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TOWNSON ROAD PRECINCT

ENVIRONMENTAL NOISE IMPACT ASSESSMENT REPORT

TG008-01F02 (REV 4) ENVIRONMENTAL NOISE IMPACT ASSESSMENT

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CONTENTS

List of Tables

1 INTRODUCTION

Renzo Tonin & Associates was engaged to conduct an environmental noise impact assessment for the proposed Townson Road Precinct residential subdivision in Colebee. This report has been prepared for the residential rezoning only. Additional detailed assessment may be required for the subdivision approval or specific residential lot developments.

The study identified that the primary noise sources with the potential to impact the site were existing and future industrial operation in the vicinity of the area and future road traffic along the road network surrounding the site.

The existing industrial noise has been assessed in accordance with the requirements of the New South Wales (NSW) Office of Environment and Heritage (OEH) Industrial Noise Policy (INP). The road traffic noise assessment has been carried out in accordance with the requirements of the NSW State Environmental Planning Policy (Infrastructure) 2007 and by reference to the supporting guideline.

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 Site Description

The proposed Townson Road Precinct ("Precinct") is located in the southern portion of the West Schofields NSW Growth Centre, wholly within the Blacktown Local Government Area (LGA). The site is currently zoned 1(a) – General Rural in Blacktown Local Environmental Plan 1988 and the rezoning application seeks consent for future residential development, with an indicative subdivision plan as shown in Figure 1 below expected to yield 390 residential lots.

The site is bordered by other future Growth Centres, being the Marsden Park Industrial to the west and Colebee to the south and east. These areas have been identified for future urban development, and as such the future environment is expected to change substantially.

The site is bounded by Townson Road to the north, and new roads will border the site on the east and south. Richmond Road is approximately 300m to the west of the site, and whilst minimal development is located on the intervening road, the Marsden Park Industrial Precinct Plan identified future business park and residential land.

The CSR Brick Pits were the nearest identified industrial type development to the site, being situated to the north west of the site.

Figure 1 – Indicative Subdivision Layout

2.2 Assessment Methodology

In order to assess the potential noise impact onto subject residential development the following methodology was used:

- Evaluate through noise measurement and site inspections, the suitability of the site with respect to existing industrial noise exposure;
- Evaluate the site to determine the layout and site conditions with respect to the proximity of roads with potential noise impact, topography, etc.;
- Using predictive noise modelling to determine the extent of road noise impact from the surrounding road network onto residential lots;
- Identify where noise exposure on the site may exceed the relevant criteria; and
- Where external noise levels are predicted to exceed the relevant criteria, in-principle recommendations are provided for building envelope design in accordance with relevant internal noise criteria.

3 INDUSTRIAL NOISE ASSESSMENT

3.1 Existing Acoustic Environment

Ambient noise data is useful for setting benchmark noise levels in an area already affected by traffic and/or industrial noise. With regard to road traffic, as the surrounding roads are subject to modification as part of the Growth Centre developments, the existing traffic flows and mixes are likely to change significantly in the future. Noise modelling has therefore been used for the assessment of future road traffic, as set out in Section 4 of this report.

Noise monitoring was therefore used for the assessment of existing industrial noise, specifically the CSR Brick Pits.

Appendix B of the INP presents two methods of determining the existing background and ambient noise levels of an area being '*B1 – Long-term background noise method*' and '*B2 – Short-term background noise method*'. For this project existing ambient noise levels were measured at one location using long-term, unattended monitoring method. Supplementary short-term noise measurements were also carried at additional locations on site and on the CSR Brick Pits site.

3.1.1 Long-Term Unattended Noise Monitoring

Long-term noise monitoring was undertaken between Wednesday 14th and Friday 23rd November 2012 at the following location:

- Location L1 Lot 8 Townson Road, Colebee – North-eastern corner of the lot

  The logger was located on the north-eastern corner of the Precinct in a secure, fenced site across from the driveway leading to 55 Townson Road. The logger was positioned approximately 24m from the centre of Townson Road at 1.5m above the local ground level in the free field.

  The noise environment of the area was dominated by intermittent local road traffic including heavy vehicles accessing the CSR Brick Pits. No noise from industrial operation in the area was noted during the logger setup and pickup.

Figure 2 on page 11 shows the long-term monitoring location. Appendix B of this report details the long-term noise monitoring methodology and the graphical recorded output from the noise monitoring is included in Appendix C.

A summary of the noise monitoring results are presented in Table 1 below. Table 1 presents 'free field' noise levels in accordance with the INP. The graphs in Appendix C were analysed to determine a single assessment background level (ABL) for each day, evening and night-time period in each 24-hour period of noise monitoring, and based on the median of the individual ABLs, an overall single Rating Background Level (RBL) for the day, evening and night-time periods is determined over the entire monitoring period.

Table 1 – Measured Existing Background (L_{A90}) & Ambient (L_{Aeq}) Noise Levels

Noise Monitoring Location		L_{A90} Background Noise Levels			L_{Aeq} Ambient Noise Levels		
		Day	Evening	Night	Day	Evening	Night
L1	Lot 8 Townson Road	40	38	37	57	52	52

Notes: Day is defined as 7:00am to 6:00pm, Monday to Saturday; 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; 10:00pm to 8:00am Sundays & Public Holidays.

3.1.2 Short-Term Attended Noise Monitoring

Short-term noise measurements were undertaken at the following locations (see Figure 2 on page 11):

- Location S1 Lot 8 Townson Road, Colebee – In front of the existing entry gate into the site

  Sound level meter was positioned approximately 110m from the eastern boundary of the Precinct and approximately 10m from the centre of Townson Road at 1.5m above the local ground level in the free field.

- Location S2 CSR Bricks, Lot 21 Townson Road, Schofields – Carpark

  Sound level meter was positioned approximately 4m from an identified area source of approximately 4m from outdoor pumps serving the CSR Brick Pits operation. The microphone was 1.5m above the local ground level in the free field.

- Location S3 CSR Bricks, Lot 21 Townson Road, Schofields – Driveway entry

  Sound level meter was positioned approximately 19m from the south-western corner of the CSR factory building and at 1.5m above the local ground level in the free field.

- Location S4 Lot 5 Townson Road, Colebee – In front of the existing chicken-wire fence at the boundary of the site

  Sound level meter was positioned approximately 80m from the western boundary of the Precinct, approximately 8m from the centre of Townson Road, and at 1.5m above the local ground level in the free field.

Sound level measurements were undertaken in general accordance with AS1055.1-1997 "*Acoustics – Description and Measurement of Environmental Noise*" using a Brüel & Kjær Type 2250 precision sound level meter. Statistical noise levels were acquired in both overall and octave band frequencies. This instrument complies with AS IEC 61672.1 2004 "*Electroacoustics – Sound Level Meters*" and is designated as a Type 1 instrument having an accuracy suitable for field and laboratory use. The calibration of the meter was checked in the field immediately before and after the noise measurements using a Brüel & Kjær Type 4231 calibrator and no drift in calibration was observed.

A summary of the measurement results are presented in Table 2 below.

Table 2 – Short-Term Noise Measurement Results

Location / Time	Measured Noise Level, dB(A)		Comments on Measured Noise Levels
	L_{Aeq}	L_{A90}	
Daytime Survey, 14th November 2012			
S1 – Lot 8 Townson Road 11:45 – 11:55	56	38	Background L_{A90} determined by distant road traffic. Noise from sand-blasting of a truck towards the northern boundary of 51 Townson Road was excluded from measurement data as the property owner advised that it was atypical operations.
S2 – CSR Bricks Carpark 12:20 – 12:22	58	–	Ambient L_{Aeq} controlled by the CSR pumps under investigation.
Daytime Survey, 23rd November 2012			
S3 – CSR Bricks, factory building 15:31 – 15:46	56	–	Ambient L_{Aeq} controlled by the noise emission from the openings on the factory building and the various plant and equipment on the western boundary of the factory building under investigation.
S4 – Lot 5 Townson Road 15:53 – 16:08	67	45	Background L_{A90} determined by distant road traffic. Ambient LAeq determined by local road traffic along Townson Road.

Figure 2 – Site Map showing Noise Monitoring Locations

3.2 Industrial Noise Criteria

The NSW INP sets appropriate noise criteria to protect noise amenity of areas. The basis for its policy relies on two components – firstly, controlling intrusive noise impacts in the short term for residences and secondly, maintaining noise level amenity for particular land uses.

The first component (noise intrusiveness) ensures that industrial noise does not exceed the existing background noise level by an excessive margin. This is commonly referred to as the "background plus 5" criterion, that is, that the noise level from the new industrial development should not exceed the existing background noise level (measured in the absence of that development) by more than 5dB(A).

The second component (noise amenity) ensures that industrial noise levels do not increase without limit. If a number of industrial noise sources were permitted to increase the background noise level by 5dB(A) in turn, there would be a point where the cumulative noise level is unacceptable. A limit on the ultimate acceptable noise level is therefore introduced as a way of ensuring that cumulative noise impact from industrial growth is curtailed. This limit is referred to as the amenity goal. The appropriate limit in any circumstance relates to the land use category, for example, there are different limits for rural, suburban and urban areas.

