

# SEASIDE CITY DEVELOPMENT, KINGSCLIFF ACOUSTIC TRAFFIC NOISE ASSESSMENT

TF543-01F02 (REV 2) TRAFFIC NOISE INTRUSION ASSESSMENT

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Prepared for:

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## DOCUMENT CONTROL

Date	Revision History	Non-Issued Revision	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
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# 1 INTRODUCTION

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Renzo Tonin & Associates were engaged to review the existing acoustic environment and traffic noise impacts onto the proposed residential development at Seaside Development Kingscliff and review of the recommendations made in the CARDNO traffic assessment for the site, prepared in 2007.

The site consists of residential housing lots either side of the existing Casuarina Way. A service road has been created to the east of Casuarina Way to allow for access and parking to the proposed housing lots on the eastern side of road.

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 CRITERIA

### 2.1 External Traffic Noise Criteria

#### 2.1.1 Environmental Criteria for Road Traffic Noise (ECRTN).

Casuarina Way is considered a collector road for the purpose of this assessment. Therefore, based on the ECRTN the appropriate criteria are presented in the table below:

**Table 1 – External Traffic Noise Criteria**

Type of Development	Criteria		
	Day (7am – 10pm) dB(A)	Night (10pm – 7am) dB(A)	Where criteria are already exceeded
New Residential Developments affected by collector traffic noise	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 55	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development.  Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts

As the development is a new residential development affected by existing road traffic noise and not a new road development, existing traffic noise levels are used for the assessment in accordance with Section C3 of the ECRTN.

### 2.2 Internal Traffic Noise Criteria

#### 2.2.1 ECRTN

Whilst not providing specific recommendations for acceptable internal traffic noise limits, page 14 of the ECRTN provides the following guidance:

*It is preferable for internal noise level criteria to be set by the relevant planning or building authority. The internal levels that are set may vary depending on the type of development the planning authority want to encourage for an area... Sleeping areas are usually the most sensitive to noise impact, so in the absence of any local codes internal levels of 35-40dB(A) at night are recommended. As a guide for other living areas, internal noise levels 10dB below external levels are recommended on the basis of openable windows being opened sufficiently to provide adequate ventilation (refer to Building Code of Australia for additional information). For most residences this equates to a minimum of 20% of the window areas left open.*

## 2.2.2 Australian Standard AS2017:2000

As traffic noise levels are not constant, an  $L_{eq}$  noise level descriptor is used when assessing this type of noise source. The  $L_{eq}$  is the mean energy level of the noise being measured, and has been found to accurately describe the level of annoyance caused by traffic noise.

This standard provides recommended noise levels for steady state such as noise from building services and quasi-steady state sounds, such as traffic and industrial noise. The noise levels recommended in AS/NZS 2107:2000 take into account the function of the area and apply to the sound level measured within the space unoccupied although ready for occupancy.

This standard recommends the following noise levels for residential and commercial buildings.

**Table 2 – Australian/New Zealand Standard AS/NZS 2107:2000 “Acoustic – Recommended design sound levels and reverberation times for building exteriors”**

Type of Occupancy/Activity	Recommended Design Sound Level, $L_{Aeq}$ , dB(A)	
	Satisfactory	Maximum
<b>Residential Buildings - Houses and Apartments near Major Roads</b>		
– Living Areas	35	45
– Sleeping areas	30	40
- Work Areas	35	45

## 2.2.3 CARDNO Acoustic Assessment Report 2007

Cardno (Qld) Pty Ltd propose internal acoustic quality objectives in their acoustic assessment report [Acoustic Assessment Report, Job No. 2967/04, dated 13<sup>th</sup> August 2007] for the development site at Seaside City, Kingscliff.

They propose an internal acoustic quality objective of 40dB(A) for sleeping, living areas, and work areas as a conservative estimate. It is assumed that this proposed internal noise limit is for rooms with windows closed as it would otherwise conflict with the guidance provided by the ECRTN.

However there is no mention of the proposed noise descriptor or the time period in which the criteria should apply. Due to the ambiguity of the proposed criteria, we have reverted to the recommended criteria in the Australian Standard and the ECRTN.

## 2.2.4 Recommended Project Specific Acoustic Criteria

The internal traffic noise criteria for homes within the Seaside City Development, Kingscliff are based on the following documents:

1. Australian Standard AS2107:2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors"
2. Office of Environment and Heritage (OEH) Environmental Criteria for Road Traffic Noise (ECRTN)

Table 3 below summaries the airborne traffic noise criteria recommended for the proposed development.

**Table 3 – Recommended Internal Noise Criteria for Road Traffic Noise**

Occupancy	Condition	Time Period	Recommended Internal Traffic Noise Level $L_{Aeq, (1 hr)}$
Sleeping areas	Windows Closed	Night time	40 dB(A)
Living areas	Windows Closed	Day time	45 dB(A)
	Windows Open	Day time	50 dB(A)

*For the purpose of this development, the upper limits of the noise ranges presented in the ECRTN and Australian Standard AS2107:2000 have been adopted as the criteria is presented as an  $L_{Aeq} (1hr)$ , which is applied to the upper 10 percentile of road traffic noise. This generally covers peak traffic periods. The lower limits of the recommended noise ranges are more suitable when setting criteria over a longer time period, such as day time  $L_{Aeq} (18 hr)$  or night time  $L_{Aeq} (9 hour)$ .*

### 3 EXISTING TRAFFIC NOISE LEVELS

#### 3.1 Long-Term Monitoring

Cardno (Qld) Pty Ltd installed a long-term noise monitor at 19 Casuarina Way to measure traffic noise from 13<sup>th</sup> to 22<sup>nd</sup> July 2011. The logger was installed 6m from the edge of the carriageway and within 1.5m of the building facade at 19 Casuarina Way.

