ACOUSTICS AND AIR

BUNNINGS BONNYRIGG

DA NOISE ASSESSMENT

REPORT NO. 14238
VERSION A

FEBRUARY 2015

PREPARED FOR

BUNNINGS GROUP PTY LTD
C/- JOHN R BROGAN & ASSOCIATES PTY LTD
37 PITT STREET
SYDNEY NSW 2000

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	6 February 2015	George Jenner	Brian Clarke

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

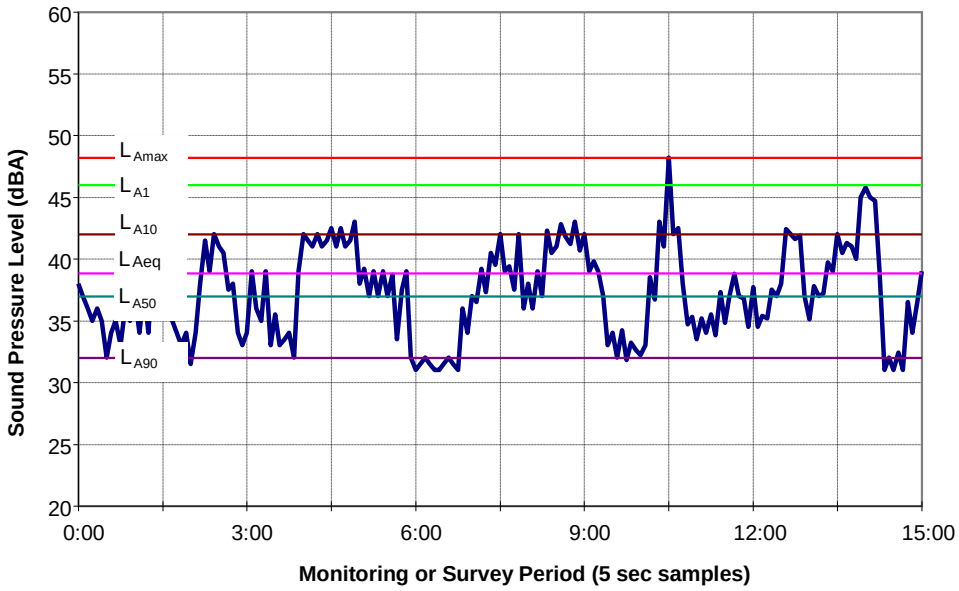
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Bunnings currently operates a store at Bonnyrigg Avenue, Bonnyrigg. It is proposed to develop a new Bunnings Warehouse store at the neighbouring block which is currently used as a bus depot. The existing store building would be repurposed and does not form part of this assessment.

Wilkinson Murray has been engaged by Bunnings to provide a noise assessment of potential operational noise impact associated with the new store. This includes assessment of noise from fixed mechanical plant, patrons and vehicle movements within the site and on surrounding roads.

Noise emissions have been assessed against the site specific noise criteria derived based on the Environmental Protection Authority's (EPA) *Noise Guide for Local Government (NGLG)* and *Road Noise Policy (RNP).*

2 SITE DESCRIPTION

Figure 2-1 shows the location of the former and proposed Bunnings stores. The proposed new Bunnings store layout is presented in Figure 2-2. The development is to consist of:

- A central store building with a timber trade sales area at the northern side of the site;
- One level of undercover parking with access points on Bonnyrigg Avenue and;
- Delivery entry and exit from Bonnyrigg Avenue;

Store operating times are proposed to be:

- 6.00am to 10.00pm Monday to Friday; and
- 6.00am to 7.00pm on weekends and Public Holidays.

Deliveries (goods receiving area) will generally be between the hours of 7.00am and 9.00pm. Night filling, which is an internal activity, may occur outside of normal store trading hours.

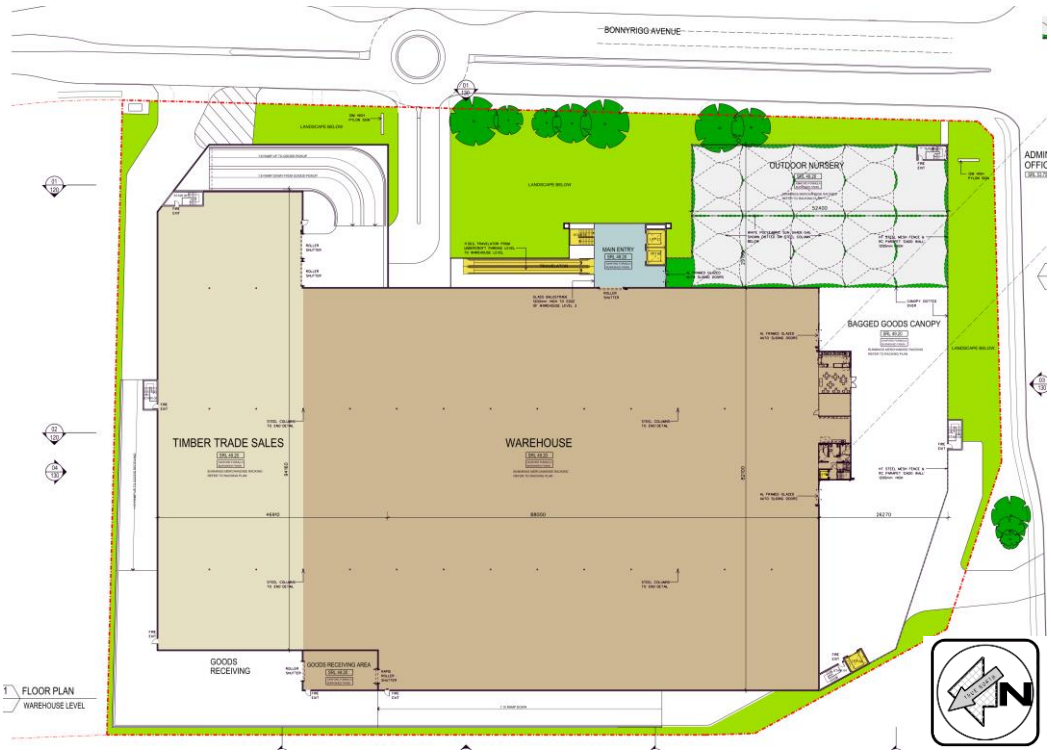
The nearest noise sensitive receivers, represented by the receivers shown on Figure 2-1, are described in Table 2-1.

Table 2-1 Surrounding Receiver Locations

No.	Location	Description
1	16 Wilton Way	This is the noise logger location. This represents a row of houses exposed to noise on Bonnyrigg Avenue.
2	Tarlington Parade	These houses are further from the store than Location 1; however, they are potentially exposed to noise from delivery vehicles
3	Gregorace Place	This represents receivers across Elizabeth Drive. These receivers are protected by a noise wall on the southern side of Elizabeth Drive.
4	6 Bonnyrigg Avenue	This is the closest receiver to the store; however, it is not close to the delivery and vehicle access areas and it is exposed to higher levels of traffic noise than the logger location.
5	Cambodian Temple	This is a place of worship to the northeast of the store.

Figure 2-1 Site & Receiver Locations

Figure 2-2 Site Layout



3 EXISTING NOISE LEVELS

Ambient noise monitoring was conducted for a period of 15 days between Wednesday, 14 January and Monday, 28 January 2015 at one residence adjacent to the site. The logging location was the rear garden of 16 Wilton Way, which is indicated as receiver Location 1 on Figure 2-1.