In respect of new land release areas, where the ambient noise level may be affected by existing industrial noise, assessment in accordance with the intrusiveness criteria is generally not considered. Residents would therefore come to an area with prevalent industrial noise and consideration is given to the amenity noise levels only. This issue is discussed in the INP as follows: [1]

Land uses can change—sometimes dramatically— with an increase in industrial activities, construction of new freeways, or the development of new residential suburbs. A consequence of this is that the land-use designation of an area may change. Changes in designation occur as a result of urban type residential subdivisions in a village or rural area with few residences, or the encroachment of industrial developments near residential areas and vice versa.

In such cases, the primary decision by planning authorities to cause or allow the development would take account of the many consequent implications. As developments introduce increased activities, they also increase environmental noise levels. Therefore, previously low ambient noise levels will not be maintained, and assessments of noise sources for control purposes should be made against the acceptable noise level relevant to the modified land use.

Assessment of the acceptability of the development should be made against the acceptable noise level relevant to the modified land use. Table 2.1 of the INP sets appropriate noise amenity limits for residential premises for different land uses for day, evening and night-time periods as replicated in Table 3 below.

[1] INP Section 2.2.5 Effects of changing land use

Table 3 – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface – for existing situations only	Day	65	70
		Evening	55	60
		Night	50	55

Notes: Daytime 7:00am to 6:00pm or 8:00am to 6:00pm Sundays and Public Holidays;
Evening 6:00pm to 10:00pm;
Night-time 10:00pm to 7:00am or 10:00pm to 8.00am Sundays and Public Holidays.

The noise amenity area of the Town Road Precinct site will be dependent upon the exact nature of future development to surround the site, however would be considered to be either suburban or urban. This assessment has considered both classifications when discussing the existing and future industrial noise exposure in Sections 3.3 and 3.4 below.

3.2.1 Modifying Factor Adjustments

In accordance with the INP, where the character of the industrial noise is assessed as particularly annoying (ie. if it has an inherently tonal, low frequency, impulsive or is intermittent at night), then an adjustment of 5dB(A) for each annoyance aspect, up to a total of 10dB(A), is to be added to the measured value to penalise the noise for its potential increase in annoyance. Table 4.1 of Chapter 4 of the NSW INP provides definitive procedures for determining whether a penalty or adjustment should be applied to the measured noise level.

3.3 Existing Industrial Noise Exposure

The nearest industrial site with the potential to affect the proposed residential zoning was identified as the CSR Brick Pits located to the north west of the site at Lot 21 Townson Road.

Based on information provided to us by the Operations Manager at the site, the plant is in operation/production 24 hours a day, 7 days a week. The majority of noise from the site was identified to emanate from within the main factory building, with some external plant equipment located outside the building. We were advised that the were some forklifts operating on the site, however, these typically operated to the north and east of the factory building, being acoustically shielded from the Townson Precinct site.

The noise observed on site was typically steady state with only minor fluctuations. Based on this observation, and as the ambient L_{Aeq} recorded by the long-term noise logger was determined by road traffic, the recorded L_{A90} has been considered the more relevant descriptor in assessing existing industrial noise impact. The results of the long-term noise logger indicate that the existing L_{A90} for the day, evening and night time period are all below the urban and suburban noise amenity criteria for industrial noise, and observations during the short-term surveys identified no noise from the CSR operations at the subject site.

On this basis the subject site is considered acceptable for residential use with regards to existing industrial noise exposure.

3.4 Future Industrial Noise Exposure

The future industrial/business park developments within the adjacent Marsden Park Industrial Precinct are yet to be developed and therefore it would be the onus of the future sites to be designed to ensure noise emission onto the Townson Road Precinct complies with the relevant noise criteria.

From our review of the Marsden Park Industrial Indicative Layout Plan (ILP) (http://www.growthcentres.nsw.gov.au/mpi.html-95.html, dated 30 August 2011) the nearest development that may emit industrial type noise are the business parks identified along the eastern side of Richmond Road. Noise emission from Business parks is typically limited to mechanical services equipment and car park operations, and they are therefore considered to have a lower potential to cause noise impact than industrial zoned land. The Marsden Park Industrial ILP also identified conservation land and a riparian corridor between the Business Park zoning and the Townson Road site, which will provide greater distance separation and act as a buffer zone between the two land uses. It is noted that residential zoned land is proposed as part of the Marsden Park Industrial Precinct, to the immediate south of the Business Park zone.

The proposed residential land use within the Townson Road Precinct is therefore not considered to unduly restrict the proposed development within the Marsden Park Industrial Precinct.

4 ROAD TRAFFIC NOISE ASSESSMENT

4.1 Road Traffic Noise Criteria

Our understanding is that Blacktown City Council has not set out any specific criteria or standards to which the road traffic noise assessment is to be undertaken.

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) on the 1st of July 2011, the only noise criteria for the assessment of new residential developments impacted by road traffic noise is the State Environmental Planning Policy (Infrastructure) 2007 ('ISEPP'). The ISEPP sets out internal noise criteria for residential development adjacent roads having Annual Average Daily Traffic (AADT) greater than 40,000.

In regard to the RNP, the change in policy resulted in the removal of noise criteria for new residential developments. The effect of the criteria removal is there is no requirement to assess noise for new housing developments unless they are exposed to noise from roads with average annual daily traffic (AADT) volume of 40,000 cars. Furthermore, there is no external noise requirement for new residential development as the ISEPP only stipulates criteria that apply within residential developments (inside habitable rooms).

The north/south collector road bounding the east side of the precinct has been identified as the greatest source of potential road traffic noise impact onto the precinct. Based on the forecast traffic volumes, the north/south collector road has an AADT volume of less than 40,000 cars meaning compliance with the ISEPP is not strictly required. However, the ISEPP guideline also recommends that it be used as a best practice approach for development along roads having volumes between 20,000 and 40,000 AADT. It is noted that residential developments adjacent to roads with AADT's below 20,000 can still be subject to noise levels that exceed the ISEPP noise criteria. As there is no other more relevant noise guideline or requirement, the Townson Road Precinct has been assessed against the ISEPP.

4.1.1 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 as follows;

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 building for residential use,*
   - *a place of public worship,*
   - *a hospital,*
   - *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:*

   - *in any bedroom in the building--35dB(A) at any time between 10pm and 7am,*
   - *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.*

4.1.2 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.

4.1.2.1 Clarification of ISEPP Noise Limits

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

- Daytime 7am-10pm $L_{Aeq(15hr)}$
- Night-time 10pm-7am $L_{Aeq(9hr)}$

L_{Aeq} is the Equivalent Continuous Noise Level and accounts for both the level of fluctuating noise and also the number of noise events over the time period. 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 4 – ISEPP Internal Road Traffic Noise Criteria

Internal Space	Time Period	Noise Metric	Internal Criteria^
Bedrooms	7am – 10pm	$L_{Aeq(15hrs)}$	40*
	10pm to 7am	$L_{Aeq(9hrs)}$	35
Other Habitable Rooms	Any Time	$L_{Aeq(15hrs)}$ and $L_{Aeq(9hrs)}$	40

Notes: ^ With windows and doors closed
** Whilst not specified in the ISEPP, daytime criteria for bedrooms set to 40dB(A), as per other habitable rooms.*

The Guideline in Section 3.6.1 'Airborne Noise' states as follows;

> *"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. This external noise criterion is used to determine which building façades may require specific acoustic treatment to meet the requirements of the ISEPP. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

Table 5 – ISEPP Road Traffic Noise Criteria for New Residential Development

Room	Location	$L_{Aeq, 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living Rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External Free-Field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External Free-Field (allowing windows to remain open)^	60	55

*Notes: * Requisite for 40,000AADT Roads only under ISEPP 2007.*

^ ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

4.2 Road Traffic Noise Prediction

4.2.1 Road Design and Traffic Flow

Future AM/PM Peak Hour daily traffic flows for the year 2026 have been provided by Road Delay Solutions (model outputs only). As the road traffic assessment is on the basis of daytime (7am – 10pm) and night time (10pm – 7am) traffic flows, these volumes have been calculated based on the following assumptions, commonly used for such assessments:

- Peak hour traffic volumes are 10% of the 24hr volume;
- The 15hr daytime volume is 85% of the 24hr volume;
- Percentage of heavy vehicles in traffic mix is assumed to be 10% for Richmond Road, 5% for Townson and the North/South Collector Roads, and 0% for East/West Local Collector Road.

The traffic volumes used for the assessment are set out in Table 6. It is noted that variations in the actual traffic volumes will affect the noise level impact at receiver locations in particular heavy vehicle percentages. A sensitivity assessment could be undertaken during the detail design phase of the development.

Table 6 – Year 2026 Road Traffic Volumes

Road	Calculated Volumes			% Heavy Vehicles
	AADT*	15hr Day	9hr Night	
Richmond Road (4-lane)	43525	36996	6529	10
Townson Road (2-lane) – from Richmond Road to future north/south collector road	13370	11365	2006	5
Eastern Boundary – North/South Collector Road (2-lane)	19840	16864	2976	5
Southern Boundary – East/West Local Collector Road (2-lane)	8525	7246	1279	0

*Note: * AADT calculated from the average of the AM/PM peak hour daily traffic flows from* Road Delay Solutions*' model outputs received on* February 2013.

Although there are both 'day' and 'night' traffic noise goals to be satisfied, based on the difference in traffic volume between day and night, the day time period was established as the worst case scenario for road traffic noise impacts.

