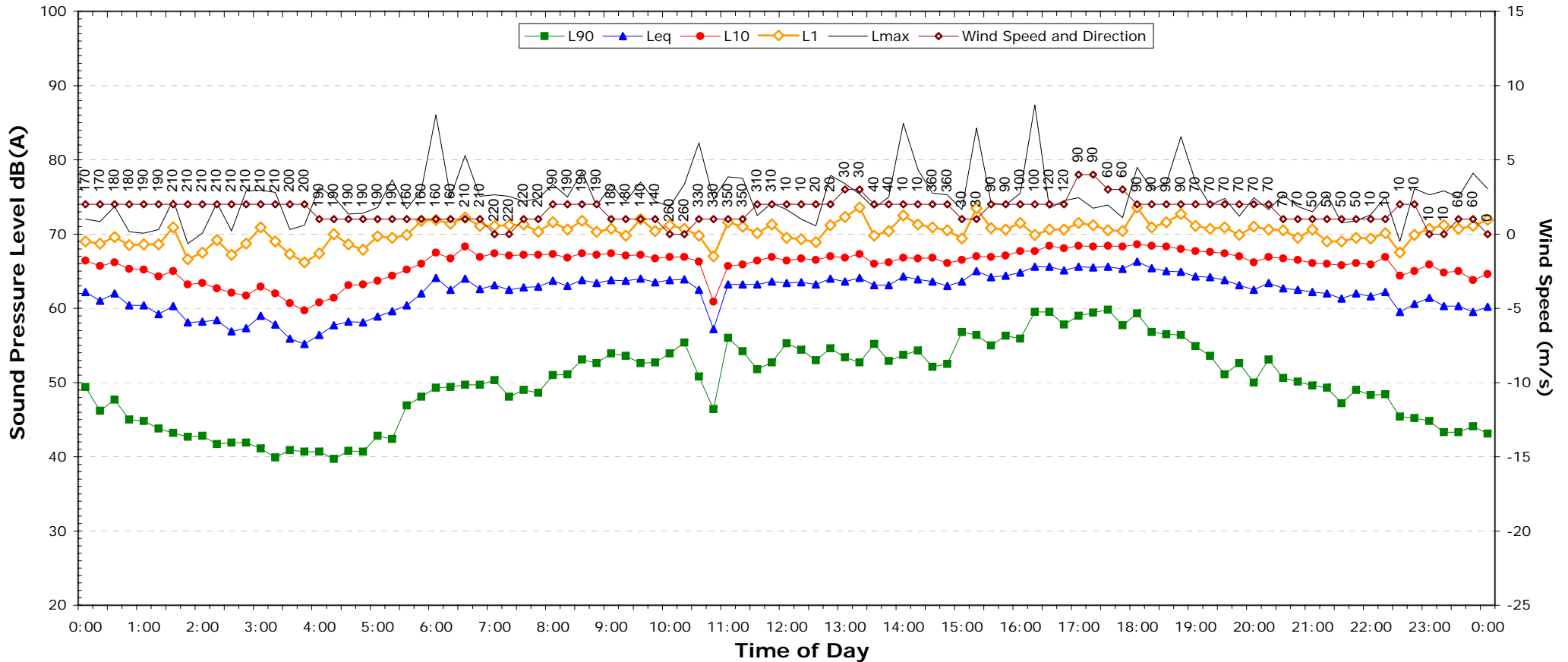
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	67.4	63.3
L <sub>eq</sub> 1hr upper 10 percentile	68.9	65.6
L <sub>eq</sub> 1hr lower 10 percentile	64.7	58.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	74.6	to	86.1
Lmax - Leq (Range)	15.6	to	24.2

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Sunday, 13 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	50.8	48.3	41.4
Leq (see note 3)	64.0	63.4	66.0

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	66.3	68.5
L <sub>eq</sub> 1hr upper 10 percentile	68.1	73.7
L <sub>eq</sub> 1hr lower 10 percentile	64.5	60.5

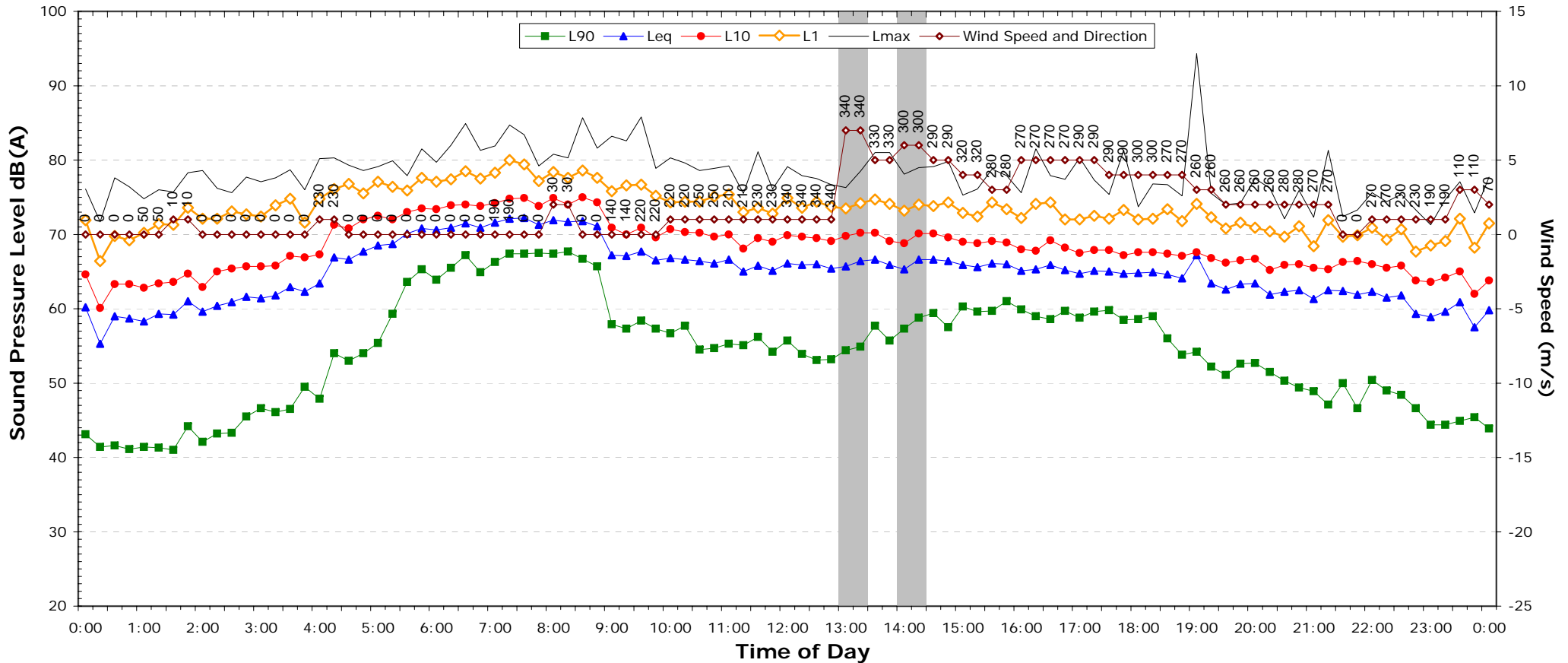
Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	76.1	to	80.2
Lmax - Leq (Range)	15.1	to	19.6



# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Monday, 14 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	54.4	47.1	39.9
Leq (see note 3)	67.7	63.4	64.5

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

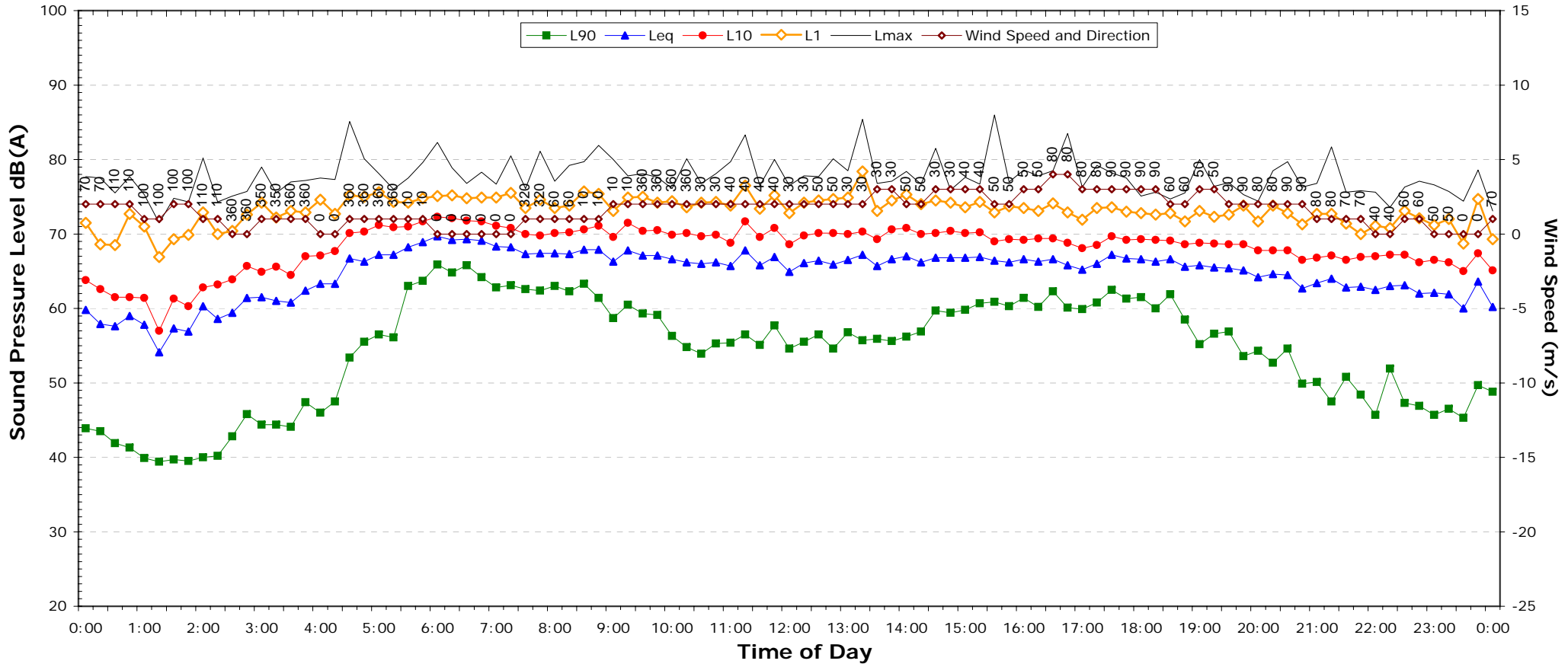
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	69.3	67.0
L <sub>eq</sub> 1hr upper 10 percentile	73.9	71.5
L <sub>eq</sub> 1hr lower 10 percentile	64.7	60.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	77.5	to	85.1
Lmax - Leq (Range)	15.5	to	22.5

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Tuesday, 15 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	55.1	47.5	45.6
Leq (see note 3)	66.7	64.7	68.3

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

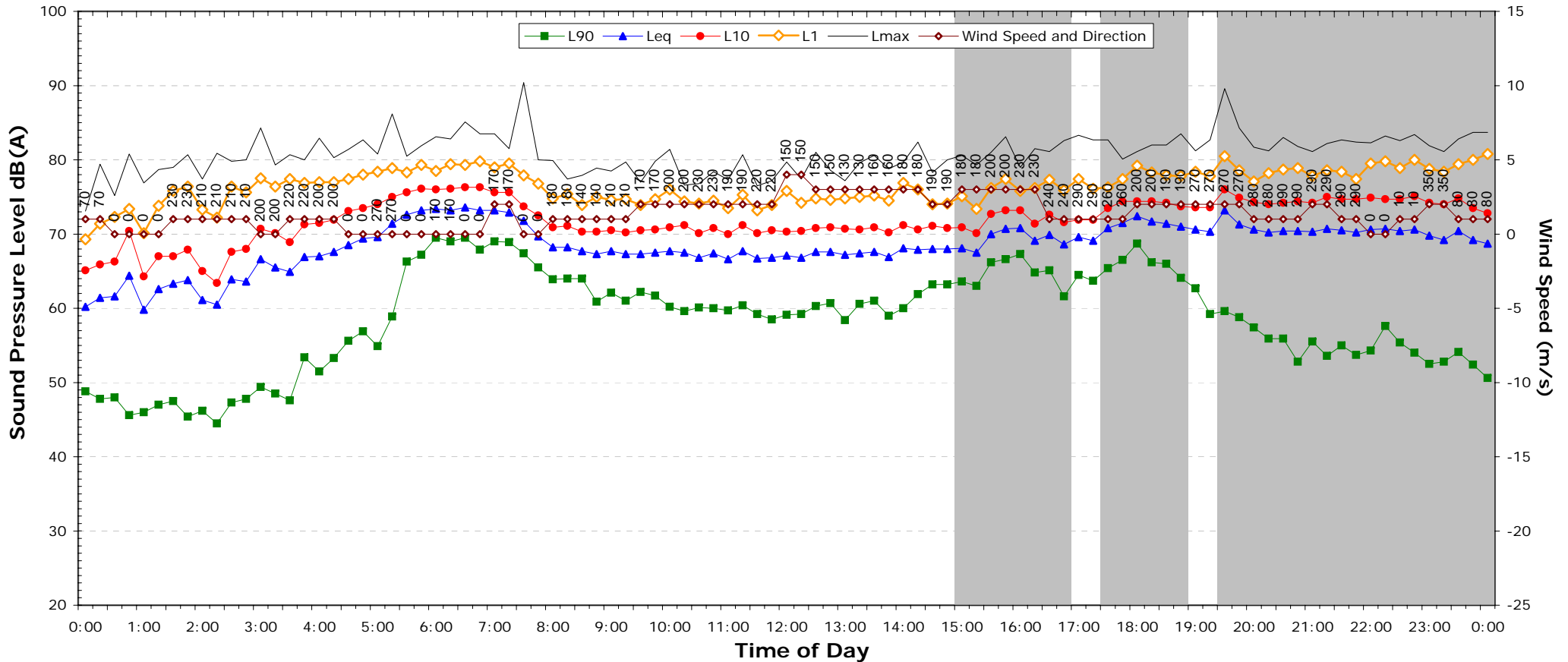
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	68.7	70.8
L <sub>eq</sub> 1hr upper 10 percentile	70.0	75.8
L <sub>eq</sub> 1hr lower 10 percentile	66.0	64.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	78.6	to	84.3
Lmax - Leq (Range)	16.7	to	20.1

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Wednesday, 16 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

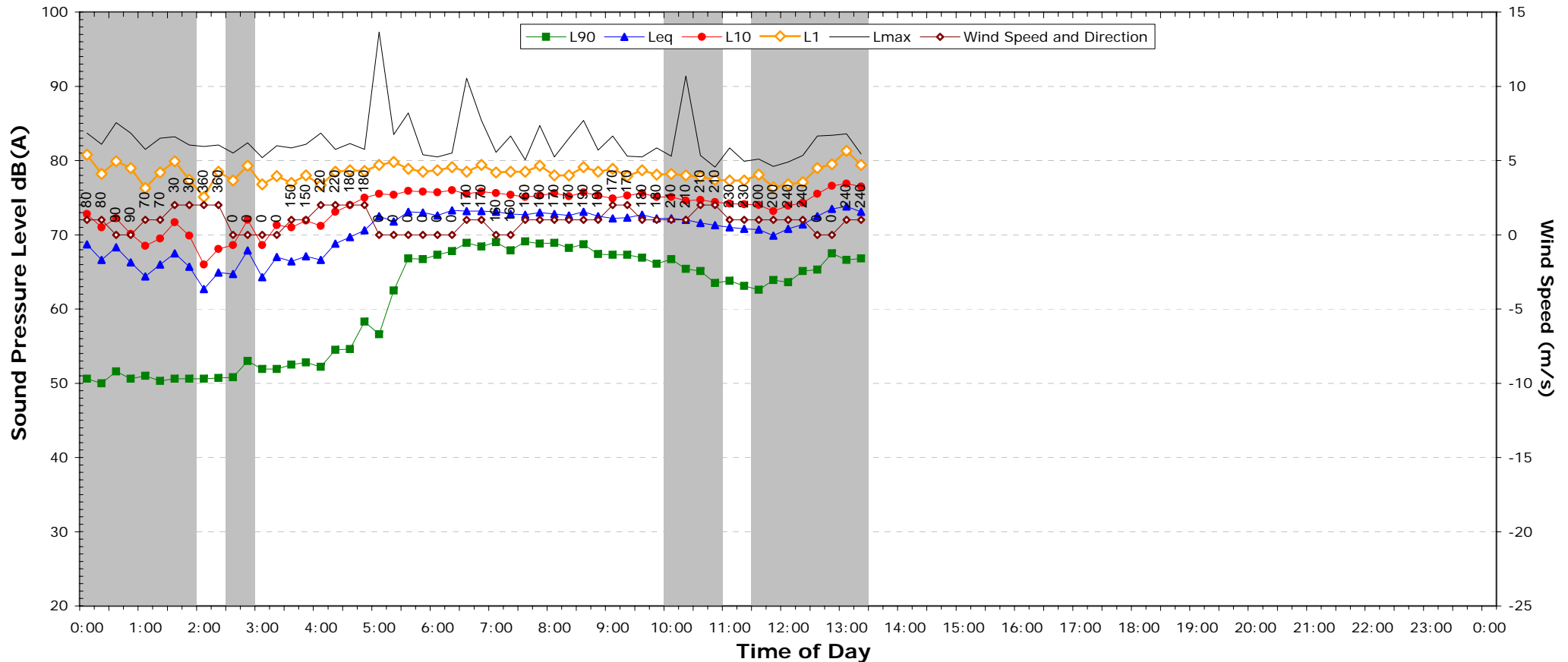
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.9	73.3
L <sub>eq</sub> 1hr upper 10 percentile	73.4	75.7
L <sub>eq</sub> 1hr lower 10 percentile	69.6	65.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	81.9	to	97.3
Lmax - Leq (Range)	16.9	to	26.7