The noise monitoring equipment used for the noise measurements consisted of an ARL EL 215 Noise Logger set to A-weighted, fast response, continuously monitoring each 15-minute period. The loggers determine a variety of noise descriptors of the existing noise environment.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the existing noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample time respectively. The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional passby of a heavy vehicle. The L_{A90} level is normally taken as the background noise level. The L_{Aeq} level is the Equivalent Continuous Sound Level and has the same sound energy over the sampling period as the actual noise environment with its fluctuating sound levels. Whilst the L_{A10} has in the past been used as a descriptor for traffic noise, the L_{Aeq} is now the standard descriptor for traffic noise.

The location was slightly shielded from the road by garden fences; this would have little effect on the measurement of RBLs, but may have reduced traffic noise by up to 5dBA. The dominant noise was traffic on Bonnyrigg Avenue and Elizabeth Drive.

Table 3-1 summarises the Rating Background Level (RBL) values derived from data collected during the unattended noise monitoring (RBL is a standard measure of background noise which is defined in the EPA's *Industrial Noise Policy*. The table also shows the L_{Aeq} traffic noise level for the same periods. Noise charts are presented in Appendix A.

The hour from 6.00am to 7.00am is classified as part of the night time period (10.00pm to 7.00am). This period is considered as a "shoulder" period which has been considered for weekdays, Saturdays and Sundays as presented in Table 3-1.

Table 3-1 Measured Noise Levels at 16 Wilton Way

Receiver Location	Noise Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-6am	Early Morning Shoulder Period 6am-7am		
					Weekday	Saturday	Sunday
16 Wilton Way	RBL	49	44	36	45	41	40
	$L_{eq,period}$	64	58	52	54	51	50

4 NOISE CRITERIA

The following noise policies published by the Environmental Protection Authority (EPA) have been used to establish the site specific operational noise criteria:

- NSW "*Noise Guide for Local Government" (NGLG)* , dated October 2010;
- NSW "*Road Noise Policy Noise" (RNP)*, dated March 2011;
- NSW "*Industrial Noise Policy" (INP),* dated January 2000.

4.1 Noise Criteria for Residences

To assist council's in assessing smaller commercial activities EPA has prepared the *Noise Guide for Local Government (NGLG)*. Within this document, local councils are encouraged to develop noise policies which specify intrusive noise level criteria using appropriate noise level descriptors.

The *NGLG* recommends that council's develop intrusive criteria that limit the permissible level of L_{Aeq} noise emissions from commercial or industrial premises to no more than the background noise (RBL) plus 5dBA when measured over a 15-minute period.

The time periods for which intrusive criteria are applied are;

- Daytime (7.00am-6.00pm),
- Evening (6.00pm-10.00pm); and,
- Night Time (10.00pm-7.00am).

The background level is the Rating Background Noise Level (RBL) which is determined from measurement of L_{A90} noise levels, in the absence of noise from the source. The site specific noise criteria are presented in Table 4-1. The noise goal for the Cambodian Temple is discussed in Section 4.3.

Table 4-1 Site Specific Noise Criteria, $L_{Aeq,15min}$

Receiver Location	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-6am	Early Morning 6am-7am
All Residential	54	49	41	45
Cambodian Temple	50	50	50	50

4.2 Assessment of Sleep Disturbance

In the case of operation between 10.00pm and 7.00am, the *NGLG* notes that;

> *Currently, there is no definitive guideline to indicate a noise level that causes sleep disturbance and more research is needed to better define this relationship. Where likely disturbance to sleep is being assessed, a screening test can be applied that indicates the potential for this to occur.*

For example, this could be where the subject noise exceeds the background noise level by more than 15 dB(A). The most appropriate descriptors for a source relating to sleep disturbance would be $L_{A1\ (1\ minute)}$ (the level exceeded for 1% of the specified time period of 1 minute) or L_{Amax} (the maximum level during the specified time period) with measurement outside the bedroom window.

Based on the above advice, a sleep disturbance screening criteria are presented in Table 4-2 nearby residences for the operational period between 6.00am and 7.00am. If an exceedance of the above "screening criterion" is indicated then further review is recommended.

Table 4-2 Screening Noise Criteria[1] for Sleep Disturbance, L_{Amax}

Receiver Location	Background Noise Level	Criteria
All Residential	40	55

Note: 1. Minimum background noise levels measured for shoulder period noise levels between 6am to 7am.

In this regard, the research reviewed as part of the NSW *Environmental Criteria for Road Traffic Noise* (*ECRTN*) and the NSW *Road Noise Policy* (*RNP*), which supersedes the *ECRTN,* shall be referenced.

Considering all the information presented in the *ECRTN*, the following conclusion can be drawn using the $L_{A1,1\ min}$ descriptor:

- Internal noise levels below 50-55dBA are unlikely to cause awakening reactions; and
- One or two noise events per night, with internal noise levels of 65-70dBA, are not likely to affect health and wellbeing significantly.

Assuming that the typical noise reduction through a bedroom facade with windows sufficiently open for adequate ventilation is 10dBA, then an external noise level of 65dBA is unlikely to cause sleep disturbance. This noise level is assessed at the façade.

4.3 Cambodian Temple

Appropriate noise goals for places of worship are given in the *INP.* The noise guide is for internal noise and applies when the place of worship is in use. The recommended level is L_{Aeq} 40dBA. Following the discussion of noise through open windows in Section 4.2, this leads to a criterion of L_{Aeq} 50dBA outside the Cambodian Temple.

5 NOISE ASSESSMENT

5.1 Noise Modelling

Site related noise emissions were modelled using the Bruel and Kjaer Predictor noise prediction software. To complete this, a representative 3-D model within the software was constructed of the site and surrounding residences.

Factors that are addressed in the modelling are:

- Equipment sound level emissions and locations;
- Screening effects from buildings;
- Receiver locations;
- Ground topography;
- Noise attenuation due to geometric spreading;
- Ground absorption; and
- Atmospheric absorption.

5.2 Noise Sources

Wilkinson Murray has conducted noise measurements of other Bunnings facilities in the past. Based on these, measured typical noise levels of operations and equipment have been established for assessment purposes. Table 5-1 details these continuous L_{Aeq} noise levels.

Table 5-1 L_{Aeq} Noise Levels of Operation & Events – dBA

Noise Source	Sound Pressure Level at 3m	Sound Power Level
Truck loading / unloading with Fork Lift	77	95
Fork Lift working	78	96
Truck moving on site	86	104
Carpark	59	77
Exhaust fans	77	95
Fork Lift idle	72	90

Table **5-2** presents maximum noise levels associated with the site.

Table 5-2 L_{Amax} Noise Levels of Operation & Events – dBA

Noise Source	Sound Pressure Level at 3m	Sound Power Level
Fork Lift reversing alarm	82	100
Car pass-by	62	80
Van pass-by	67	85
Truck pass-by	87	105

The above noise levels have been used in the noise modelling.

In addition to the noise source levels, the following assumptions were made for the modelling:

- Delivery trucks were modelled travelling at 5 km/h, averaged over the full length of their route.
- Delivery trucks would take up to 7 minutes to manoeuvre and park or to leave site.