4.2.2 Road/Residential Interface

Dwelling footprints in the Townson Road Precinct are not available as it is understood that lots will be developed by individual owners/developers. The subdivision design is also indicative only at this stage. On this basis, noise predictions have been carried out for the first row of dwellings fronting each of the roads identified above, and assuming nominal building setbacks. These predictions are to provide an indication of the worst impacted lots on the site. Detailed modelling should be carried out once the subdivision layout has been finalised and the building setback controls are confirmed.

For the residential lots along Townson Road, access is to be from the internal local road to the south, and therefore a solid fence along the northern boundary of the site has been considered in the noise predictions. Further detail on the fencing is included in Section 4.4.

Lots fronting the eastern collector road are assumed to be accessed from the collector road and therefore continuous boundary fences have not been considered practical.

By reference to the Marsden Park Industrial (Employment) Precinct Plan dated August 2009, future development along Richmond Road will provide some shielding from Richmond Road to The Townson Road Precinct. This has been included in the noise model by consideration of minimum 6m high buildings along the Richmond Road frontage.

4.2.3 Prediction Methodology

Noise predictions are based on a method developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the CoRTN (1988) method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board and as a result it is recognised and accepted by the Environment Protection Authority. The model predicts noise levels for steady flowing traffic and noise from high truck exhausts is taken into account.

The noise prediction calculation takes into account the following:

Table 7 – Summary of Modelling Inputs

Input Parameters	Input used
Traffic volumes and mix	As described in Section 4.2.1
Vehicle speed (Year 2026)	Richmond Road – 80km/h , Townson Road – 60km/h, Eastern Boundary Collector Road – 60km/h and Southern Boundary Local Collector Road – 50km/h
Gradient of roadways	Assumed flat ground
Source height	0.5m for car exhaust, 1.5m for car and truck engines and 3.6m for truck exhaust as detailed within CoRTN
Ground topography at receiver and road	Assumed flat ground
Angles of view from receiver	Determined from drawings – 160° for front row of dwellings
Reflections from existing barriers, structures and cuttings on opposite side of road	None identified
Air and ground absorption – Values vary between 0 (hard surface) to 1 (100% absorptive)	0.5 has been used in this study *It is noted that where screening is calculated CoRTN uses hard surface correction.*
Receiver Heights	1.5m above ground level for ground floor and 4.5m above ground level for 1st floor
Free Field Noise Levels	Free field noise levels were used in this assessment as it is directly relevant to the assessment against the ISEPP criteria
Australian conditions correction	-1.7dB(A) near façade
Acoustic properties of road surfaces	Assumed dense graded asphalt
Roadside mounds / barriers	Barriers considered reflective on both sides

4.3 Road Traffic Noise Assessment Results

The noise modelling results are set out in Table 8 below.

Table 8 – Road Traffic Noise Assessment Results

Receiver Location	Traffic Source	Distance from Edge of Carriageway to Facade	Time Period	Noise Metric	External Criteria	Receiver Height above ground	Fence/Barrier Height	Free-Field Predicted Noise Level at Facade, dB(A)	Compliance Achieved (Y/N)
Lots on south side of Townson Rd	Townson Rd	10	7am – 10pm	$L_{Aeq(15hrs)}$	60	4.5m	1.8m fence	65	No
						1.5m	1.8m fence	58	Yes
Second row lots south side of Townson Rd, west side of precinct	Townson and Richmond Rds	30	7am – 10pm	$L_{Aeq(15hrs)}$	60	1.5	Partial shielding from first row housing	57	Yes
Lots on west side of N/S Collector Rd	Eastern Boundary Collector Rd	7	7am – 10pm	$L_{Aeq(15hrs)}$	60	1.5 and 4.5m	No fence	68	No
Lots on north side of E/W Local Collector Rd	Southern Boundary Local Collector Rd	7	7am – 10pm	$L_{Aeq(15hrs)}$	60	1.5 and 4.5m	No fence	61	No
Lots on west side of precinct	Richmond Rd	300	7am – 10pm	$L_{Aeq(15hrs)}$	60	1.5 and 4.5m	6m-high buildings within Marsden Park Business Park	47	Yes

4.3.1 Townson Road

The results presented in Table 8 indicate that ground or first floor facades directly exposed to Townson Road will exceed the ISEPP criteria of $L_{Aeq\ (15hour)}$ 60dB(A). The first row of houses fronting these roads will require architectural acoustic treatment to the building envelope so as to comply with the internal noise criteria.

Initial analysis indicates that the addition of 1.8m high solid fencing along the northern boundary of the site may provide sufficient shielding to the ground floor of these dwellings to achieve compliance without the need for building envelope treatment. The fence would also need to return along the eastern and western boundaries of the first row of property lots. First floor facades would still require acoustic treatment.

4.3.2 Eastern Boundary N/S Collector Road

The results based on the assumed traffic flow data indicate that ground or first floor facades directly exposed the north/south collector road will exceed the ISEPP criteria of $L_{Aeq(15hour)}$ 60dB(A). The first row of houses fronting these roads will require architectural acoustic treatment to the building envelope so as to comply with the internal noise criteria. Continuous fencing will not be practical for use as shielding as the plans provided indicate access to the lots will be from this collector road. Alternatively, consideration should be given to revising the subdivision plans to provide access to these lots from an internal road. This would allow for the provision of continuous fencing, providing additional shielding from road traffic noise.

4.3.3 Southern Boundary E/W Local Collector Road

The results based on the assumed traffic flow data indicate that ground or first floor facades directly exposed the east/west local collector road will exceed the ISEPP criteria of $L_{Aeq(15hour)}$ 60dB(A) by a small margin of 1-2dB(A). The first row of houses fronting these roads will require architectural acoustic treatment to the building envelope so as to comply with the internal noise criteria. Continuous fencing will not be practical for use as shielding as the plans provided indicate access to the lots will be from the boundary road.

4.3.4 Richmond Road

The results indicate that facades facing Richmond Road, on the western limit of The Townson Road Precinct will comply with ISEPP criteria of $L_{Aeq\ (15hour)}$ 60 dB (A). Sufficient noise reduction is provided by the distance from Richmond road to the lots and by acoustic shielding from the future development along Richmond Rd.

4.4 Road Traffic Noise Control Recommendations

Where noise levels at building facades are predicted to exceed the ISEPP equivalent external noise limits, the ISEPP internal noise criteria should be achieved through building design and glazing selection. Windows and doors would need to be closed to meet the internal noise levels.

The following recommendations provide in-principle noise control solutions to reduce noise impacts inside residential premises and are based on a number of assumptions relating to the built form. Furthermore, the advice provided here is in respect of acoustics only. Supplementary professional advice should be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

4.4.1 Indicative Building Construction Requirements

On the basis of our noise modelling and in accordance with the internal noise goals set out in Table 4, recommendations for building element constructions are presented for the following generic room types:

Table 9 – Room Parameters

Room	Item	Description
Bedroom	Dimensions (L x W x H)	4m x 4m x 2.7
	Surface Finishes	Carpeted floors with underlay, plasterboard walls, plasterboard ceiling, and bed
Living Room	Dimensions (L x W x H)	7m x 5m x 2.7
	Surface Finishes	Timber or tiled floors, plasterboard walls, plasterboard ceiling
Lounge	Dimensions (L x W x H)	6m x 4m x 2.7
	Surface Finishes	Carpeted floors with underlay, plasterboard walls, plasterboard ceiling

Indicative acoustic treatment is presented in Table 10 below. The treatment has been provided for four Categories which correspond to varying levels of noise exposure. Category 1 would typically apply for external noise levels between 57-60dB(A), Category 2 for 60-63dB(A), Category 3 for 63-66dB(A) and Category 4 for 66-69dB(A).

Table 10 - Acoustic Constructions for Treatment Categories

Room	Construction Element	Recommended Acoustic Performance	Indicative Construction
Category 1 (Alternative Ventilation Not Required)			
Bedrooms and adjoining Ensuites	Windows/Glazed Doors*	Less than $4m^2$ = R_w 24 $4m^2$ - $8m^2$ = R_w 27	No specific treatment required 6mm float glass with acoustic seals
	Walls/Roof/Ceiling		Standard Constructions
Lounge/Living Rooms	Windows/Glazed Doors*	Less than $8m^2$ = R_w 29 $8m^2$ - $16m^2$ = R_w 32	6mm float glass with acoustic seals 6.38mm laminated glass with acoustic seals
	Timber Doors		35mm Solid Core Timber – Acoustic Seals
	Walls/Roof/Ceiling		Standard Constructions
Category 2 (Alternative Ventilation Required)			
Bedrooms and adjoining Ensuites	Windows/Glazed Doors*	Less than $2m^2$ = R_w 24 $2m^2$ - $4m^2$ = R_w 27 $4m^2$ - $8m^2$ = R_w 30	No specific treatment required 6mm float glass with acoustic seals 6.38mm laminated glass with acoustic seals
	Walls/Roof/Ceiling		Standard Constructions
Lounge/Living Rooms	Windows/Glazed Doors*	Less than $4m^2$ = R_w 29 $4m^2$ - $8m^2$ = R_w 32 $8m^2$ - $16m^2$ = R_w 35	6mm float glass with acoustic seals 6.38mm laminated glass with acoustic seals 10.38mm laminated glass with acoustic seals
	Timber Doors		45mm Solid Core Timber – Acoustic Seals
	Walls/Roof/Ceiling		Standard Constructions
Category 3 (Alternative Ventilation Required)			
Bedrooms and adjoining Ensuites	Windows/Glazed Doors*	Less than $2m^2$ = R_w 27 $2m^2$ - $4m^2$ = R_w 30 $4m^2$ - $8m^2$ = R_w 33	6mm float glass with acoustic seals 6.38mm laminated glass with acoustic seals 10.38mm laminated glass with acoustic seals
	Roof/Ceiling		Standard Constructions