Weather data was provided by the Bureau of Meteorology and used to determine periods that were adversely affected by wind and rain. This data was then excluded from the measurement results.

The noise logger record noise levels on a continuous basis and store data every fifteen minutes. The dates of measurement and the results obtained from the logger surveys are shown in Appendix C.

Approximate set backs of the building facades from the curb of Casuarina Way have been provided by B & P Surveys Consulting Surveyors & Town Planners as 10.5m on the western side Casuarina Way and 18.5m on the eastern side of Casuarina Way. These setbacks represent all worst affected dwellings located on the corresponding sides of Casuarina Way.

Based on the measurement location and the proposed location of the dwelling, noise levels have been adjusted to represent the noise levels impacting on the proposed facades of the development.

The table below presents the measured traffic noise levels and the resulting design noise levels impacting on the proposed building facades adjoining Casuarina Way.

**Table 4 – Calculated External Traffic Noise Levels, dB(A)**

Facade	Occupancy	Predicted Traffic Noise Level L <sub>Aeq</sub> (1 hour)	ECRTN Criteria L <sub>Aeq</sub> (1 hour)	Complies? Y/N
Measurement location 19 Casuarina Way (approximate set back from curb of 6m)	Day time (7am to 10pm)	61	-	-
	Night time (10pm to 7am)	57	-	-
Facade of proposed buildings on western side of Casuarina Way (approximate set back from curb of 10.5m)	Day time (7am to 10pm)	59	60	YES
	Night time (10pm to 7am)	55	55	YES
Facade of proposed buildings on Eastern side of Casuarina Way (approximate set back from curb of 18.5m)	Day time (7am to 10pm)	56	60	YES
	Night time (10pm to 7am)	52	55	YES



Noise levels at the worst affected building facades of the Seaside City Development along Casuarina Way, Kingscliff comply with the nominated external traffic noise criteria as determined in accordance with the ECRTN.

## 4 RECOMMENDATIONS

### 4.1 Building Envelope Design

Renzo Tonin & Associates have assessed the proposed building facades that have been designed to comply with the requirements of the Tweed Shire Council's DCP for the development site "Building Style and Design for Areas Outside of Village Centre".

Generally, external walls will be lightweight construction consisting of fibre cement cladding fixed to a timber or metal stud with plasterboard lining internally and fibrous thermal insulation (glasswool, polyester or rockwool) in the wall cavity.

Roof constructions will typically be metal deck roofing with suspended plasterboard ceilings and fibrous thermal insulation (glasswool, polyester or rockwool) in the ceiling void.

Windows and sliding doors will be glazed with either 6mm standard float glass, 6m toughened glass or 6mm laminated glass.

Assistance relating to suitable forms of construction for facades facing Casuarina Way can also be sought from the NSW Department of Planning's document "Development Near Rail Corridors and Busy Roads – Interim Guidelines" – Appendix C, (attached in Appendix B). The guideline also presents minimum recommended acoustic ratings for facade elements impacted on by traffic noise levels equivalent to those impacting on the proposed development site, which are summarised in Table 5 below.

The acoustic ratings are presented in the form of the Weighted Sound Reduction Index (Rw). The Rw is a measure of the noise reduction property of the partition where a higher rating implies a higher sound reduction performance.

The table below summarises the acoustic ratings (Rw) of each facade element used in determining the presented forms of construction presented in the guideline. These acoustic ratings can also be used to find alternative materials to those presented in Appendix B for facades of buildings adjoining Casuarina Way.

**Table 5- Recommended Acoustic Ratings for Facade Elements facing Casuarina Way**

Facade Element	Recommended Rw Rating of Facade Element
Windows/ Sliding Doors	Rw 24
Frontage Facade (external walls)	Rw 38
Roof	Rw 40
Entry Door	Rw 28
Exposed Floors (where applicable)	Rw 29

The recommendations are based on standard window and room areas and may vary depending on facade element areas, room volumes and room furnishings.

The proposed facade constructions for the Seaside City Development as outlined above will achieve the acoustic ratings presented in Table 5 and are similar in construction to the facade constructions nominated in Appendix B; thus providing adequate noise reduction to comply with the acoustic criteria set out in Table 3 above. Therefore no additional acoustic treatment to the facades is required.

It has long been industry standard to assume a 10dB loss of noise from external to internal through an opened window in a building facade. It is based on the average results of a number of test cases, experimental data and published papers. This assumption has been well documented in The Roads and Traffic Authority (RTA) publications, including the RTA's Environmental Noise Management Manual (ENMM), Table 4.2. Recent studies on noise reduction through facades with open windows [Ryan, Lanchester and Pugh, 2011] have further measured and supported this assumption.

Therefore, mechanical ventilation is not required as the internal noise levels can comply with the nominated windows open criteria assuming a loss of 10dB through an open window.

## 5 DISCUSSION OF RESULTS

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It is noted that noise levels calculated by Renzo Tonin and Associates using current traffic noise data monitored by CARDNO in 2011 differ from the predicted noise levels presented in the CARDNO acoustic assessment report dated 2007.

The main reason for the discrepancies was that noise measurements made in 2007 appear to be adversely impacted on by construction traffic noise, construction noise due to the development of the surrounding estates either side of the Seaside City Development and other extraneous noise sources that could not be identified at the time.

