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WET 'N' WILD SYDNEY

NOISE AND VIBRATION ASSESSMENT

TF070-01F01 (REV 2) NOISE ASSESSMENT.DOC

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Prepared for:

Prospect Aquatic Investments Pty Ltd

C/- JBA Planning

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CONTENTS

List of Tables

1 INTRODUCTION

Renzo Tonin & Associates was engaged to conduct a noise assessment for the Wet ‘n’ Wild Sydney project, to be submitted as part of the Part 3A application.

The issues addressed in this study include noise emissions from:

- Patrons,
- Traffic arriving and departing the site while on public roads
- Car parking activities
- Mechanical plant
- Music events on site, and
- Construction activities

To assist in addressing these issues and setting noise criteria, the existing ambient noise environment was characterised by conducting:

- A site inspection, and
- long-term noise monitoring at nearby residences

Noise emissions from site activities have been predicted to the nearest surrounding receivers and compared to relevant noise criteria.

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 Location

The proposed site is described as Lot 1 in DP 1045771. The site has an area of approximately 25.5 hectares and is an irregular shape parcel of land. The site is owned by the NSW Government's Western Sydney Parklands Trust, and is currently subject to an Agreement to Lease to Prospect Aquatic Investments Pty Ltd which will convert to a 50 year lease immediately upon practical completion of the construction works.

The site is bound by the M4 Motorway to the north, Reservoir Road to the south, Watch House Road to the east, and a property being used for rural purposes to the west.

The topography of the site forms a natural undulating amphitheatre of gentle slopes from the southern boundary to the northern boundary (M4 Motorway). The high point is towards the south eastern corner and the low point is towards the centre of the northern boundary.

To the north of the site immediately on the opposite side of the M4 Motorway is further vacant land (owned by the NSW Government), followed by the great Western Highway, and then the residential suburb of Prospect (some 800 metres to the north of the site). To the south of the site is an environmental conservation area of native bushland surrounding Prospect Reservoir. To the east of the site are the Greystanes employment lands. To the west of the site is the remainder of the Western Sydney Parklands used for various rural and recreational purposes including Eastern Creek Raceway, the Western Sydney Dragway and a recently completed industrial land subdivision.

2.2 Indicative Staging

The proposal is to continually upgrade and enhance the water park on a regular basis, and allow for subsequent capital reinvestment and further development of rides and attractions over the first 15 years of operation and beyond. The Concept Plan incorporates various expansion possibilities. The indicative staging of the project and phasing of construction is described in the following table, subject to market demand..

Stage	Estimated Timing
Stage 1	Completion for park opening in September 2012
Stage 2	Phasing of construction over 5 years
Stage 3	Phase of expansion over 10 – 15 years

2.3 Rides and Activities

A preliminary concept plan for Wet 'n' Wild Sydney has been prepared and is attached in Appendix B. The rides and attractions include:

- Toddlers Pool Area – the toddler's pool area will include a wide variety of water play attractions designed specifically for ages 1-9 years.
- Wave Pool – will form the signature attraction of the park;
- A combination of family and thrill style water slides.
- Undercover dining and shaded seating areas,
- Events Area - An events area to host a wide range of shows and activities including musical events.

2.4 Operating Times and Capacity

The proposed operating times for the Wet 'n' Wild Sydney water theme park are as follows:

Months	Operating Hours
December and January	9am to 11pm and to 12 midnight for special events
February to April	9am to 6pm weekdays 9am to 10pm weekends
May to August	Mix of closures for upgrades and Operating 9am to 5pm if weather and circumstances permit
September to November	9am to 6pm weekdays 9am to 10pm weekends

The water theme park is envisaged to cater for patronage in the order of approximately 925,000 visitors per year, and between 9,000 to 10,000 visitors per day in the peak summer period. There is a possibility that some (very rare) days will have more than 11,000 visitors. The water park will operate on an 8 month operating cycle from September to April (inclusive), and will be closed over the cooler winter months. The water park will have several low attendance weekdays (1,500 to 2,000 visitors), and the design of the park will support its seasonal nature and expected fluctuation in attendance levels.

2.5 Potential Noise Issues

Following an inspection of the site, a review of the proposed development, proposed operating times, and an inspection of the adjoining land uses, it has been concluded that the following noise issues should be considered to satisfy the Director General's Requirements:

- Noise from patrons in various areas of the park and on slide platforms,
- Noise from patron shouts and yells when on rides.
- Noise emissions from traffic movements in car park,
- Noise emissions from mechanical plant,
- Noise from increased traffic on public roads,
- Construction noise and vibration,
- Noise from events, particularly those including amplified music

3 EXISTING ACOSUTIC ENVIRONMENT

3.1 Sensitive Receivers

The proposed site is located within a rural area and there are several rural-residential lots surrounding the site. Several residences will be demolished as part of the site development, and the remaining residential receivers that may potentially be affected by either construction or operation of the proposal include:

R1 - 24 Watch House Road, residential premises to the east

R2 - 425 Reservoir Road, residential premises to the west with associated poultry sheds

R3 – 517 Reservoir Road, residential premises to the south-west

R4 – 525 Reservoir Road, residential premises to the south-west

R5 – 533 Reservoir Road, Coptic Catholic Church of St Mark, at corner of Reservoir Road and Prospect Highway

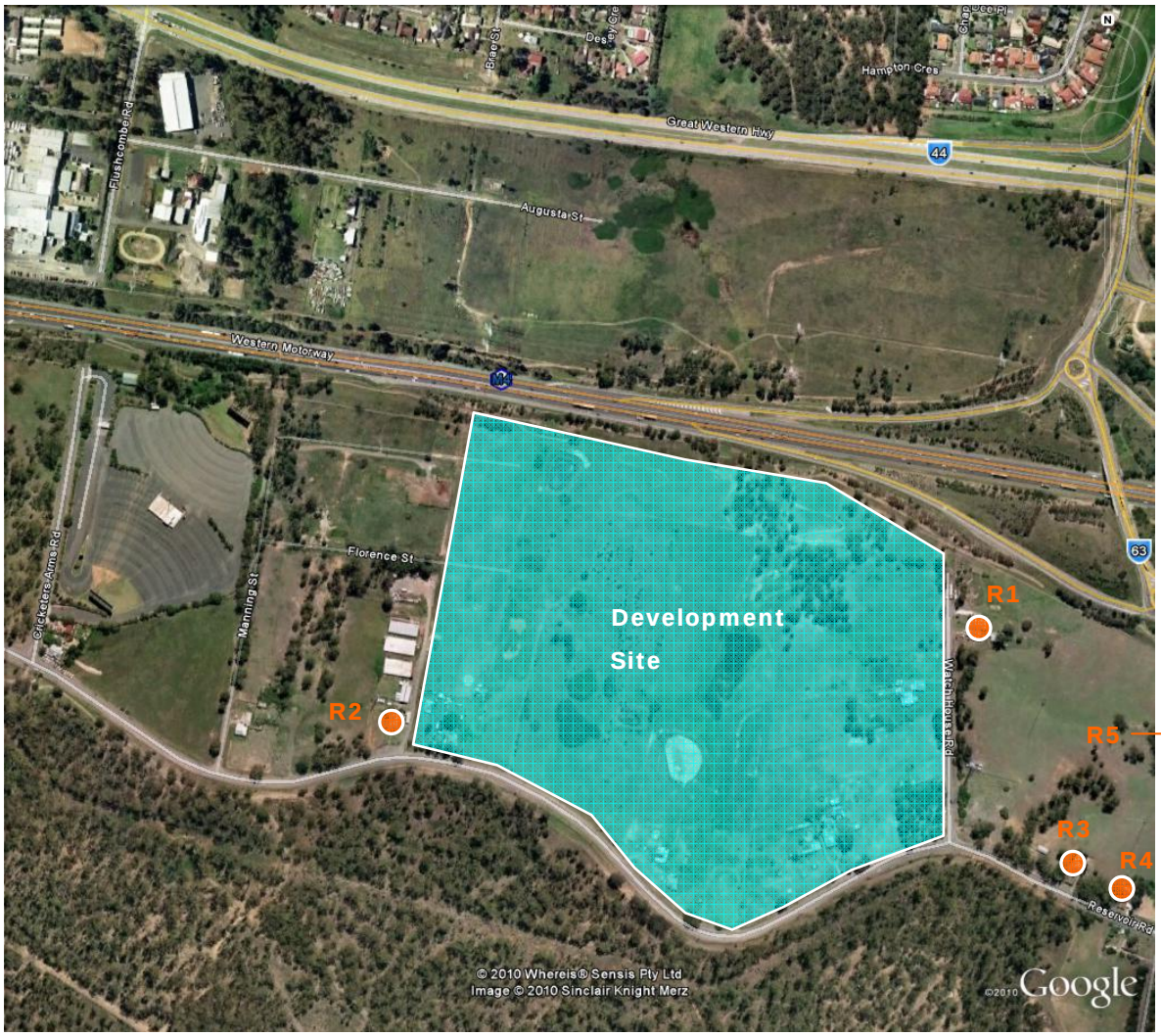

Figure 1 – Location Map and Receivers

3.2 Existing Noise Levels

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NSW *Industrial Noise Policy* (INP, Environment Protection Authority 2000) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The INP defines these periods as follows:

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

Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.

Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Traffic noise levels are assessed separately for daytime and night time periods, defined by the NSW *Environmental Criteria for Road Traffic Noise* (ECRTN, Environment Protection Authority 1999) as follows:

Day is defined as 7:00am to 10:00pm;

Night is defined as 10:00pm to 7:00am.

To quantify the existing noise environment, long-term (unattended) noise monitoring was conducted, between Friday 5th and Wednesday 17th November, 2010. The monitoring locations were:

Location M1: 24 Watch House Road. Noise monitor setup at front property boundary. The noise environment at this location was dominated by M4 motorway traffic noise.

Location M2: 431 Reservoir Road. Noise monitor setup in line with the front facade of the dwelling to quantify existing levels of traffic noise from Reservoir Road. The noise data collected at this location is representative of the noise environment at R2 (425 Reservoir Rd).

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

A summary of the measured noise levels are presented in Table 1.

Table 1 – Measured Existing Noise Levels

Location	L_{A90} Background Noise Levels			L_{Aeq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Location M1 – 24 Watch House Rd	47	48	43	53	53	50
Location M2 – 431 Reservoir Rd	44	44	36	61	58	60

Although the representative daytime background level at Watch House Road is 47dBA, the background level on Sunday was measured to be 45dBA. Since the Park will generally be busier on Sundays than during the week, 45dBA has been used as the basis for setting conservative day/evening operational noise criteria at this location. Also based on Sunday data, 42dBA has been used for the night time extended trading period between 10pm and midnight.

Similarly for Reservoir Road, the lowest measured background level on a weekend evening was 40dBA, and therefore this has been used to set conservative day/evening noise criteria. Also based on Sunday data, 34dBA has been used for the night time extended trading period between 10pm and midnight at this location.

4 LEGISLATION & ACOUSTIC REQUIREMENTS

4.1 SEPP (Western Sydney Parklands) 2009

While containing no specific conditions for noise, The SEPP contains the following condition which may relate to noise;

> ***12 Matters to be considered by the consent authority - generally***
>
> *(j) the impact on surrounding residential amenity*

The application of the NSW Industrial Noise Criteria (INP) is the appropriate NSW noise policy for retaining acoustic amenity.

4.2 Director-General's Requirements

The Director-General's Requirements contain the following requirement relating to noise and vibration emissions from the proposal:

> ***17. Noise and Vibration***
>
> *Provide a quantitative assessment of the potential demolition, construction, operation and traffic noise impacts of the project.*

4.3 NSW Industrial Noise Policy (INP)

Industrial Noise Policy is the Department of Environment, Climate Change & Water's (DECCW) current noise policy for large developments and includes criteria and a methodology for assessing intrusive noise impacts. The INP has been used to assess operational noise from the proposal.

4.4 NSW Environmental Criteria for Road Traffic Noise (ECRTN)

The ECRTN is DECCW's current noise policy for assessing road traffic noise impacts and has been used to assess increased noise on public roads as a result of the development.

4.5 NSW Interim Construction Noise Guideline (ICNG)

The ICNG is DECCW's current noise policy for assessing noise impacts from construction activities.

5 OPERATIONAL NOISE ASSESSMENT

5.1 Noise Criteria

5.1.1 DECCW's Industrial Noise Policy (INP)

The assessment procedure in terms of the NSW *Industrial Noise Policy* (INP, Environment Protection Authority 2000) has two components:

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

Intrusive Noise Impacts

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

The intrusiveness criterion is summarised as follows:

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

The intrusiveness criteria for each assessment location are presented below:

Table 2 – INP Intrusiveness Criteria

Location	Intrusiveness Criteria $L_{Aeq,15min}$		
	Day	Evening	Night
Location R1 – 24 Watch House Rd	50	50	47
Location R2 – 425 Reservoir Rd	45	45	39

Notes: 1. Daytime refers to the period from 0700 to 1800h (Monday to Saturday) and 0800 to 1800 h (Sundays and Public Holidays)

2. Evening refers to the period from 1800 to 2200 h

3. Night time refers to the period from 2200 to 0700h (Monday to Saturday) and 2200 to 0800 h (Sundays and Public Holidays)

Protecting Noise Amenity

The Amenity Criteria are determined in accordance with Chapter 2 of the NSW INP. The INP recommends base acceptable noise levels for various receivers, including residential, commercial, industrial receivers and sensitive receivers such as schools, hospitals, churches and parks.

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the policy, the applicable parts of which are reproduced below.

The residential receivers have generally been classified as 'suburban' rather than 'rural' since the area has significant existing traffic noise from the M4 Motorway and Reservoir Road. The one residence at 24 Watch House Road has been classed as 'urban' since it is adjacent to the M4 Motorway on ramp from Prospect Hwy and is exposed to continuous heavy traffic flows, as per Note 6 on p18 of the INP.

Table 3 - Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable	Recommended Maximum
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Places of Worship	All	When in use	50	55

5.1.2 'Modifying Factor' Adjustments

Further, to the above, where the character of the noise in question is assessed as particularly annoying (i.e. if it has an inherently tonal, low frequency, impulsive or intermittent character), 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 from increased annoyance.

5.1.3 Noise Goals

By comparing the intrusiveness with the amenity criteria, and selecting the strictest criteria for day, evening and night periods, the project specific noise levels (noise criteria) are:

Table 4 – Project Specific Noise Levels

Location	L_{Aeq} Noise Goals		
	Day	Evening	Night (10pm to midnight)
Location R1 – 24 Watch House Rd	50	50	47
Location R2 – 425 Reservoir Rd	45	45	39

5.1.4 Sleep Disturbance Criteria

The DECCW has formally produced the following statement with respect to sleep disturbance in their INP Application Notes:

> *"Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.*
>
> *DEC reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*
>
> *From the research, DEC recognised that current sleep disturbance criterion of an LA1, (1 minute) not exceeding the LA90, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DEC will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*
>
> *The detailed analysis should cover the maximum noise level or LA1, (1 minute), that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:*
>
> - *how often high noise events will occur*
> - *time of day (normally between 10pm and 7am)*
> - *whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).*

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. DEC will accept analysis based on either LA1, (1 minute) or LA, (Max)."

The policy confirms that a sleep disturbance criterion of $L_{A1(1min)} < L_{A90(15min)} + 15dB(A)$, should only be used as a first step 'guide' as it is 'not ideal' and 'where it is not met, a more detailed analysis is required'. That detailed analysis includes a reference to the research material contained in the ECRTN in the assessment of the subject proposal.

Recent work produced by Griefahn [Acoustics Australia vol 20 No 2 August 1992 pp43-47], shows a dose/response curve developed from recent research relating noise induced awakenings with the number of short noise events which occur during a night.

For intermittent or short-duration noise events, Griefahn shows that there are zero awakenings amongst 90% of the exposed population (including the aged) if maximum noise levels inside bedrooms are at:

- 59.4dB(A) for 2 noise events per night
- 54.1dB(A) for 10 noise events per night, and
- 53.6dB(A) for 30 noise events per night.