Room	Construction Element	Recommended Acoustic Performance	Indicative Construction
	Walls	R_W 46	Brick Veneer Construction, standard internal plasterboard with R1.5 wall batts Or Reverse Brick Veneer Construction, external metal or FC cladding with R1.5 wall batts Or Metal studs with 1 layer of 16mm fire-rated plasterboard inside, metal or FC external cladding, R1.5 wall batts
Lounge/Living Rooms	Windows/Glazed Doors*	Less than $4m^2$ = R_W 32 $4m^2$ - $8m^2$ = R_W 35 $8m^2$ - $16m^2$ = R_W 38	6.38mm laminated glass with acoustic seals 10.38mm laminated glass with acoustic seals Heavy laminated glass or double glazing with acoustic seals
	Timber Doors		45mm Solid Core Timber – Acoustic Seals
	Roof/Ceiling		Standard Constructions
	Walls	R_W 46	Brick Veneer Construction, standard internal plasterboard with R1.5 wall batts Or Reverse Brick Veneer Construction, external metal or FC cladding with R1.5 wall batts Or Metal studs with 1 layer of 16mm fire-rated plasterboard inside, metal or FC external cladding, R1.5 wall batts
Category 4 (Alternative Ventilation Required)			
Bedrooms and adjoining Ensuites	Windows/Glazed Doors*	Less than $2m^2$ = R_W 30 $2m^2$ - $4m^2$ = R_W 33 $4m^2$ - $8m^2$ = R_W 36	6.38mm laminated glass with acoustic seals 10.38mm Laminated glass with acoustic seals 12.38mm laminated glass with acoustic seals
	Roof/Ceiling		Tiled or metal pitched roof / 2 x 13mm plasterboard ceiling / bulk insulation in cavity
	Walls	R_W 49	Brick Veneer Construction, standard internal plasterboard with R1.5 wall batts Or Reverse Brick Veneer Construction, external metal or FC cladding with R1.5 wall batts Or Metal studs with 2 layers of 16mm fire-rated plasterboard inside, metal or FC external cladding, R1.5 wall batts

Room	Construction Element	Recommended Acoustic Performance	Indicative Construction
Lounge/Living Rooms	Windows/Glazed Doors*	Less than $4m^2$ = R_W 35 $4m^2$ - $8m^2$ = R_W 38 $8m^2$ - $16m^2$ = R_W 41	10.38mm Laminated glass with acoustic seals Heavy laminated glass or double glazing with acoustic seals Double glazed with acoustic seals
	Timber Doors	45mm Solid Core Timber – Acoustic Seals	
	Roof/Ceiling	Tiled or metal pitched roof / 2 x 13mm plasterboard ceiling / bulk insulation in cavity	
	Walls	R_W 49	Brick Veneer Construction, standard internal plasterboard with R1.5 wall batts Or Reverse Brick Veneer Construction, external metal or FC cladding with R1.5 wall batts Or Metal studs with 2 layers of 16mm fire-rated plasterboard inside, metal or FC external cladding, R1.5 wall batts

*Note: * Area of windows and doors shall be the total of all glazing for the given room.*

The acoustic requirements for windows and doors have been provided on an R_W basis so as to allow flexibility with the developer and variations in design due to other design requirements such as thermal performance. The R_W rating sets the basis of the recommended acoustic performance and the constructions are provided for guidance only. The acoustic performance of specific building components should be confirmed by manufactures or suitably qualified professional prior to installation.

Unless otherwise specified, the base building envelope of dwellings is considered to be of standard constructions which are assumed to consist of the following;

- Walls of brick veneer construction, double brick, or light weight clad construction which could consist of fibre-cement cladding on the outside of timber stud walls and internal plasterboard lining. All walls are assumed to have minimum R1.5 insulation in the cavity. It is noted that both brick veneer and cavity double brick construction is of significantly higher acoustic performance than light weight cladding systems. In higher traffic noise areas, there may be a requirement to upgrade light weight systems. These instances will be noted in the acoustic recommendations.

- Roof to be pitched, with concrete or terracotta tile or sheet metal roof with sarking, R3.0 insulation in the roof space (combination of below roof and above ceiling), and one layer of either 13mm thick standard plasterboard or 10mm thick ceiling plasterboard fixed to ceiling joists.
- External doors to be solid core timber or glazed, fitted with acoustic seals around the perimeter. Pivot style doors are not recommended as full perimeter acoustic seals are not readily incorporated. The performance of any external doors should have the same acoustic performance as that required for general glazing.

4.4.2 Boundary Fences

An acoustically rated fence can be constructed of common building materials but needs to be from any durable material with sufficient mass (min. 10kg/m^2) to prevent direct noise transmission eg. masonry, fibrous-cement, lapped and capped timber fence, polycarbonate, or any combination of such materials, provided they withstand the weather elements. A natural barrier of trees or shrubs is not an effective noise screen. The boundary fence should be continuous with no gaps between panels or underneath panels (other than that required for gates). It is recommended that rebates be incorporated into any gates.

4.4.3 Mechanical Ventilation

Where the external ISEPP criteria are exceeded, windows and doors are to be kept closed to meet the internal noise goals. It is noted that windows are not required to be sealed shut/fixed and can be operable.

It is recommended that a mechanical engineer is consulted to ensure the ventilation requirements of the Building Code of Australia and Australian Standard 1668 "The use of ventilation and air-conditioning in buildings" are achieved. The internal noise goals are to be met with mechanical ventilation systems not operating.

Mechanical ventilation with air filtering is a good solution for adequately ventilating a building adjacent to a busy road in terms of both noise and air quality. The 'Aeropac' acoustic ventilator is one such system which has previously been installed in dwellings around Sydney.

If the internal criteria can only be achieved with windows closed, then **mechanical ventilation or air conditioning that meets the requirements of the Building Code of Australia must also be provided** to ensure fresh airflow inside the dwelling. 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.

4.4.4 Building Layout

Further to the above construction recommendations, dwellings constructed in traffic noise affected areas can be designed so that their layouts minimise noise in living and sleeping areas. Best practice elements for good acoustic design of development around road transport corridors include:

- Designing the layout of residential buildings to have bedrooms on the opposite side of the building to the road transport corridor. Non-habitable rooms (such as the bathroom, hallway, laundry, kitchen) can be placed on the road side of the building. It is noted that these recommendations are not requisites for development within the Townson Road Precinct.
- Provide adequate acoustic windows and doors with good quality acoustic seals (where applicable) on the residential building facades exposed to traffic noise.

- Whilst not required by the ISEPP, external amenity can be improved through use of solid boundary fences to appropriate height or use of the building envelope to provide acoustic shielding from the road traffic noise.

4.4.5 Scope of Acoustic Recommendations

The recommended mitigation measures for road traffic noise cannot take into account the specific design of each dwelling as those details are not available at this stage of development. The recommendations have been developed in order for the approvals process and cost planning, and to provide the indicative measures required for each dwelling. While it is the intent for the recommendations and this report to minimise the need for detailed acoustic assessment of each dwelling, it is recommended that a review of the acoustic assessment be carried out at the subdivision stage. Furthermore, an individual acoustic review of the 'Construction' drawings could be carried out for each noise affected lot to ensure correct interpretation and application of the recommendations.

5 CONCLUSION

Renzo Tonin & Associates have completed an assessment of environmental noise impact for the proposed Townson Road Precinct residential subdivision in Colebee. This report has been prepared for the residential rezoning only.

The study identified that the primary noise sources with the potential to impact the site were existing and future industrial operation in the vicinity of the area and future road traffic along the road network surrounding the site.

The existing industrial noise has been assessed in accordance with the requirements of the New South Wales (NSW) Office of Environment and Heritage (OEH) Industrial Noise Policy (INP). The results of the study, based on long-term and short term noise logger indicate that the existing industrial noise levels are below the relevant noise amenity criteria for residential development. The subject site is considered acceptable for residential use with regards to existing industrial noise exposure.

The road traffic noise assessment has been carried out in accordance with the the NSW State Environmental Planning Policy (Infrastructure) 2007 and by reference to the supporting guideline. While roads surrounding the site are below AADT 40,000, a best-practice approach has been adopted, and the noise assessment has been carried out against the guideline. The results of the study, based on the available future road traffic volume forecasts for Year 2026, identified that the first row of housing fronting Townson Road, the eastern boundary north/south collector road and the southern boundary east/west local collector road will be impacted by road traffic noise exceeding the ISEPP criteria. Affected houses will require architectural acoustic treatment to the building envelope so as to comply with the internal noise criteria. It is recommended that a more detailed assessment be carried out once the subdivision is finalised.

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.

Adverse Weather	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).
Ambient Noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background Noise	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 L_{90} noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	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.
Frequency	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.
Impulsive noise	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.
Intermittent noise	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.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	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 L_{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B - LONG-TERM NOISE MONITORING METHODOLOGY

B.1 Noise Monitoring Equipment

A noise monitor consists of a sound level meter housed inside a weather resistant enclosure. Noise levels are monitored continuously with statistical data stored in memory for every 15-minute period.