Furthermore, extraneous noise is evident each day from around 6am and does not reflect the typical gradual build up of traffic noise in morning and evening peak periods. It is not known if this noise source had an adverse impact of the remainder of the daytime data.

Instead, noise levels measured near the site in 2011 reflect typical traffic noise curves and were used as part of the assessment presented in this report, while the 2007 monitored noise levels were used in the original noise assessment report.

## 6 CONCLUSION

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Renzo Tonin & Associates have completed an assessment of the traffic noise impacts from Casuarina Way onto the proposed residential development Seaside City Development, Kingscliff.

External noise levels at the building facades were found to comply with the nominated criteria as determined in accordance with the Environmental Criteria for Road Traffic Noise (ECRTN).

The proposed facade designs for the development will achieve the minimum recommended acoustic ratings for building elements in order to meet the internal noise criteria as determined in accordance with the ECRTN and Australian Standard Australian Standard AS2107:2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors". **No further acoustic treatment is required for building facades.**

## 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.



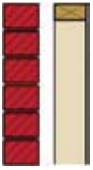

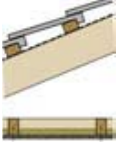
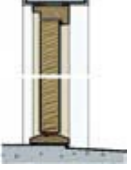
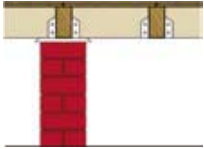

Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights 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 L90 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.
Lmax	The maximum sound pressure level measured over a given period.
Lmin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
Leq	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 Leq 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 - RECOMMENDED FORMS OF CONSTRUCTION

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Category No.	Building Element	Standard Constructions	sample
1	<b>Windows/Sliding Doors</b>	Openable with minimum 4mm monolithic glass and standard weather seals	
	<b>Frontage Facade</b>	<b>Timber Frame or Cladding:</b> 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		<b>Brick Veneer:</b> 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		<b>Double Brick Cavity:</b> 2 leaves of 110mm brickwork separated by 50mm gap	
	<b>Roof</b>	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	<b>Entry Door</b>	35mm solid core timber door fitted with full perimeter acoustic seals	
	<b>Floor</b>	1 layer of 19mm structural floor boards, timber joist on piers	
Concrete slab floor on ground			

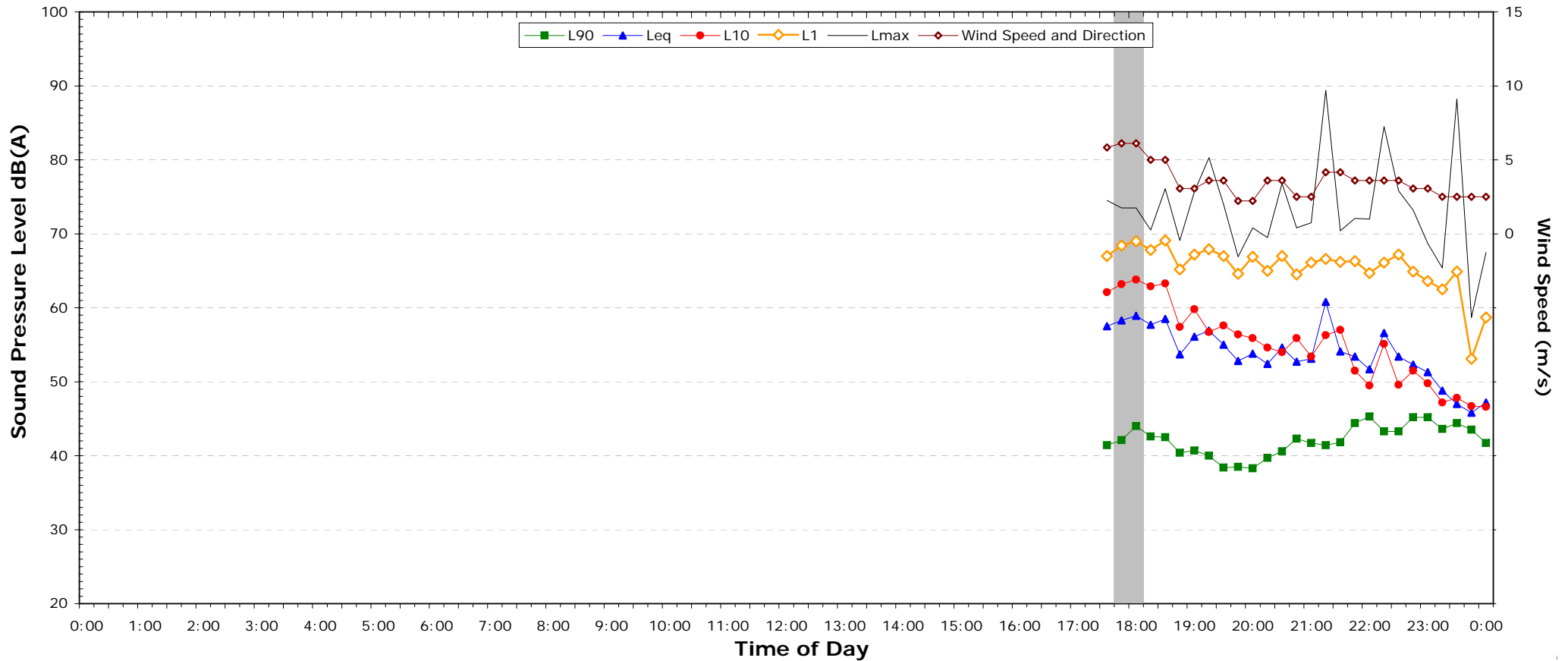
## APPENDIX C - LONG-TERM MONITORING RESULTS AND LOCATION