5.3 Predicted Noise Levels at Residences

Operational noise levels have been predicted at receivers surrounding the site. The noise modelling assumed that the store roof plant and dock areas are operational during all trading hours. This represents the general noise emission from the store between 6.00am and 10.00pm. These levels are listed in Table 5-1. The table shows that noise is predicted to comply with the noise criteria at all receivers and in all periods for this case. Delivery vehicles will arrive after 7.00am, and during this period the worst-case noise emission will include noise from the delivery vehicle; noise emissions from this situation are listed in Table 5-2. Again, noise is predicted to comply at all receivers.

Table 5-3 Predicted Noise without Delivery

No.	Location	Noise Level, $L_{Aeq,15min}$ dBA	Criteria Compliance		
			Day (54)	Evening (49)	Early Morning Mon-Sun (45)
1	16 Wilton Way	45	Y	Y	Y
2	Tarlington Parade	45	Y	Y	Y
3	Gregorace Place	35	Y	Y	Y
4	6 Bonnyrigg Avenue	41	Y	Y	Y
5	Cambodian Temple (Criteria 50)	43	Y	Y	Y

Table 5-4 Predicted Noise with Delivery

No.	Location	Noise Level, $L_{Aeq,15min}$ dBA	Criteria & Compliance	
			Day (54)	Evening (49)
1	16 Wilton Way	49	Y	Y
2	Tarlington Parade	46	Y	Y
3	Gregorace Place	36	Y	Y
4	6 Bonnyrigg Avenue	48	Y	Y
5	Cambodian Temple (Criteria 50)	50	Y	Y

Daytime noise contours for typical worst-case operation are shown in Figure 5-1Figure 5-1.

5.4 Sleep Disturbance Assessment

In the case of sleep disturbance, maximum noise levels associated with activity in the forklifts in the dock area combined with carpark noises have also been predicted for the period between 6.00am to 7.00am.

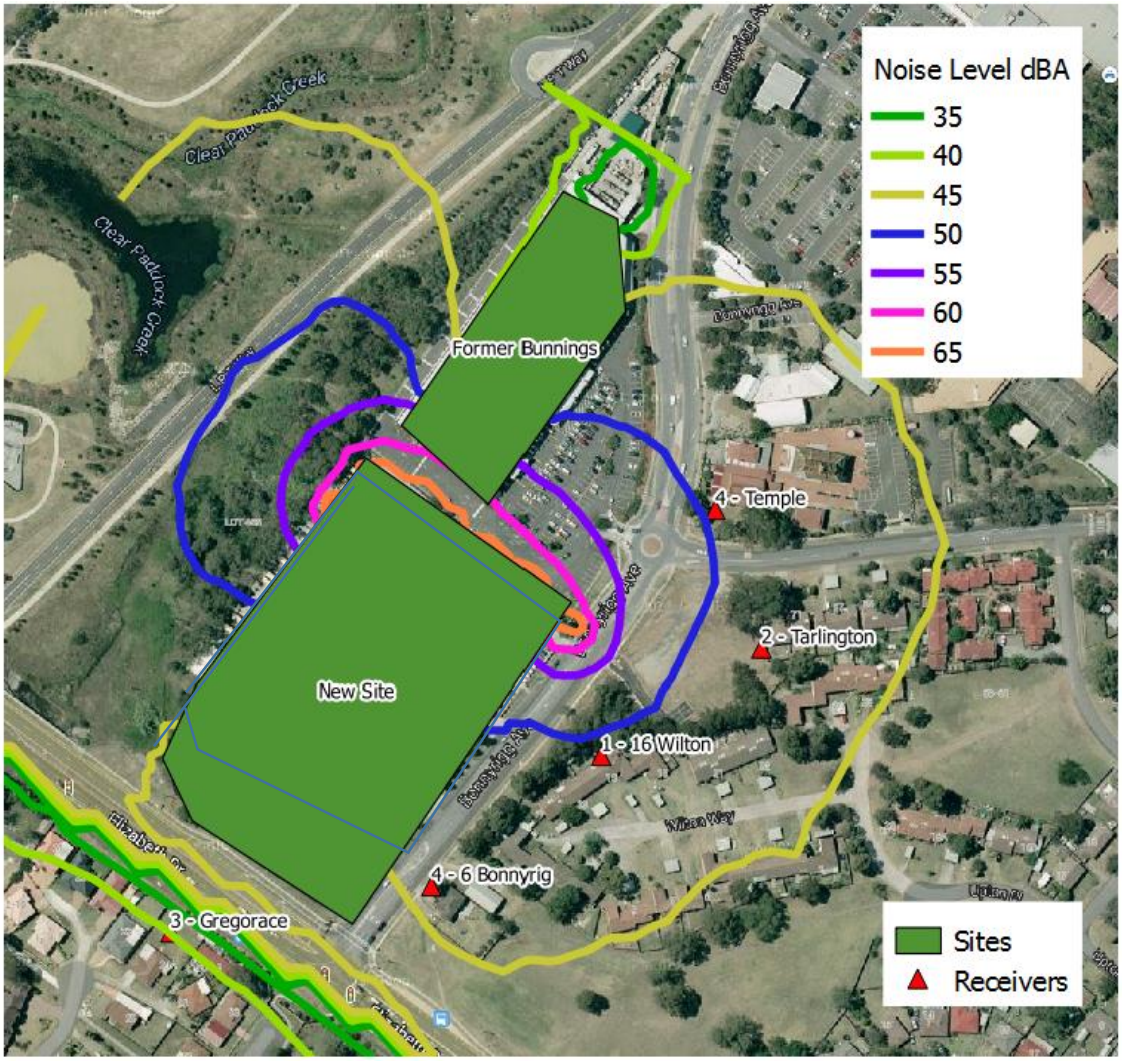
Table 5-5 presents the predicted maximum noise levels at surrounding residences.

Table 5-5 Predicted Maximum Noise Levels at Residences – $L_{A1,1min}$ dBA*

No.	Location	Noise Level, $L_{A1,1min,-}$ dBA	Complies with Screening Criterion (55dBA)
1	16 Wilton Way	50	Y
2	Tarlington Parade	50	Y
3	Gregorace Place	40	Y
4	6 Bonnyrigg Avenue	46	Y

Noise is predicted to comply with the screening criteria at all locations for the early morning period from 6am to 7am.

Figure 5-1 Predicted Daytime $L_{Aeq(15\ minute)}$ Noise levels with Delivery



6 ROAD TRAFFIC NOISE

6.1 Increased Traffic

The development will increase the traffic on the road network, potentially increasing traffic noise. The projected increase in traffic flow is presented in the traffic report "*Proposed Bunnings Development Cnr Elizabeth Drive, Bonnyrigg Avenue, Bonnyrigg Assessment of Traffic and Parking Implications*" prepared by Transport and Traffic Planning Associates, January 2015.

6.2 Road Traffic Noise Criteria

The *Road Noise Policy* (RNP) sets out criteria for assessment of noise from vehicles on public roads. The *RNP* sets out noise criteria for 'arterial', 'sub-arterial' and 'local roads'.

Most traffic will use the Elizabeth Drive, an arterial road, and Bonnyrigg Avenue, which would be considered a sub-arterial road for the purposes of assessment of noise are shown in Table 6-1. Tarlington Parade joins the entrance of the existing store, and would be classed as a local road.