# EXISTING AMBIENT NOISE LEVELS

## 990 Richmond Road, Marsden Park

### Thursday, 17 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	74.9	-
L <sub>eq</sub> 1hr upper 10 percentile	75.3	-
L <sub>eq</sub> 1hr lower 10 percentile	73.3	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

**1029 Richmond Road, Marsden Park**

**BACKGROUND & AMBIENT NOISE MONITORING RESULTS  
NSW DECCW's 'INDUSTRIAL NOISE POLICY', 2000**

Day	L <sub>A90</sub> Background Noise Levels <sup>5</sup>			L <sub>Aeq</sub> Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Tuesday-08-November-2011	-	-	36	-	-	67
Wednesday-09-November-2011	54	46	39	69	65	66
Thursday-10-November-2011	56	46	35	69	66	66
Friday-11-November-2011	56	47	32	69	67	64
Saturday-12-November-2011	53	47	34	68	65	62
Sunday-13-November-2011	50	45	35	66	65	65
Monday-14-November-2011	54	47	37	69	65	66
Tuesday-15-November-2011	53	47	40	69	65	66
Wednesday-16-November-2011	-	-	-	-	-	-
Thursday-17-November-2011	-	-	-	-	-	-
<b>Representative Level</b>						
	<b>54</b>	<b>47</b>	<b>36</b>	<b>69</b>	<b>65</b>	<b>66</b>

Notes:

- Day is taken to be 7:00am to 6:00pm
- Evening is taken to be 6:00pm to 10:00pm.
- Night is taken to be the remaining periods.
- Partial day's monitoring
- Assessment Background Level (ABL)
- Rating Background Level (RBL) for L90 and logarithmic average for Leq

**TRAFFIC NOISE MONITORING RESULTS**

**NSW DECCW 'ENVIRONMENTAL CRITERIA FOR ROAD TRAFFIC NOISE', 1999**

Day	L <sub>Aeq</sub> Noise Levels			L <sub>Aeq 1hr</sub> Noise Levels		
	Day	Night	Day - Up	Day - Low	Night - Up	Night - Low
Tuesday-08-November-2011	71	69	71	70	74	60
Wednesday-09-November-2011	71	68	73	66	73	61
Thursday-10-November-2011	71	68	73	67	73	62
Friday-11-November-2011	71	66	72	68	70	61
Saturday-12-November-2011	70	64	71	66	67	59
Sunday-13-November-2011	69	68	69	66	73	60
Monday-14-November-2011	71	68	72	66	73	61
Tuesday-15-November-2011	70	69	73	67	73	61
Wednesday-16-November-2011	72	66	73	71	70	62
Thursday-17-November-2011	-	-	-	-	-	-
<b>Representative Weekday</b>						
	<b>71</b>	<b>68</b>	<b>72</b>	<b>68</b>	<b>72</b>	<b>61</b>
<b>Representative Weekend</b>						
	<b>69</b>	<b>66</b>	<b>70</b>	<b>66</b>	<b>71</b>	<b>60</b>
<b>Representative Week</b>						
	<b>71</b>	<b>68</b>	<b>72</b>	<b>68</b>	<b>72</b>	<b>61</b>

noise logger results

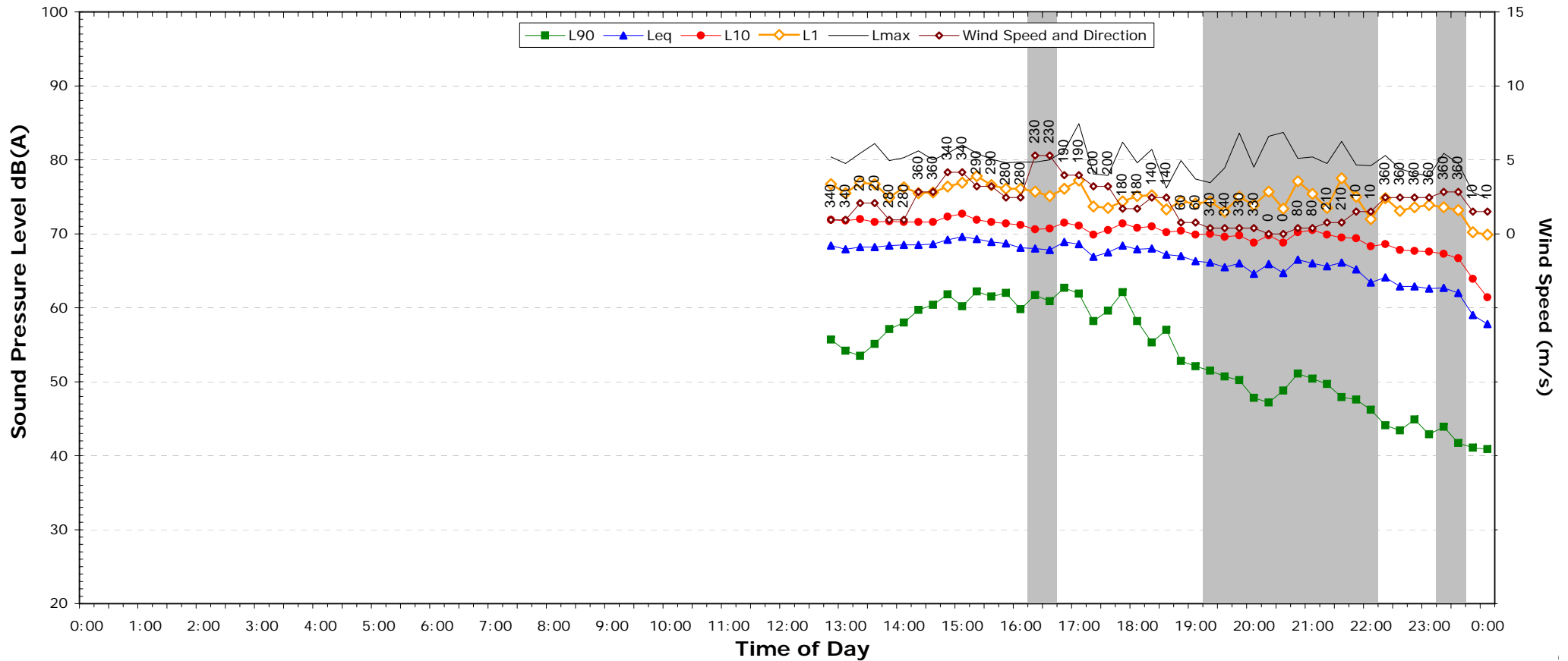
25

1982-2007  
ACOUSTIC  
ENGINEERING  
EXCELLENCE

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Tuesday, 8 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	36.0
Leq (see note 3)	-	-	66.6

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

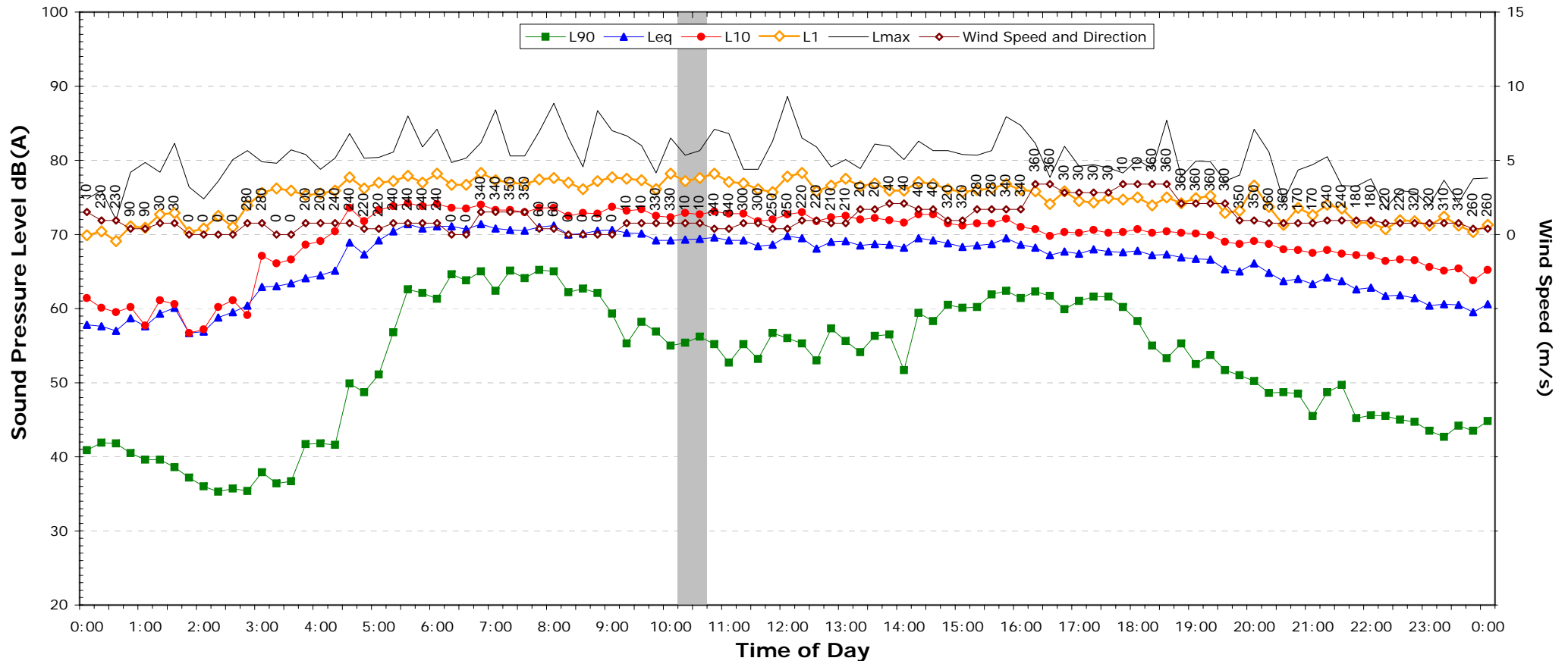
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.8	69.1
L <sub>eq</sub> 1hr upper 10 percentile	71.5	73.5
L <sub>eq</sub> 1hr lower 10 percentile	69.7	60.3

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	75.6	to	86.8
Lmax - Leq (Range)	15.1	to	23.8

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Wednesday, 9 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	54.1	45.5	39.2
Leq (see note 3)	69.2	65.3	65.5

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

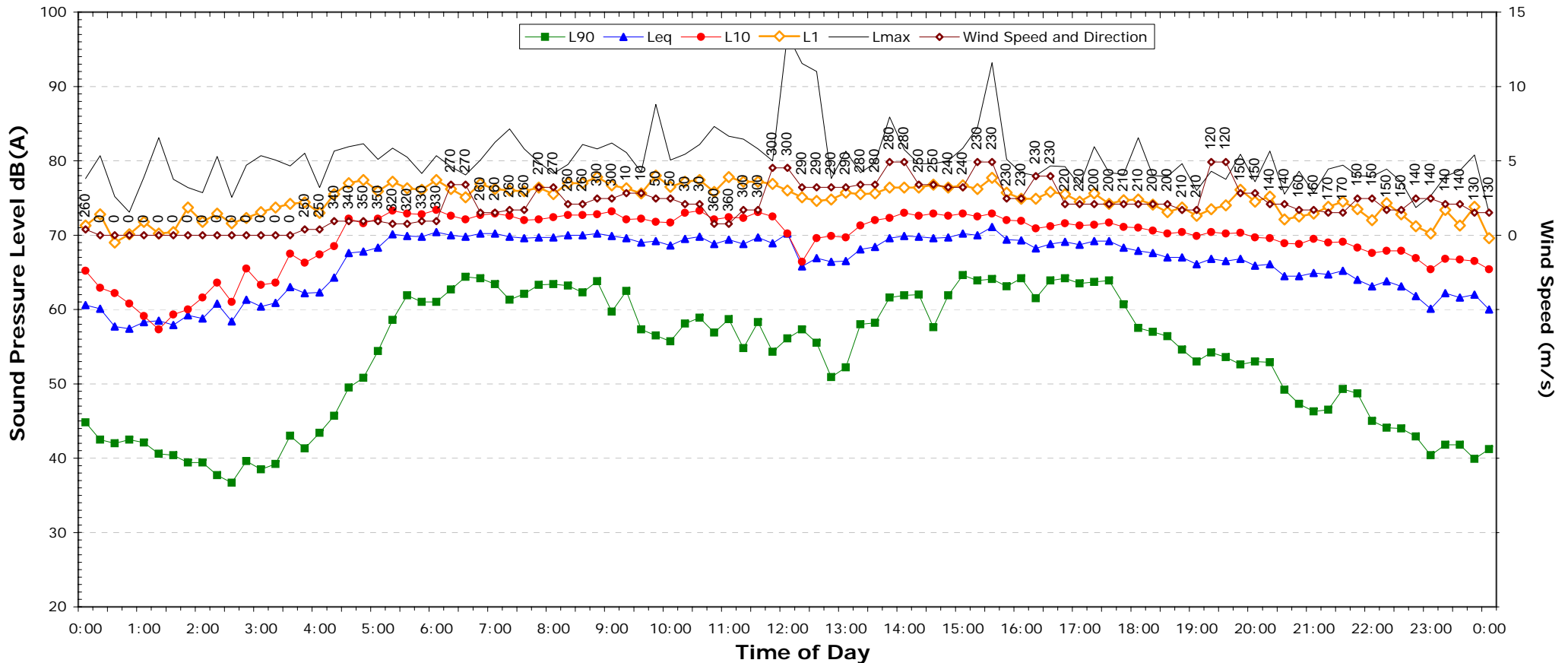
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.9	68.0
L <sub>eq</sub> 1hr upper 10 percentile	73.1	72.6
L <sub>eq</sub> 1hr lower 10 percentile	66.2	61.0

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	77.6	to	83.1
Lmax - Leq (Range)	15.1	to	24.5

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Thursday, 10 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	55.5	46.3	35.3
Leq (see note 3)	69.2	65.8	65.8

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	71.0	68.3
L <sub>eq</sub> 1hr upper 10 percentile	72.5	72.8
L <sub>eq</sub> 1hr lower 10 percentile	67.2	62.0