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# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Monday, 13 June 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	39.7
Leq (see note 3)	-	53.1	50.0

**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 1m from facade; tabulated results free-field 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)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	55.8	52.5
L <sub>eq</sub> 1hr upper 10 percentile	57.5	57.3
L <sub>eq</sub> 1hr lower 10 percentile	53.3	41.4

Night Time Maximum Noise Levels			
		(see note 4)	
Lmax (Range)	69.4	to	88.2
Lmax - Leq (Range)	18.3	to	40.9

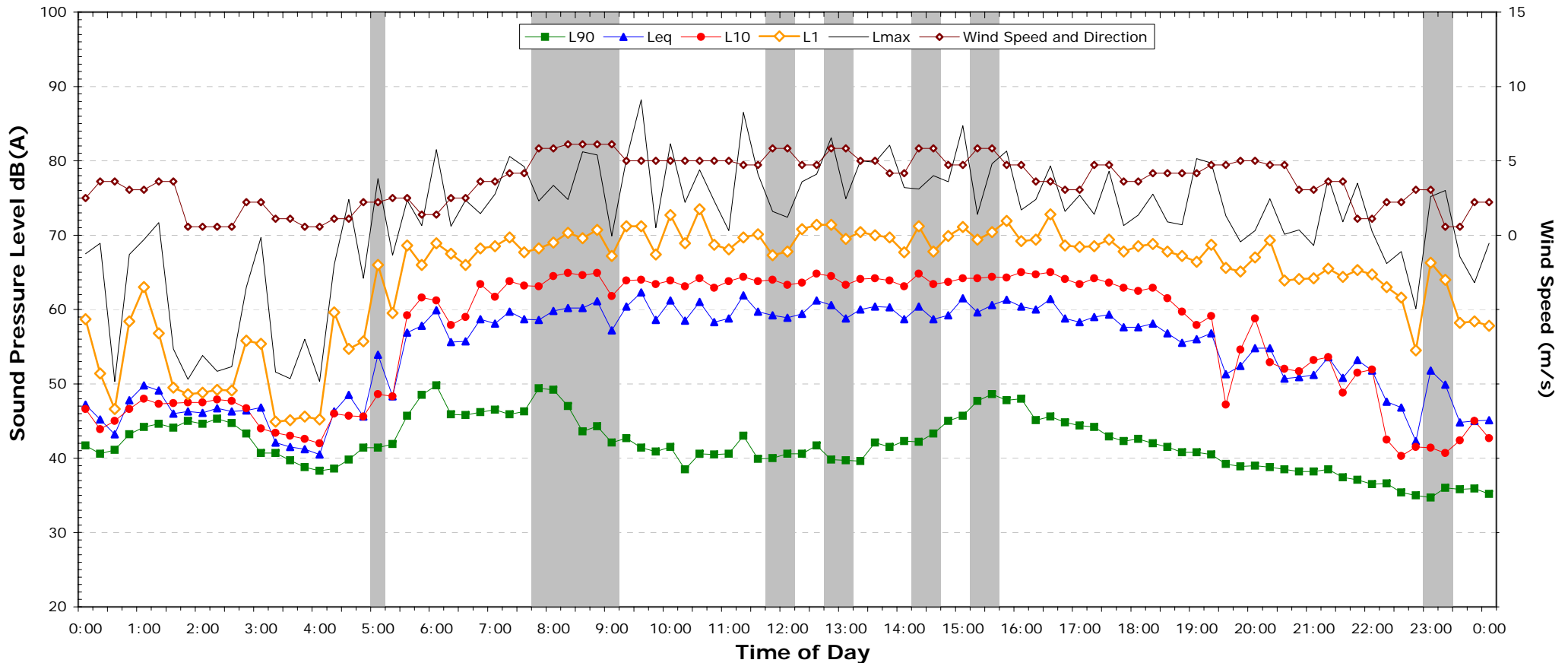
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Template QTE-05A (rev 75) Sydney Logger Graphs

# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Tuesday, 14 June 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	37.1	-
Leq (see note 3)	-	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 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