Long term noise monitoring was conducted using the following instrumentation:

Description	Type	Octave Band Data	Logger Location(s)
NTi Audio XL2	Type 1	1/1	L1

Note: All meters comply with AS IEC 61672.1 2004 "Electroacoustics – Sound Level Meters" and designated either Type 1 or Type 2 as per table, and are suitable for field use.

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 or 4231 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 (BOM) provided meteorological data, which is considered representative of the site, for the duration of the noise monitoring period. The data was modified to allow for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is at 1.5m above ground level (less than 3m). The correction factor applied to the data was taken from *Australian Standard AS1170.2 1989 Section 4.2.5.1*.

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 $\mathbf{L_{10}}$, $\mathbf{L_{90}}$, and $\mathbf{L_{eq}}$ levels. The statistical descriptors $\mathbf{L_{10}}$ and $\mathbf{L_{90}}$ measure the noise level exceeded for 10% and 90% of the sample measurement time. The $\mathbf{L_{eq}}$ 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, as presented in this report, illustrate these concepts for the broadband results.

APPENDIX C - LONG-TERM NOISE MONITORING RESULTS

RENZO TONIN & ASSOCIATES
inspired to achieve

Consultants in Acoustics, Vibration & Structural Dynamics
email: sydney@renzotonin.com.au
website: www.renzotonin.com.au

noise logger results

North-Eastern Corner of Site

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

	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Day	Day	Evening	Night	Day	Evening	Night
Wednesday-14-November-2012	-	37	34	-	52	51
Thursday-15-November-2012	40	37	35	57	52	51
Friday-16-November-2012	-	-	-	-	-	-
Saturday-17-November-2012	38	39	37	52	50	47
Sunday-18-November-2012	-	-	38	-	-	52
Monday-19-November-2012	-	-	37	-	-	52
Tuesday-20-November-2012	-	39	39	-	52	53
Wednesday-21-November-2012	42	38	-	56	52	-
Thursday-22-November-2012	42	38	32	58	52	52
Friday-23-November-2012	40	-	-	59	-	-
Representative Level	**40**	**38**	**37**	**57**	**52**	**52**

Notes:

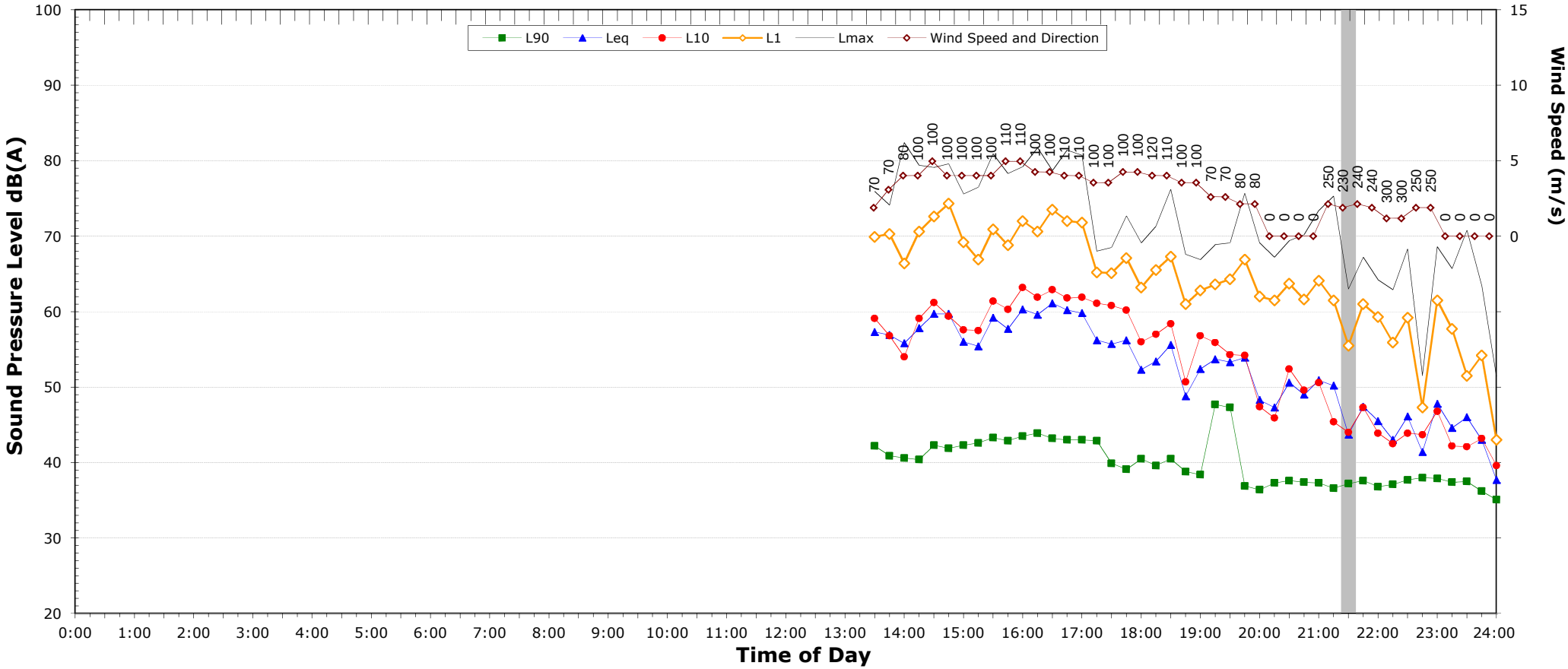
1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Rating Background Level (RBL) for L90 and logarithmic average for Leq
5. Assessment Background Level (ABL)

30 1982-2012 ACOUSTIC ENGINEERING EXCELLENCE

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Wednesday, 14 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	36.6	33.6
Leq	-	51.6	51.4

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)

Data File: 2012-11-14_SLM_000.XL2

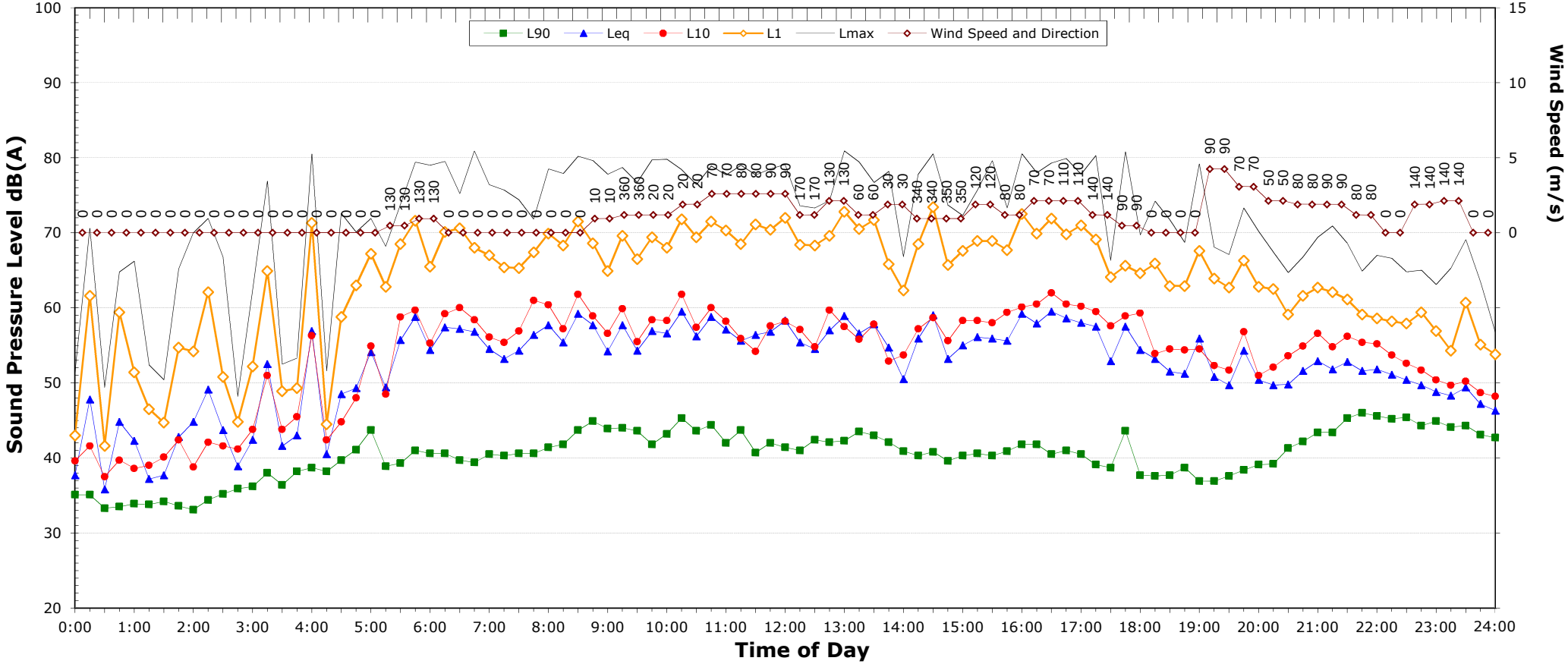
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Thursday, 15 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	40.3	36.9	35.0
Leq	56.9	52.2	51.5