Griefahn also notes that at an absolute level of 53.2dB(A) measured indoors, there are zero awakenings in 90% of the population. This level "represents the upper risk which must not be exceeded in order to avoid long-term effects on health".

A level of 53.2dB(A) measured indoors corresponds to a conservative level of 65dB(A) measured outside the bedroom window assuming windows are open for ventilation.

5.2 Noise Sources

5.2.1 Patrons

Patron noise consists of two components, a steady hubbub measured as L_{Aeq} and occasional transients (yells and shouts) measured as L_{Amax}. From tests carried out at a number of licensed venues, the following empirical equations which can be used to determine the sound power levels appropriate for a congregating group patrons:

$$L_{WA(max)} = 90 + 5\log N$$
$$L_{WA(eq)} = 73 + 10\log N$$

where N = number of patrons.

The equations presented above are based upon measurements at licensed premises and would over-estimate the sound level emanating from the patron areas of a water theme park for the following reasons:

- Experience has shown that alcohol influences the behaviour of patrons with respect to noise generation. People affected by alcohol are noisier than those who are not. While there is a beer garden on the site, the majority of patrons will attend the park to use the rides, not to congregate and drink alcohol.
- Patrons primarily visit the areas of concern, for example platforms on top of slides, in order to get on the ride and not socialise as for pubs and clubs. Due to the nature of the queuing, conversations would be limited to the patrons in your direct vicinity, couples or small groups. For the same number of people, the noise emissions from Wet 'n' Wild would be expected to be less as people that at a hotel.

The reduction of source noise levels due to the reasons outlined above is estimated to be around 5dBA. The previous equations have therefore been adjusted to reflect this reduction.

Table 5 below lists the areas in the park where patrons are likely to congregate (refer to numbering Concept Plan in Appendix B), the number of patrons likely in each area, and the resulting sound power levels. For areas where patrons may be seated such as the Wave Pool beach area, dining areas and cabanas, an occupancy of 1 person per $2m^2$ has been assumed.

L_{Amax} sound power levels have only been applied to adult rides with a high 'thrill' factor. These L_{Amax} levels correspond well to documented vocal noise levels for 'shouting' (Ref: p16.2, 'Acoustical Measurements and Noise Control', C. M. Harris, 1998).

Table 5 - Patron Sound Power Levels

No.	Area	Patron Number	Estimated Source Height	Sound Power Level	
				$L_{WA(eq)}$	$L_{WA(max)}$
1-5	Entry	100	1.5	88	-
16	River beach entry/exit	20	1	81	-
17/18/19	Group Picnic/Group Food/Special Events Lawn	750	1	97	-
24-25	Tots Island Sidepool / Spray Pad	50	1	85	-
26/27	Giant Rainfortress / Shade Sails	50	1	85	-
28-29	Family Double Python / Whizzard Mat Racer (top)	40	16	84	93
28-29	Family Double Python / Whizzard Mat Racer (bottom)	40	1	84	-
30	Dueling Master Blaster (top)	30	16	83	92
	Dueling Master Blaster (bottom)	30	1	83	-

No.	Area	Patron Number	Estimated Source Height	Sound Power Level	
				$L_{WA(eq)}$	$L_{WA(max)}$
31	Double Aqualoop / Freefall Complex (top)	30	16	83	92
	Double Aqualoop / Freefall Complex (bottom)	30	1	83	-
33-34	Beer Garden / Fast Food	100	1	88	-
35	Boomerang Bay Surf Wave Pool (water)	100	1	88	-
12/13, 35/36/37 /38	Dining areas, Wave pool sand / Beach lounging / Rental cabanas / Food	1500	1	100	-
43	Sloping lawn	600	1	96	-
44	Innertube slides (top)	50	16	85	93
	Innertube slides (bottom)	50	1	85	-
45	Boomerango / Abyss Raft (top)	50	16	85	93
	Boomerango / Abyss Raft (bottom)	50	1	85	-

5.2.2 Car Park

General L_{Aeq} noise from vehicles moving around the car park has been calculated using the RLS 90 standard with the following assumptions:

- Maximum of 400 vehicles per hour entering the car park, and
- One event / hour per space.

For impact noises such as vehicle doors closing and engines starting, an L_{A1} sound power level of 100dBA has been used in the sleep disturbance assessment.

5.2.3 Mechanical Plant

There are three mechanical plant spaces nominated on the concept plans, and most plant will be located inside enclosed plant rooms. The locations of the plant rooms are as follows:

Plant Room 1 – behind wave pool, approximately 200m from Watch House Road residence,

Plant Room 2 – adjacent to Reservoir Road, approximately 350m from any residence,

Plant Room 3 – adjacent to M4 Motorway, approximately 300m from any residence.

Detailed noise data for the proposed mechanical equipment is unavailable at this stage of the project, however we expect internal noise levels of approximately 100dBA inside each plant room. A preliminary review of likely noise impact from mechanical plant indicates that noise from Plant Room 2 and Plant Room 3 would likely comply with the set noise goals without any additional noise mitigation due to their location and the large distances from residences.

For Plant Room 1, provision should be made for the following mitigation measures to be included:

- Acoustic silencers or louvres to be installed in any ventilation openings in the walls or roof,
- Internal lining of the plant room with acoustic insulation,
- Installing a noise screen around any plant located externally on the east side of the plant room.

The task of reducing noise emission levels from any plant area to achieve the set criteria is uncomplicated and can readily be achieved using standard noise control treatments and commonly available building materials. Mechanical plant noise and design of mitigation measures will be further addressed at the detailed design stage of the project.

5.3 Predicted Noise Levels

5.3.1 Noise Modelling - CadnaA

Noise emissions from the water park were determined by modelling the noise sources, receiver locations, and topographical features of the area using the CadnaA computer model. The model calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models takes into account:

- Location of noise sources and receiver locations;
- Height of sources and receivers referenced to the ground contour;
- Separation distances between sources and receivers;
- Meteorological conditions such as wind,
- Ground type between sources and receivers; and
- Attenuation from barriers (natural and purpose built).

5.3.2 Cumulative L_{Aeq} Operational Noise

L_{Aeq} noise levels from operational sources have been predicted to the nearest residential receivers and the results are shown in Table 6 below. The noise levels at R2 (425 Reservoir Road) include a solid boundary fence between this receiver and the car park to provide approximately 5dBA shielding from car park activities.

Table 6 – Predicted Operational L_{Aeq} Noise Levels

Receiver Location	Patron Noise (Calm)	Car Park (Calm)	Cumulative Noise Level (Calm)	Cumulative Noise Level (3m/s wind source to receiver)	Criteria (Day / Evening	Criteria (Night)
R1 (24 Watch House Rd)	45	30	45	49	50	47
R2 (425 Reservoir Rd)	39	40	42	43	45	39

During the day and evening periods, operational noise is expected to generally comply with the set criteria at the nearest locations under both calm and windy conditions.

During the night period between 10pm to 12 midnight, if operations continued the same as the day, then exceedances of up to 2dBA at R1 and 4dBA at R2 could be possible. However during this late night period, vehicle movements would probably be less than the maximum of 400 vehicles per hour, and the park would not be at its capacity with patrons, and therefore noise levels would probably mostly comply.

At locations R3, R4 and R5 further removed and at a lower level, noise levels would be less than those shown and would generally comply.

5.3.3 L_{Amax} Patron Noise

The NSW INP does not include any methodology for the assessment of L_{Amax} noise levels from shouts and yells from patrons. However based on criteria established in the Supreme Court Proceedings No.2267 of 2005 (Luna Park), peak noise events from patrons would not be considered to be intrusive where the L_{Amax} noise levels do not exceed 'background + 5dBA'.

Table 7 below presents and assessment of L_{Amax} noise events, assuming these events would only be associated with adult rides having a high 'thrill' factor, and based on the L_{Amax} sound power levels presented in Table 5.

During the day and evening periods, the results show that L_{Amax} noise events are expected to comply with the set criteria and should not cause any adverse noise impacts.

After 10pm at night, there may be a minor 1 – 2 dBA exceedance at the nearest receivers.

Table 7 – Predicted Patron L_{Amax} Noise Levels

Receiver Location	LAmax Patron Noise (Calm)	LAmax Patron Noise (3m/s wind source to receiver)	Criteria (Day / Evening	Criteria (Night)
R1	43	46	50	47
R2	37	41	45	39

5.3.4 Sleep Disturbance

Both L_{max} noise levels from patrons, and L_1 noise levels from car park activities have the potential to cause sleep arousal. Table 8 presents an assessment of sleep disturbance based on peak noise levels associated with patrons and vehicles. The predicted noise levels shown are external, outside the dwelling window. The noise levels at R2 (425 Reservoir Road) include a solid boundary fence between this receiver and the car park to provide approximately 5dBA shielding from car park activities.

Table 8 – Sleep Disturbance Assessment

Receiver Location	L_{Amax} Patron Noise (Calm)	L_{A1} Car Park Noise	Criteria (Night)
R1	43	40	57
R2	37	51	49

Sleep disturbance is generally not expected to be an issue other than possibly when vehicles are parked in the far western side of the car park, adjacent to receiver R2. Since this location is furthest from the park entry plaza (least likely to be used), and since the car park is unlikely to be at capacity late at night, noise levels lower than those shown are probably more realistic. Furthermore the predicted levels are well below 65dBA which recent research shows is the level likely to cause awakenings, and therefore sleep disturbance from general operation of the park after 10pm is probably unlikely.

5.3.5 Outdoor Amplified Music Events

Outdoor amplified music events may occur on special events lawn (area 19), and the secondary overflow parking area. Music events need to be clearly heard by the viewing crowd and therefore assuming a sound pressure level of approximately 85dBA at 30m from the front of house speakers, we have determined a sound power level of 125dB(A) for music events. Based on this sound power level, and a speaker height of 3m above the local ground, noise emissions are predicted as shown in Table 9.

Table 9 – Predicted L_{Aeq} Music Noise Levels

Receiver Location	Location of Event		Criteria (Day / Evening	Criteria (Night)
	Special Events Area	Secondary Parking Area		
R1	64	62	50	47
R2	64	61	45	39

Significant exceedances of the criteria are possible when a music event is taking place. Recommendations for minimising noise impacts to residences from music events are provided in Section 5.5 below.

5.4 Vibration

Vibration from operational activities is not expected to be an issue. The nearest receivers are at least 100m from any mechanical plant items or rides, and are therefore too far away to be impacted

5.5 Operational Noise Recommendations

Operational noise levels from the water park are generally expected to comply with the set criteria, with some minor exceedances of less than 5dBA possible during the extended trading hours after 10pm.

However acoustic screening between the car park and the residence at 425 Reservoir Road is required . This acoustic fence should be approximately 3m high with no gaps between fence panels, and of sufficient length to shield the residence from the nearest car parking areas,

To minimise noise impacts from music events, the following should be considered and implemented wherever possible;

- Notify residents of schedules events and provide a contact phone number for complaints,
- Assign a dedicated and trained staff member to respond to noise complaints during events,
- Orientate speakers so that they do not face directly towards residences,
- Use more low powered speakers rather than a few high powered speakers if possible. Point speakers downward and toward the audience.
- Locating events in the secondary parking area with the stage and speakers towards the M4 Motorway would minimise the noise impacts.

6 TRAFFIC NOISE ASSESSMENT

6.1 Noise Criteria

Road traffic noise impact is assessed in accordance with the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN, Environment Protection Authority 1999).

This policy divides land use developments into different categories and lists the respective criteria for each case. The Wet 'n' Wild site will be accessed by vehicles using Reservoir Road (existing collector road), Prospect Highway (sub-arterial), and the M4 Motorway (existing arterial). The criteria categories relevant to these roads are reproduced below:

Table 10 – NSW Environmental Criteria for Road Traffic Noise

Type of Development	Criteria		
	Day	Night	Where Criteria are Already Exceeded
7. Land use developments with potential to create additional traffic on existing freeways/arterials	$L_{Aeq(15hr)}$ 60	$L_{Aeq(9hr)}$ 55	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB
8. Land use developments with potential to create additional traffic on collector road	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 55	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating time of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB

Sensitive Land Use Developments

The ECRTN also sets guidelines for the assessment of traffic noise on sensitive land use developments. The Coptic Catholic Church of St Mark is located near the corner of Reservoir Road and Prospect Highway, and the traffic noise criteria for this church is as follows:

Table 11 - Road Traffic Noise Criteria for Sensitive Land Use Developments

Type of Development	Criteria		
	$L_{Aeq(1hr)}$		Noise Mitigation Measures
	Day	Night	
Places of worship	40 [1]	40 [1]	To achieve internal noise criteria in the short-term, the most practicable mitigation measures are often related to building or facade treatments. Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 0.5dB(A) for new roads and 2dB(A) for redeveloped roads or land use development with potential to create additional traffic.

Note: 1. Internal noise criteria

6.2 Traffic Volumes

A traffic study has been completed by ARUP (ref: Sydney Water Theme Park – Transport Assessment, July 2009). This study predicts the following traffic generation from the site, which have been used as the basis of future traffic noise predictions.

Table 12 – Site Traffic Generation

Period		Day of week	AM Peak (vph)				PM Peak (vph)			
			8-9am		9-10am		4-5pm		5-6pm	
			in	out	in	out	in	out	in	out
Off Peak	non holidays	week day	41	0	144	5	14	184	0	41
	non holidays	weekend	82	0	214	7	9	170	13	214
Shoulder	non holidays	week day	82	0	234	8	15	152	10	216
	non holidays	weekend	82	0	376	15	29	294	29	409
Peak	holidays	week day	98	0	294	10	35	372	35	397
	holidays	weekend	98	0	295	10	33	352	33	377

6.3 Predicted Traffic Noise Levels

Traffic noise levels to the facades of residential properties on Reservoir Road have been predicted using the 'CoRTN88' 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 DECCW.

The source noise levels used in this project to model traffic noise levels are contained within the calculation algorithms of the CoRTN88 noise model. The noise prediction model takes into account:

- traffic volume and heavy vehicle forecasts;
- vehicle speed;
- road gradient;
- the differing source heights of cars and heavy vehicles (3-source heights used);
- ground reference levels of the road and receivers;
- separation distances of the road to receivers;
- ground type between the road and receivers;
- angles of view of the road from the receiver's position;
- attenuation from barriers (natural and purpose built) and cuttings;
- reflections from barriers, cuttings, roadside structures etc;
- corrections for building facade reflections under Australian conditions.

Noise levels have been predicted at 15m from the road edge which is representative of the nearest residential properties. It is assumed that the peak hourly flow could include up to 12 buses, which equates to a heavy vehicle percentage of 3%.

Table 13 – Predicted Traffic Noise Levels

Day	Existing Noise Level		Additional Noise from Site Traffic		Total Traffic Noise	
	AM Peak (9 – 10am)	PM Peak (5 – 6pm)	AM Peak (9 – 10am)	PM Peak (5 – 6pm)	AM Peak (9 – 10am)	PM Peak (5 – 6pm)
Saturday	60	59	59	61	63	63
Sunday	61	57	59	61	63	62

Site traffic causes increases in traffic noise of 2 – 5dBA. This exceeds the 2dBA allowance permitted by the ECRTN and therefore all reasonable and feasible noise mitigation measures should be investigated. These traffic noise impacts could affect any houses along Reservoir Rd, of which there are two to the east and two to the west of the site.

We note that the precinct, including the site and surrounding properties, are identified in the Draft Western Sydney Parklands Plan of Management as 'Precinct 7 – Prospect Recreation' with the site identified as a 'tourism hub'. There is a planned future road link from Prospect Highway to Wetherill Park to the south and as a result, significantly increased traffic flows are expected in the area, likely increasing the existing noise levels.

Traffic noise mitigation can be further considered as the project progresses, and as more information about the future development of the precinct becomes available.