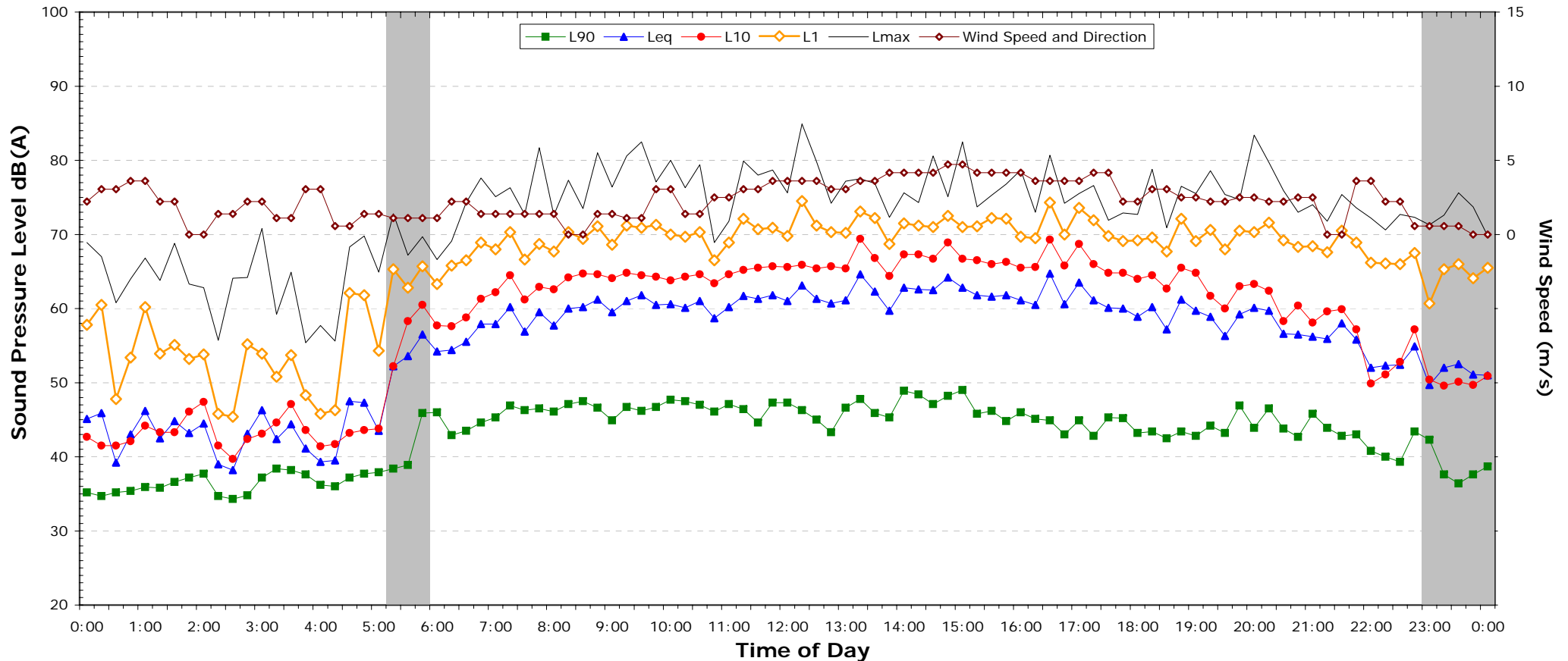
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	58.7	49.6
L <sub>eq</sub> 1hr upper 10 percentile	60.9	56.7
L <sub>eq</sub> 1hr lower 10 percentile	52.4	42.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	67.0	to	77.6
Lmax - Leq (Range)	20.9	to	27.9

# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Wednesday, 15 June 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	44.6	42.5	-
Leq (see note 3)	58.9	55.8	-

**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 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

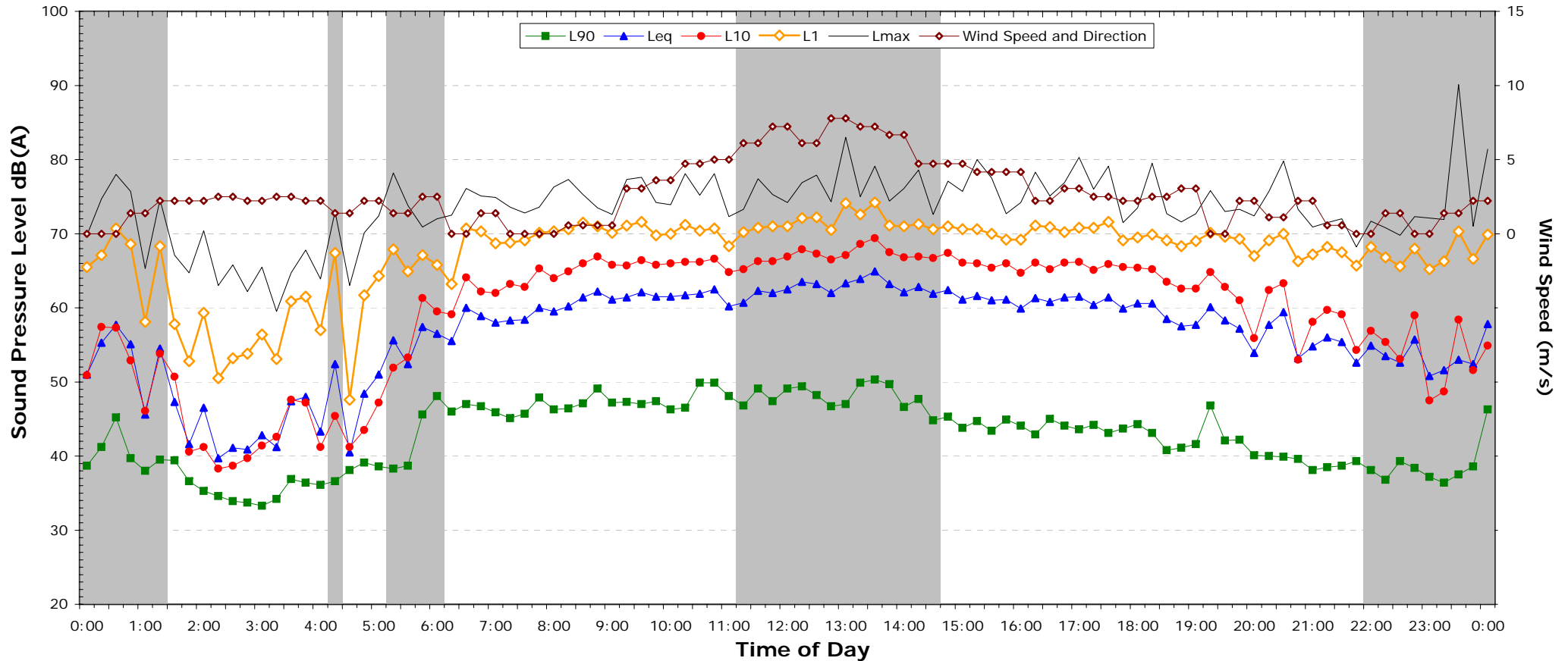
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	60.8	52.7
L <sub>eq</sub> 1hr upper 10 percentile	62.9	58.4
L <sub>eq</sub> 1hr lower 10 percentile	56.8	41.3