The difference in road type implies:

- The criteria for Tarlington Parade is 5dBA lower than for the main roads; and
- The criteria for Tarlington Parade is assessed over the busiest hour of the day, whereas for the major roads the noise is averaged over the whole daytime period.

Table 6-1 *RNP* Traffic Noise Criteria

Road Category	Type of Project / Land Use	Assessment Criteria – dB(A) Day (7am–10pm)	Night (10pm–7am)
Freeway / arterial / sub-arterial roads	Existing residences affected by additional traffic on existing arterial / sub-arterial roads generated by land use developments	$L_{Aeq15hr}$, 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	L_{Aeq1hr}, 55 (external)	$L_{Aeq,1hr}$ 50 (external)

Where predicted noise levels exceed the project-specific noise criteria, an assessment of all feasible and reasonable mitigation options should be considered. The *RNP* states that *an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person*.

6.3 Assessment

The noise logger results show that the existing traffic noise at the noise monitoring location are typically 60-65dBA during daytime and exceed the base noise goal. As Elizabeth Drive carries more traffic than Bonnyrigg Avenue, the noise emission from Elizabeth Drive would be higher than that of Bonnyrigg Avenue. However, residences on Elizabeth Drive are protected by a noise barrier.

The traffic report concludes that the projected "additional" Bunnings generated traffic is:

- Thursday / Friday PM +54 vehicle trips per hour (vtph); and
- Saturday Midday +284 vtph.

The overall traffic figures for the streets surrounding the development are listed in Figure 5-1 of the Traffic Report for the future case. That table indicates that approximately 70% of the traffic on weekends accesses Bunnings from Elizabeth Drive – this means that the highest impact on Bonnyrigg Avenue would be the short section between the Bunnings access point and Elizabeth Drive. The future predicted traffic flow past residences is shown in Table 6-2 together with the predicted increase in noise level.

Table 6-2 Peak Hour Traffic Flows and Traffic Noise Increase

Day	Elizabeth Drive		Bonnyrigg Avenue		Tarlington Parade	
	Future Traffic Flow, Vehicles per Hour	Maximum Increase in Noise Level due to Development, dBA	Future Traffic Flow, Vehicles per Hour	Maximum Increase in Noise Level due to Development, dBA	Future Traffic Flow, Vehicles per Hour	Maximum Increase in Noise Level due to Development, dBA
Weekday	3115	<0.1	1137	<0.2	114	0.0
Saturday	3037	<0.2	1552	<0.5	228	<0.8

- The change in traffic noise levels on Elizabeth Drive is negligible and no impact is predicted.
- The change in traffic noise on Bonnyrigg Avenue is up to 0.5dBA at residences between the Bunnings Access point and Elizabeth drive. This increase is not noticeable and no adverse impact is predicted. The change to residents north of Bunnings on Bonnyrigg Avenue will be even lower. Both Elizabeth Drive and Bonnyrigg Avenue are assessed over a 15-hour period, so the increase overall will be less than shown in the table.
- The change in noise level on Tarlington Parade is predicted to be insignificant on weekdays, and up to 0.8dBA for the peak hours on weekends. As noted by the *RNP*, a change of 2dBA is considered barely perceptible. The predicted change of less than 1dBA is considered a negligible impact.

Based on these findings, residences will not be adversely affected by traffic generated by the new Bunnings Store.

7 CONCLUSION

A noise assessment was completed for the proposed Bunnings store at Bonnyrigg which has included the assessment of noise from fixed mechanical plant, patrons, traffic and activities associated with the delivery of goods.

Background noise monitoring was used to establish the existing noise levels from which project specific noise criteria were derived. These criteria were developed using the EPA's *Noise Guide for Local Government*.

The noise assessment has determined that:

- Compliance with established site specific noise criteria will be achieved at all residential receivers;
- Compliance with the established sleep disturbance screening criterion has been determined at all residential receivers as truck deliveries occur after 7.00am; and
- Compliance with traffic noise criteria was established at all existing residences

APPENDIX A

NOISE MEASUREMENT RESULTS AT 16 WILTON WAY

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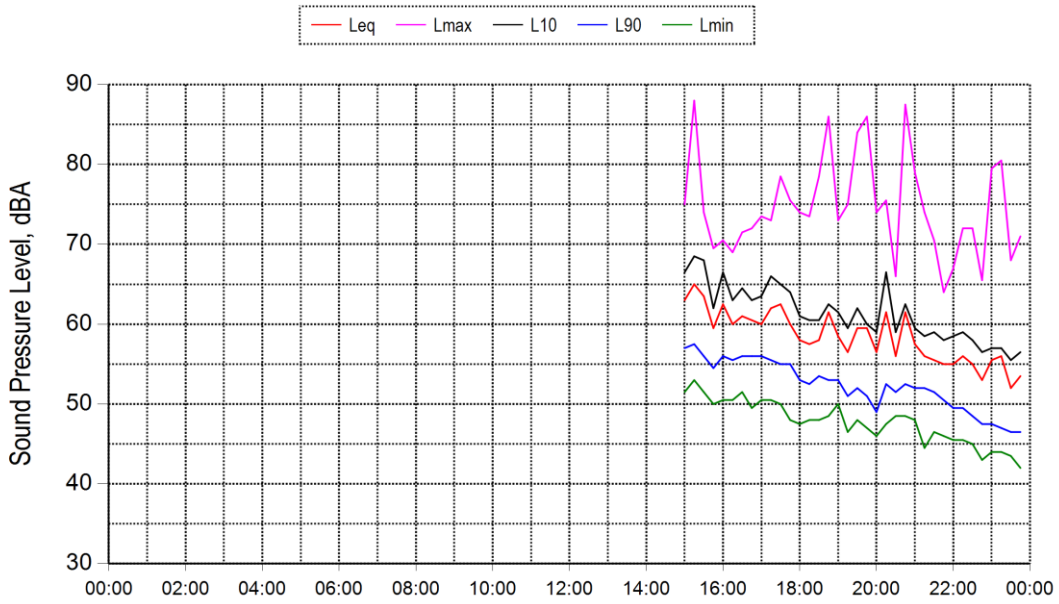

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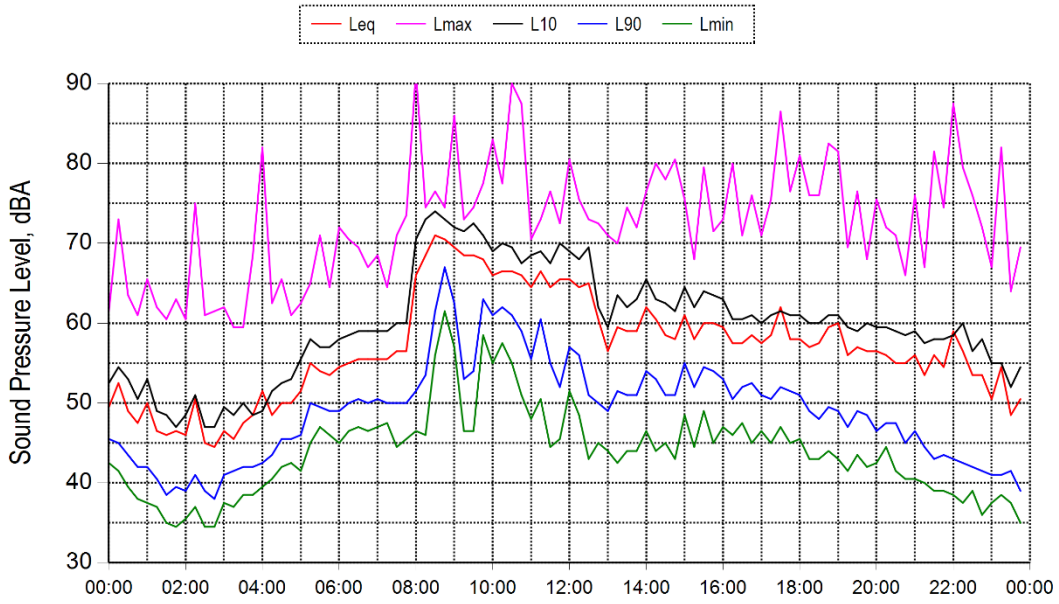