St Mark's Coptic Church

This church is located near the intersection of Prospect Highway and Reservoir Road. According to Table 9 of the ARUP transport assessment, the existing peak hour traffic volumes, through the Reservoir Rd / Prospect Hwy / Reconciliation Road intersection is 702vph during the morning peak hour and 554vph during the afternoon peak on a weekday. These volumes well exceed the peak traffic generated by Wet 'n' Wild which is predicted to be less than 400vph during the busiest days, and much less at other times.

Therefore since the church is currently operating in this high traffic environment, it is not expected that traffic associated with Wet 'n' Wild will cause an increase in traffic noise over what is already being experienced at the church.

7 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

7.1 Construction Noise Criteria

The Department of Environment, Climate Change & Water released its *Interim Construction Noise Guideline* (ICNG) in July 2009. This document is currently only issued as an interim guideline, although it is being referred to as DECCW's standard policy for assessing construction noise on new projects.

The key components of the ICNG are:

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

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

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

2. Application of feasible and reasonable noise mitigation measures

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

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

3. Quantitative and qualitative assessment

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

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

A qualitative assessment is recommended for small projects with a short-term duration where works are not likely to affect an individual or sensitive land use for more than three weeks in total. It focuses on minimising noise disturbance through the implementation of feasible and reasonable work practices, and community notification.

Given the significant scale of the construction works proposed for this Project, a quantitative assessment is carried out herein, consistent with the ICNG's requirements.

4. Management Levels

Residences

Table 14 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

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

Table 14 - Noise at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq\ (15\ min)}$ *	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	▪ A strong justification would typically be required for works outside the recommended standard hours. ▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. ▪ For guidance on negotiating agreements see section 7.2.2.

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

Sensitive Land Use

Table 15 below (reproduced from Table 2 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 15 - Noise at Other Sensitive Land Uses Using Quantitative Assessment

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

7.2 Construction Noise Sources

The earthworks phase of construction would likely be the noisiest phase. Details of other phases such as construction of rides and buildings on site are not yet known.

For the earthworks phase, the likely equipment to be used by the contractor would include scrapers, bulldozers, trucks, rollers and ripping of the shale at lower levels of excavation. The geo technical studies for the site indicate that rock breaking and piling will probably not be necessary. Site access during construction will be from Reservoir Road at the proposed entrance position. Earthworks would likely take 2 - 3 months.

The following table lists construction plant and equipment likely to be used by the contractor to carry out the necessary earthworks for this project.

Table 16 - Typical Construction Equipment & Sound Power Levels

Plant Item	Plant Description	Sound Power Levels	
		Range	Typical Leq (Mid-Point)
6	Bulldozer	102 – 115	109
10	Scraper	107 – 112	110

Plant Item	Plant Description	Sound Power Levels	
		Range	Typical Leq (Mid-Point)
11	Front End Loader	107 – 112	110
16	Tracked Excavator	102 – 112	107
19	Dump Trucks	99 – 110	105
20	Rollers	97 – 110	104

The sound power levels for the majority of activities presented in the above table are based on maximum levels given in Table A1 of Australian Standard 2436 - 2010 "Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites", DECCW's 'NSW Interim Construction Noise Guideline', information from past projects and information held in our library files.

The sound power data within the column marked "Typical (Mid-Point)" has been used in this study to calculate typical noise levels at the nominated assessment locations.

7.3 Predicted Construction Noise Levels

Two of each construction plant has been assumed on the site concurrently during the earthworks phase. Equipment would move around the site which is reflected in the range of predicted noise levels presented in Table 17.

Table 17 – Predicted Construction Noise Levels

Receiver Location	L_{Aeq} Construction Noise	Noise Management Level
R1	54 – 68	55
R2	55 - 74	50

These predicted constriction noise levels exceed the management levels and therefore all reasonable and feasible noise management measures should be implemented. Noise management options are presented in Section 7.5 below. We note that these predicted noise levels are below 75dBA and therefore surrounding residences are not expected to be "highly affected" during the construction works.

Construction noise at the Coptic Church is not expected to be an issue since the church is far removed from the site and the key church activities are likely to be on Sundays when no construction activities are occurring.

7.4 Construction Vibration

Significant construction vibration during construction work is usually from items such as piling machines and rock hammers, of which there are none expected for this project. Furthermore, for the plant items that are to be used, buffer distances of approximately 30m are usually more than enough to prevent vibration impacts. Since the nearest residences are more than 40m away from where any heavy construction would occur, this buffer distance is easily achieved, and therefore vibration during construction is not expected to be an issue.

7.5 Construction Phase Recommendations

The following recommendations provide in-principle noise control solutions to reduce noise impacts to residential receivers. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site.

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

Table 18 below outlines a number of techniques and options for controlling construction noise and vibration, where considered reasonable and feasible.

Table 18 – Construction Noise and Vibration Management Options

Construction Noise and Vibration Management Options	
Source controls	
Time constraints	Limit work to daylight hours. Consider implementing respite periods with low noise/vibration-producing construction activities.
Scheduling	Perform noisy work during less sensitive time periods.
Equipment restrictions	Select low-noise plant and equipment. Ensure equipment has quality mufflers installed.
Emission restrictions	Establish stringent noise emission limits for specified plant and equipment. Implement noise monitoring audit program to ensure equipment remains within specified limits.
Substitute methods	Use quieter and less vibration emitting construction methods where possible.
Limit equipment on site	Only have necessary equipment on site.
Limit activity duration	Where possible, concentrate noisy activities at one location and move to another as quickly as possible. Any equipment not in use for extended periods during construction work should be switched off.
Equipment Location	Noisy plant and equipment should be located as far as possible from noise sensitive areas, optimising attenuation effects from topography, natural and purpose built barriers and materials stockpiles.
Site access	Vehicle movements outside construction hours, including loading and unloading operations, should be minimised and avoided where possible.

Equipment maintenance	Ensure equipment is well maintained and fitted with adequately maintained silencers which meet the design specifications.
Reduced equipment power	Use only necessary size and power.
Quieter work practices	For example, implement worksite induction training, educating staff on noise sensitive issues and the need to make as little noise as possible.
Reversing alarms	Consider alternatives, such as manually adjustable or ambient noise sensitive types ("smart" reversing alarms)
Path controls	
Noise barriers	Locate equipment to take advantage of the noise barriers provided by existing site features and structures, such as embankments and storage sheds.
Project Planning	Construction should be programmed so that noise barriers or mounding required to control noise are built as soon as possible.
Enclosures	Install noise-control kits for noisy mobile equipment and shrouds around stationary plant, as necessary.
Increased distance	Locate noisy plant as far away from noise-sensitive receptors as possible.
Site access	Select and locate site access roads as far away as possible from noise-sensitive areas.
Receptor controls	
Consultation	Community consultation, information, participation and complaint responses are essential aspects of all construction noise management programs. They typically involve: ▪ A community information program before construction and/or high risk activities are commenced. This usually involves a leaflet distribution and direct discussions and negotiations with affected residents, explaining the type, time and duration of expected noise emissions. ▪ The involvement of affected residents in the development of acceptable noise management strategies. ▪ A nominated community liaison officer with a contact telephone number. ▪ A complaints hotline. ▪ Timely responses to complaints, providing information on planned actions and progress towards the resolution of concerns.

Reference to Australian Standard 2436, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C of AS2436 presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C of AS2436 presents the relative effectiveness of various forms of noise control treatment.

Table 19 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 19 – Relative Effectiveness of Various Forms of Noise Control, dB(A)

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Noise Control Kits	Residential class mufflers & engine silencing	5 to 10	5 to 10	20	20
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	5 to 10	5 to 10	15	15
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 25	10 to 20	50	30
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this assessment.

Table 20 below identifies possible noise control measures, which are applicable on the construction plant likely to be used on site.

Table 20 – Noise Control Measures for Likely Construction Plant

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Dump Trucks	✔	x	✔	x
Excavator	✔	x	✔	x
Bulldozer	✔	x	✔	x

To ensure efficient noise attenuation performance is achieved using any of the methods listed above, it is recommended acoustic engineers work closely with the construction contractors and carry out preliminary testing prior to commencement of works.

A construction noise and vibration management plan should be implemented to avoid adverse noise and vibration disturbance to affected residences.

8 CONCLUSION

Renzo Tonin & Associates have completed an investigation of environmental noise impact from the proposed Wet 'n' Wild, Sydney onto surrounding sensitive receivers, to satisfy item 17 of the Director General's Requirements. Noise impact has been quantified and compared to relevant noise guidelines set by the NSW DECCW.

The findings of this study are:

Operational Noise

- Operational noise levels from the water park are generally expected to comply with the set criteria, with some minor exceedances of less than 5dBA possible during the extended trading hours after 10pm. An acoustic fence has been recommended to be constructed along the common boundary between the residence at 425 Reservoir Road and the car park / driveway to minimise noise impacts.
- Outdoor music events could cause significant noise impacts. Orientating stage and speakers so they face towards the M4 Motorway rather than towards residences could assist in minimising noise levels. Good communication such as notifying residents of scheduled events and providing a noise complaints contact phone number would also be important management measures.
- Provision should be made during the detailed design phase to incorporate noise mitigation measures into the plant room design, particularly for Plant Room 1 located behind the wave pool.

Traffic Noise

- Traffic noise along reservoir Road is predicted to increase by more than the allowable 2dBA as a result of site related traffic during the busiest periods, when compared to current levels of traffic noise in the area. However due to the planned future road link from Prospect Highway to Wetherill Park, and the resulting significantly increased traffic flows that expected in the area, Wet 'n' Wild traffic may not be such a significant contributor to overall traffic noise in the future. Traffic noise mitigation can be further considered as the project progresses, and as more information about the future development of the precinct becomes available.

Construction Noise & Vibration

- Construction noise levels during the bulk earthworks phase are predicted to exceed the set management levels at the nearest receivers; however no receivers are predicted to be "highly affected". Noise management measures have been recommended at should be implemented during the construction phase where reasonable and feasible.

- Due to the significant distances between large construction plant and adjacent residences, vibration emission during the construction phase is not expected to be an issue.

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 $\mathbf{L_{90}}$ 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 Martin Place 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 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 - CONCEPT PLANS

LEGEND

1. ENTRY PLAZA
2. TURNSTILES
3. GUEST SUPPORT
4. TICKETING/ GROUP SALES (UNDER CANOPY)
5. PARK ENTRY OVERVIEW
6. GROUP ENTRY
7. GUEST SERVICES/FIRST AID
8. RETAIL SHOP/PARK EXIT
9. CHANGE ROOMS /SHOWERS/ LOCKERS/ RESTROOMS
10. RENTALS
11. MAIN FOOD SERVICE
12. DINING AREA UNDER SHADE CANOPY
13. 'ALL YOU CAN EAT' DINING
14. CENTRAL OVERLOOK PLAZA
15. TUBE STORAGE
16. RIVER BEACH ENTRY/EXIT
17. GROUP PICNIC PAVILIONS
18. FOOD & BEVERAGE SERVICES
19. SPECIAL EVENTS LAWN
20. LAZY/ADVENTURE RIVER
21. EXTREME RIVER
22. RIVER GROTTO/WATERFALLS
23. RIVER WAVE EQUIPMENT
24. TOTS ISLAND SLIDES POOL
25. TOTS ISLAND GIANT SPRAY PAD
26. GIANT RAINFORTRESS WATERPLAY ON WET DECK
27. SAILS FABRIC SHADE STRUCTURE
28. FAMILY DOUBLE PYTHON AND FAMILY RAFT RIDE
29. WHIZZARD MAT RACER (6 LANES)
30. DUELING MASTER BLASTER TUBE RIDE
31. DOUBLE AQUALOOP,FREELOOP AND FREEFALL COMPLEX
32. DOUBLE FLOW RIDER
33. BEER GARDEN
34. FAST FOOD
35. 'BOOMERANG BAY' SURF WAVE POOL
36. TERRACED SAND BEACH LOUNGING
37. RENTAL CABANAS
38. SMOKING AREA
39. SKY COASTER
40. PLAZA WITH ICONIC GIANT GEYSER
41. WATER WALKWAY WITH INTERACTIVE SPRAYS
42. LOUNGING SHADE STRUCTURES
43. SLOPING LAWN
44. INNERTUBE SLIDES (6 FLUMES) W/ SUPERBOWL/ RATTLER/HIGH-SPEED DROP/CONSTRICTOR
45. FAMILY BOOMERANGO AND ABYSS RAFT RIDE
47. MECHANICAL SPACE
48. ADMINISTRATION AND STAFF
49. MAINTENANCE/STORAGE/SERVICE AREA
50. ZIP LINE

DESIGNED BY: JR	DATE: JAN10, 2011	PROJ. ENG. CHECK:	DATE:
DRAWN BY:	DATE:	DRAFTING CHECK:	DATE:
SCALE: 1:2000		ARCHIVE FILE No:	

NOTE:- METRIC DIMENSIONS
ALL ELEVATIONS AND CO-ORDINATES ARE IN METRES
ALL OTHER DIMENSIONS ARE IN MILLIMETRES

WHITE WATER
WhiteWater West Industries Ltd
6700 McMillan Way, Richmond, B.C. Canada V6W 1J7
Tel (604) 273-1068 Fax (604) 273-4518

PRELIMINARY
NOT FOR CONSTRUCTION

OVERALL SITE PLAN

WET 'n' WILD WATERPARK
SYDNEY, AUSTRALIA

PROJECT No.	DRAWING No.	REVISION
16156	SD-1	-

O C U L U S
level 1, 5 wilson street / post box 307 **newtown** nsw 2042
p 02.9557.5533 f 02.9519.8323 mail@oculus.com.au
LANDSCAPE ARCHITECT

DATE	DESCRIPTION	REV
01.12.10	FOR REVIEW	A
01.12.10	FOR REVIEW	B
17.12.10	FOR REVIEW	C
-	-	-
-	-	-
-	-	-

DATE	DESCRIPTION	REV
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

REVISIONS

CLIENT
PROSPECT AQUATIC INVESTMENTS
Suite 1, 121 Holterman Street
Crows Nest NSW 2065

ARCHITECT
-

PROJECT
WET 'N' WILD SYDNEY
Reservoir Road
Prospect NSW

DRAWING TITLE
LANDSCAPE MASTER PLAN
CAR PARK LAYOUT

DRAWING INFORMATION

NORTH	SCALE	1:1000 @ A1	DRAWN BY	LB	DRAWING NO.
	DATE	14.01.2011	CHECKED BY	RJ	SK-L-01
	JOB NO.	S10-038	APPROVED BY	RJ	
	FILENAME	N/A			

PURPOSE OF DRAWING
SKETCH DESIGN

APPENDIX C - NOISE MONITORING METHODOLOGY

C.1 Noise Monitoring Equipment

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

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

C.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. The correction factor applied to the data was taken from *Australian Standard AS1170.2 1989 Section 4.2.5.1*.

C.3 Noise vs Time Graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10}, L_{90}, and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time. The 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 in Appendix D illustrate these concepts.