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.8	to	76.1
Lmax - Leq (Range)	17.7	to	24.6

# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Thursday, 16 June 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	-	38.5	-
Leq (see note 3)	-	55.0	-

**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 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

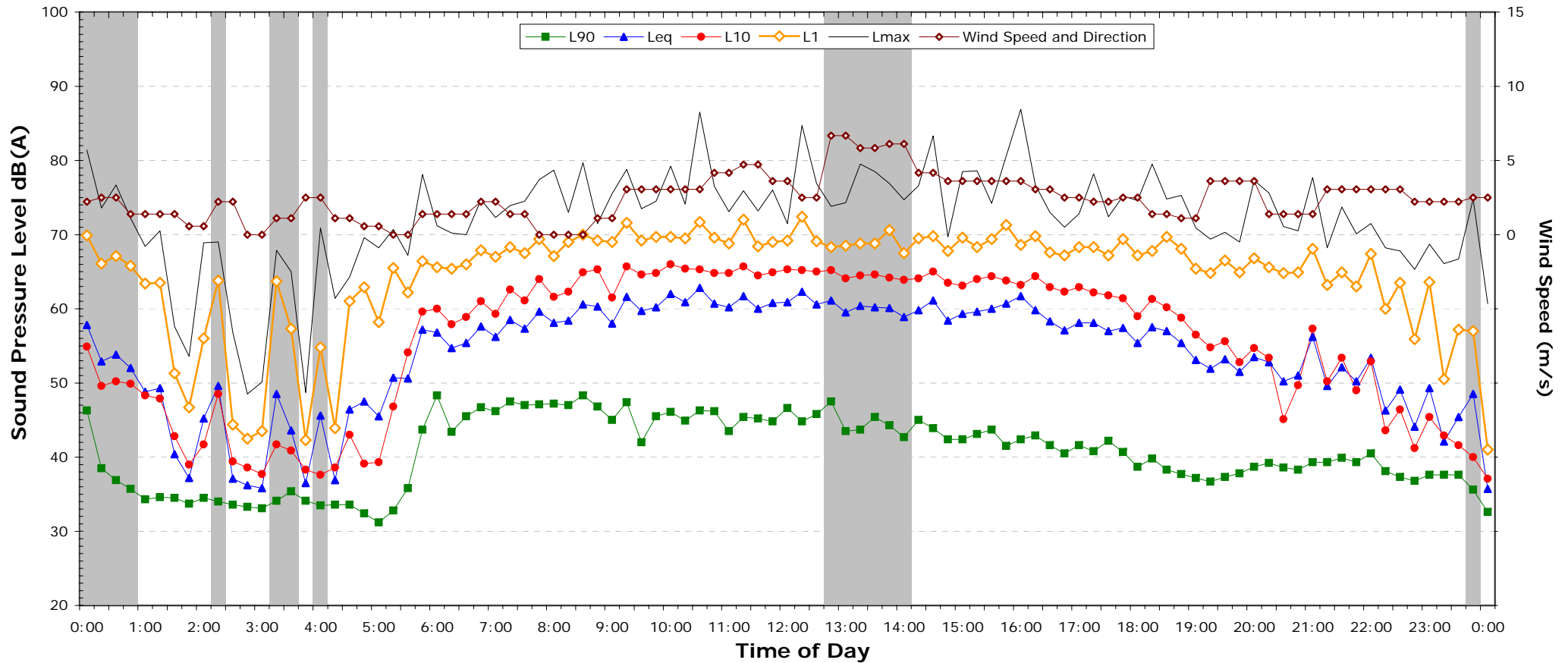
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	60.2	51.9
L <sub>eq</sub> 1hr upper 10 percentile	61.8	56.1
L <sub>eq</sub> 1hr lower 10 percentile	55.4	36.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	68.4	to	78.1
Lmax - Leq (Range)	18.6	to	25.2

# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Friday, 17 June 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	40.8	37.2	32.6
Leq (see note 3)	57.5	51.2	49.0