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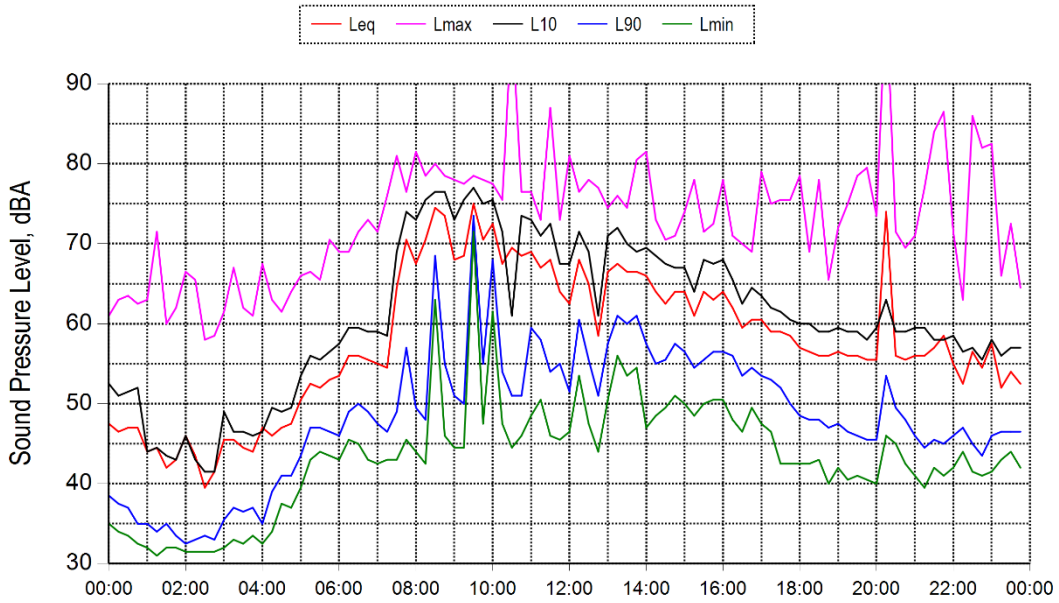

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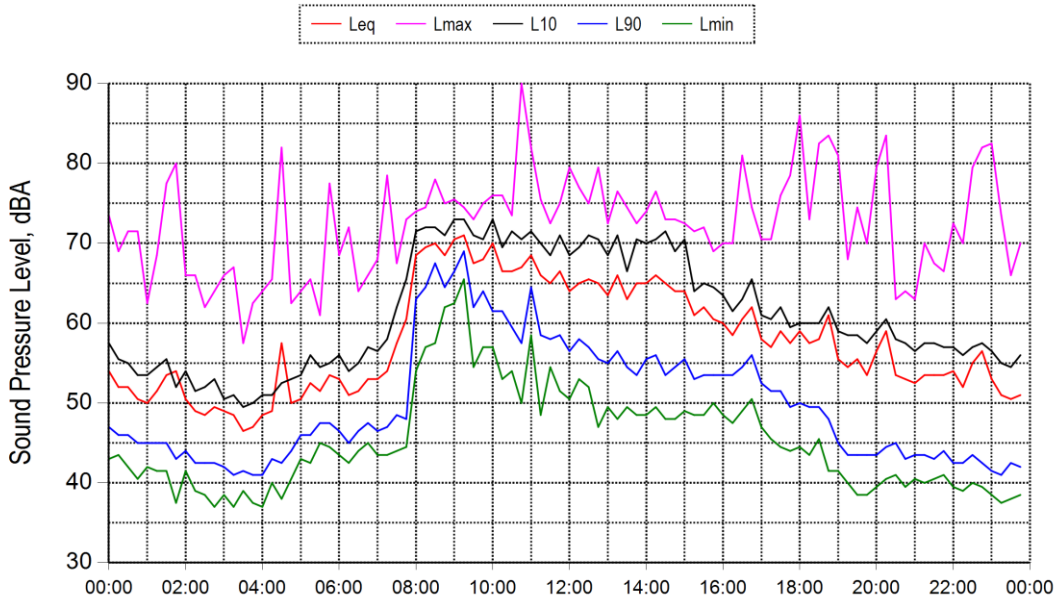

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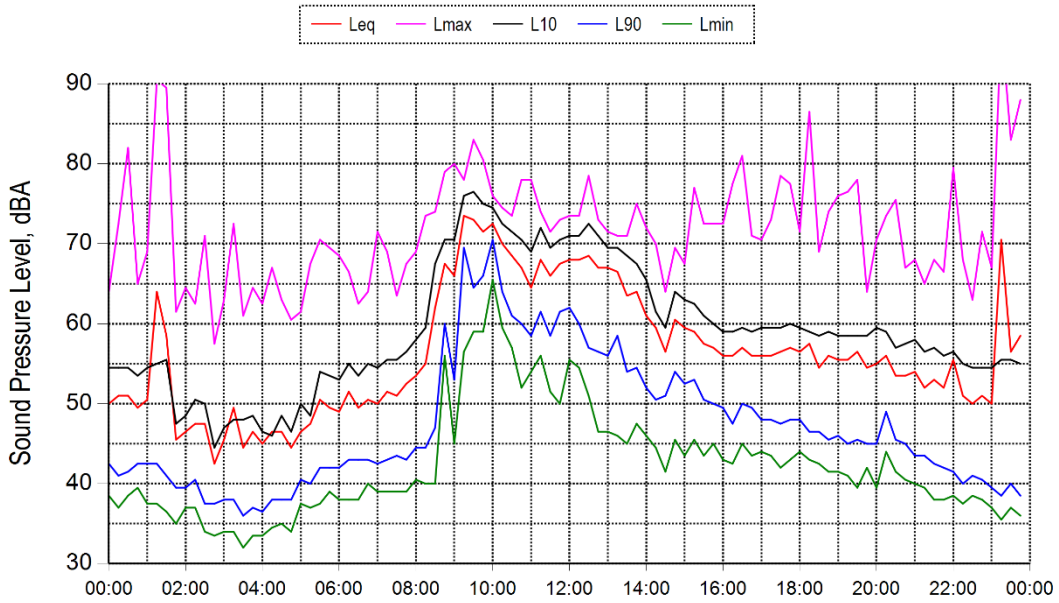