APPENDIX D - NOISE MONITORING GRAPHS

RENZO TONIN & ASSOCIATES
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website: www.renzotonin.com.au

noise logger results

24 Watchouse Road - Front Yard

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

	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Day	Day	Evening	Night	Day	Evening	Night
Monday-08-November-2010	-	-	47	-	-	54
Tuesday-09-November-2010	49	50	43	54	56	50
Wednesday-10-November-2010	48	50	45	54	54	51
Thursday-11-November-2010	47	51	45	52	54	52
Friday-12-November-2010	47	49	44	53	53	50
Saturday-13-November-2010	46	47	42	53	51	47
Sunday-14-November-2010	45	46	40	52	52	48
Monday-15-November-2010	-	47	40	-	51	48
Tuesday-16-November-2010	46	48	39	53	52	47
Wednesday-17-November-2010	-	-	-	-	-	-
Representative Level	**47**	**48**	**43**	**53**	**53**	**50**

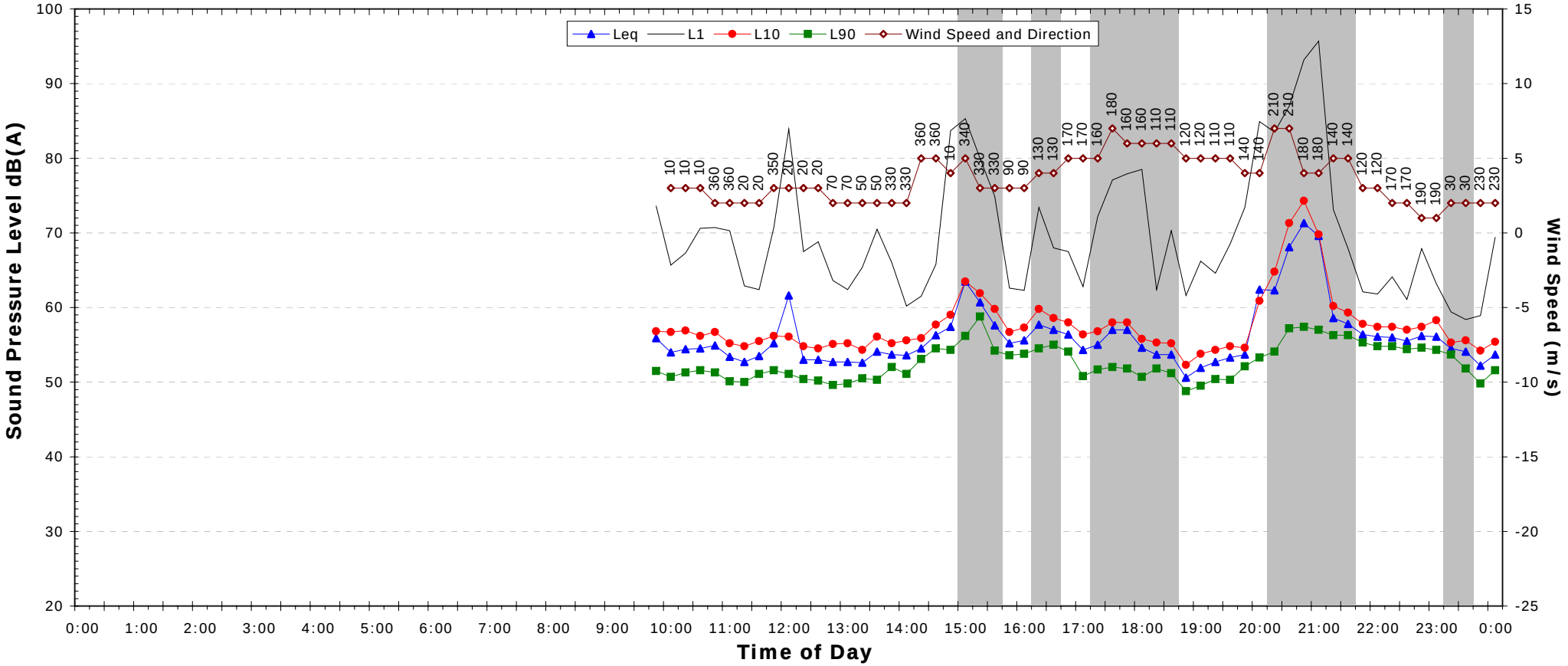
Notes:

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. Partial day's monitoring
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Monday, 8 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	47.0
Leq (see note 3)	-	-	54.3

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

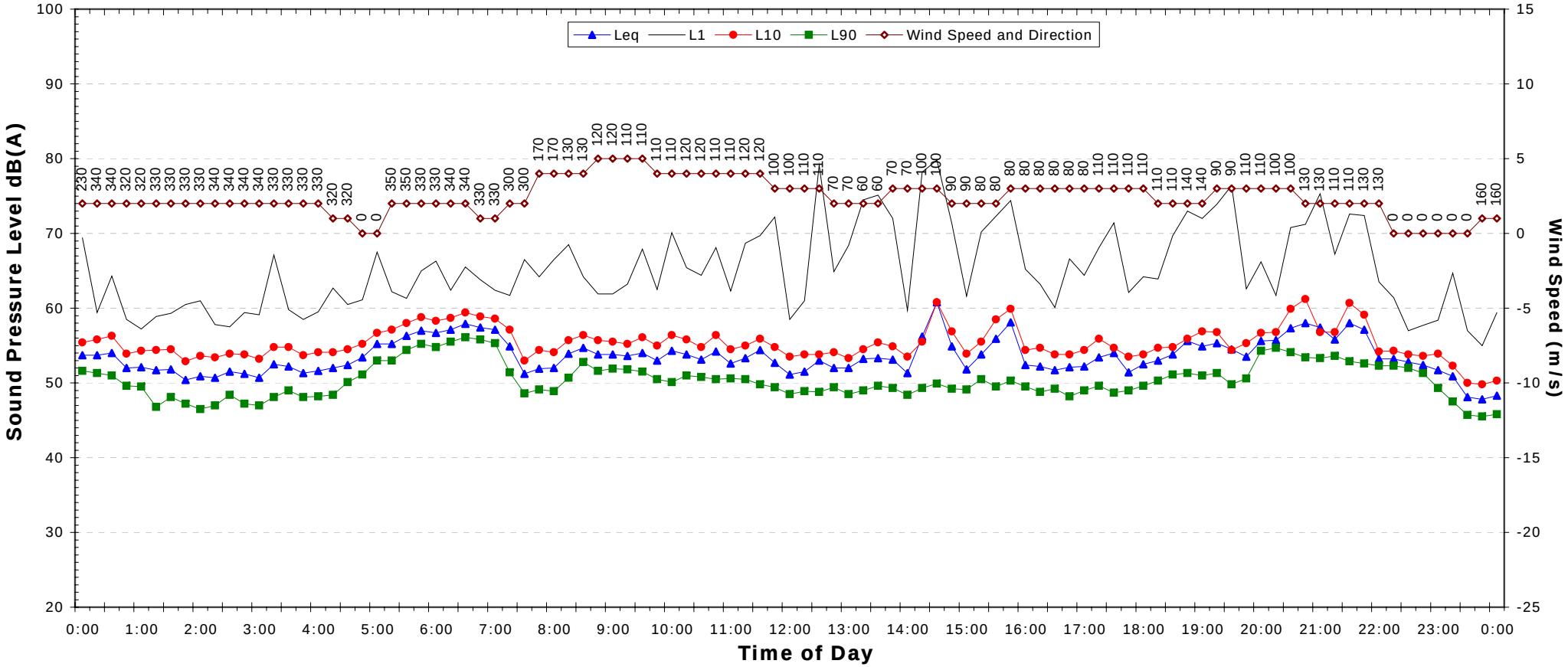
3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Tuesday, 9 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	48.6	50.3	42.8
Leq (see note 3)	53.9	55.8	50.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

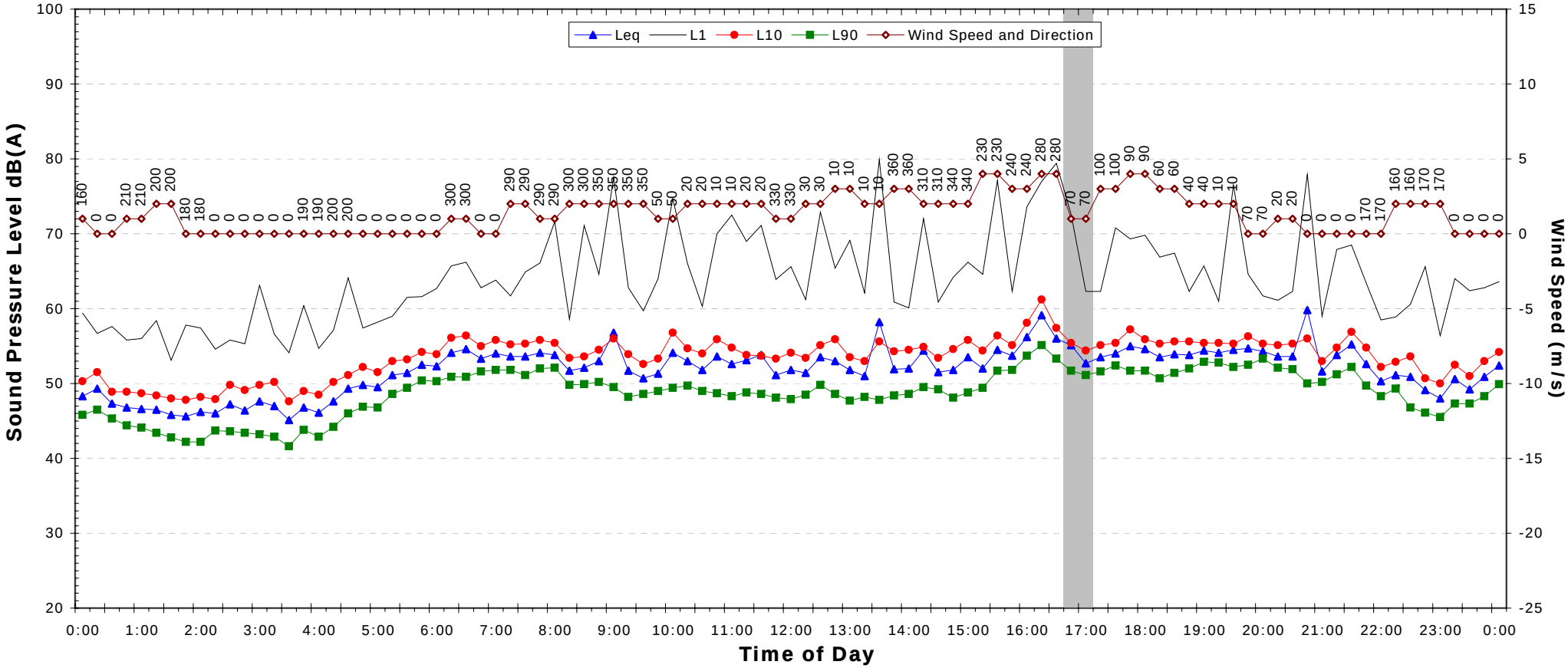
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Wednesday, 10 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	48.1	49.7	45.1
Leq (see note 3)	53.8	54.5	51.3

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

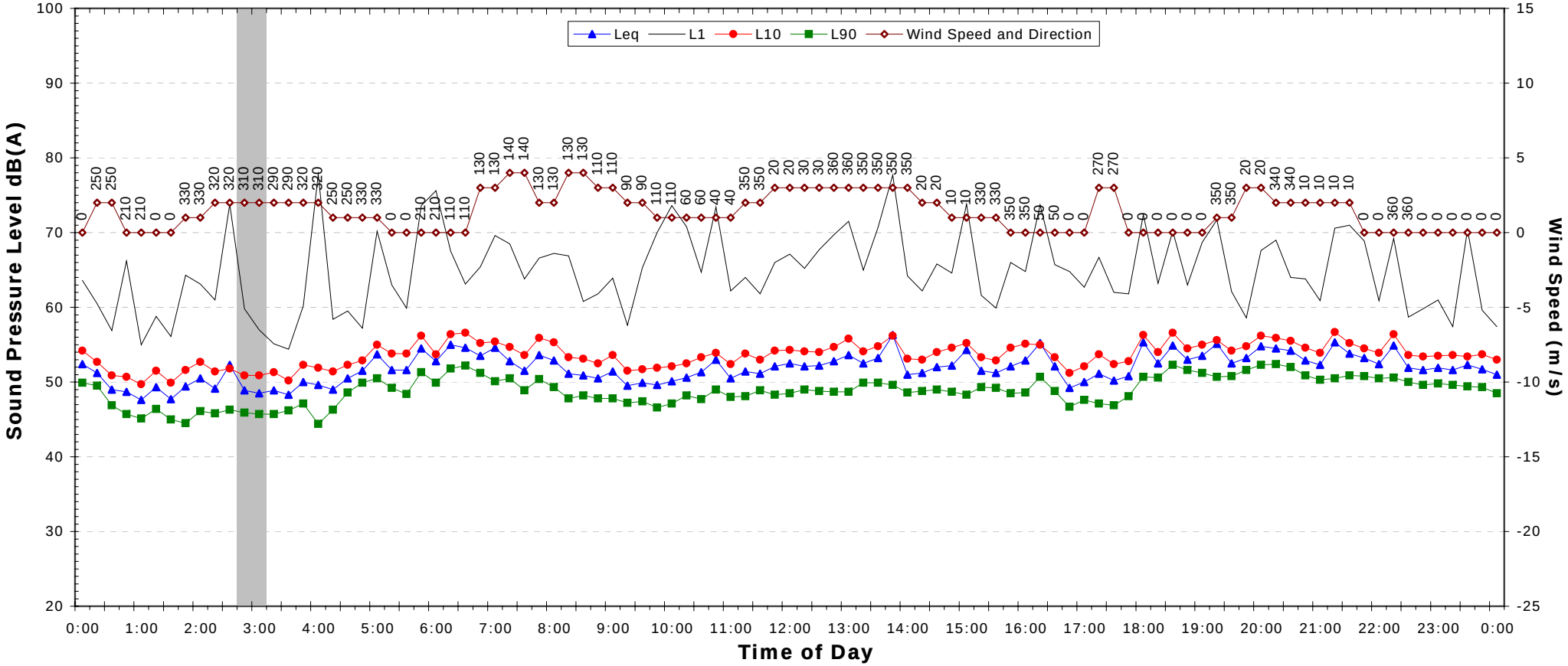
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Thursday, 11 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	47.1	50.5	45.4
Leq (see note 3)	52.1	53.7	52.0

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

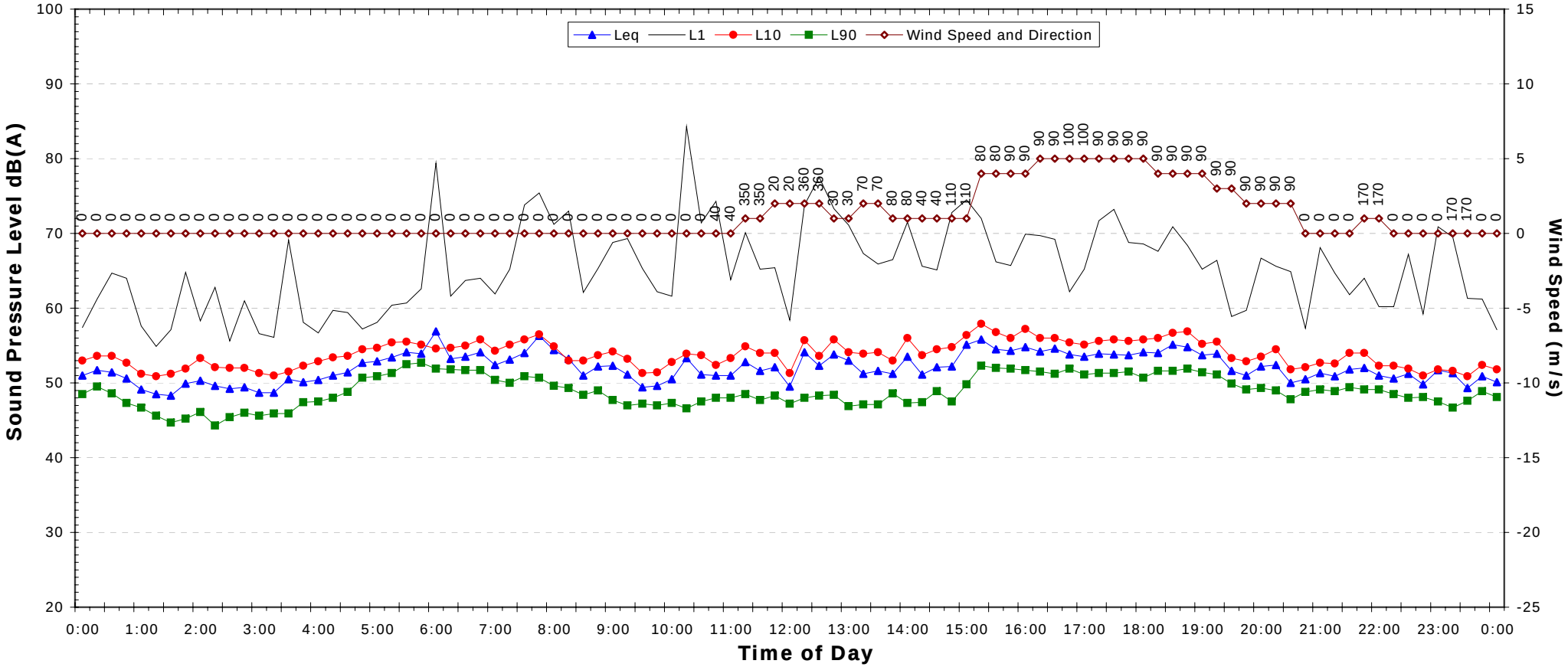
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Friday, 12 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	47.1	48.8	44.2
Leq (see note 3)	53.1	52.5	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 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)