**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 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

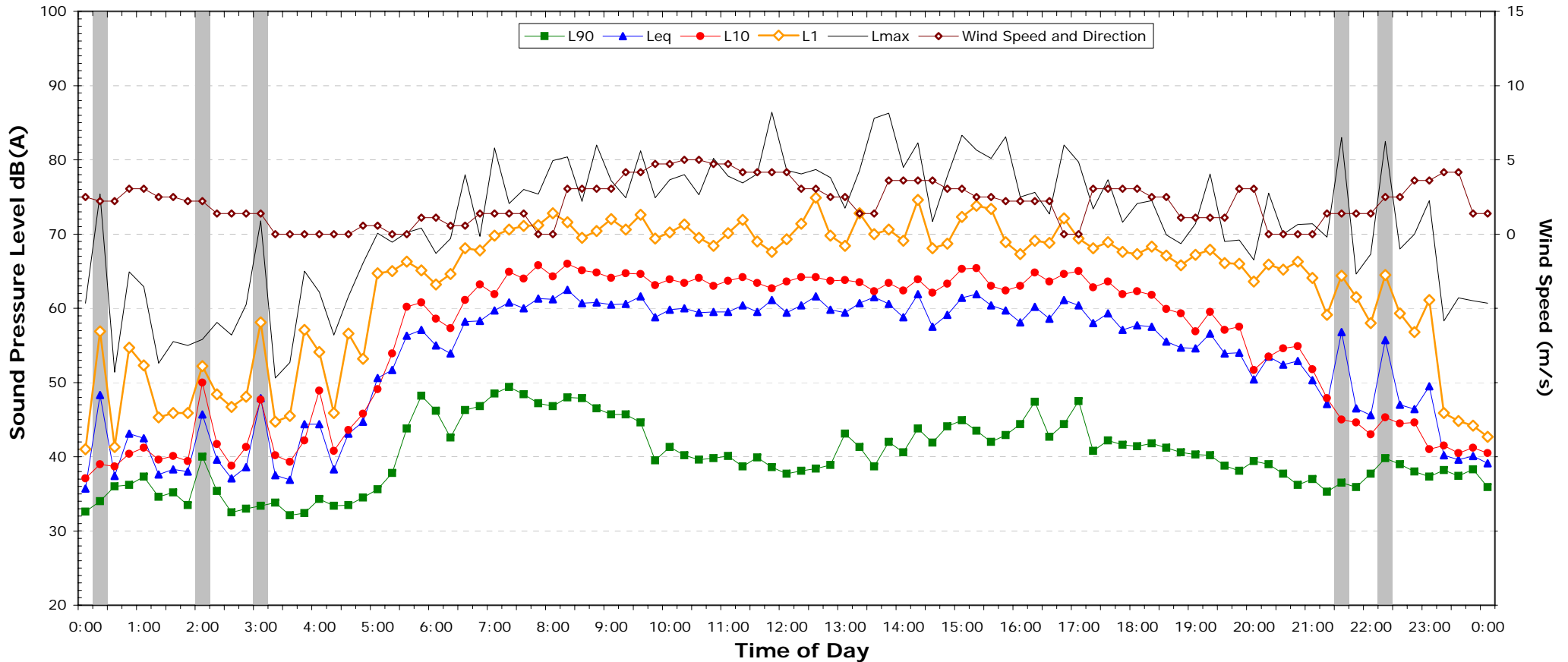
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	58.8	51.5
L <sub>eq</sub> 1hr upper 10 percentile	61.4	58.0
L <sub>eq</sub> 1hr lower 10 percentile	52.0	38.0

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.0	to	81.6
Lmax - Leq (Range)	15.3	to	24.1

# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Saturday, 18 June 2011



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night <sup>2</sup>
	7am-6pm	6pm-10pm	10pm-7am
L <sub>90</sub>	38.7	35.9	34.7
Leq (see note 3)	57.7	51.0	49.2

**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 1m from facade; tabulated results free-field 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	59.3	51.7
L <sub>eq</sub> 1hr upper 10 percentile	61.0	58.6
L <sub>eq</sub> 1hr lower 10 percentile	50.4	37.6

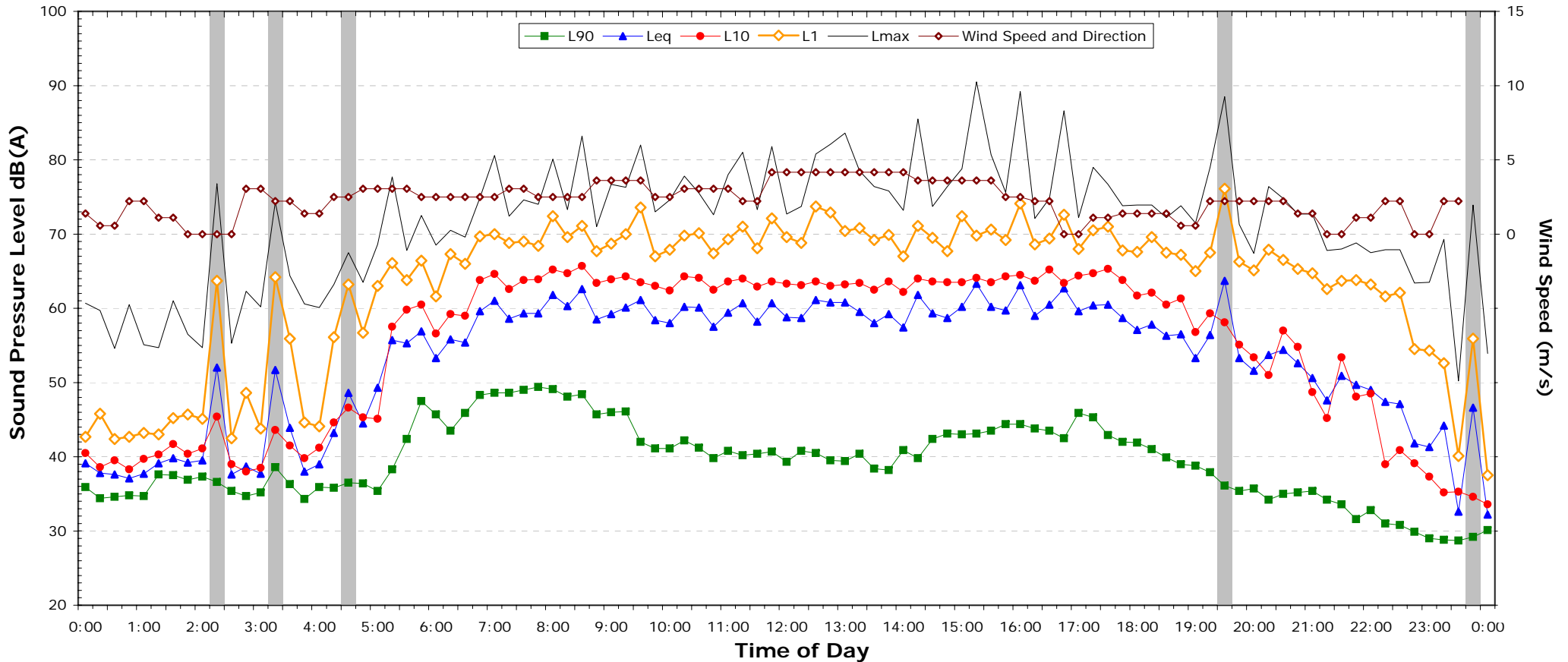
Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	68.6	to	80.6
Lmax - Leq (Range)	21.6	to	26.6



# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Sunday, 19 June 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	32.8	29.2
Leq (see note 3)	57.6	51.4	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 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

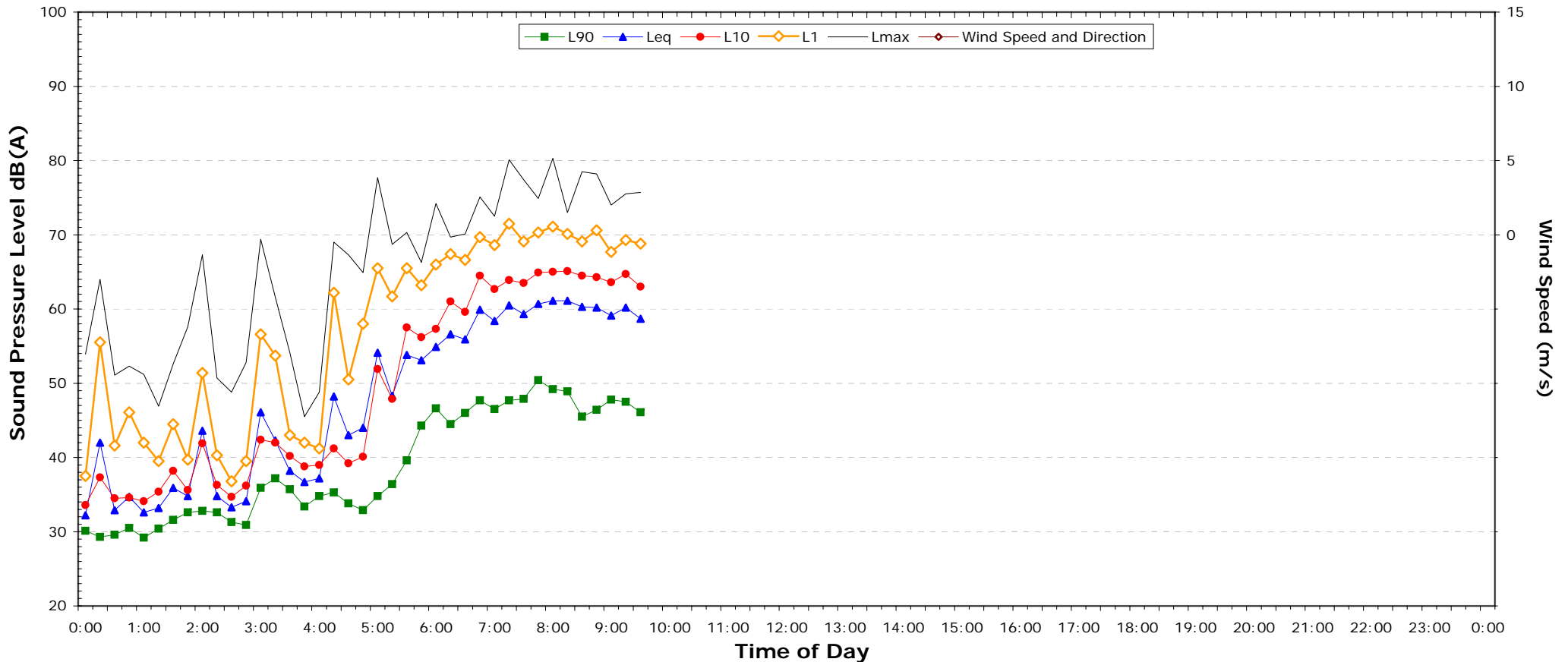
NSW ECRTN Policy (1m from facade) (see note3)		
Descriptor	Day	Night <sup>2</sup>
	7am-10pm	10pm-7am
L <sub>eq</sub> 15 hr and L <sub>eq</sub> 9 hr	59.2	50.6
L <sub>eq</sub> 1hr upper 10 percentile	61.3	58.0
L <sub>eq</sub> 1hr lower 10 percentile	51.6	37.5

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	67.3	to	77.7
Lmax - Leq (Range)	17.1	to	29.3

# EXISTING AMBIENT NOISE LEVELS

## 19 Casuarina Way, Kingscliff

### Monday, 20 June 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 1m from facade; tabulated results free-field 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	60.2	-
L <sub>eq</sub> 1hr upper 10 percentile	60.4	-
L <sub>eq</sub> 1hr lower 10 percentile	59.5	-

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