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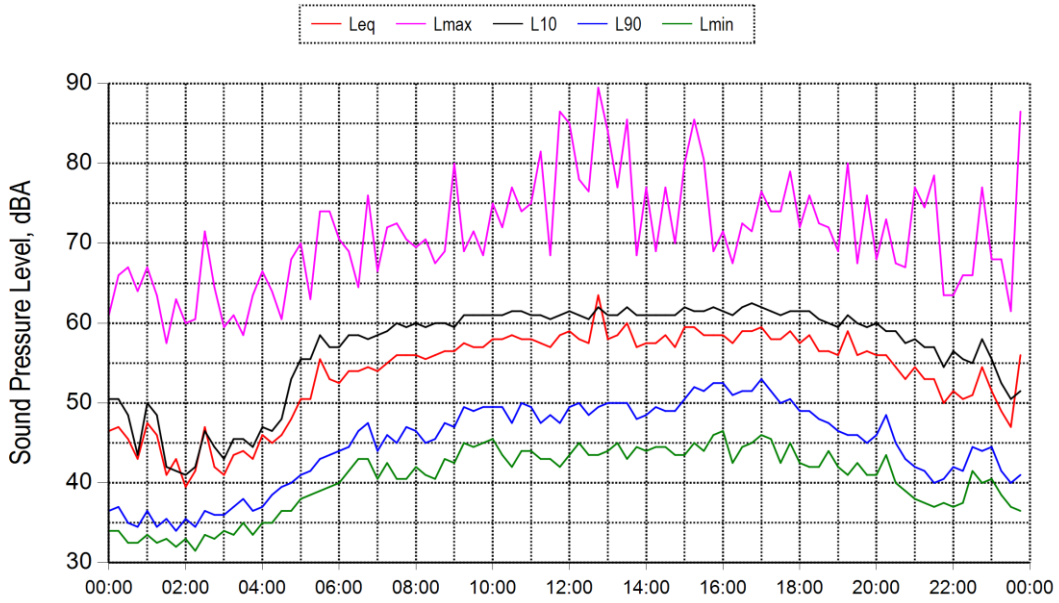

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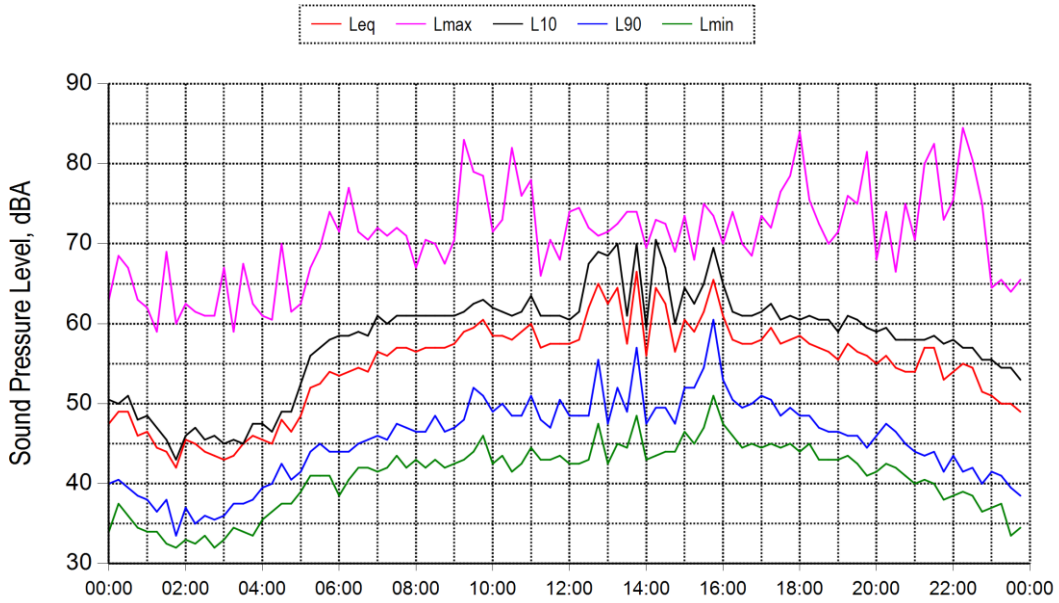

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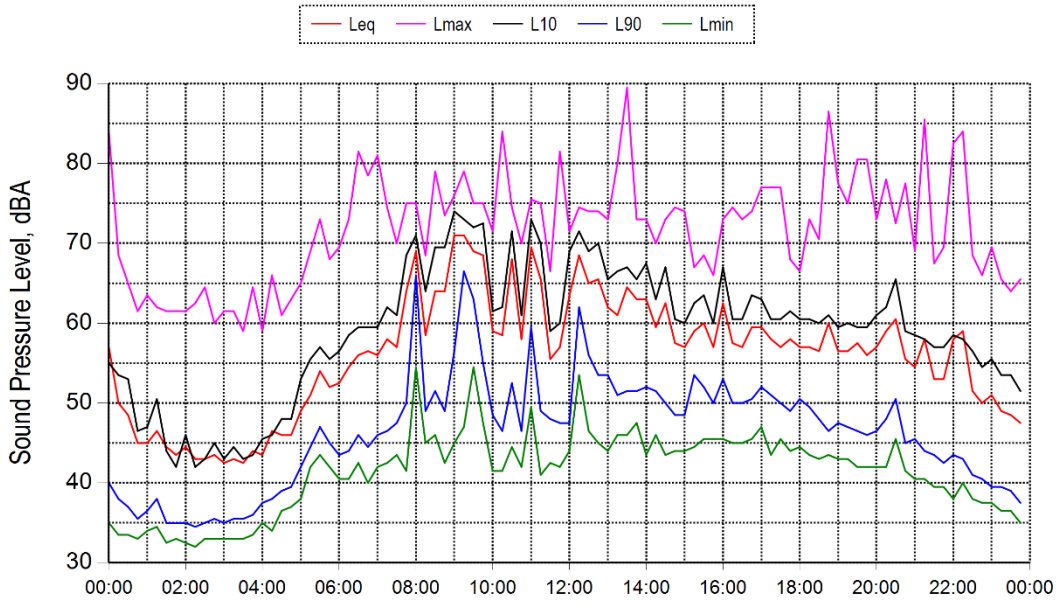