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)

Data File: 2012-11-14_SLM_000.XL2

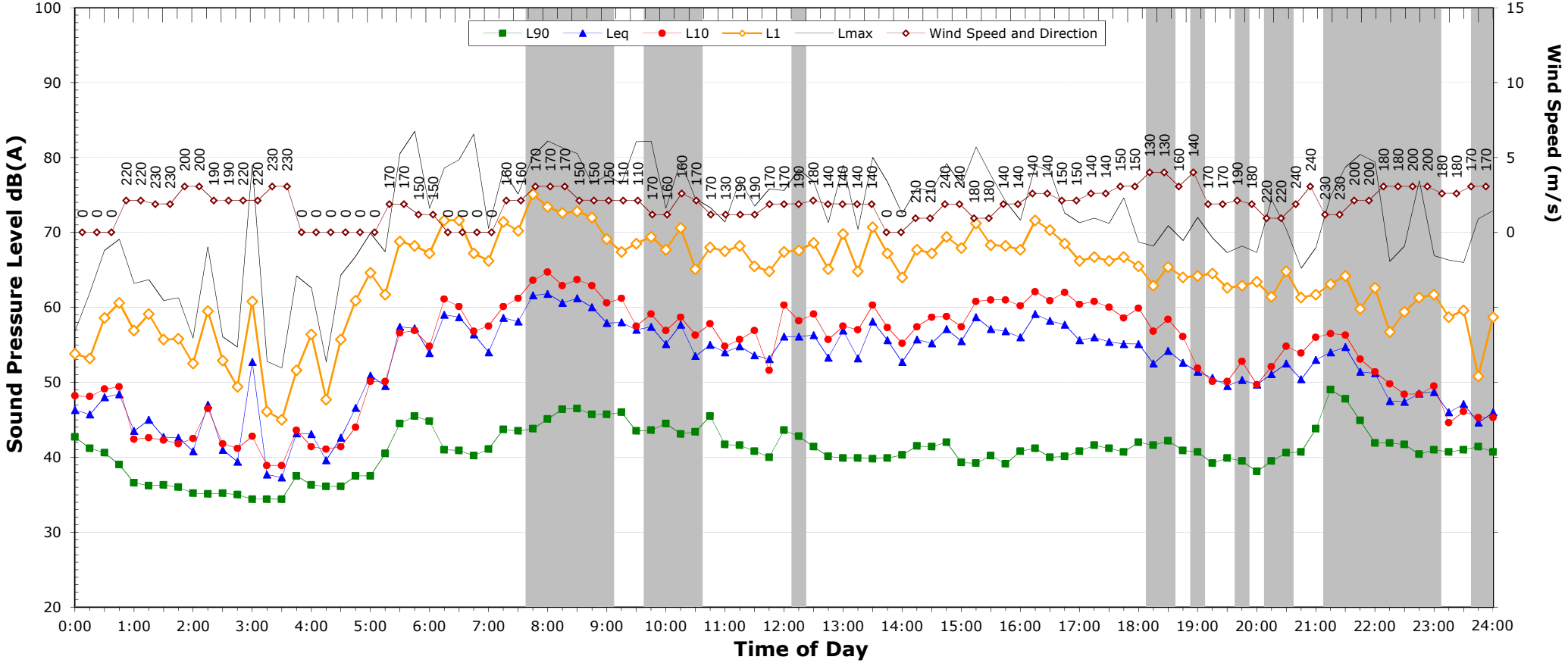
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Friday, 16 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	-
Leq	-	-	-

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)

Data File: 2012-11-14_SLM_000.XL2

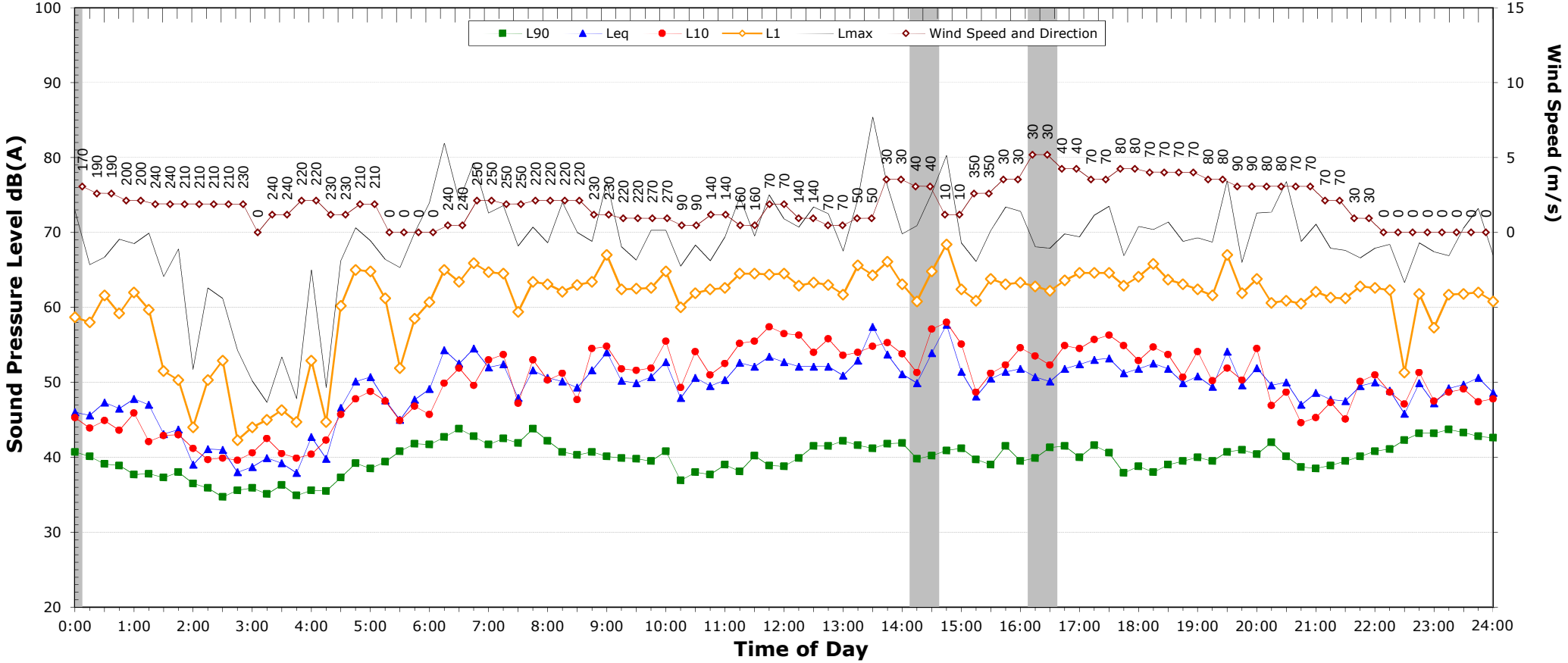
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Saturday, 17 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	38.1	38.5	37.0
Leq	52.2	50.4	46.7

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)

Data File: 2012-11-14_SLM_000.XL2

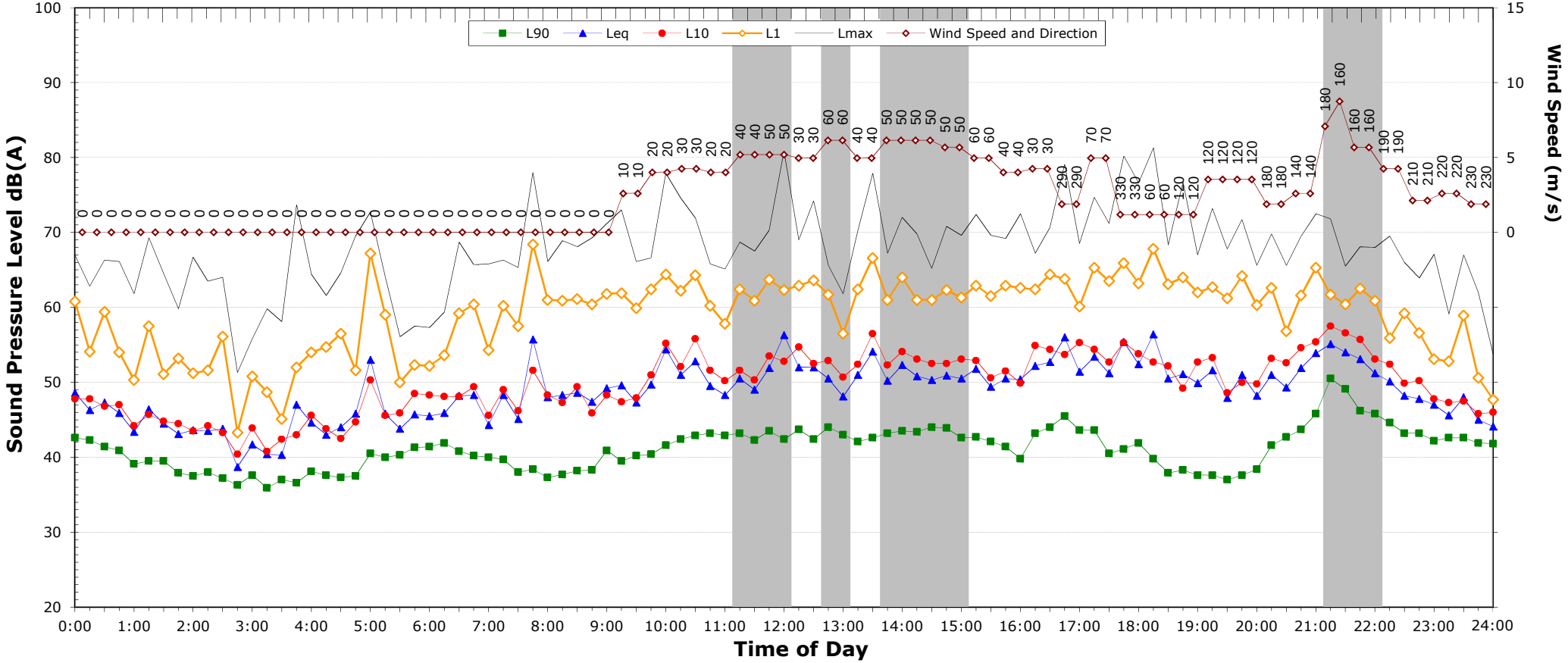
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Sunday, 18 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	37.6
Leq	-	-	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)