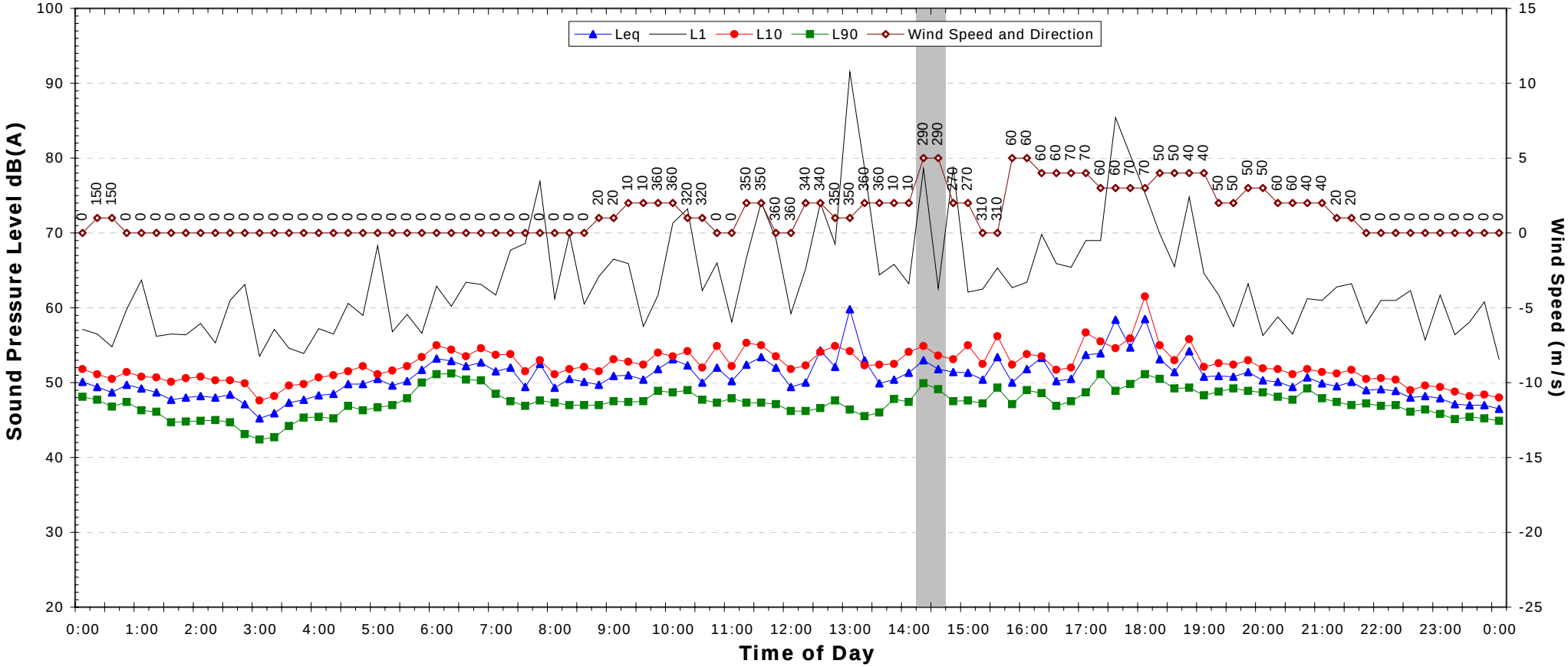
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Saturday, 13 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	46.4	47.0	41.6
Leq (see note 3)	52.9	50.9	47.4

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)

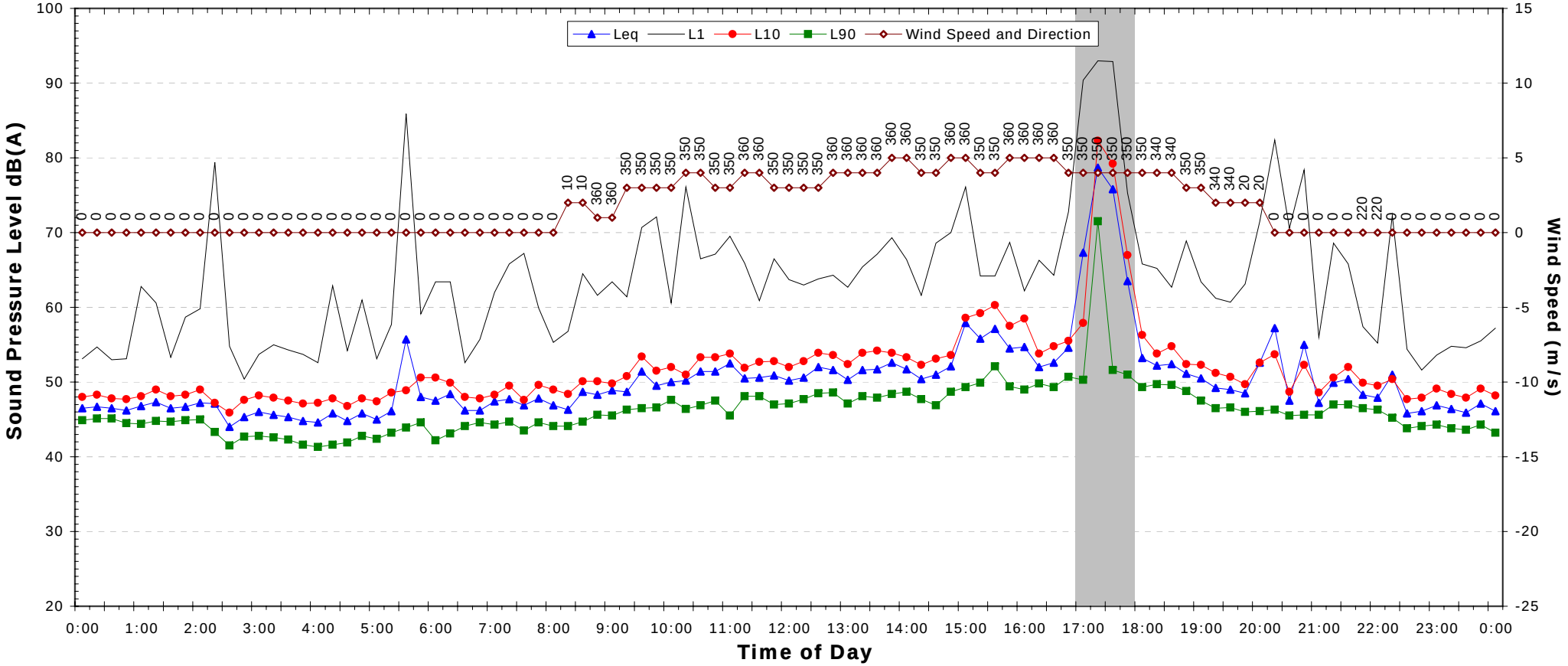
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Sunday, 14 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.7	45.6	39.7
Leq (see note 3)	52.0	51.5	47.9

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)

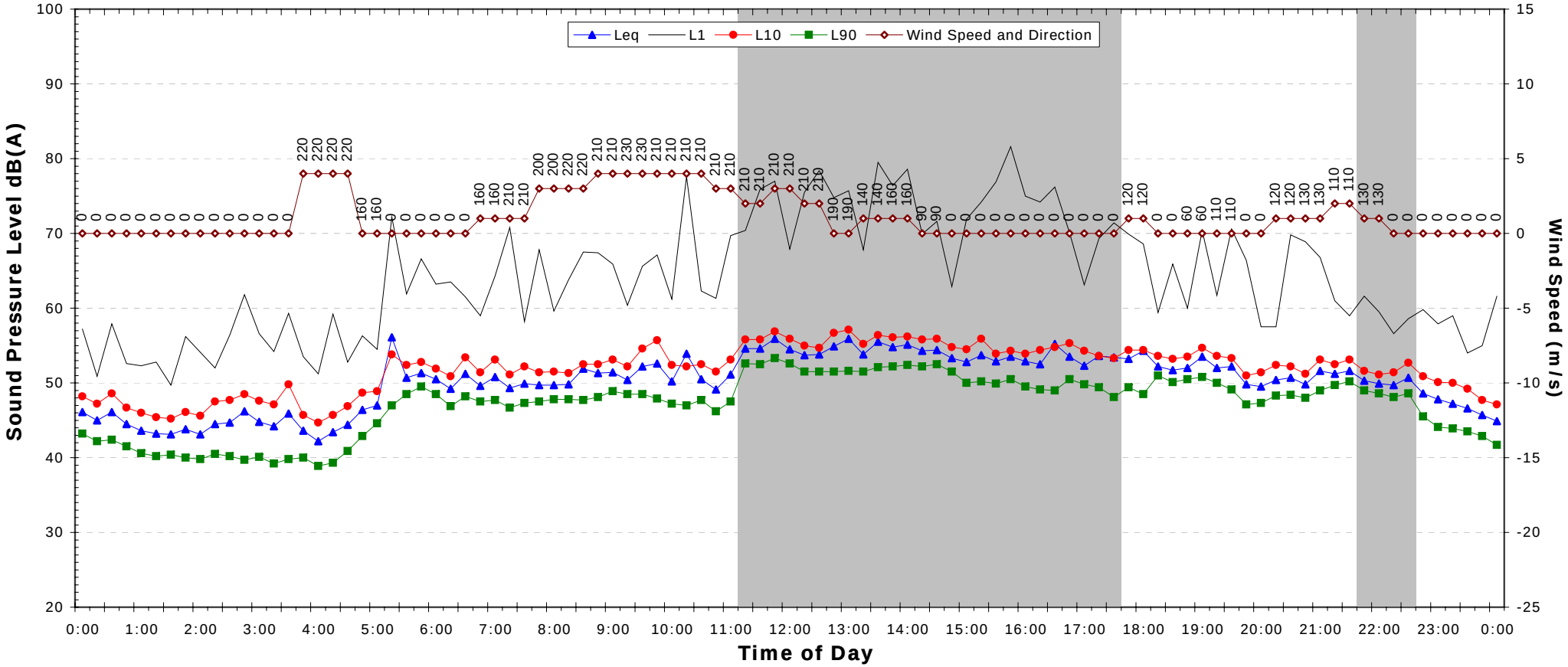
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Monday, 15 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	47.3	39.6
Leq (see note 3)	-	51.4	47.9

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)

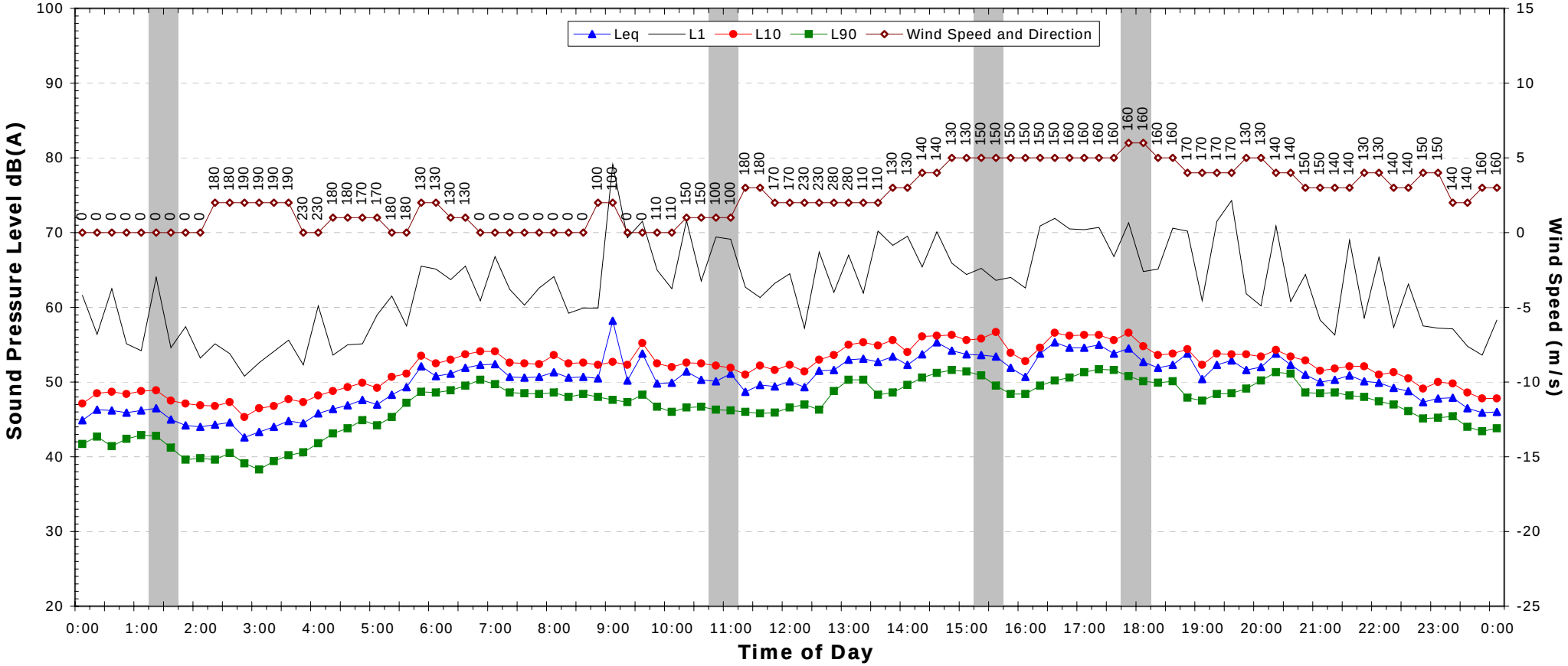
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Tuesday, 16 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	46.0	47.5	39.0
Leq (see note 3)	52.7	51.8	47.3