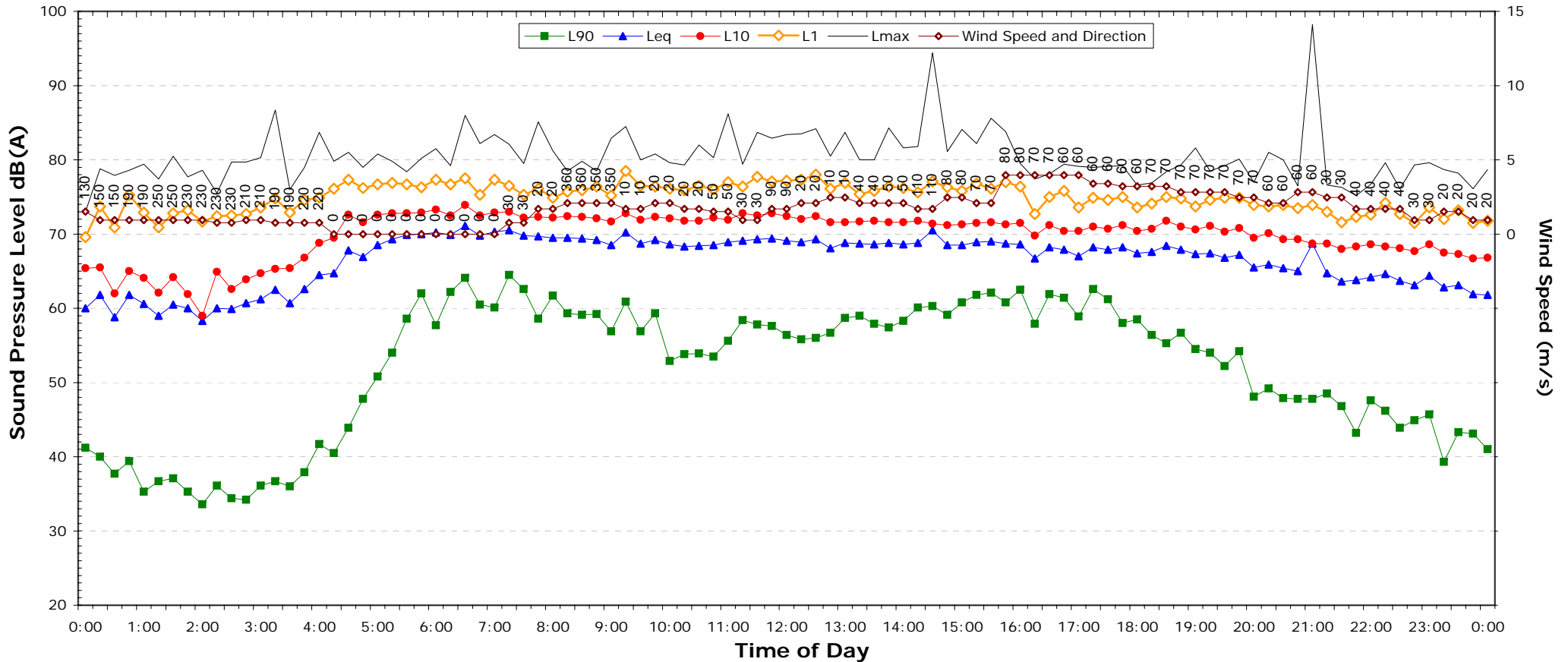
Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	78.9	to	86.7
Lmax - Leq (Range)	15.7	to	23.9



# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Friday, 11 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	55.6	46.8	32.2
Leq (see note 3)	68.9	66.5	64.0

#### NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

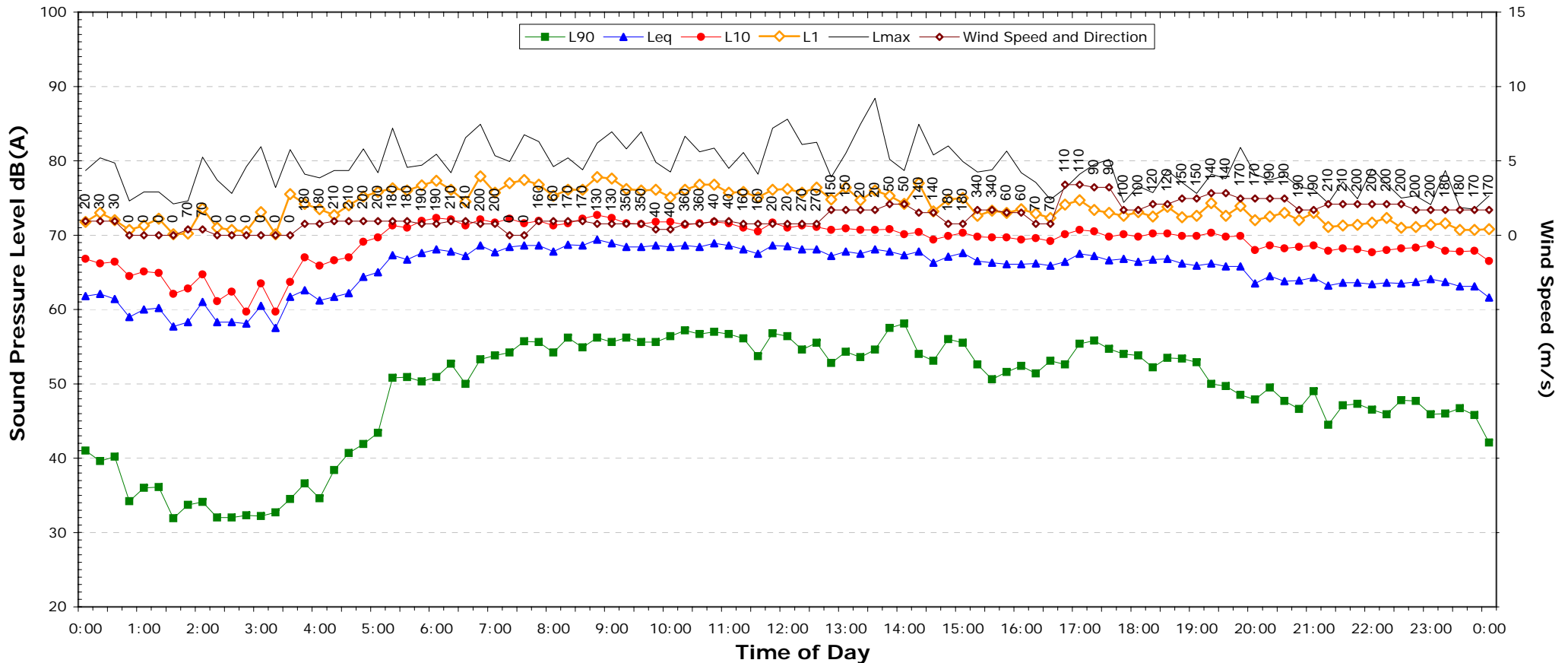
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.8	66.5
L <sub>eq</sub> 1hr upper 10 percentile	72.1	70.4
L <sub>eq</sub> 1hr lower 10 percentile	68.0	61.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	78.7	to	84.9
Lmax - Leq (Range)	15.6	to	23.0

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Saturday, 12 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	52.6	46.5	34.3
Leq (see note 3)	67.8	65.0	61.9

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

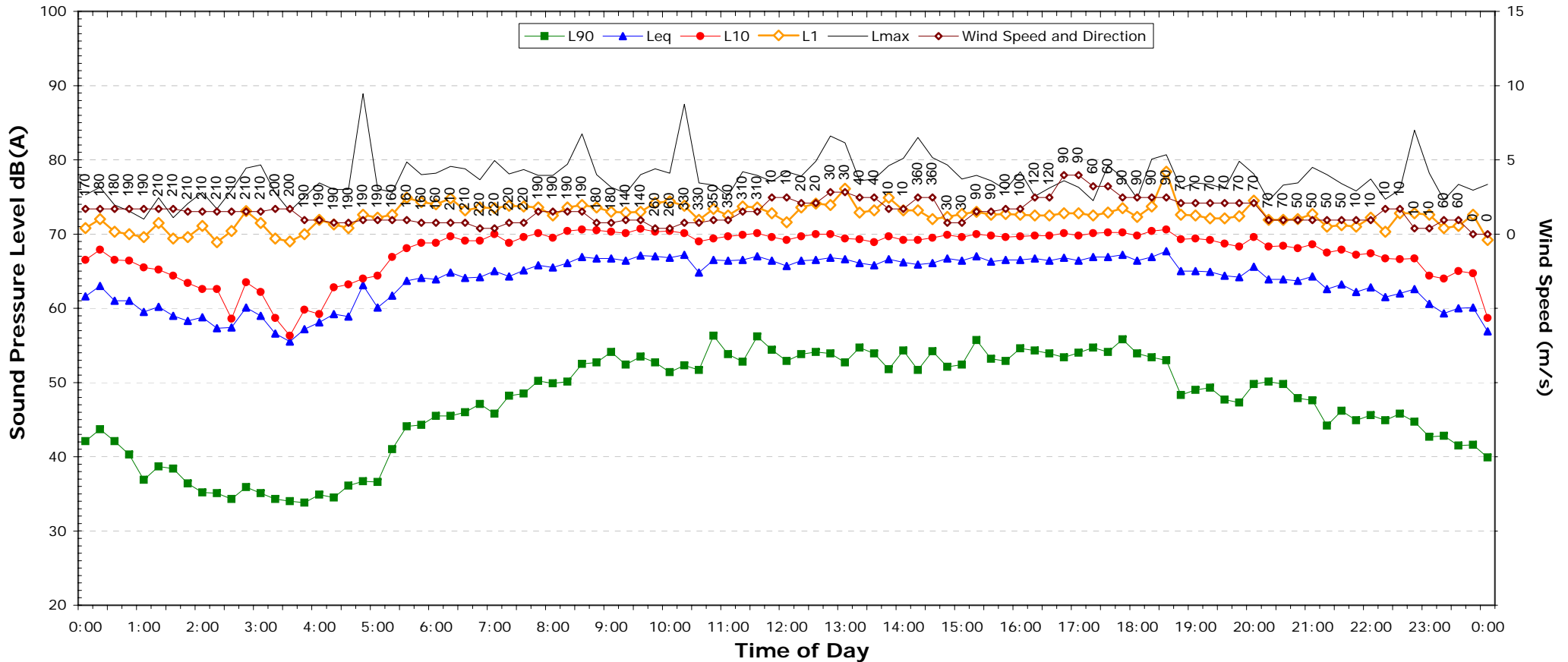
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	69.7	64.4
L <sub>eq</sub> 1hr upper 10 percentile	71.3	67.0
L <sub>eq</sub> 1hr lower 10 percentile	66.3	59.5

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	75.6	to	88.9
Lmax - Leq (Range)	15.4	to	28.2

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Sunday, 13 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	50.2	44.9	35.2
Leq (see note 3)	66.4	64.6	65.3

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

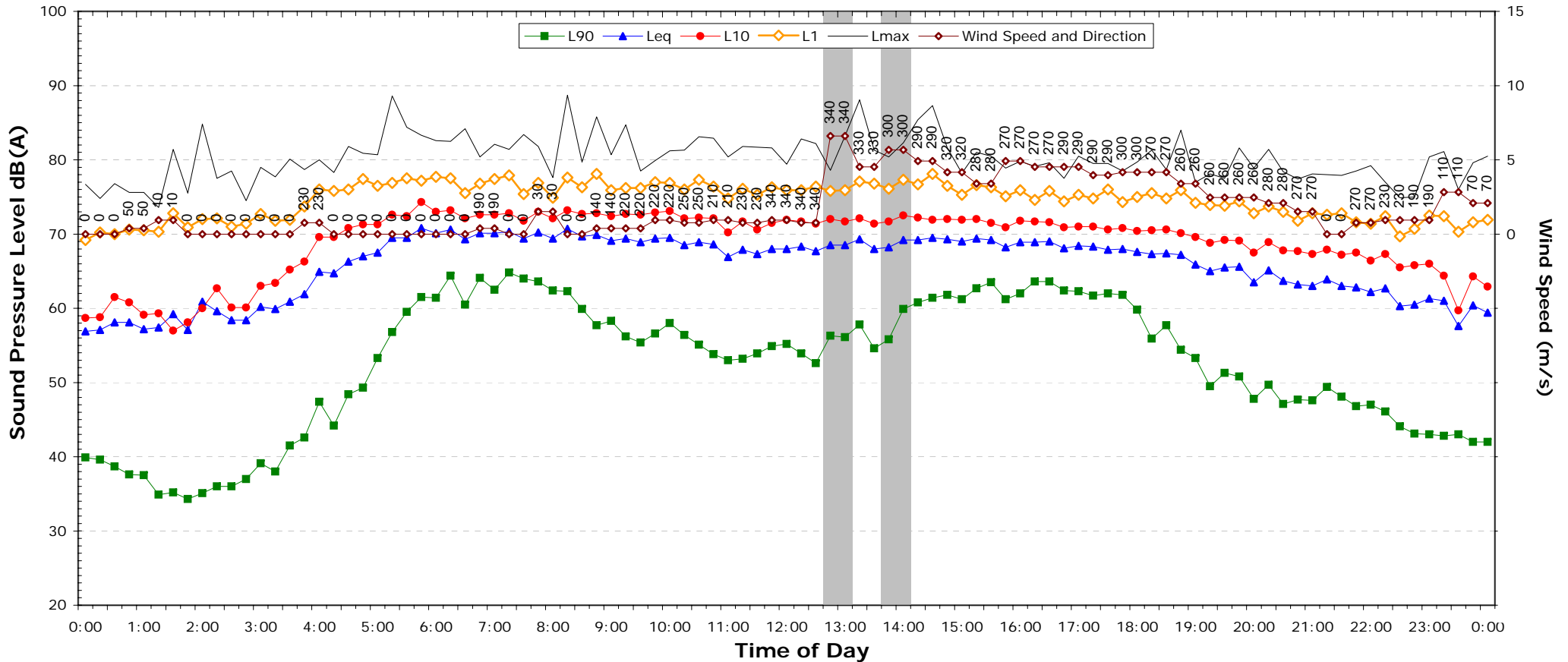
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	68.5	67.8
L <sub>eq</sub> 1hr upper 10 percentile	69.3	72.5
L <sub>eq</sub> 1hr lower 10 percentile	65.9	60.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	76.7	to	88.6
Lmax - Leq (Range)	15.3	to	25.9

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Monday, 14 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	53.9	47.0	37.4
Leq (see note 3)	68.9	65.0	65.9

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

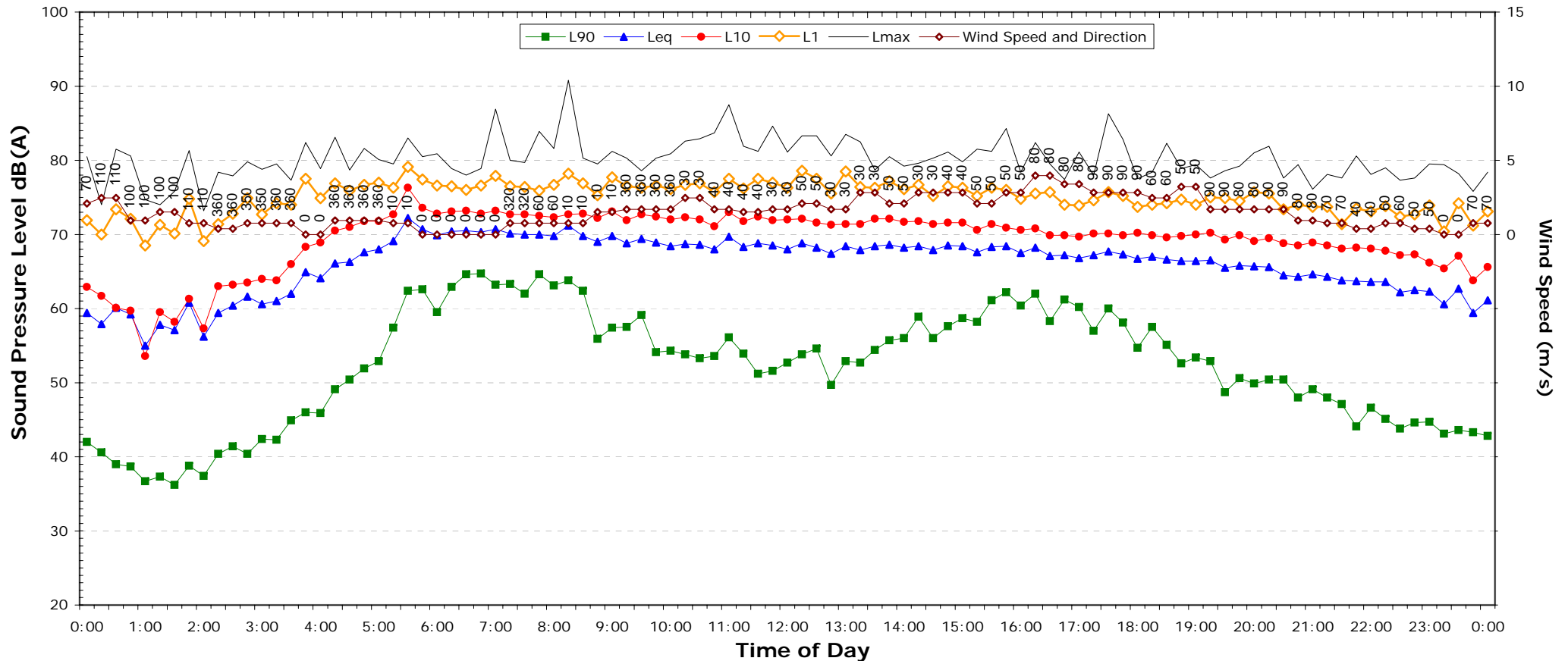
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.6	68.4
L <sub>eq</sub> 1hr upper 10 percentile	72.4	73.1
L <sub>eq</sub> 1hr lower 10 percentile	65.9	60.8