Data File: 2012-11-14_SLM_000.XL2

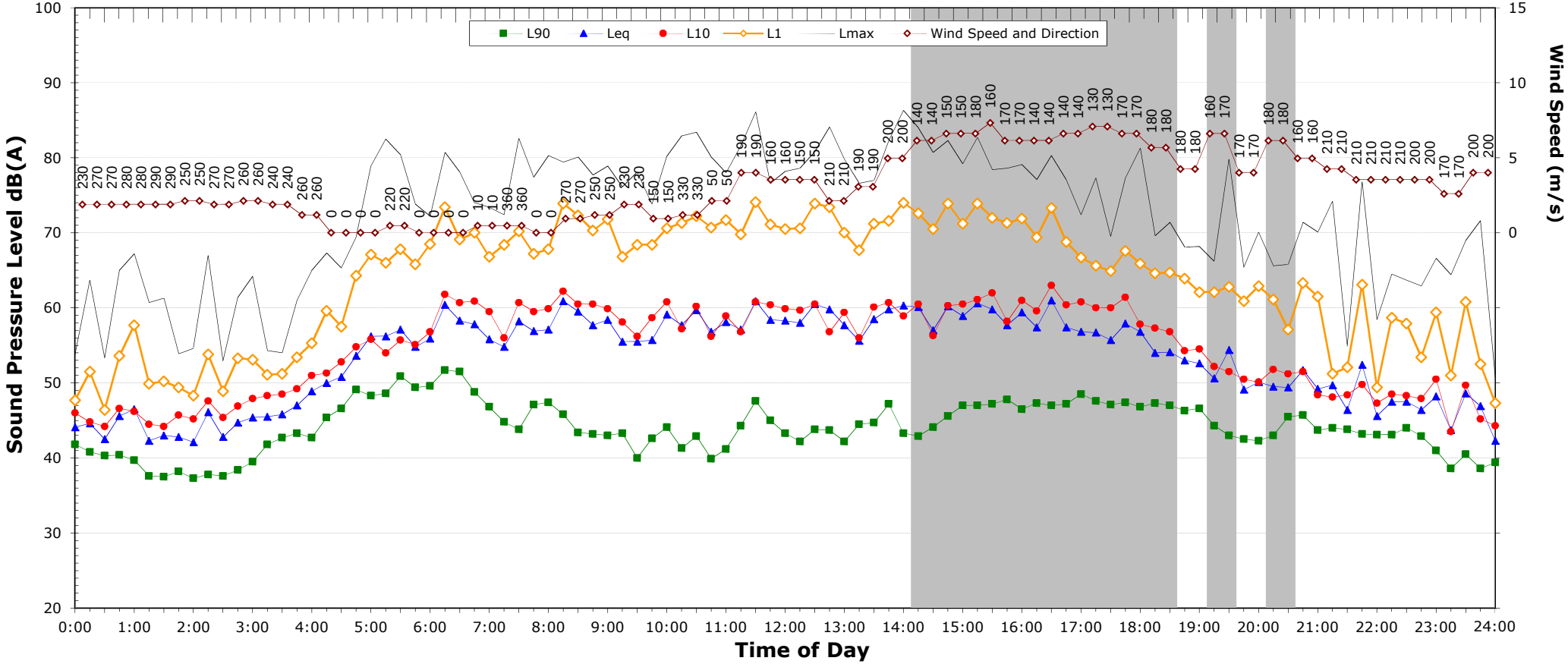
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Monday, 19 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	36.7
Leq	-	-	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)

Data File: 2012-11-14_SLM_000.XL2

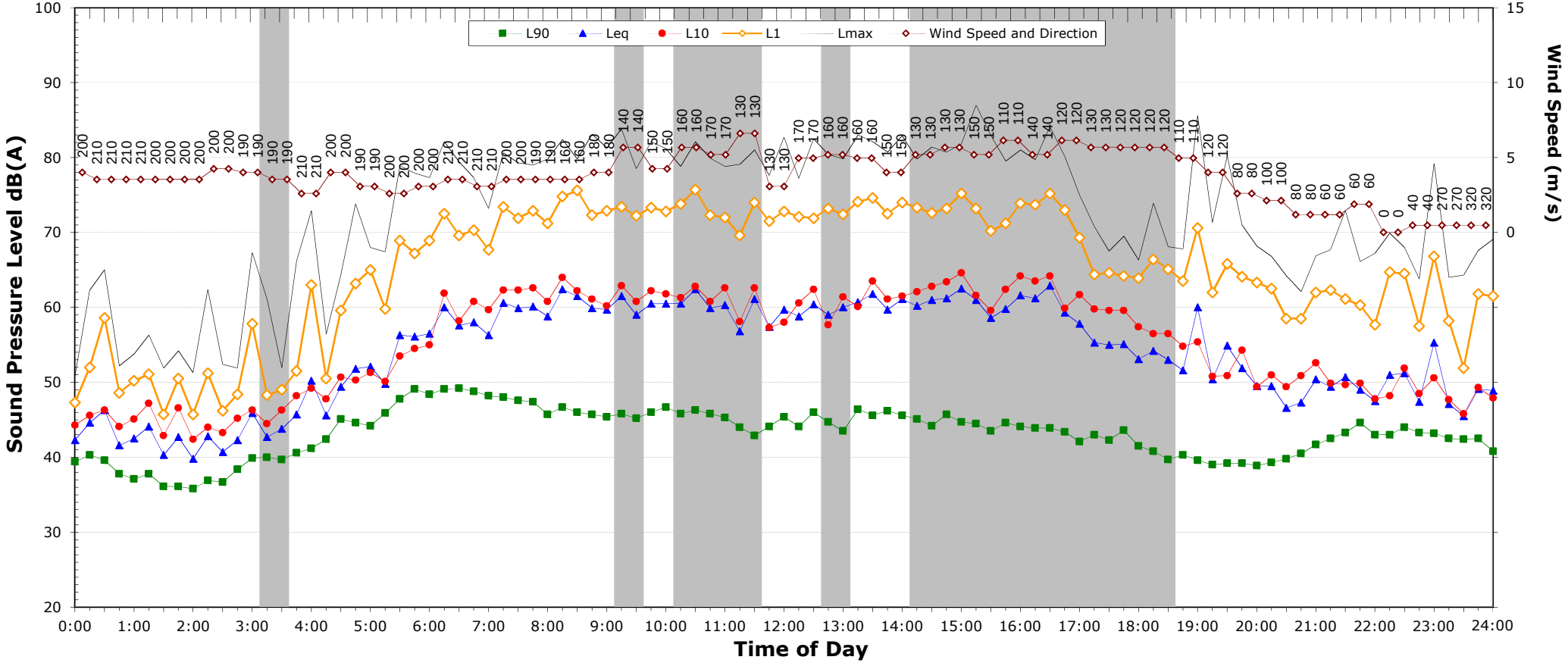
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Tuesday, 20 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	39.0	39.0
Leq	-	52.4	52.6

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)