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

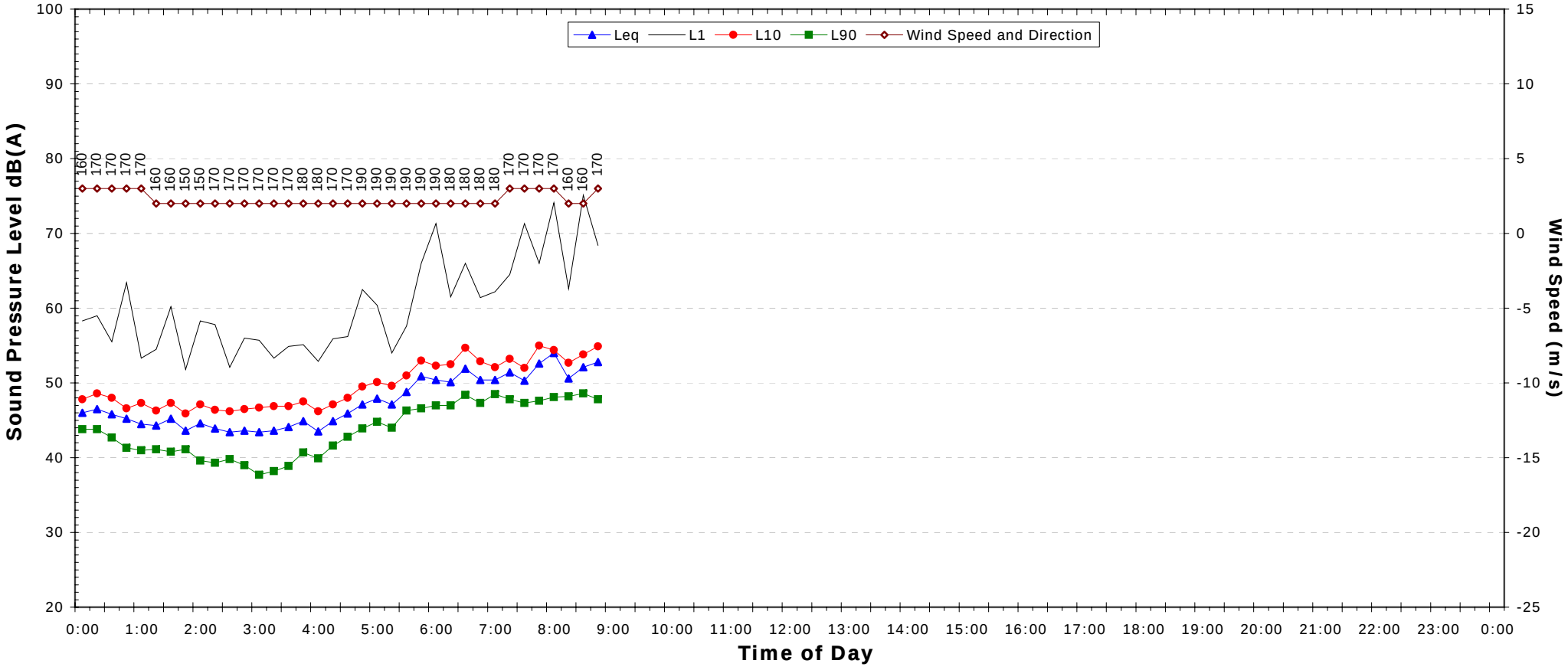
Data File: TF070-01S01 RTA-01 #036 (rev 0).xls TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

24 Watchouse Road - Front Yard

Wednesday, 17 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	-
Leq (see note 3)	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

Data File: TF070-01S01 RTA-01 #036 (rev 0).xls

TF070-01S01 (Rev 0) 24 Watchouse.xls

Template QTT-01 (rev 60) Logger Graphs

RENZO TONIN & ASSOCIATES
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website: www.renzotonin.com.au

noise logger results

431 Reservoir Rd - Front Yard

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

	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Day	Day	Evening	Night	Day	Evening	Night
Friday-05-November-2010	-	40	-	-	56	-
Saturday-06-November-2010	46	40	34	58	56	53
Sunday-07-November-2010	41	46	39	60	58	58
Monday-08-November-2010	-	-	41	-	-	59
Tuesday-09-November-2010	48	47	36	61	59	65
Wednesday-10-November-2010	44	43	37	61	59	60
Thursday-11-November-2010	44	46	39	60	57	57
Friday-12-November-2010	45	44	36	61	60	56
Saturday-13-November-2010	44	46	35	61	59	60
Sunday-14-November-2010	44	42	31	59	53	56
Monday-15-November-2010	-	50	32	-	58	61
Tuesday-16-November-2010	43	44	34	62	56	58
Wednesday-17-November-2010	-	-	-	-	-	-
Representative Level	**44**	**44**	**36**	**61**	**58**	**60**

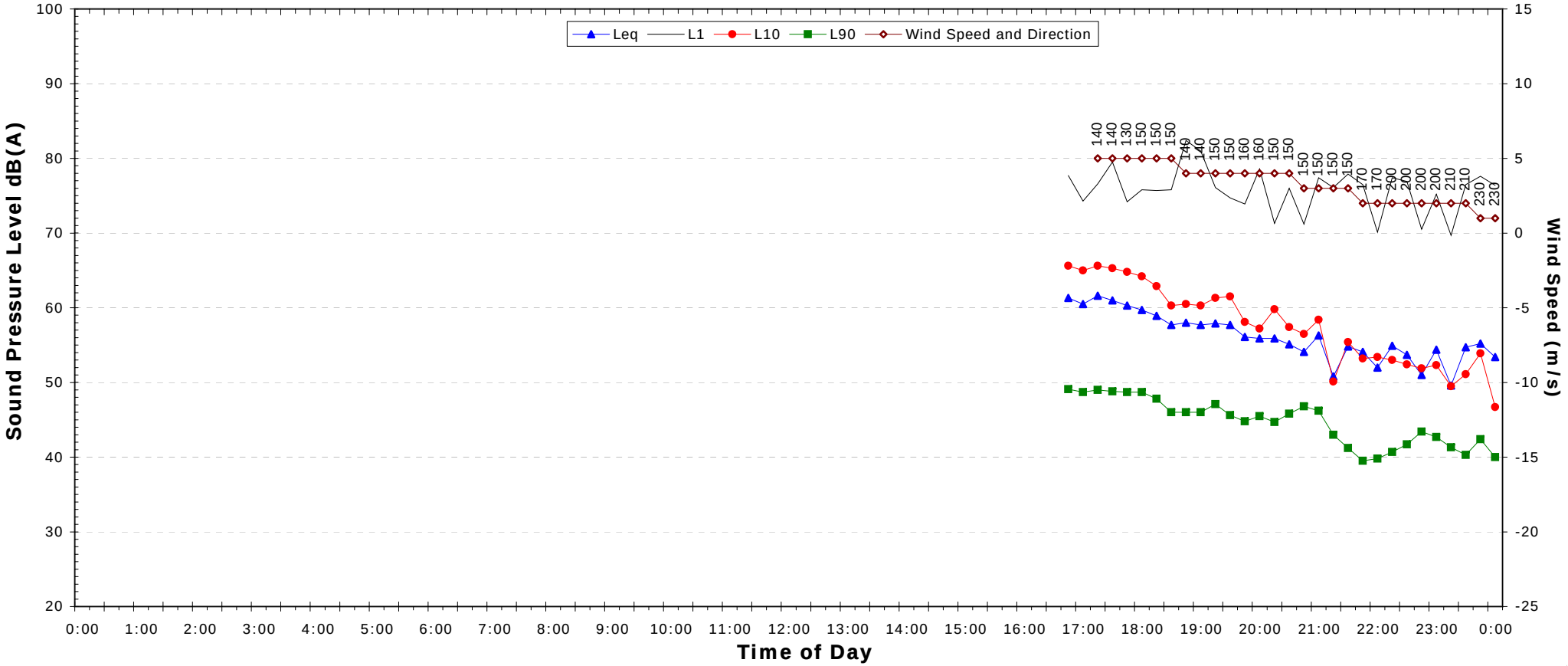
Notes:

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. Partial day's monitoring
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Friday, 5 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	39.8	-
Leq (see note 3)	-	56.3	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

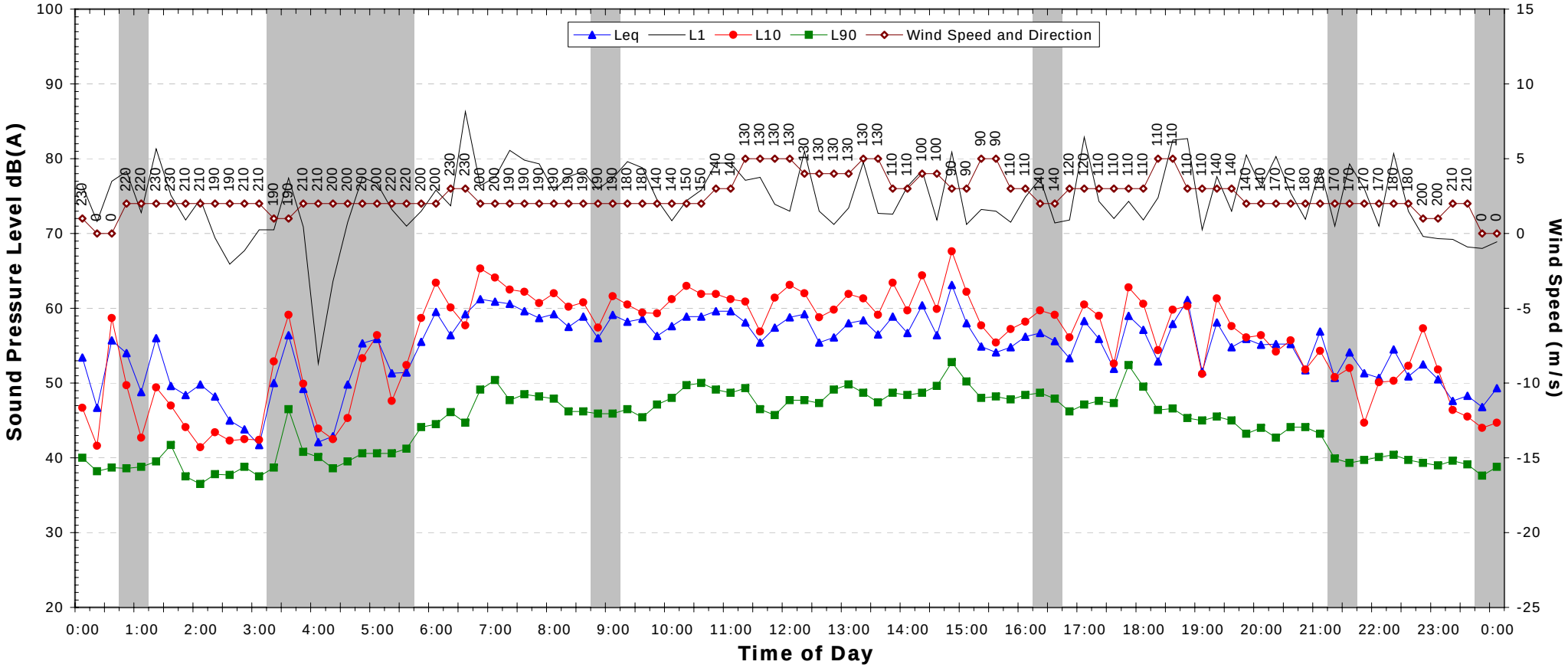
3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Saturday, 6 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	46.2	40.1	34.1
Leq (see note 3)	58.1	55.9	53.1

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: TF070-01S02 RTA-01 #017.xls

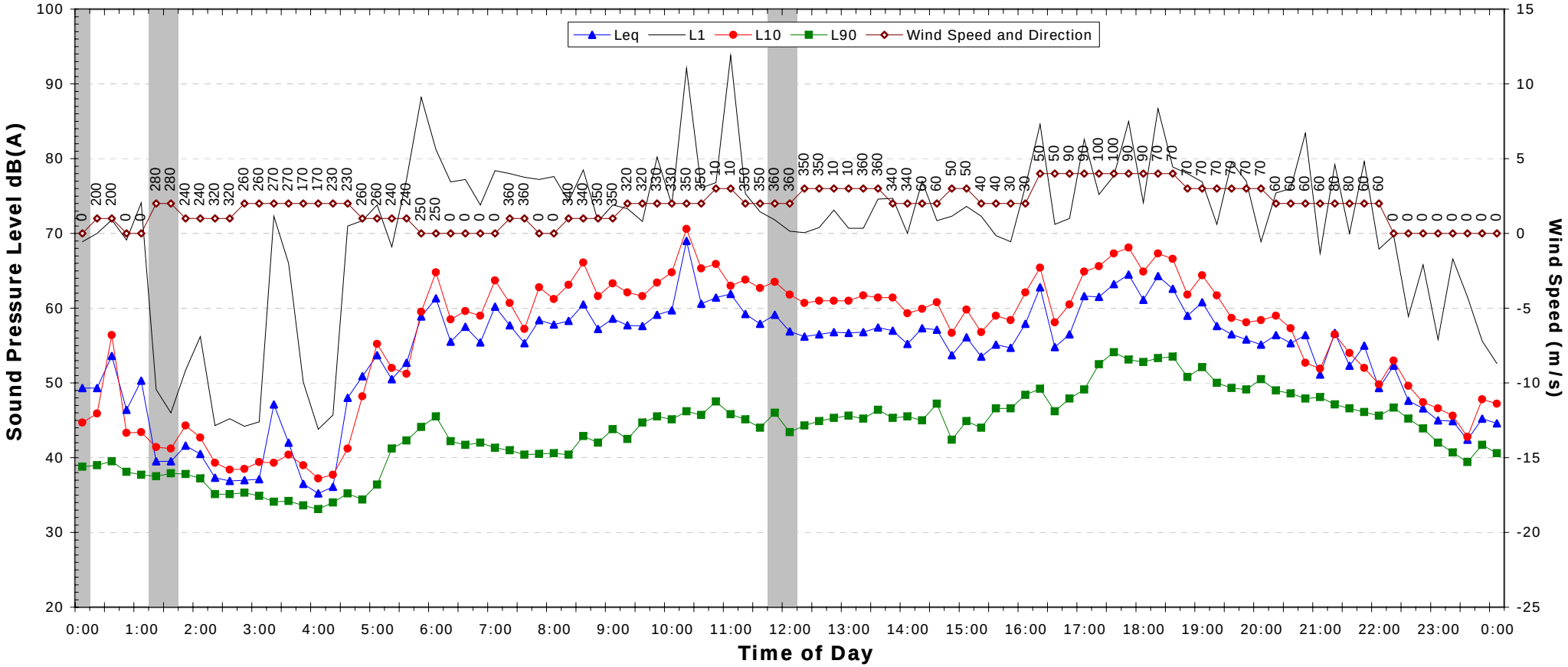
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Sunday, 7 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	41.0	46.1	39.0
Leq (see note 3)	59.8	58.2	58.0

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

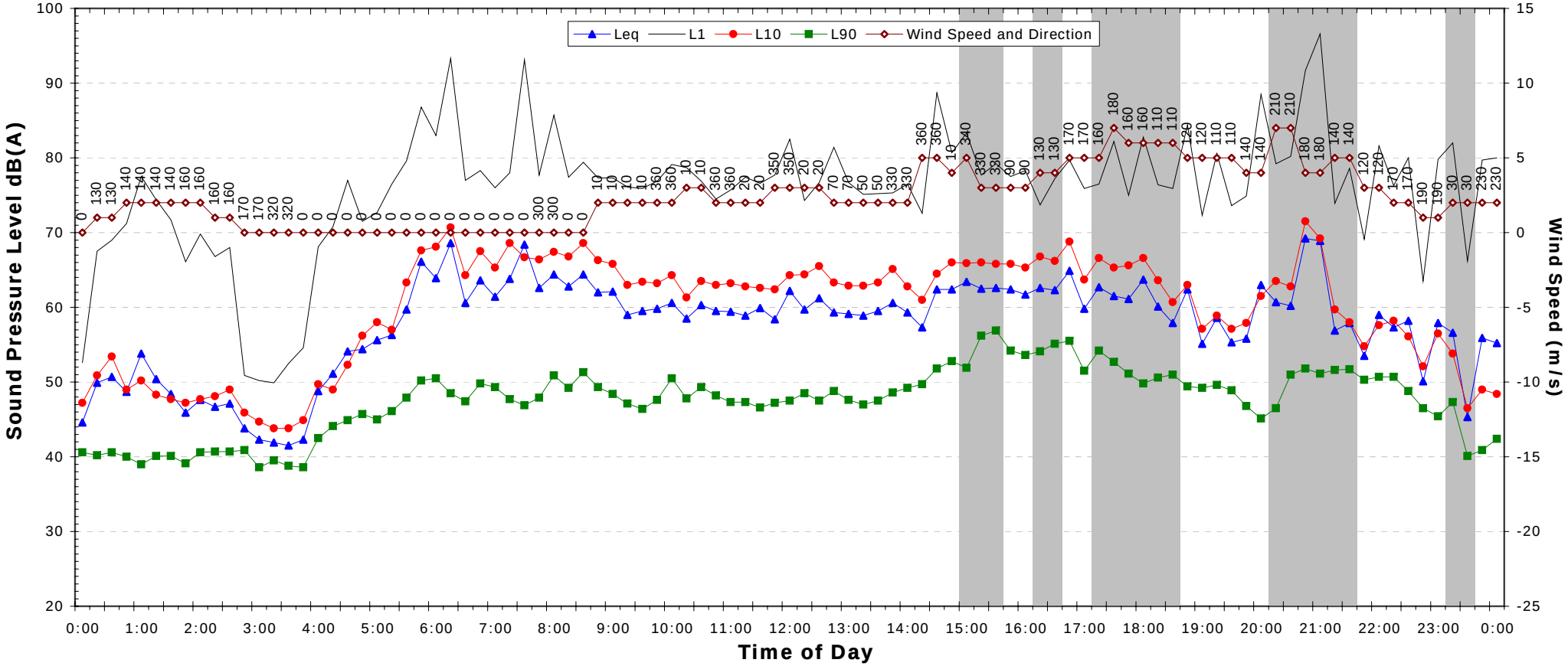
3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Monday, 8 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	40.5
Leq (see note 3)	-	-	58.6