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	79.8	to	86.9
Lmax - Leq (Range)	16.0	to	23.1

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Tuesday, 15 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	52.7	46.6	39.5
Leq (see note 3)	68.6	65.4	66.0

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

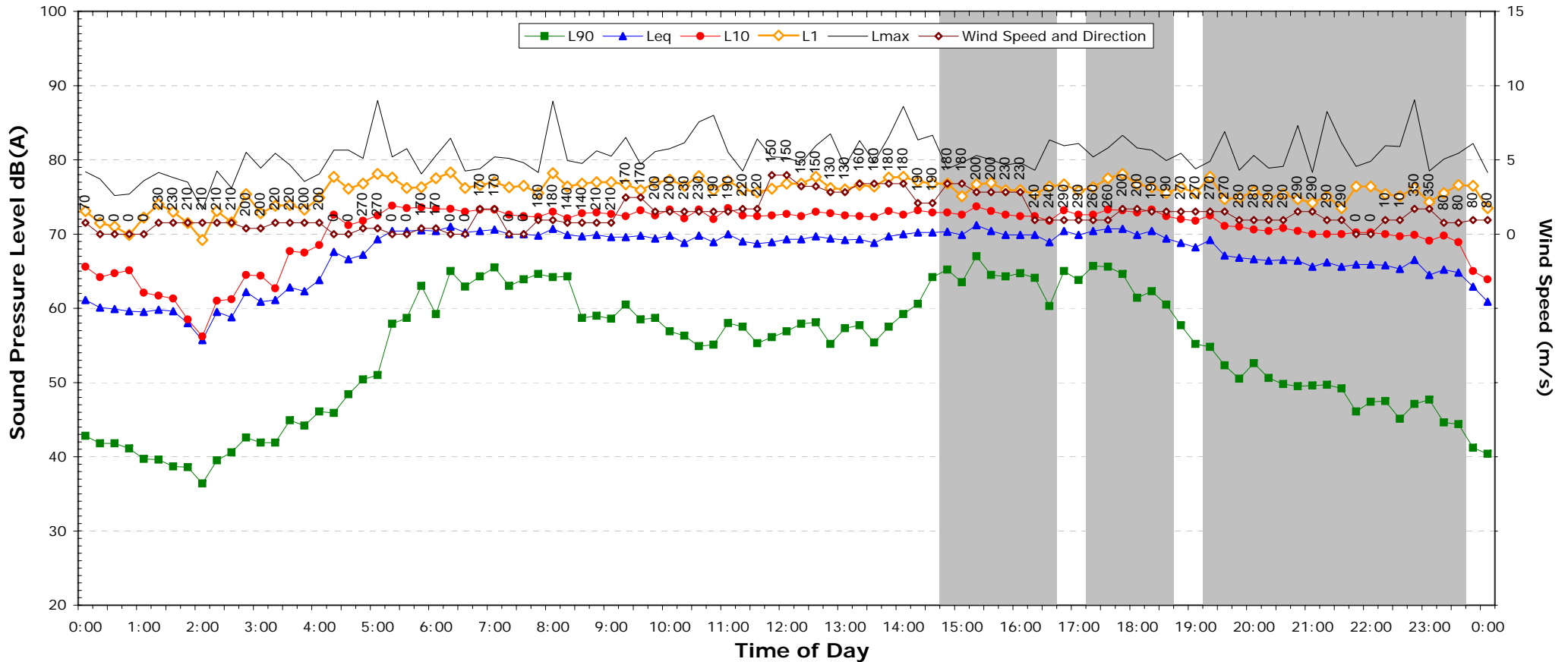
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	70.4	68.5
L <sub>eq</sub> 1hr upper 10 percentile	72.5	73.1
L <sub>eq</sub> 1hr lower 10 percentile	66.8	61.1

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	77.4	to	88.0
Lmax - Leq (Range)	16.8	to	20.5

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Wednesday, 16 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

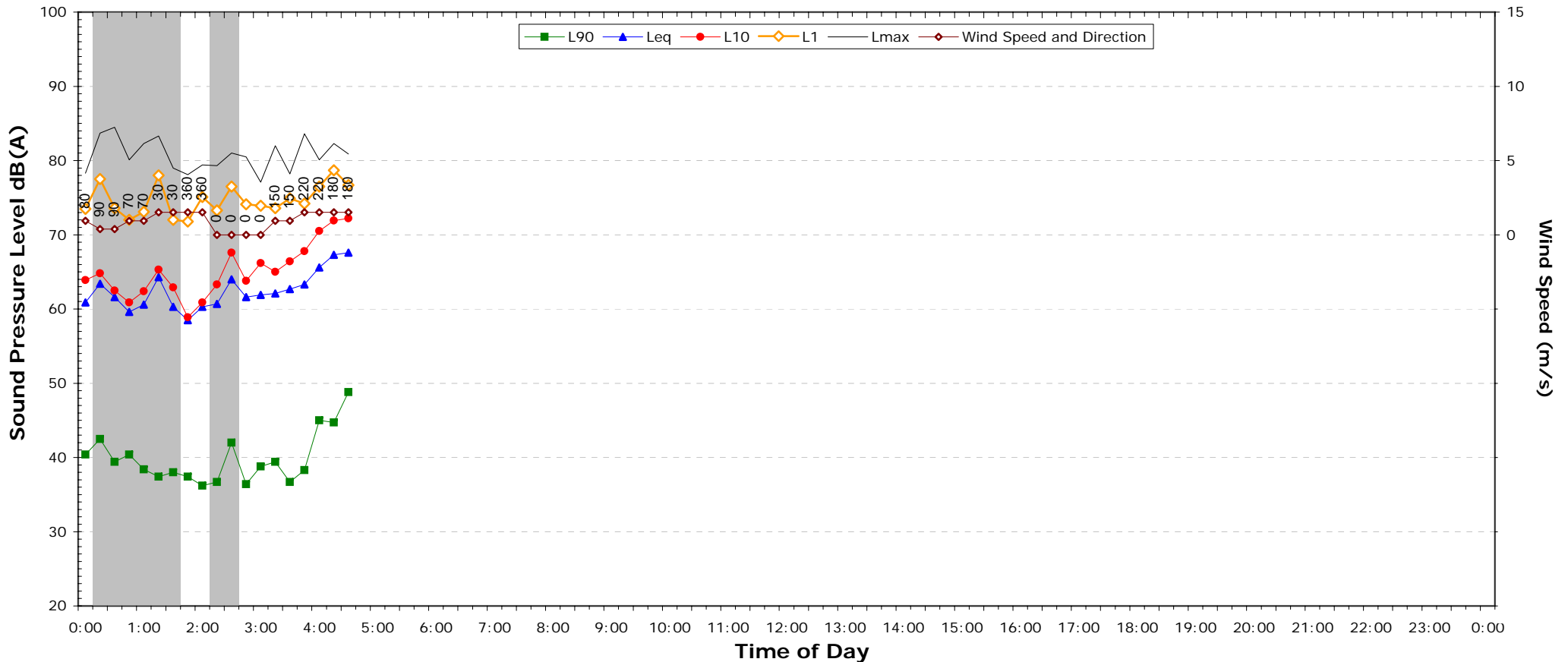
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	72.1	66.2
L <sub>eq</sub> 1hr upper 10 percentile	72.7	70.0
L <sub>eq</sub> 1hr lower 10 percentile	71.0	62.0

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	79.4	to	83.6
Lmax - Leq (Range)	18.7	to	20.2

# EXISTING AMBIENT NOISE LEVELS

## 1029 Richmond Road, Marsden Park

### Thursday, 17 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	-	-
L <sub>eq</sub> 1hr upper 10 percentile	-	-
L <sub>eq</sub> 1hr lower 10 percentile	-	-

Night Time Maximum Noise Levels (see note 4)			
Descriptor	Day	Night	Range
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

**Lot 1 / DP1078187 Richmond Road, Marsden Park**

**BACKGROUND & AMBIENT NOISE MONITORING RESULTS  
NSW DECCW's 'INDUSTRIAL NOISE POLICY', 2000**

Day	L <sub>A90</sub> Background Noise Levels <sup>5</sup>			L <sub>Aeq</sub> Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Tuesday-08-November-2011	-	-	37	-	-	60
Wednesday-09-November-2011	50	52	36	64	62	61
Thursday-10-November-2011	54	49	34	64	62	60
Friday-11-November-2011	52	48	32	64	63	59
Saturday-12-November-2011	50	46	32	62	61	57
Sunday-13-November-2011	47	49	34	61	61	60
Monday-14-November-2011	52	48	35	65	61	61
Tuesday-15-November-2011	51	48	37	63	62	61
Wednesday-16-November-2011	-	-	-	-	-	-
Thursday-17-November-2011	-	-	-	-	-	-
<b>Representative Level</b>						
	<b>51</b>	<b>48</b>	<b>35</b>	<b>63</b>	<b>62</b>	<b>60</b>

Notes:

- Day is taken to be 7:00am to 6:00pm
- Evening is taken to be 6:00pm to 10:00pm.
- Night is taken to be the remaining periods.
- Partial day's monitoring
- Assessment Background Level (ABL)
- Rating Background Level (RBL) for L90 and logarithmic average for Leq

**TRAFFIC NOISE MONITORING RESULTS**

**NSW DECCW 'ENVIRONMENTAL CRITERIA FOR ROAD TRAFFIC NOISE', 1999**

Day	L <sub>Aeq</sub> Noise Levels			L <sub>Aeq 1hr</sub> Noise Levels		
	Day	Night	Day - Up	Day - Low	Night - Up	Night - Low
Tuesday-08-November-2011	67	63	68	65	66	57
Wednesday-09-November-2011	66	64	67	63	68	59
Thursday-10-November-2011	66	63	68	63	67	59
Friday-11-November-2011	66	61	68	64	65	57
Saturday-12-November-2011	64	60	65	62	62	55
Sunday-13-November-2011	63	63	66	62	67	58
Monday-14-November-2011	67	63	70	63	67	57
Tuesday-15-November-2011	65	63	67	64	67	58
Wednesday-16-November-2011	66	66	69	65	68	57
Thursday-17-November-2011	68	-	68	66	-	-
<b>Representative Weekday</b>						
	<b>66</b>	<b>63</b>	<b>68</b>	<b>64</b>	<b>67</b>	<b>58</b>
<b>Representative Weekend</b>						
	<b>64</b>	<b>61</b>	<b>65</b>	<b>62</b>	<b>65</b>	<b>56</b>
<b>Representative Week</b>						
	<b>66</b>	<b>63</b>	<b>68</b>	<b>64</b>	<b>67</b>	<b>58</b>

noise logger results

25

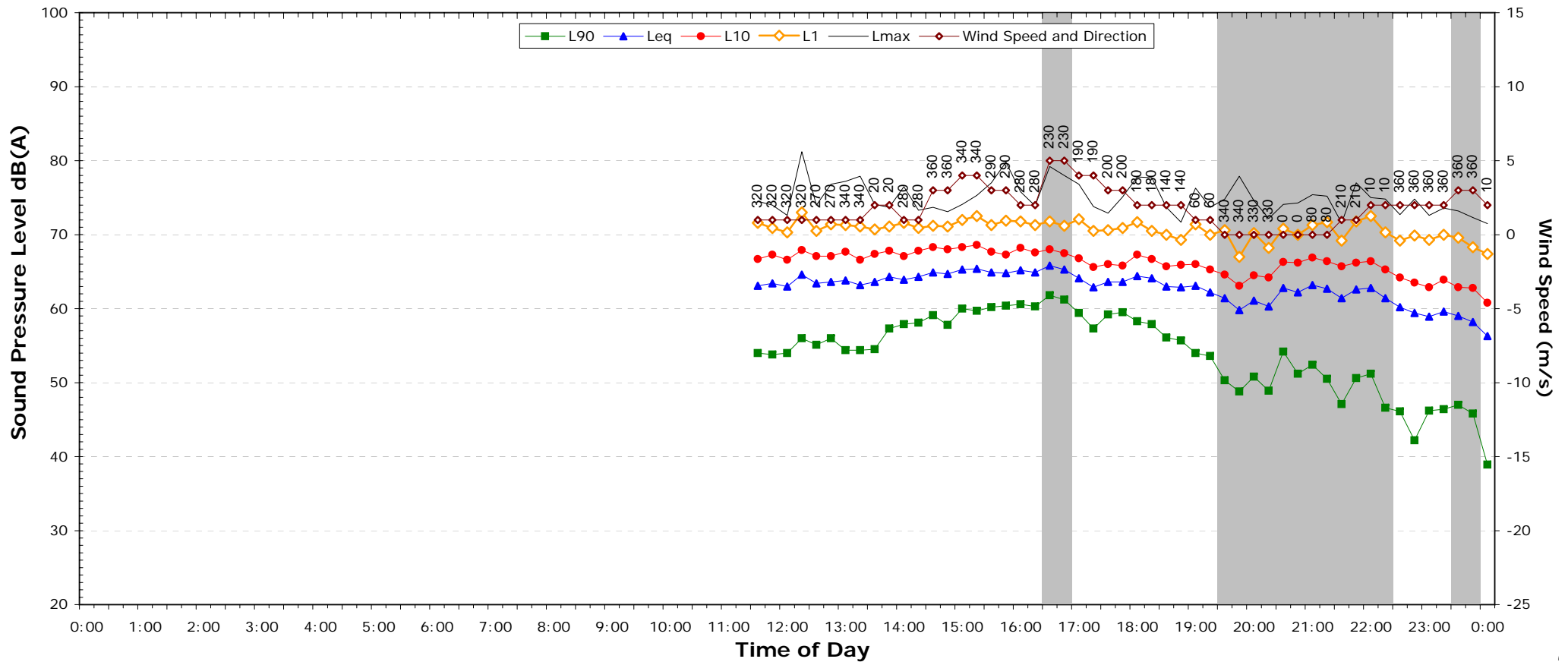
1982-2007  
ACOUSTIC  
ENGINEERING  
EXCELLENCE



# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Tuesday, 8 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	36.8
Leq (see note 3)	-	-	60.4

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

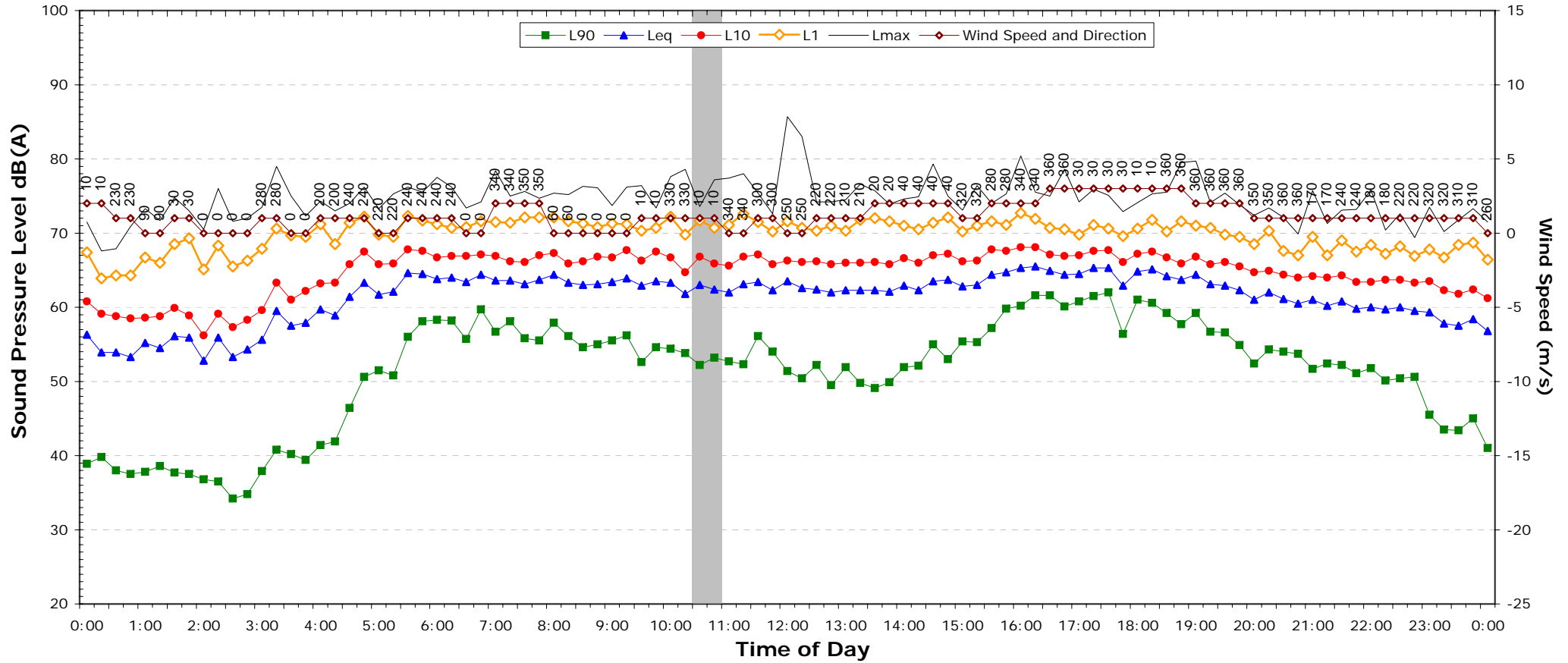
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	66.5	62.9
L <sub>eq</sub> 1hr upper 10 percentile	67.6	66.4
L <sub>eq</sub> 1hr lower 10 percentile	64.7	56.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	73.3	to	79.0
Lmax - Leq (Range)	15.3	to	21.1