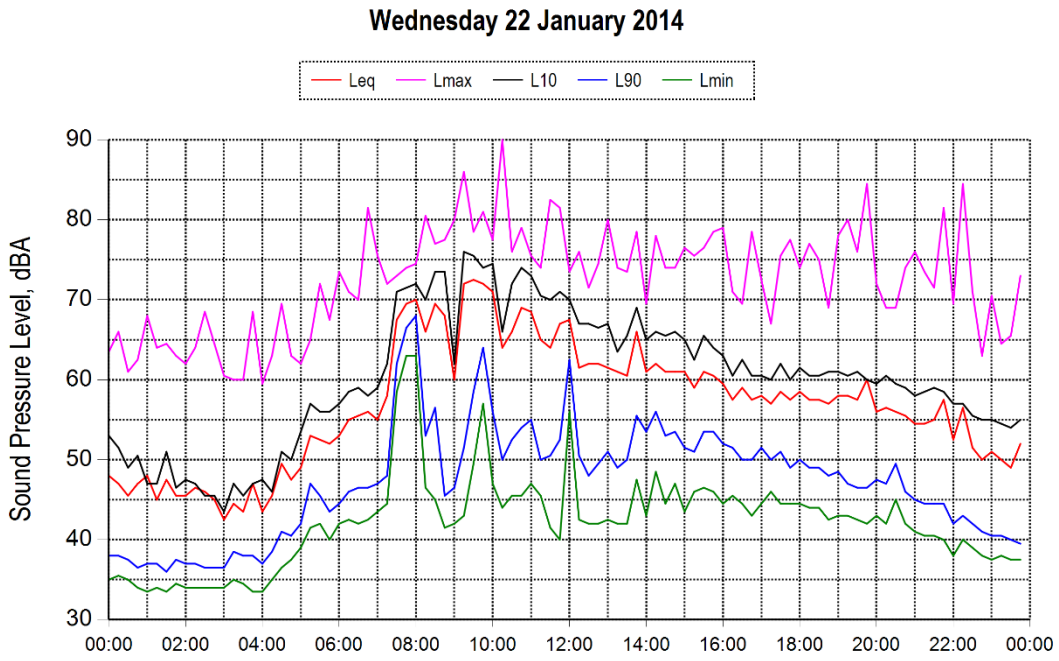
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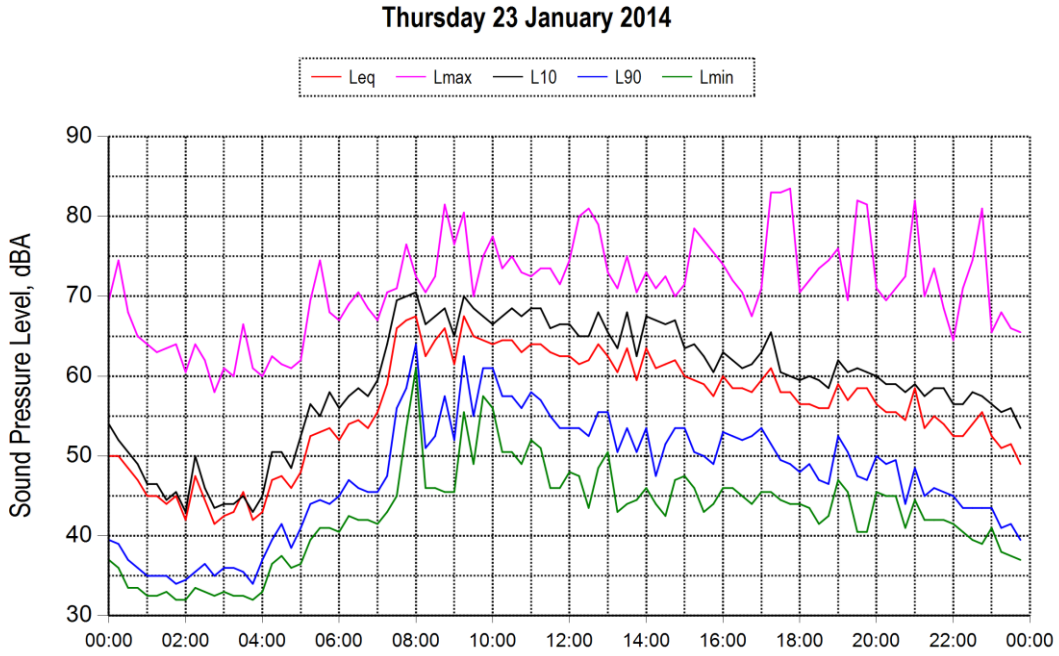
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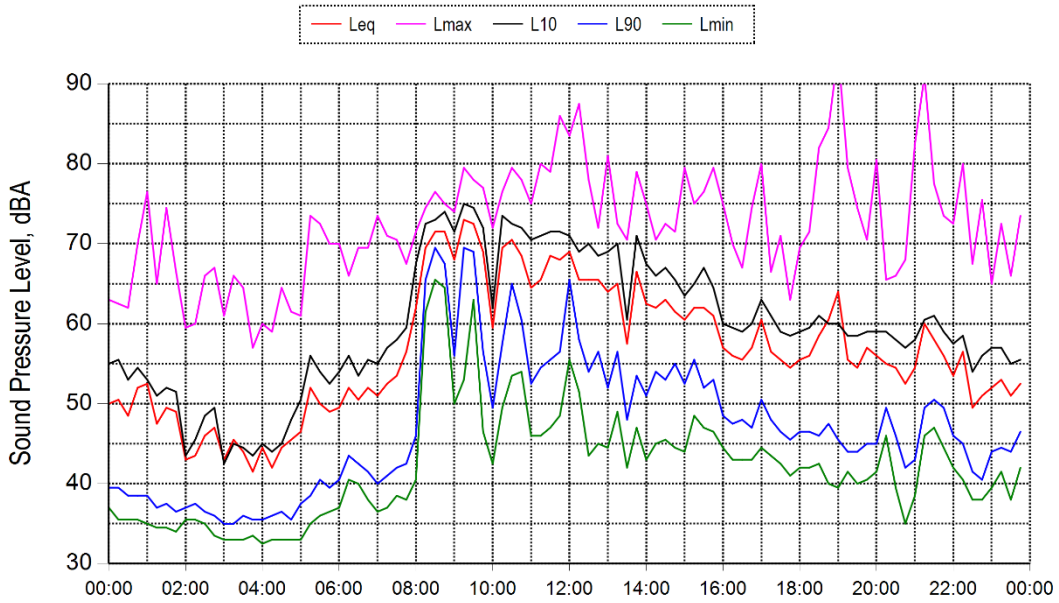

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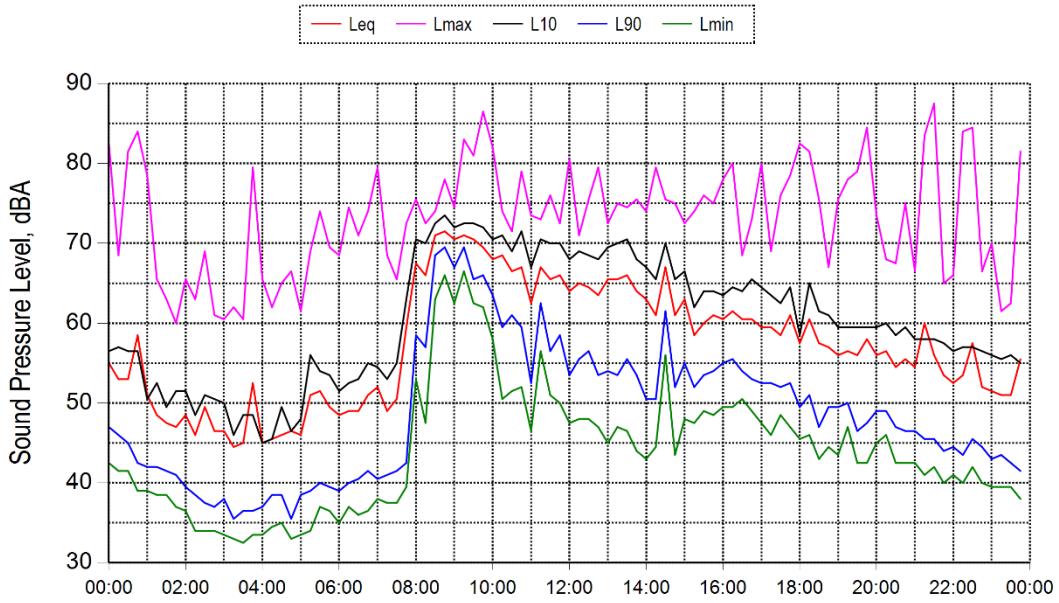