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: TF070-01S02 RTA-01 #017.xls

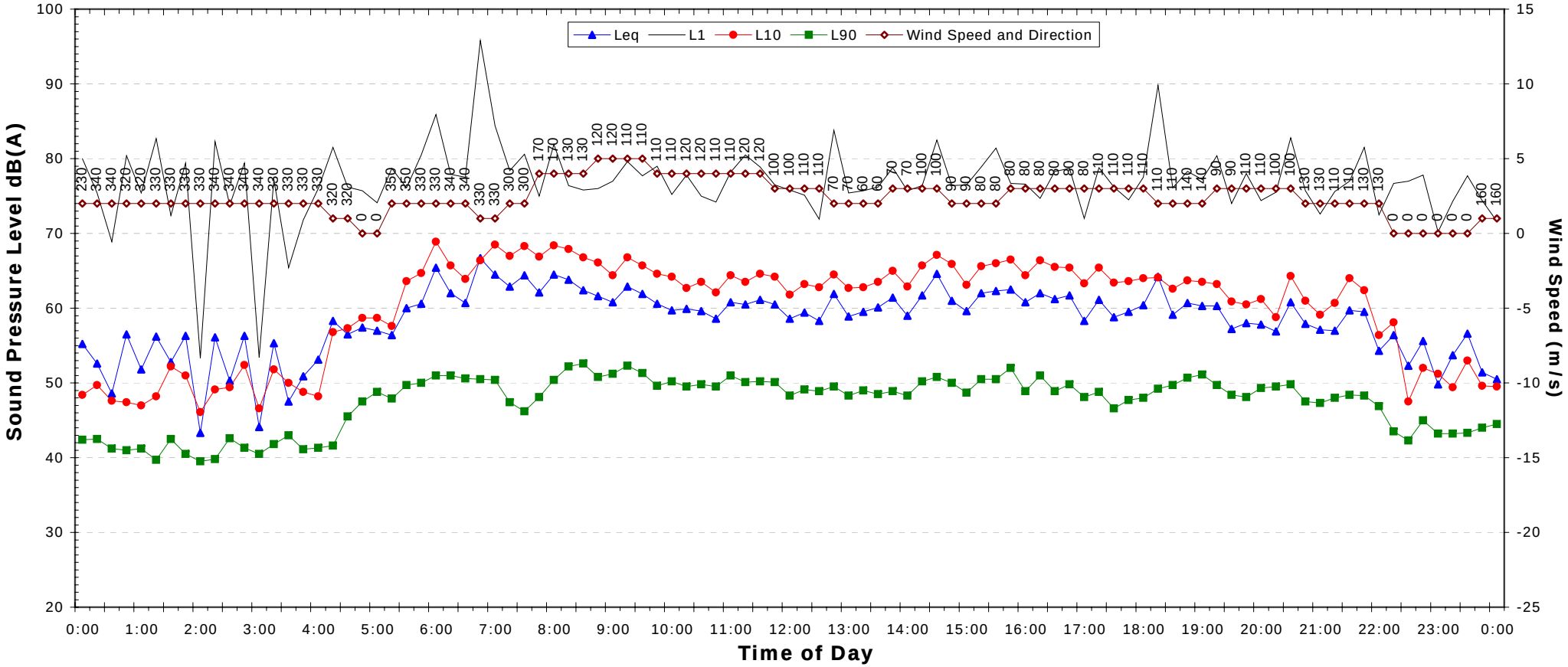
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Tuesday, 9 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	48.0	47.3	36.4
Leq (see note 3)	61.3	59.4	64.9

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: TF070-01S02 RTA-01 #017.xls

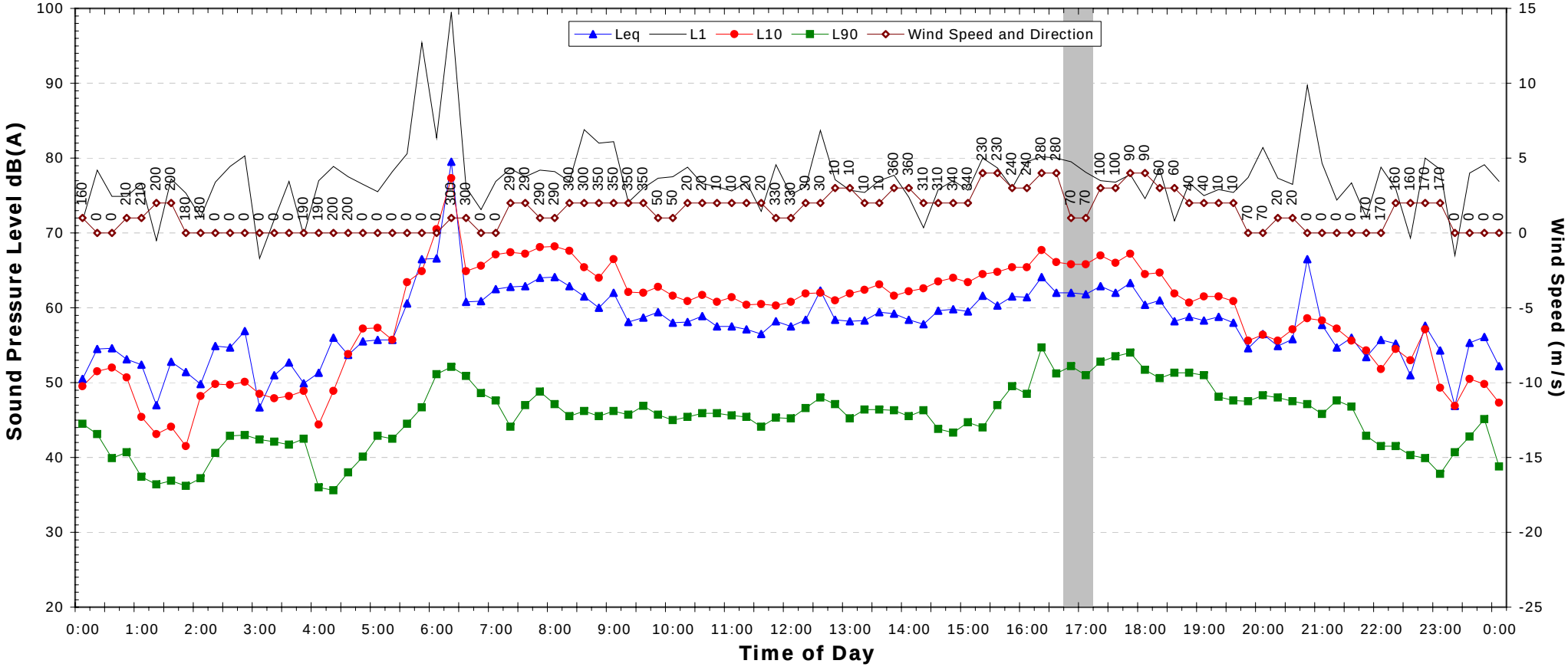
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Wednesday, 10 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.1	42.9	37.2
Leq (see note 3)	60.7	58.9	59.6

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: TF070-01S02 RTA-01 #017.xls

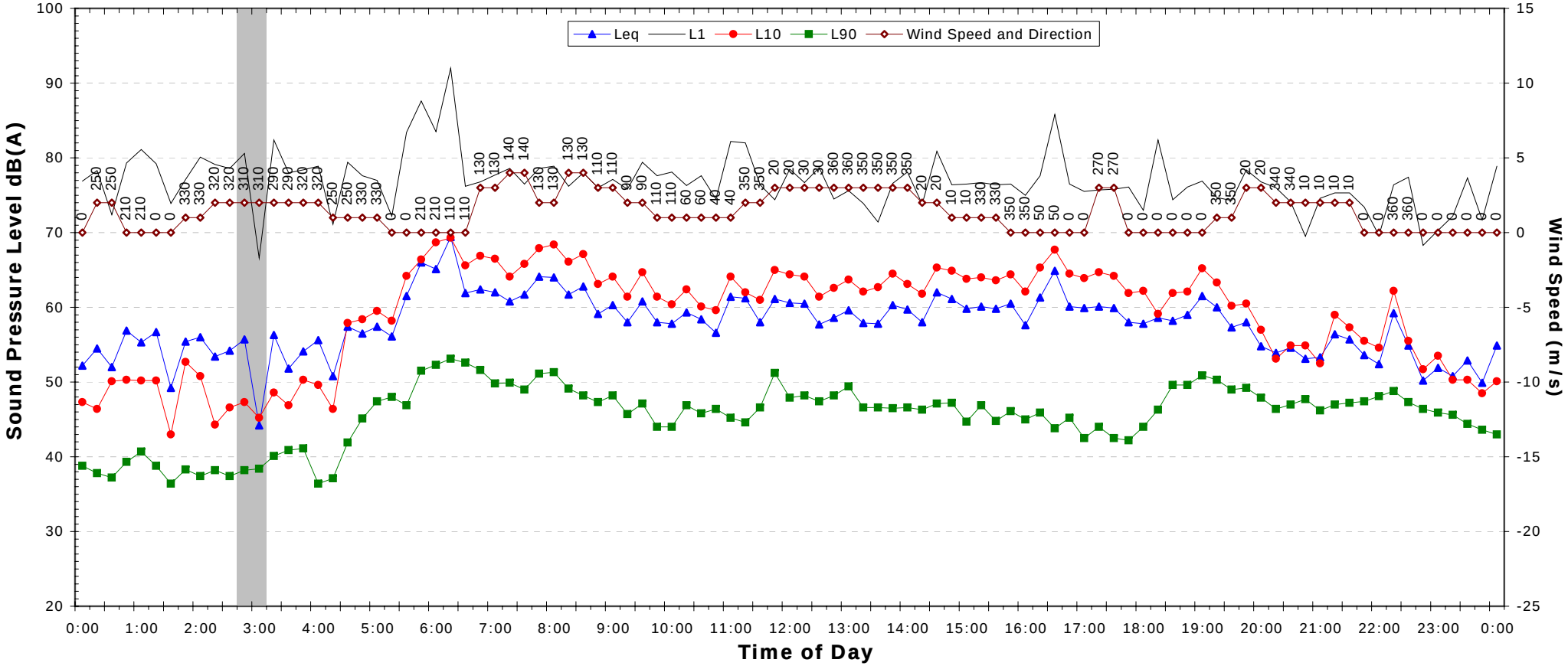
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Thursday, 11 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.0	46.3	39.4
Leq (see note 3)	60.4	57.1	56.8

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

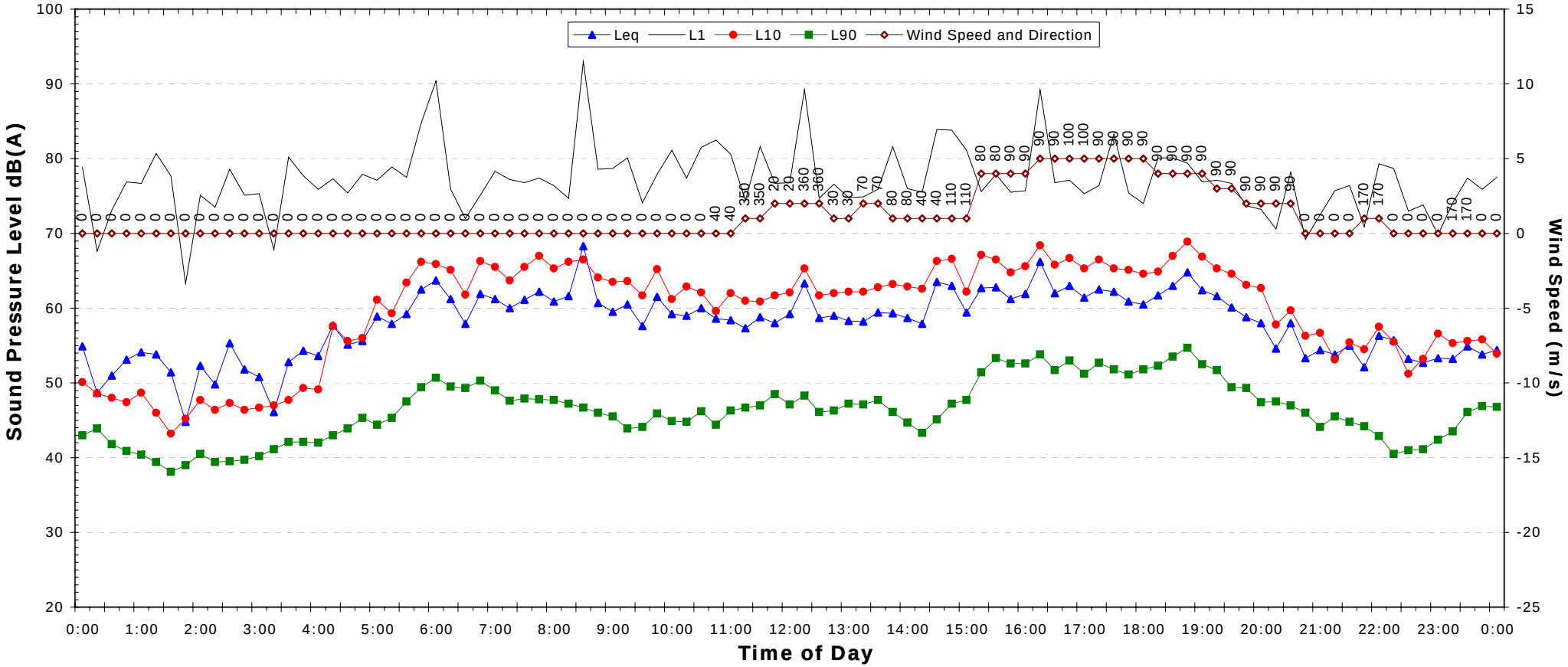
3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Friday, 12 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.7	44.1	35.9
Leq (see note 3)	61.4	59.6	55.7

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: TF070-01S02 RTA-01 #017.xls