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Wednesday, 9 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	50.4	51.7	36.1
Leq (see note 3)	63.5	62.3	61.2

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

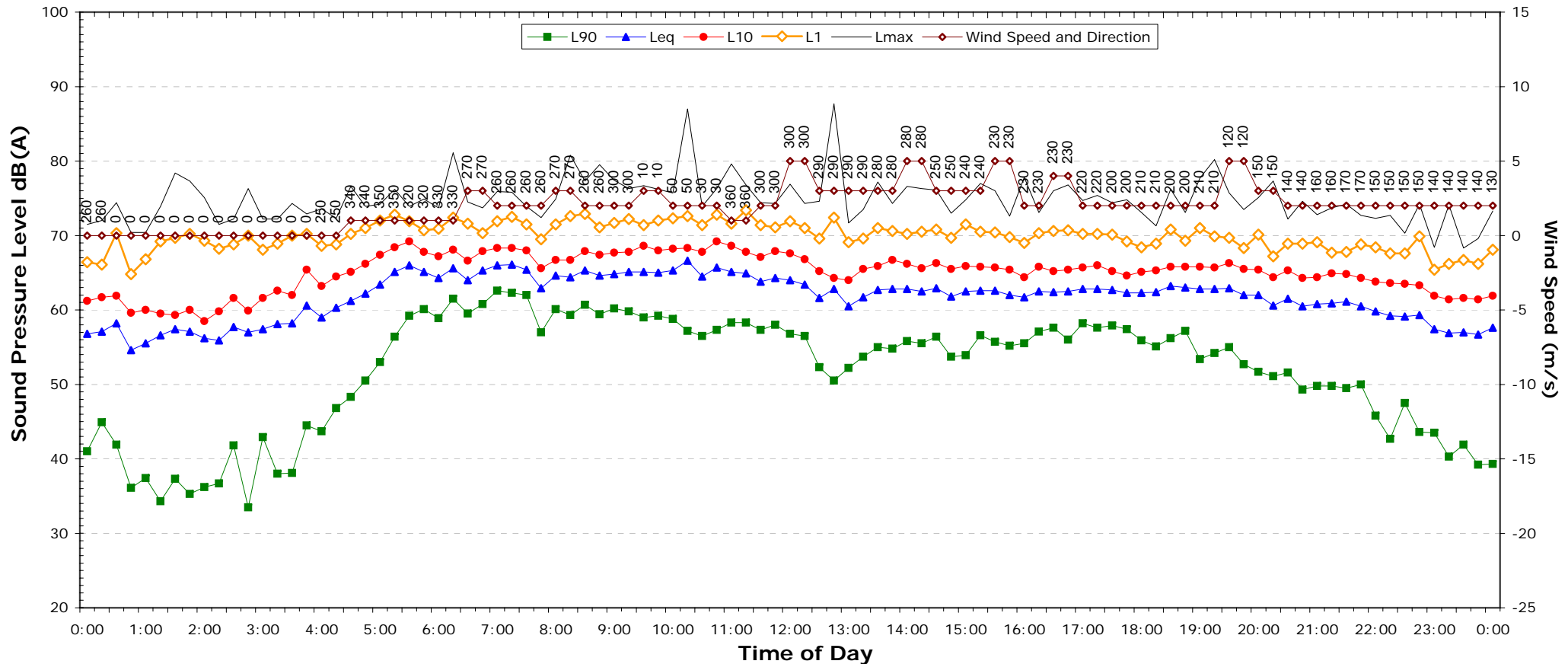
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	65.7	63.7
L <sub>eq</sub> 1hr upper 10 percentile	67.3	67.8
L <sub>eq</sub> 1hr lower 10 percentile	63.2	59.1

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	73.3	to	81.1
Lmax - Leq (Range)	15.2	to	21.6

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Thursday, 10 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	53.7	49.3	34.4
Leq (see note 3)	63.8	61.8	60.3

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

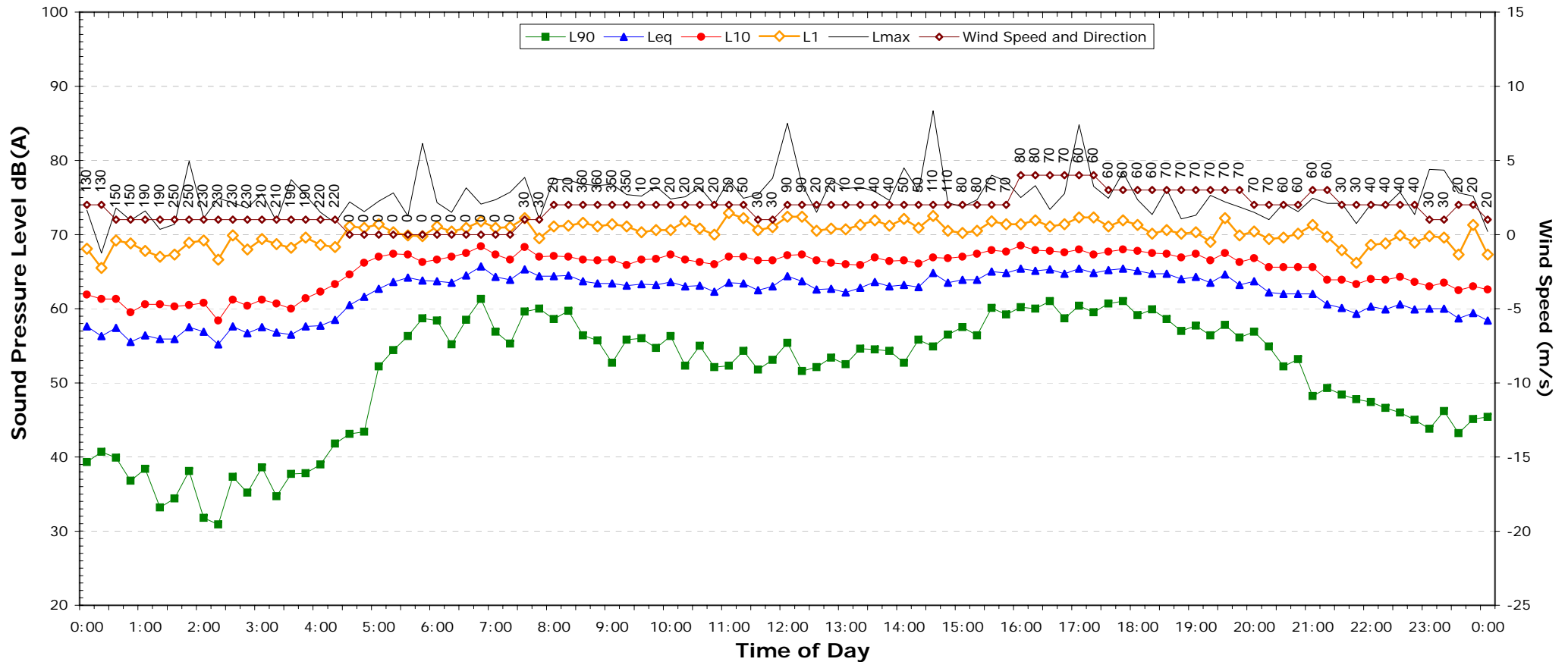
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	65.8	62.8
L <sub>eq</sub> 1hr upper 10 percentile	67.8	67.1
L <sub>eq</sub> 1hr lower 10 percentile	63.2	59.0

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	73.6	to	82.3
Lmax - Leq (Range)	15.4	to	23.3

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Friday, 11 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	52.3	47.8	32.0
Leq (see note 3)	64.0	62.9	59.0

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

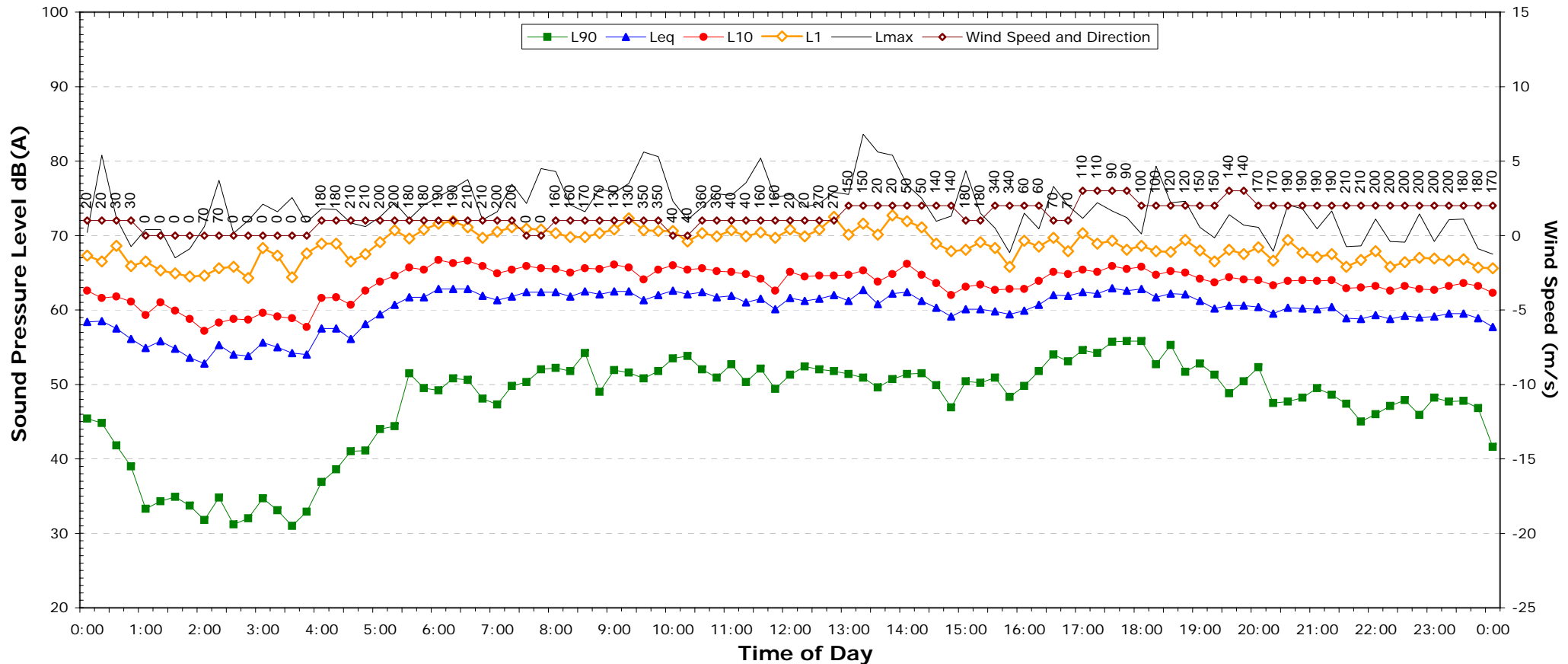
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	66.2	61.5
L <sub>eq</sub> 1hr upper 10 percentile	67.6	64.7
L <sub>eq</sub> 1hr lower 10 percentile	63.7	56.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	71.2	to	80.8
Lmax - Leq (Range)	15.3	to	23.8

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Saturday, 12 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	49.6	46.0	32.4
Leq (see note 3)	61.7	60.5	57.3

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

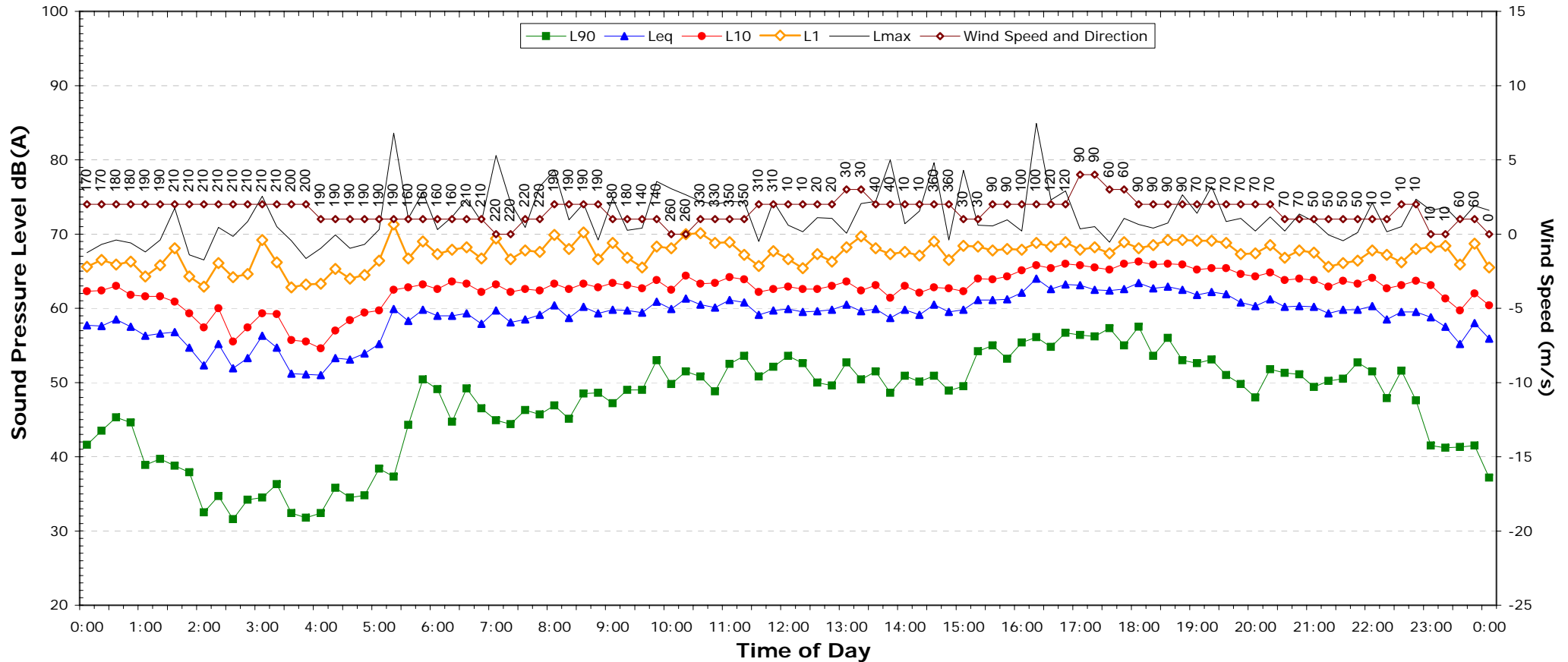
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	63.9	59.8
L <sub>eq</sub> 1hr upper 10 percentile	64.9	61.8
L <sub>eq</sub> 1hr lower 10 percentile	62.1	54.8

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	70.6	to	83.6
Lmax - Leq (Range)	16.6	to	24.3

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Sunday, 13 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	46.9	49.4	34.3
Leq (see note 3)	60.8	61.2	60.0