Data File: 2012-11-14_SLM_000.XL2

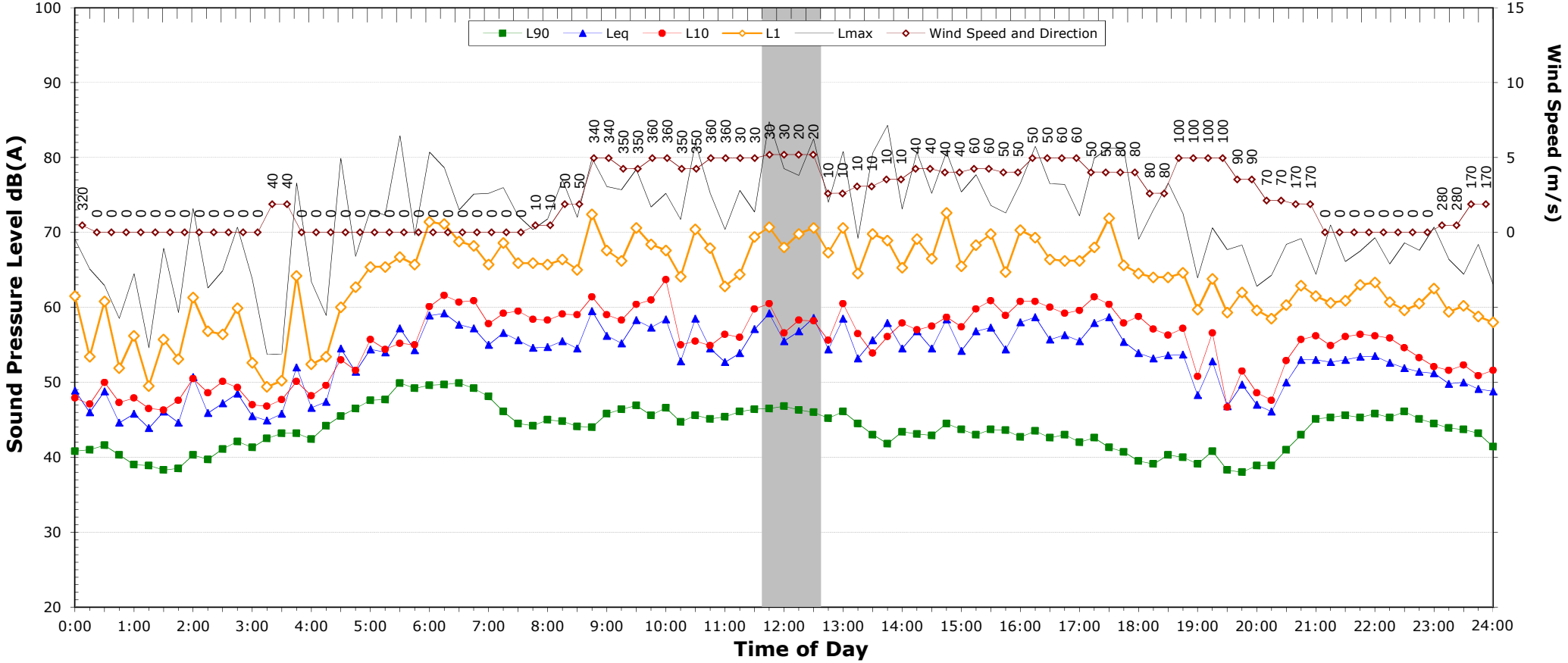
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Wednesday, 21 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	41.9	38.3	-
Leq	56.4	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)

Data File: 2012-11-14_SLM_000.XL2

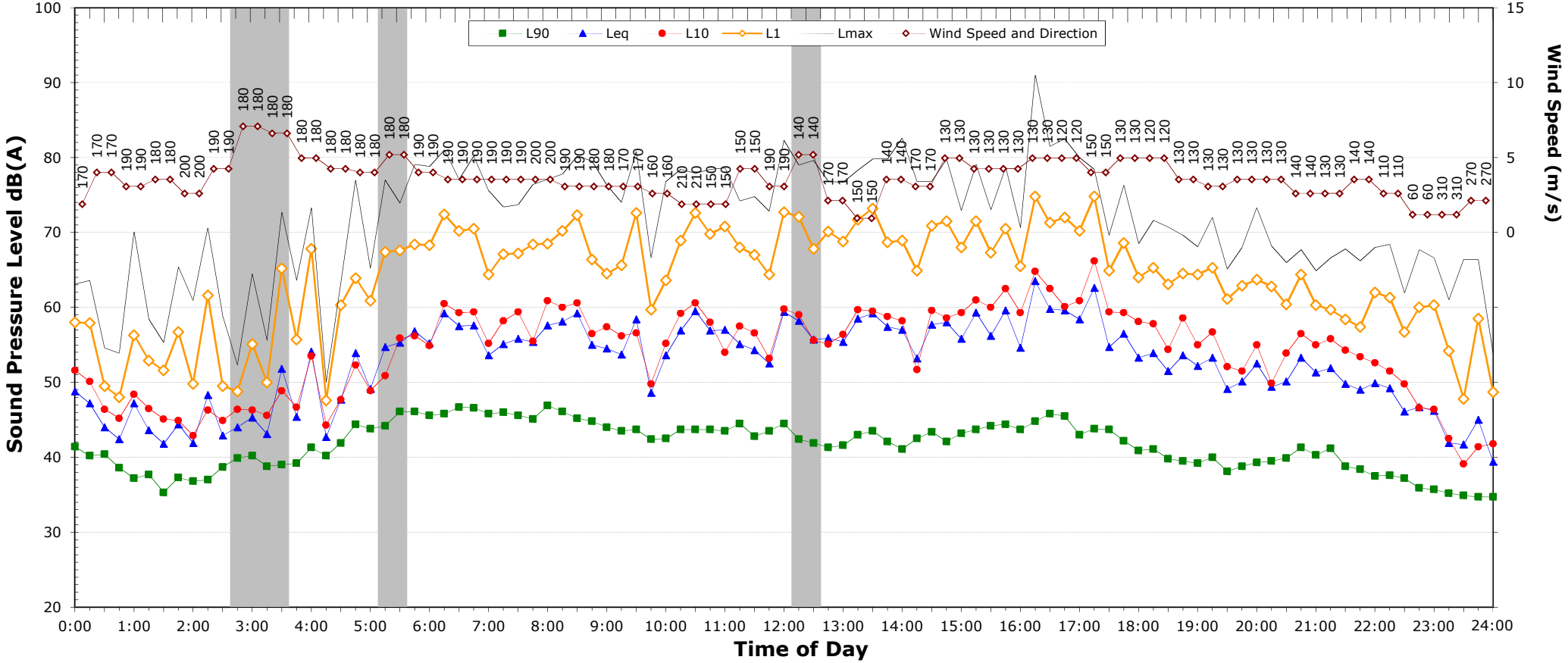
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Thursday, 22 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	42.1	38.1	32.1
Leq	57.6	51.6	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)

Data File: 2012-11-14_SLM_000.XL2

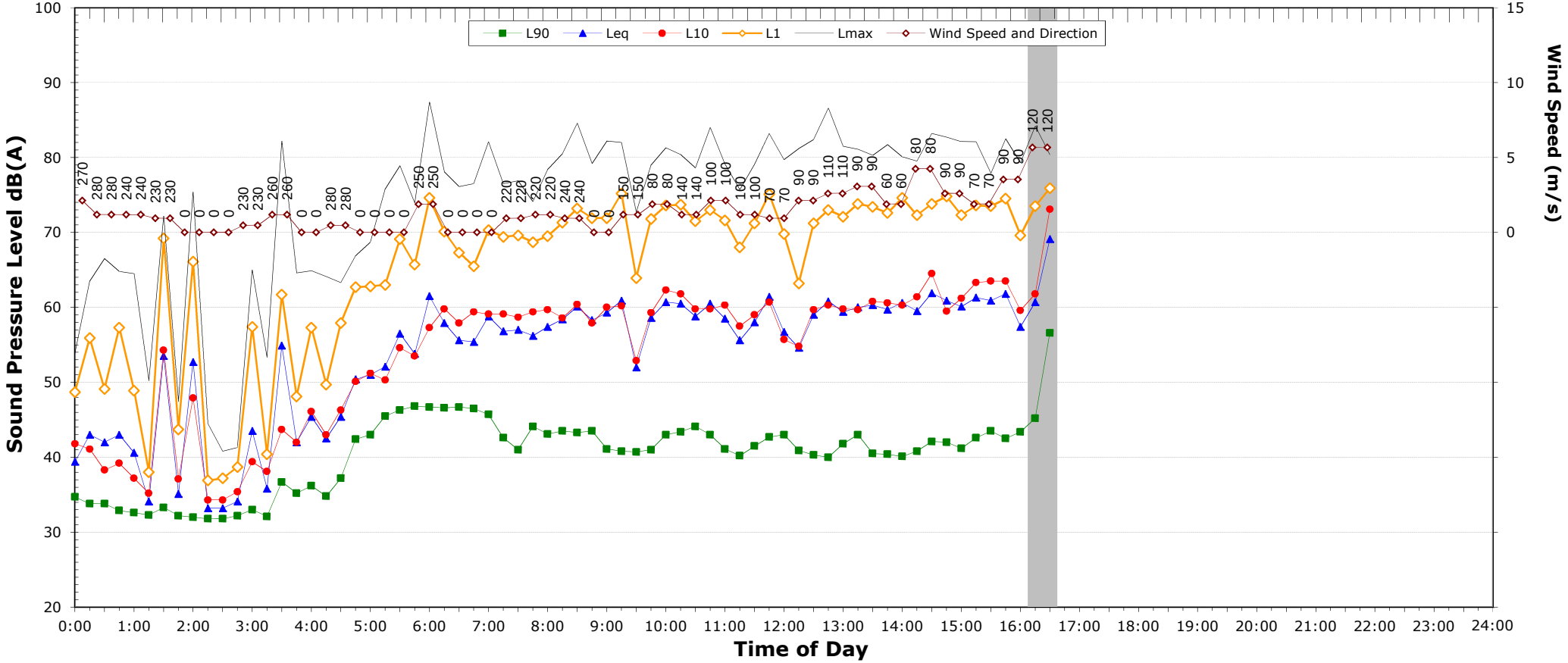
TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs

EXISTING AMBIENT NOISE LEVELS

North-Eastern Corner of Site

Friday, 23 November 2012



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	40.3	-	-
Leq	59.4	-	-

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)

Data File: 2012-11-14_SLM_000.XL2

TG008-01L01 (rev 1) North-Eastern Corner of Site

Template QTE-05B (rev 90) Sydney Logger Graphs