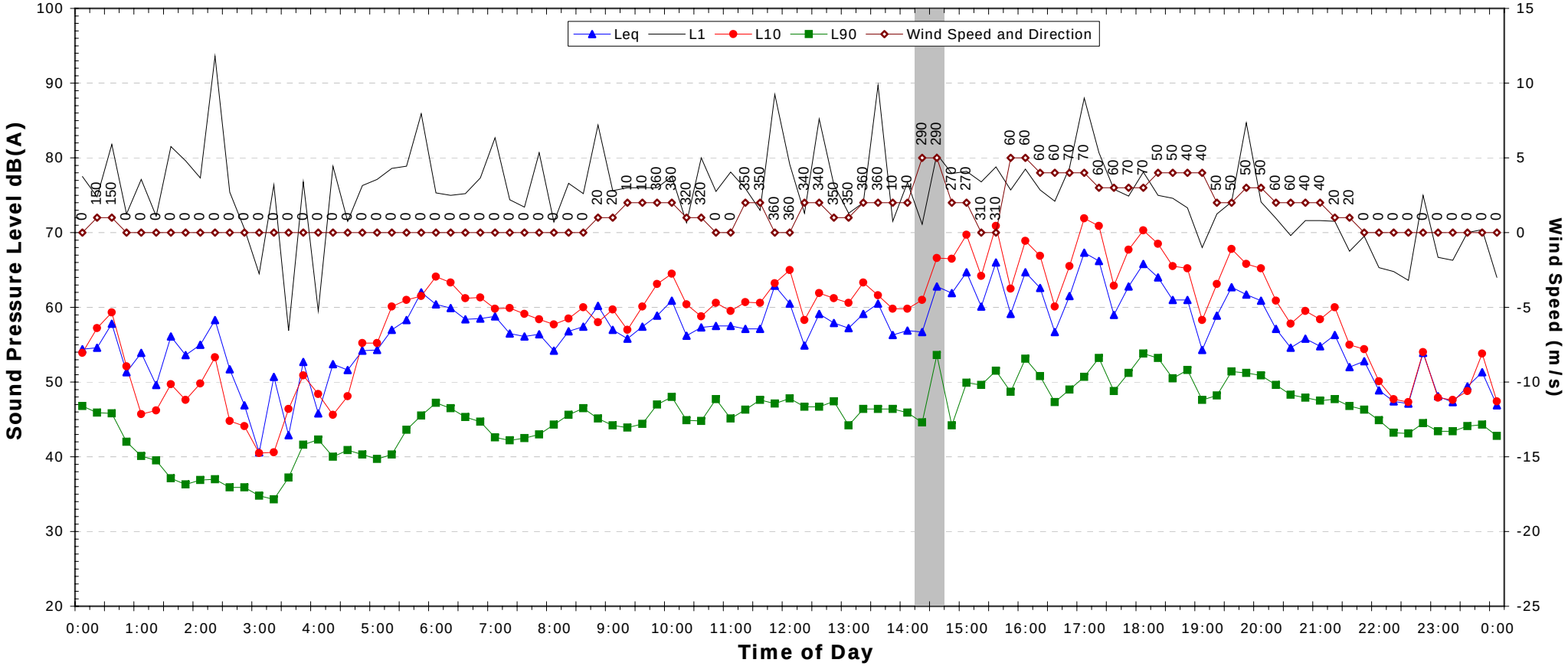
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Saturday, 13 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.2	46.3	35.3
Leq (see note 3)	60.9	59.1	60.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

Data File: TF070-01S02 RTA-01 #017.xls

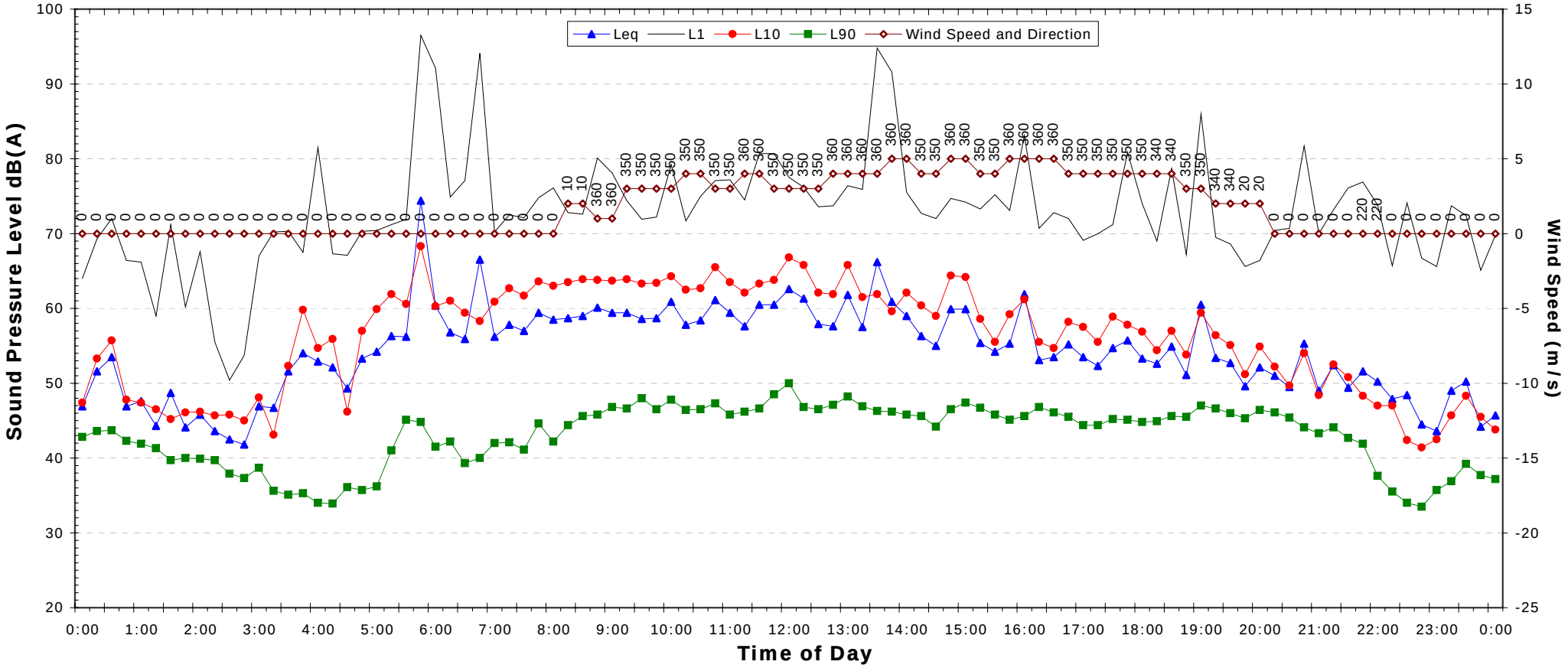
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Sunday, 14 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.4	41.9	30.7
Leq (see note 3)	59.1	53.5	56.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

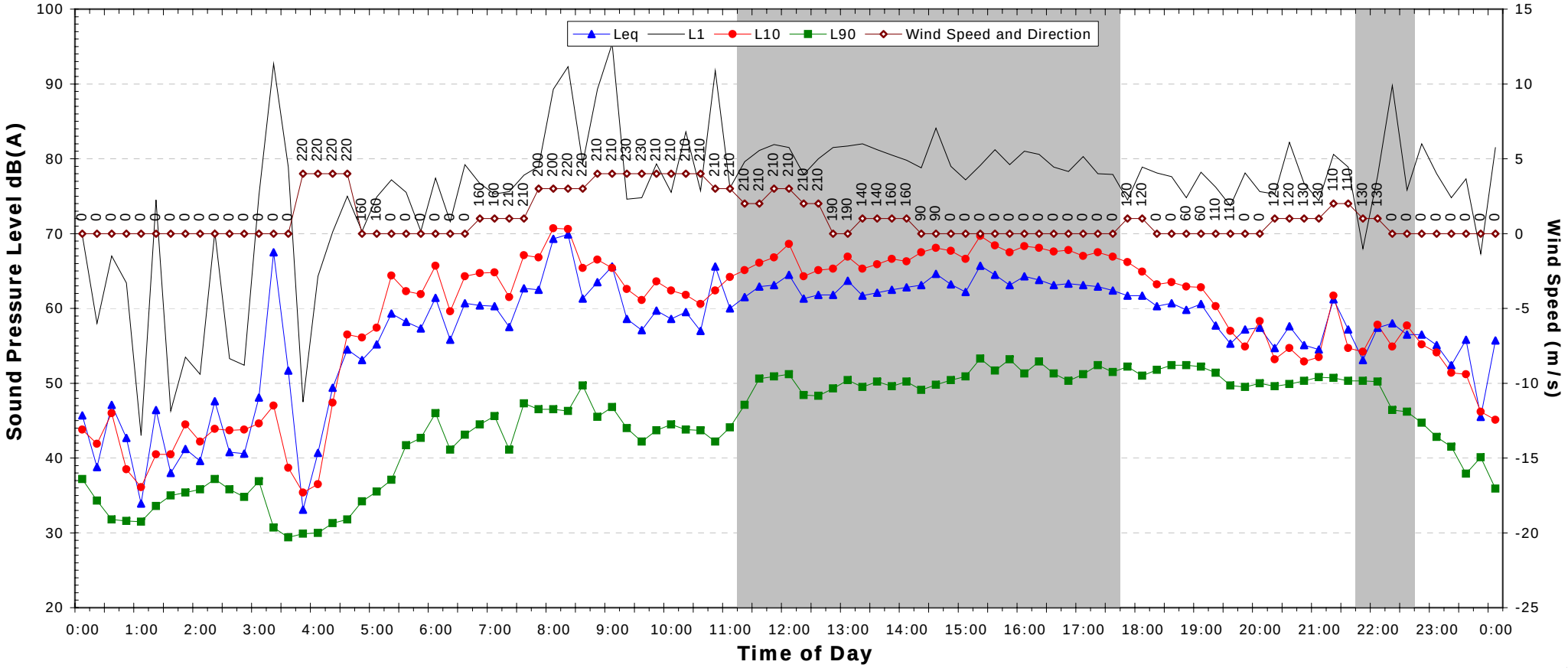
3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Monday, 15 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	49.6	31.6
Leq (see note 3)	-	58.4	61.5

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: TF070-01S02 RTA-01 #017.xls

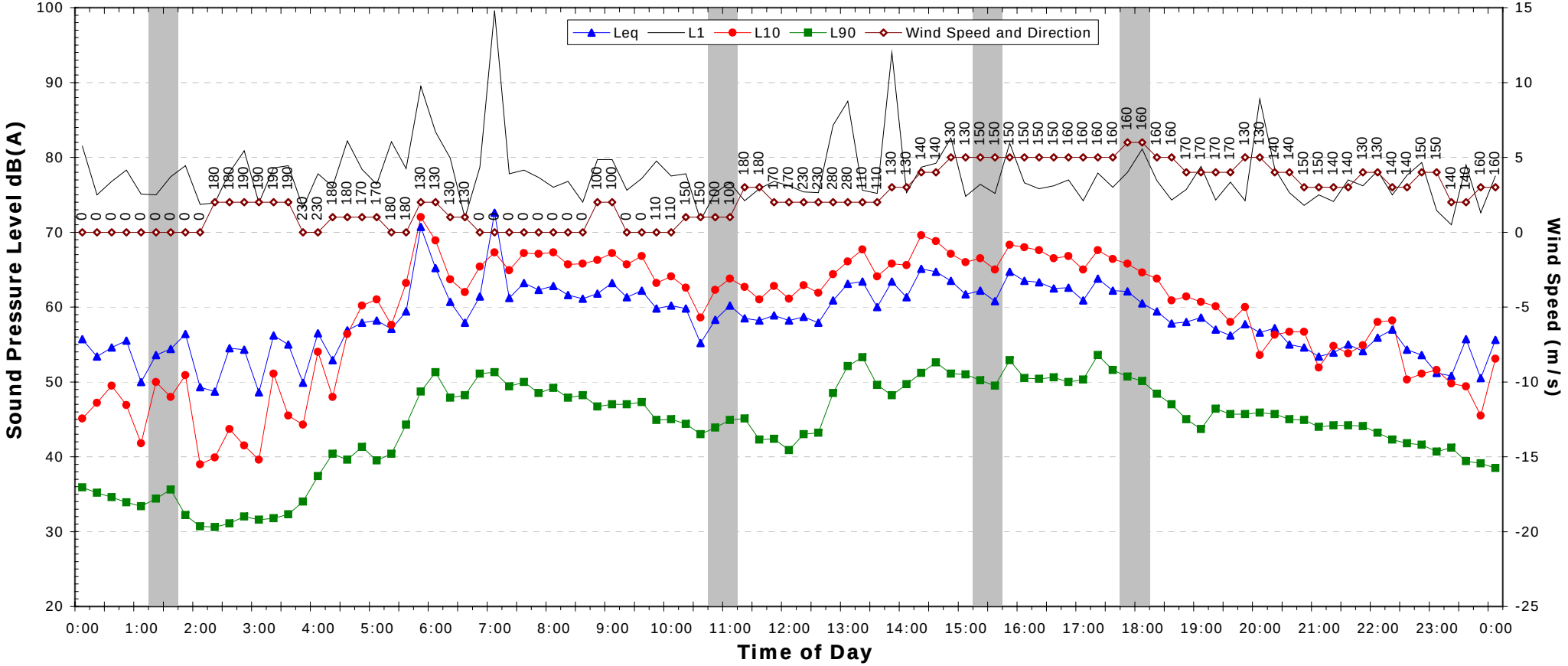
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Tuesday, 16 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	43.0	43.7	34.3
Leq (see note 3)	61.7	55.8	58.1

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: TF070-01S02 RTA-01 #017.xls

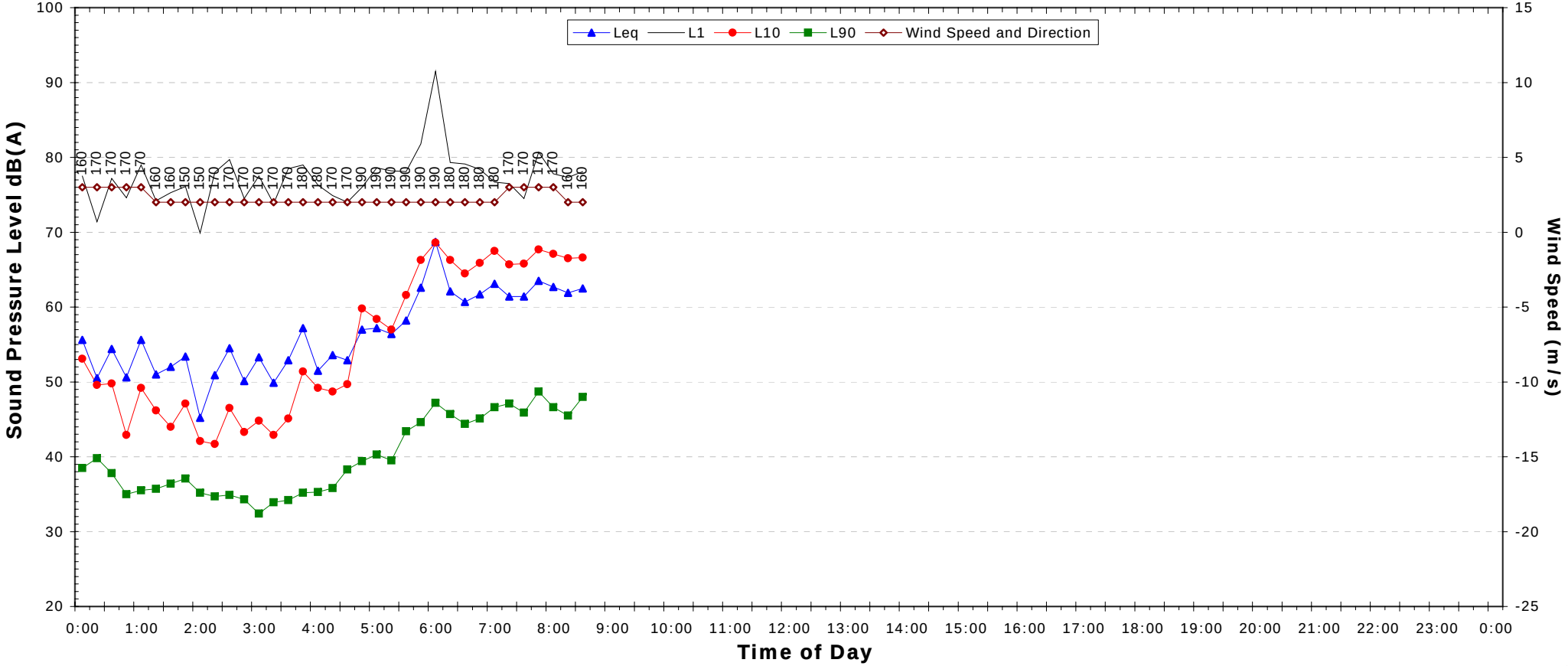
TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs

EXISTING AMBIENT NOISE LEVELS

431 Reservoir Rd - Front Yard

Wednesday, 17 November 2010



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	-
Leq (see note 3)	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

Data File: TF070-01S02 RTA-01 #017.xls

TF070-01S01 (rev 0) 431 Reservoir

Template QTT-01 (rev 60) Logger Graphs