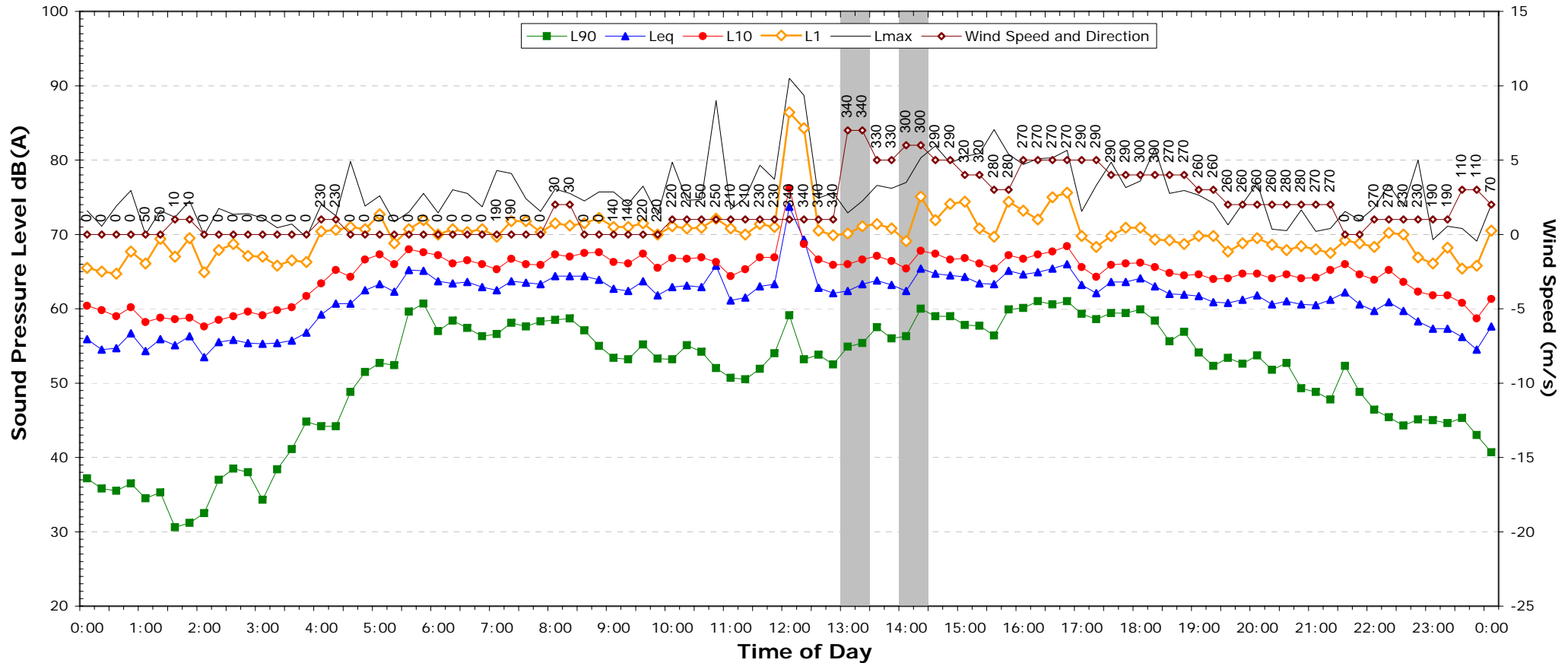
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	63.4	62.5
L <sub>eq</sub> 1hr upper 10 percentile	65.5	66.7
L <sub>eq</sub> 1hr lower 10 percentile	61.8	57.7

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	73.5	to	79.8
Lmax - Leq (Range)	15.5	to	20.7

**EXISTING AMBIENT NOISE LEVELS**  
**Lot 1 / DP1078187 Richmond Road, Marsden Park**  
**Monday, 14 November 2011**



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	52.3	47.8	34.6
Leq (see note 3)	64.8	61.3	60.9

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

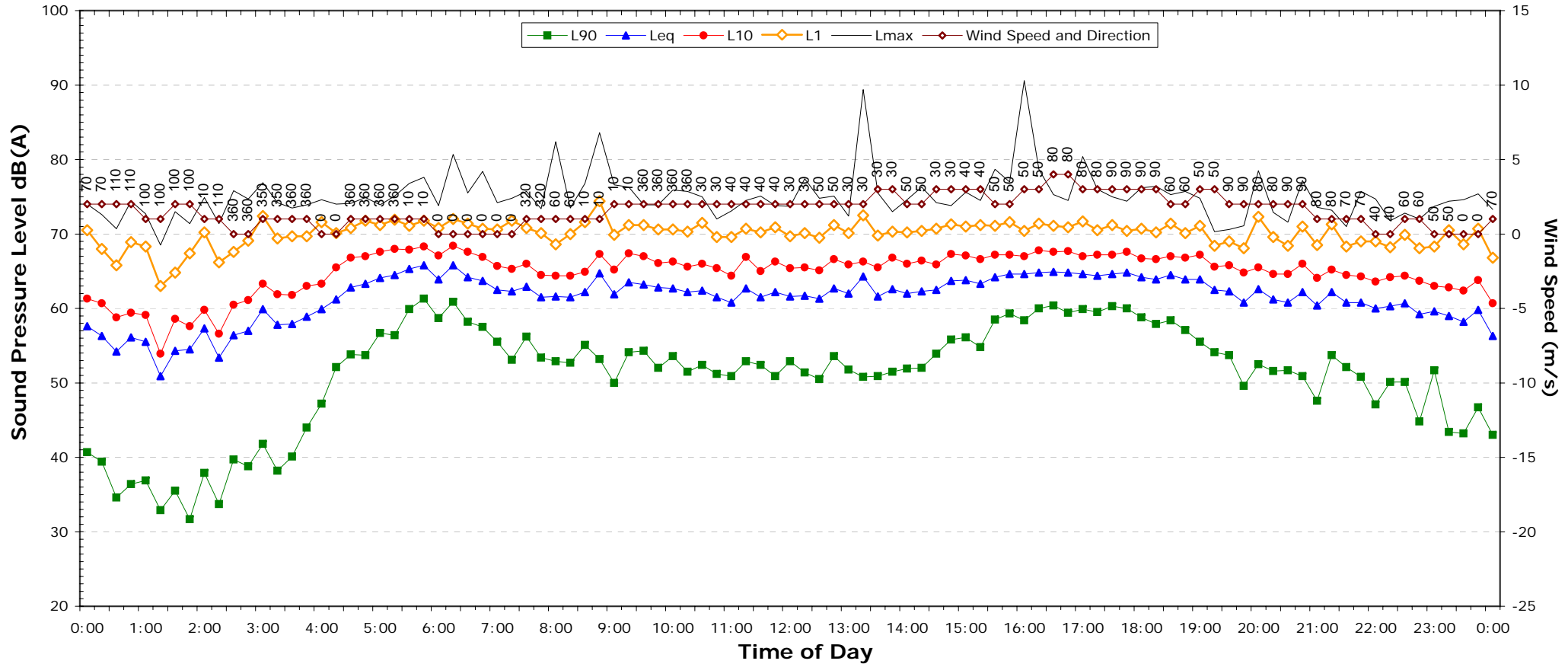
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	66.6	63.4
L <sub>eq</sub> 1hr upper 10 percentile	70.0	67.4
L <sub>eq</sub> 1hr lower 10 percentile	63.4	57.3

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	74.0	to	80.7
Lmax - Leq (Range)	15.9	to	20.7

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Tuesday, 15 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	50.9	47.6	37.3
Leq (see note 3)	63.1	62.3	60.8

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	65.4	63.3
L <sub>eq</sub> 1hr upper 10 percentile	67.1	67.4
L <sub>eq</sub> 1hr lower 10 percentile	63.6	58.4

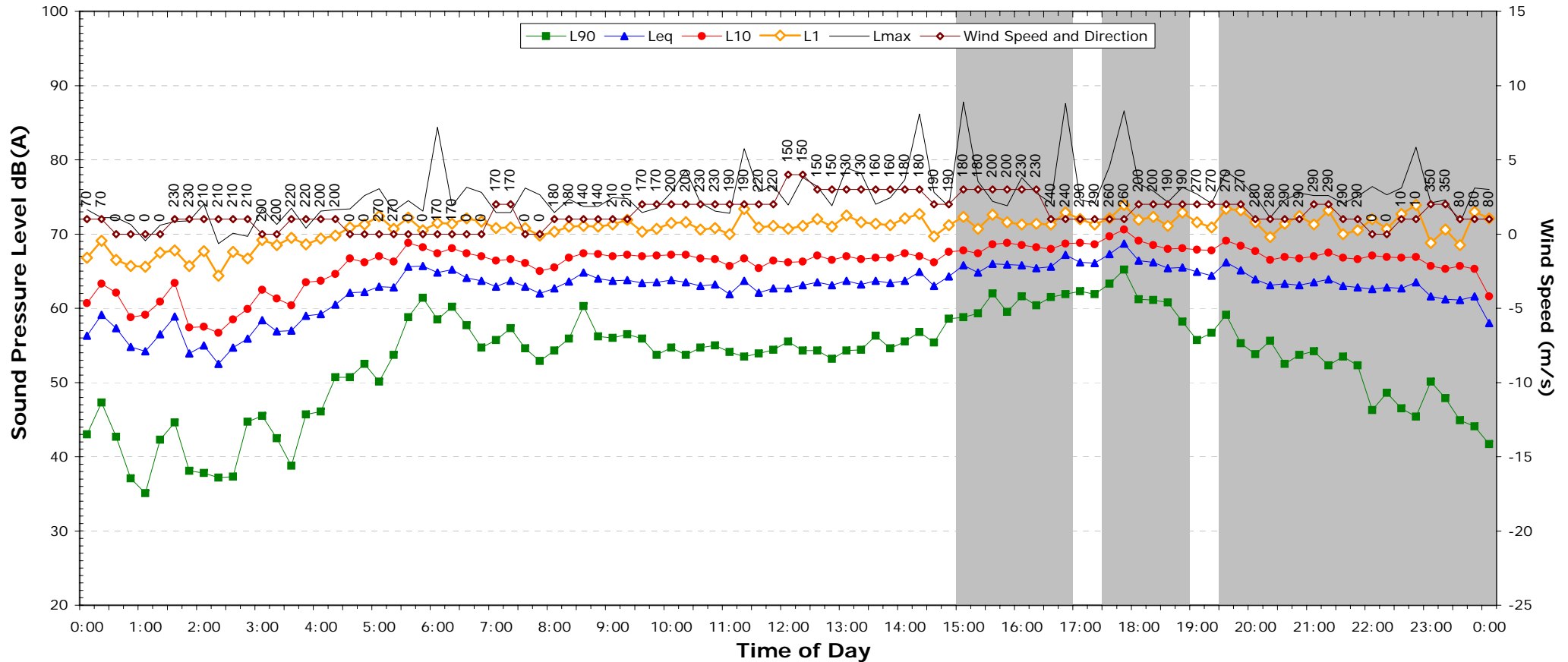
Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	72.2	to	84.4
Lmax - Leq (Range)	15.3	to	19.5



# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Wednesday, 16 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

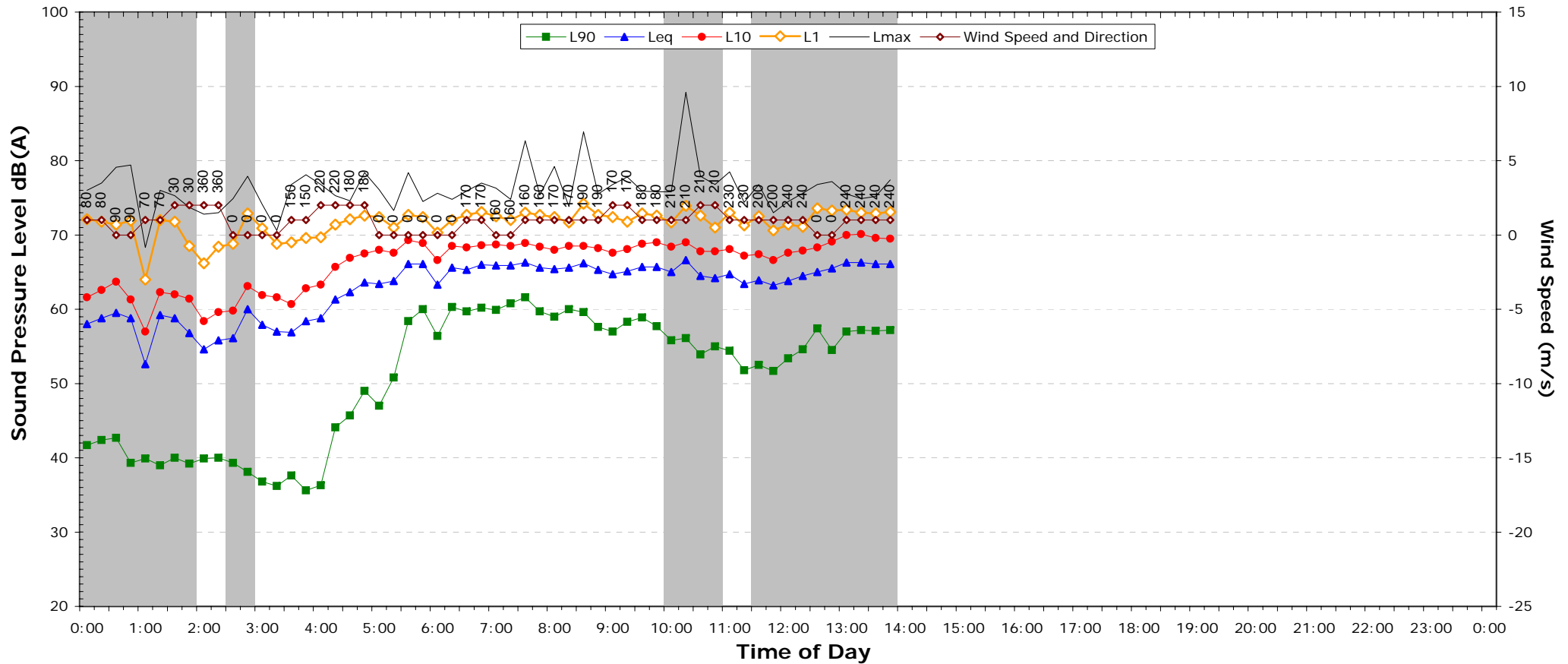
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	66.2	65.6
L <sub>eq</sub> 1hr upper 10 percentile	68.7	68.2
L <sub>eq</sub> 1hr lower 10 percentile	65.3	57.1

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	72.8	to	78.4
Lmax - Leq (Range)	15.7	to	20.2

# EXISTING AMBIENT NOISE LEVELS

## Lot 1 / DP1078187 Richmond Road, Marsden Park

### Thursday, 17 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	67.9	-
L <sub>eq</sub> 1hr upper 10 percentile	68.3	-
L <sub>eq</sub> 1hr lower 10 percentile	65.9	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

**BACKGROUND & AMBIENT NOISE MONITORING RESULTS**  
**NSW DECCW's 'INDUSTRIAL NOISE POLICY', 2000**

Day	L <sub>A90</sub> Background Noise Levels <sup>5</sup>			L <sub>Aeq</sub> Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Tuesday-08-November-2011	-	-	31	-	-	52
Wednesday-09-November-2011	39	39	30	57	54	52
Thursday-10-November-2011	41	37	29	56	53	52
Friday-11-November-2011	37	33	28	55	53	49
Saturday-12-November-2011	37	35	29	55	51	48
Sunday-13-November-2011	36	33	29	54	52	52
Monday-14-November-2011	38	35	30	57	54	53
Tuesday-15-November-2011	40	36	30	56	53	52
Wednesday-16-November-2011	-	-	-	-	-	-
Thursday-17-November-2011	-	-	-	-	-	-
<b>Representative Level</b>	<b>38</b>	<b>35</b>	<b>30</b>	<b>56</b>	<b>53</b>	<b>52</b>

Notes:

- Day is taken to be 7:00am to 6:00pm
- Evening is taken to be 6:00pm to 10:00pm.
- Night is taken to be the remaining periods.
- Partial day's monitoring
- Assessment Background Level (ABL)
- Rating Background Level (RBL) for L90 and logarithmic average for Leq

noise logger results

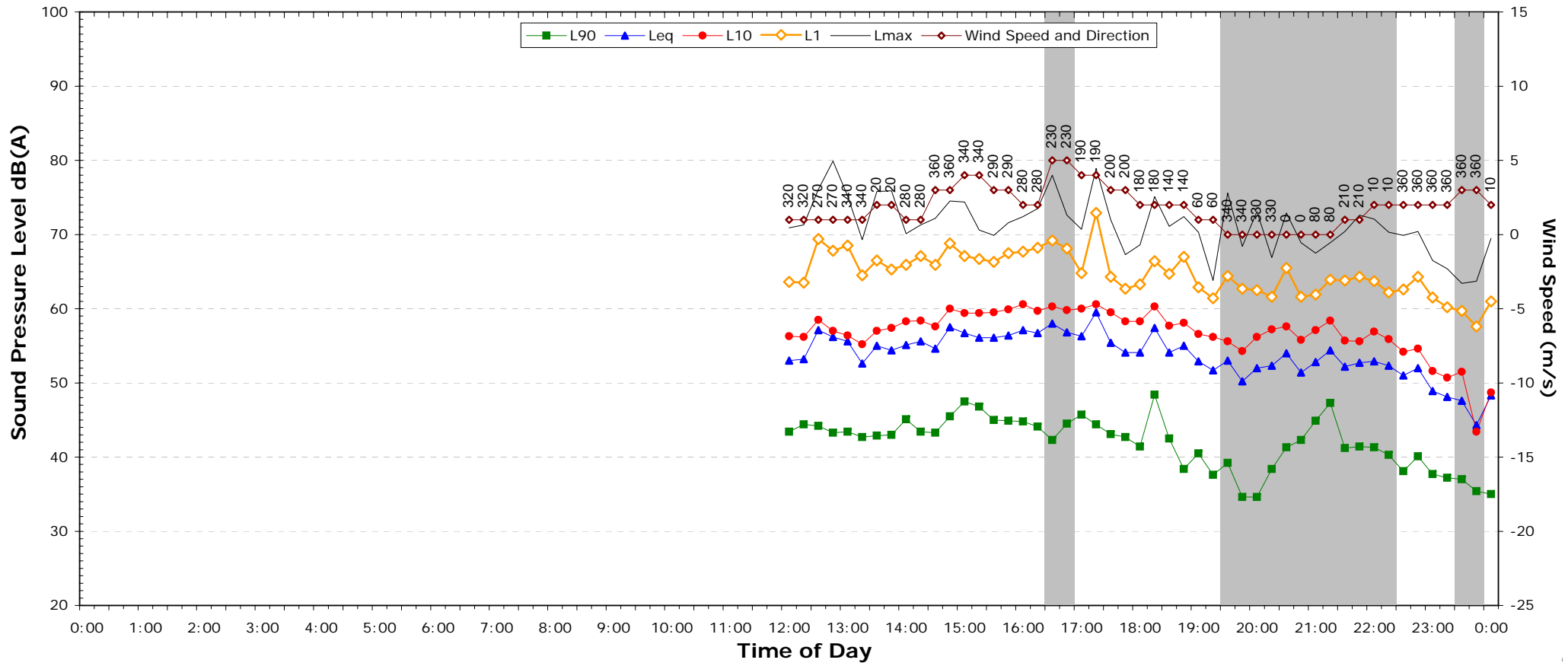
25

1993-2007  
ACOUSTIC  
ENGINEERING  
EXCELLENCE

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Tuesday, 8 November 2011



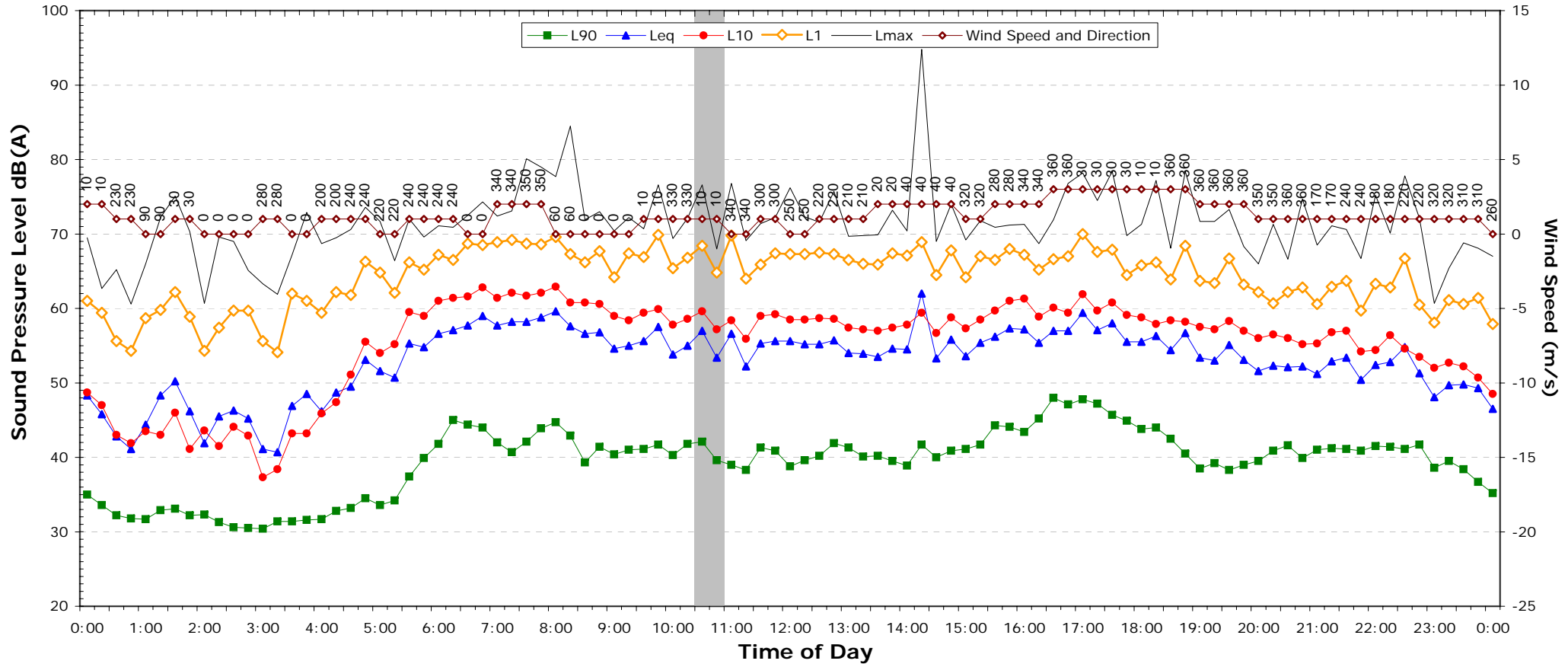
NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	31.3
Leq (see note 3)	-	-	52.1

- NOTES:**
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
  2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
  3. Graphed data measured in free-field; tabulated results facade corrected
  4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Wednesday, 9 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	39.3	38.5	30.4
Leq (see note 3)	56.5	53.5	51.9

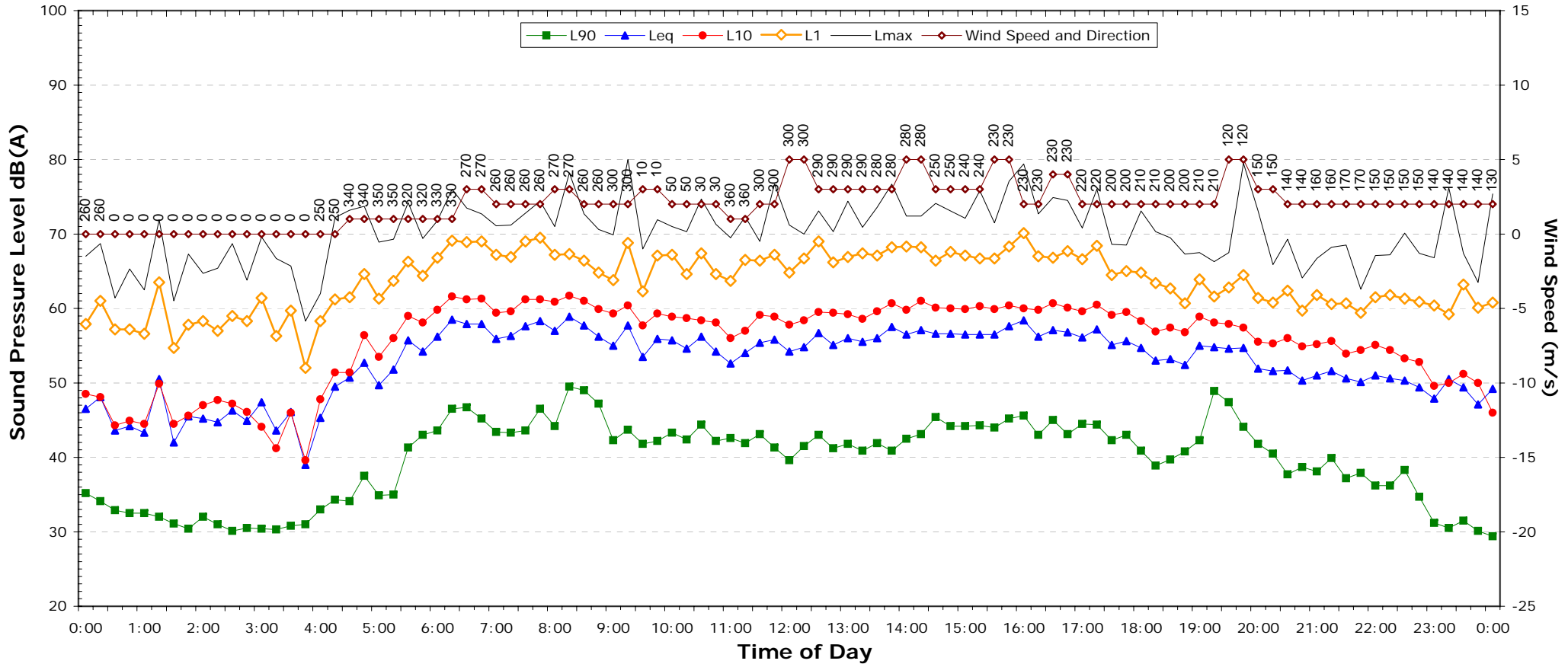
#### NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax - Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Thursday, 10 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	41.2	37.2	28.7
Leq (see note 3)	56.3	52.7	52.1

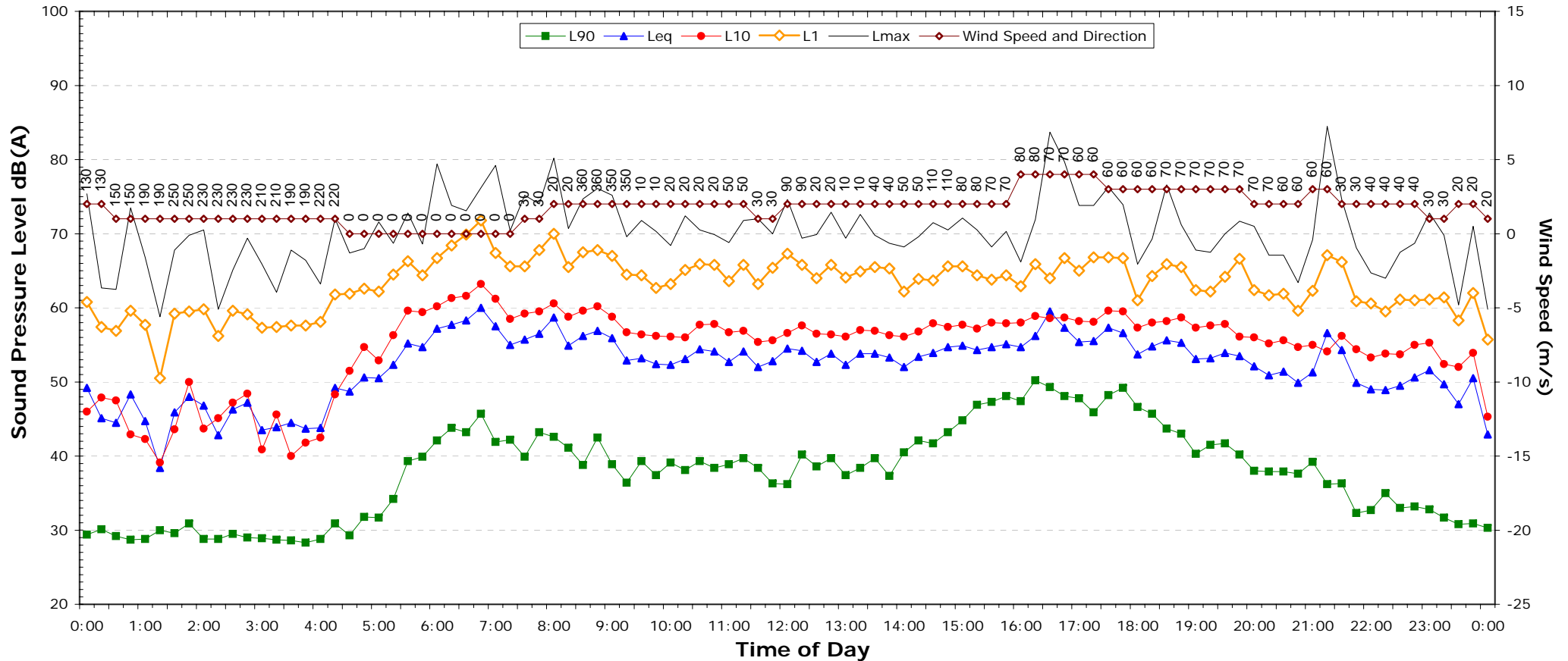
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Friday, 11 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	37.4	32.7	28.1
Leq (see note 3)	55.0	53.3	49.1

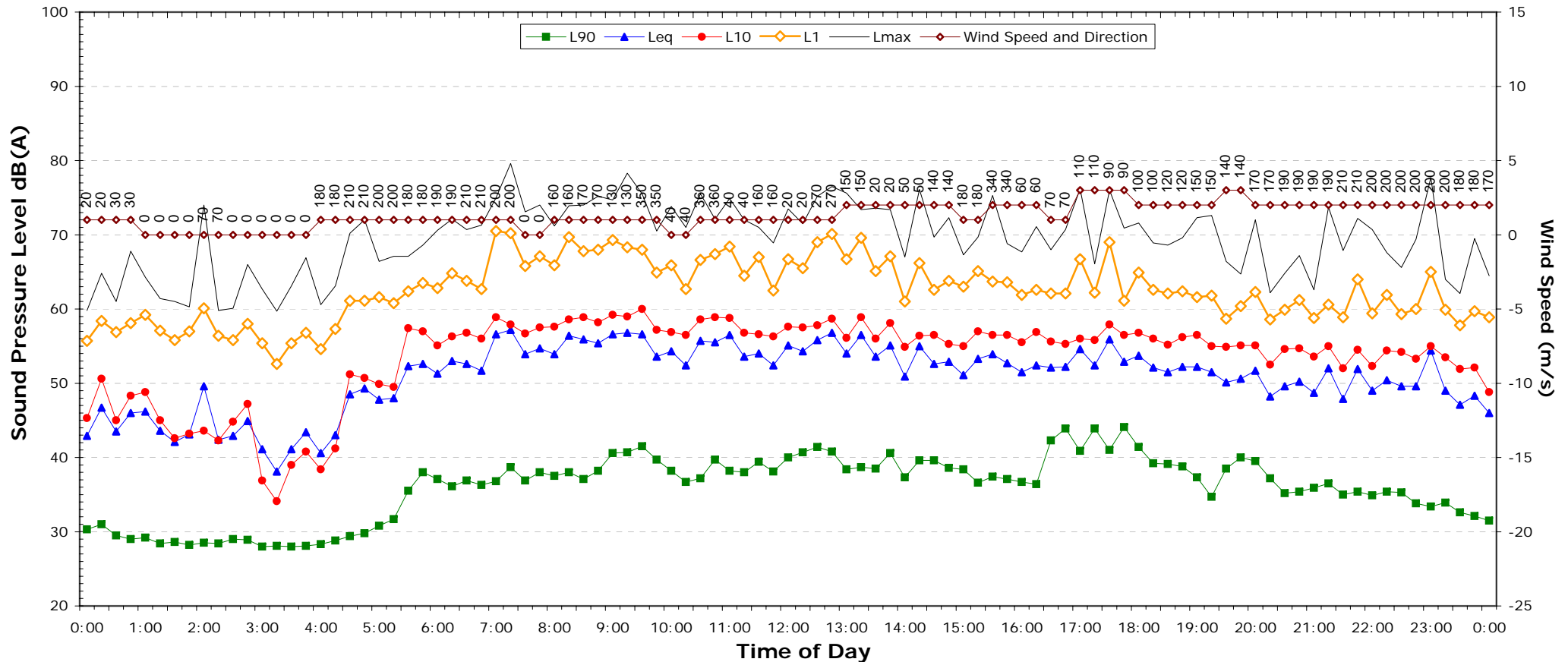
#### NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Saturday, 12 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	36.9	34.9	29.2
Leq (see note 3)	54.6	50.8	48.1