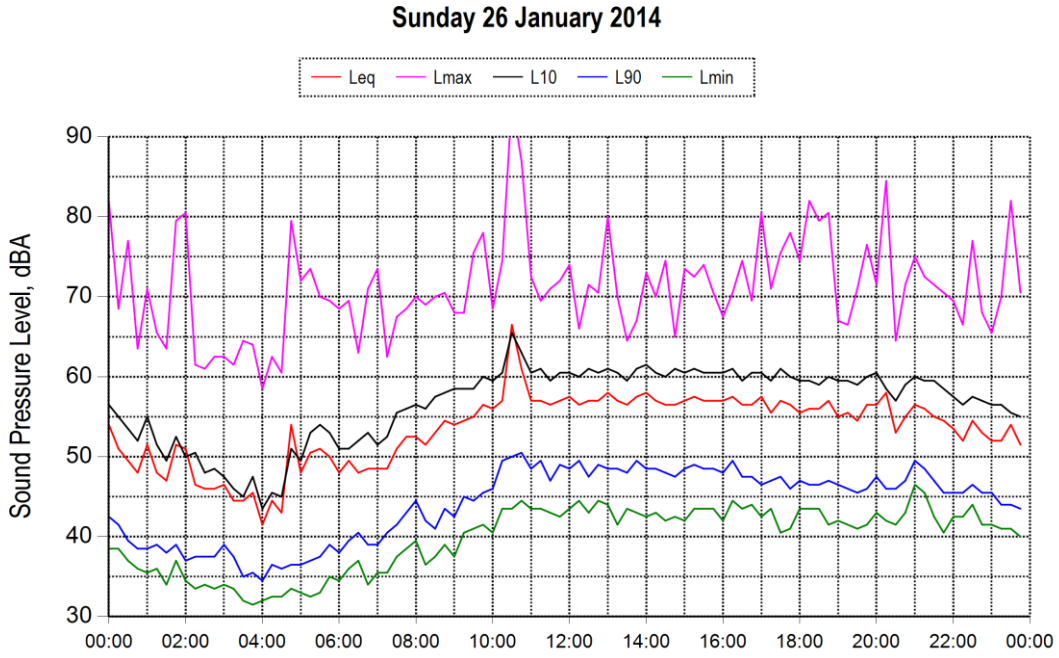
Sunday 26 January 2014
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02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
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22:00
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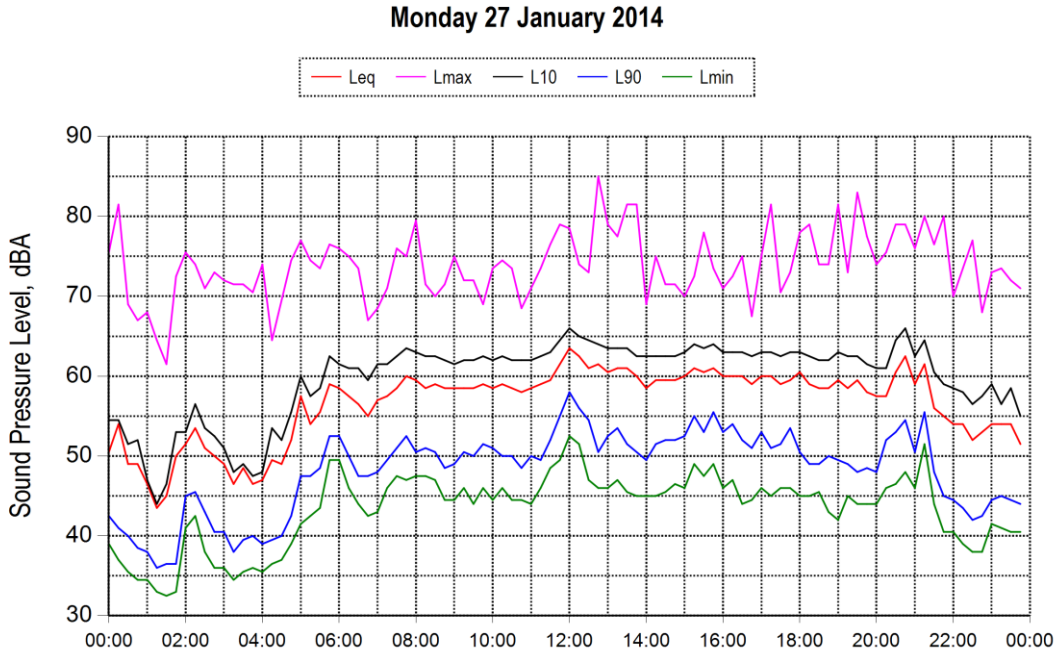
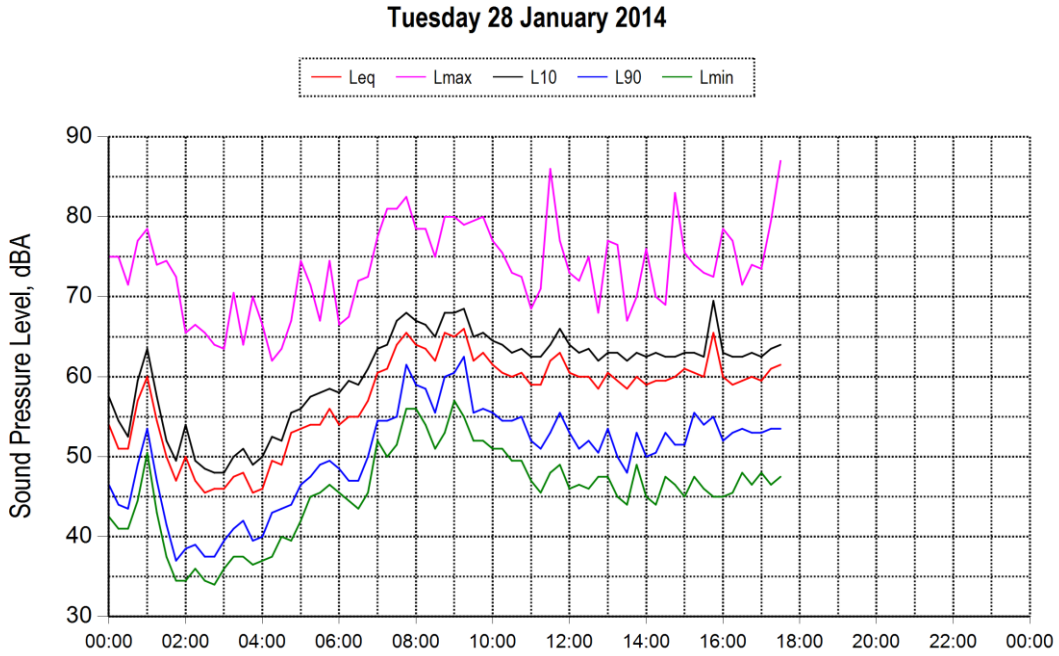

Monday 27 January 2014
Leq
Lmax
L10
L90
Lmin
Sound Pressure Level, dBA
90
80
70
60
50
40
30
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


Tuesday 28 January 2014
Leq
Lmax
L10
L90
Lmin
Sound Pressure Level, dBA
90
80
70
60
50
40
30
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
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