**NOTES:**

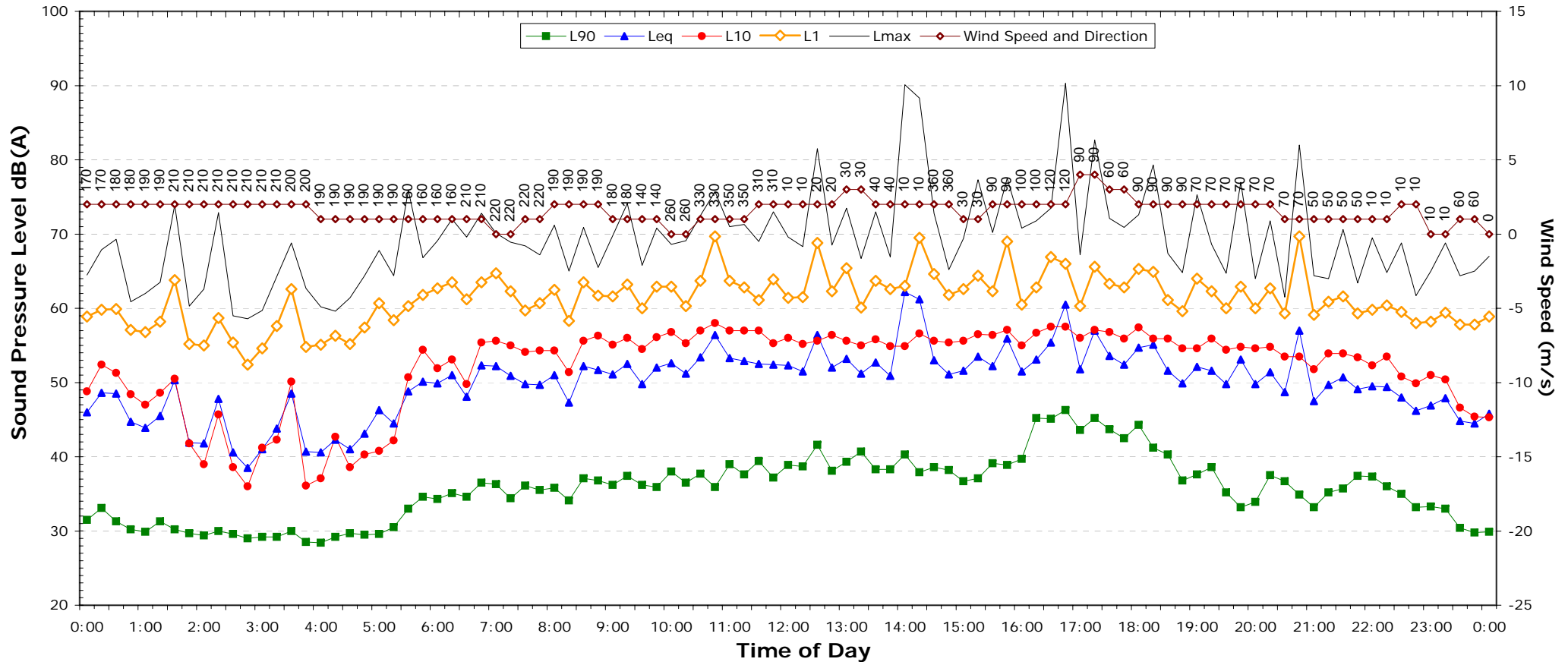
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)



# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Sunday, 13 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	35.9	33.2	29.4
Leq (see note 3)	54.4	51.8	52.1

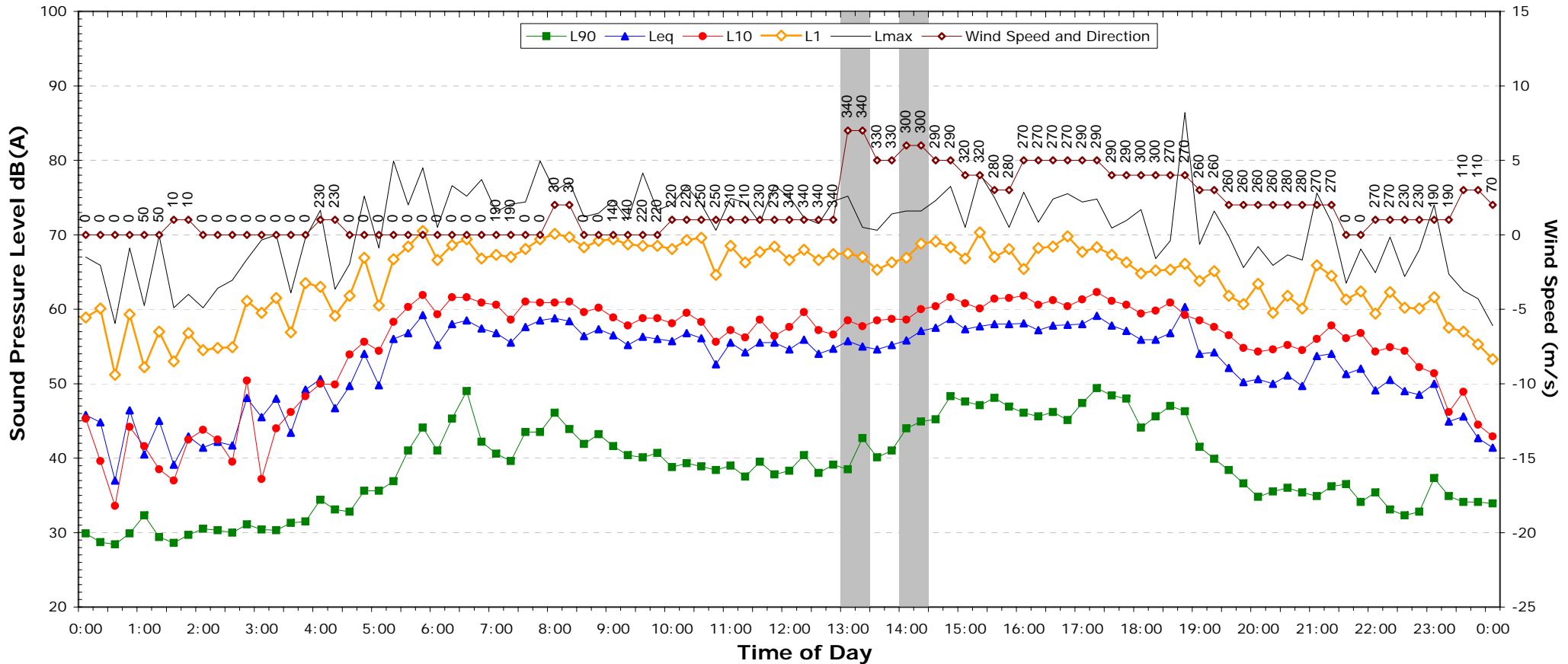
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Monday, 14 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	38.4	34.8	30.3
Leq (see note 3)	56.8	54.0	52.8

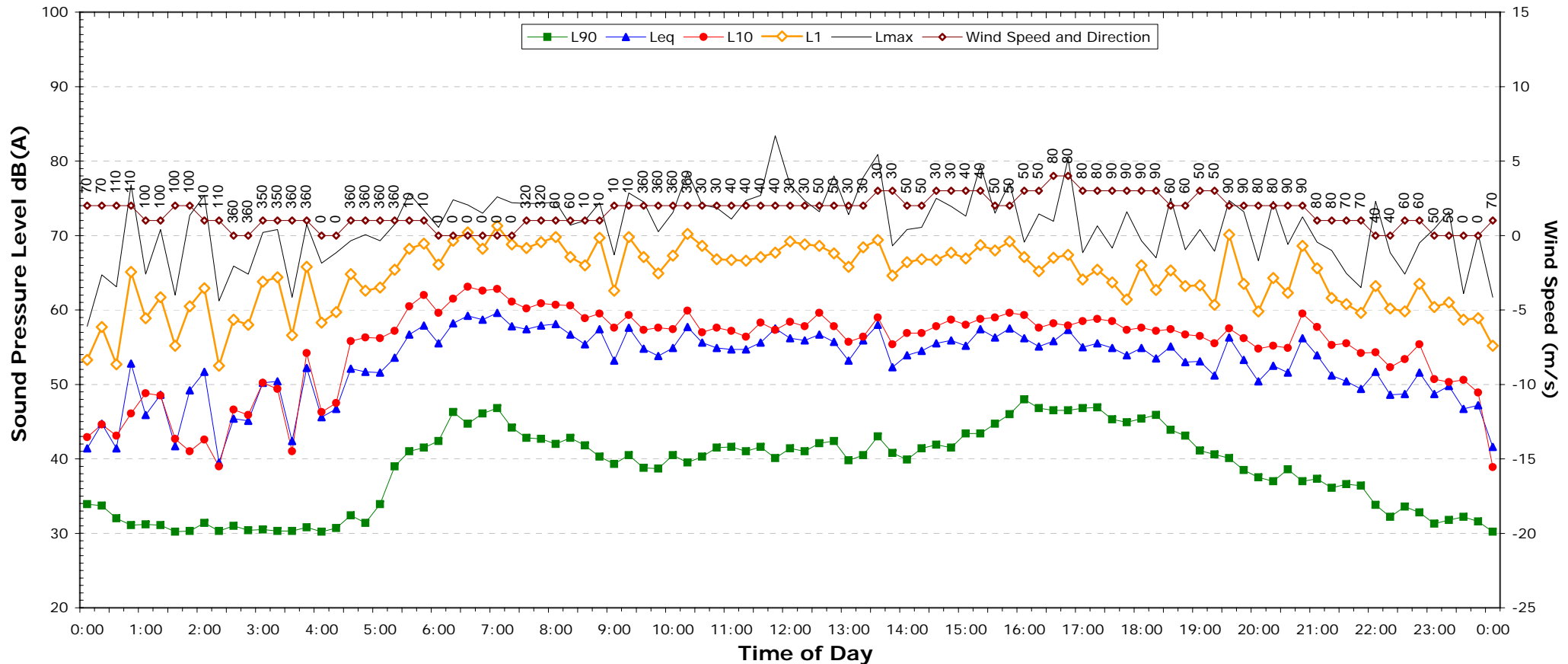
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Tuesday, 15 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	39.8	36.1	29.6
Leq (see note 3)	56.0	53.1	52.1

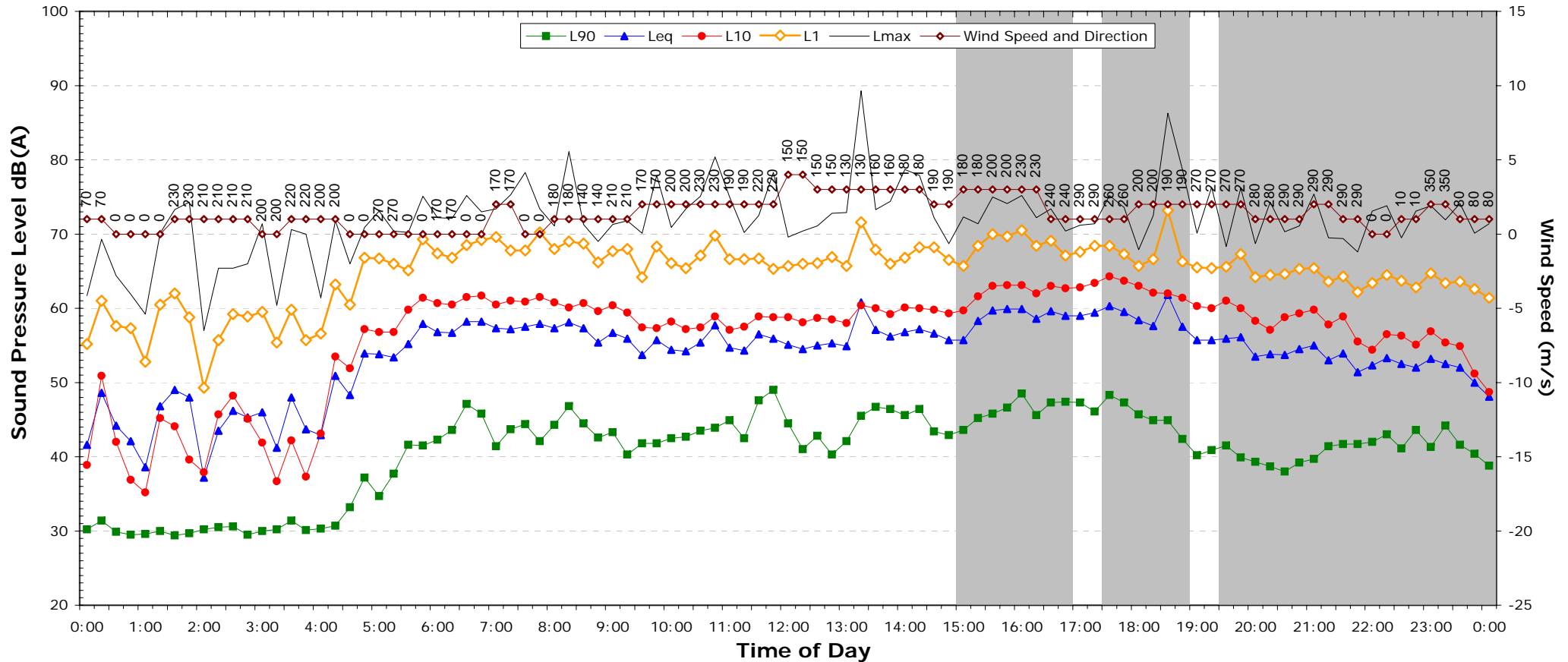
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Wednesday, 16 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

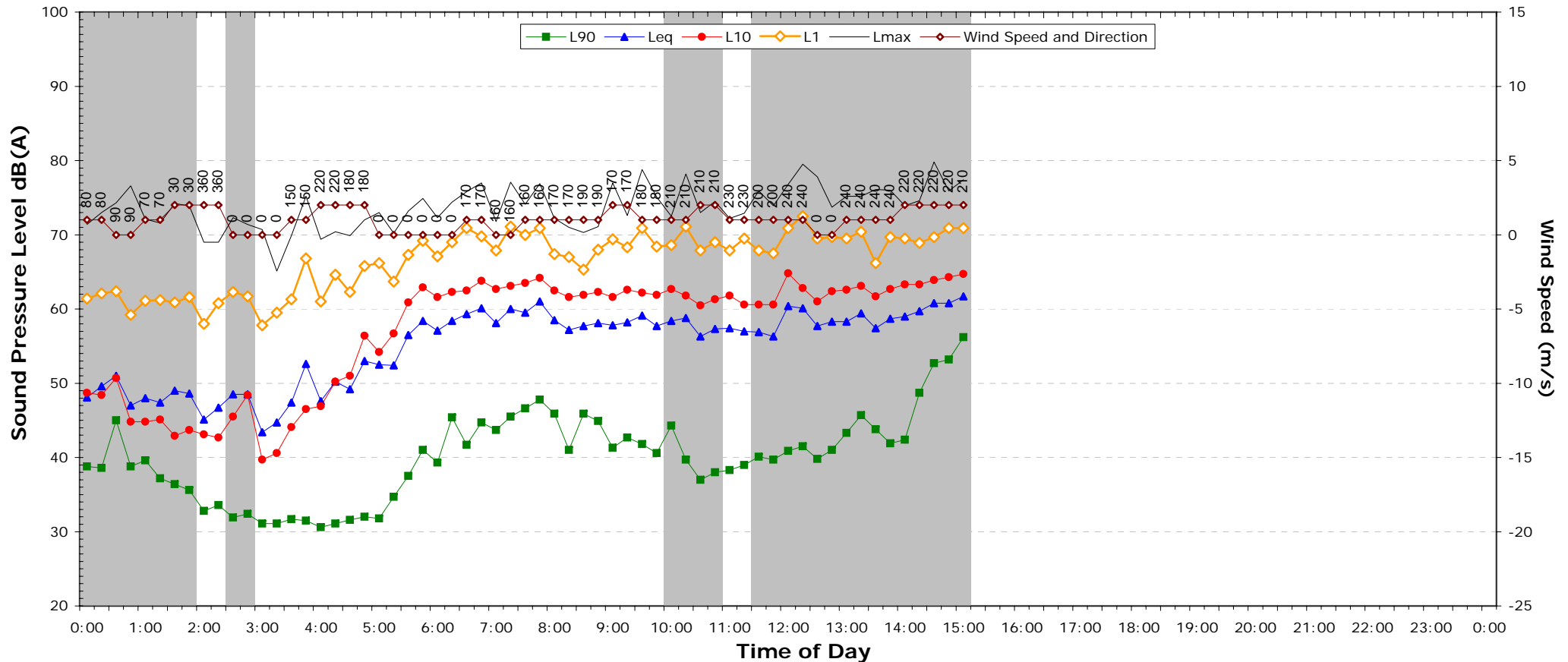
**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

# EXISTING AMBIENT NOISE LEVELS

## Lot 9 / DP1078187 Stoney Creek Road, Shanes Park

### Thursday, 17 November 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	-	-
Leq (see note 3)	-	-	-

**NOTES:**

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)