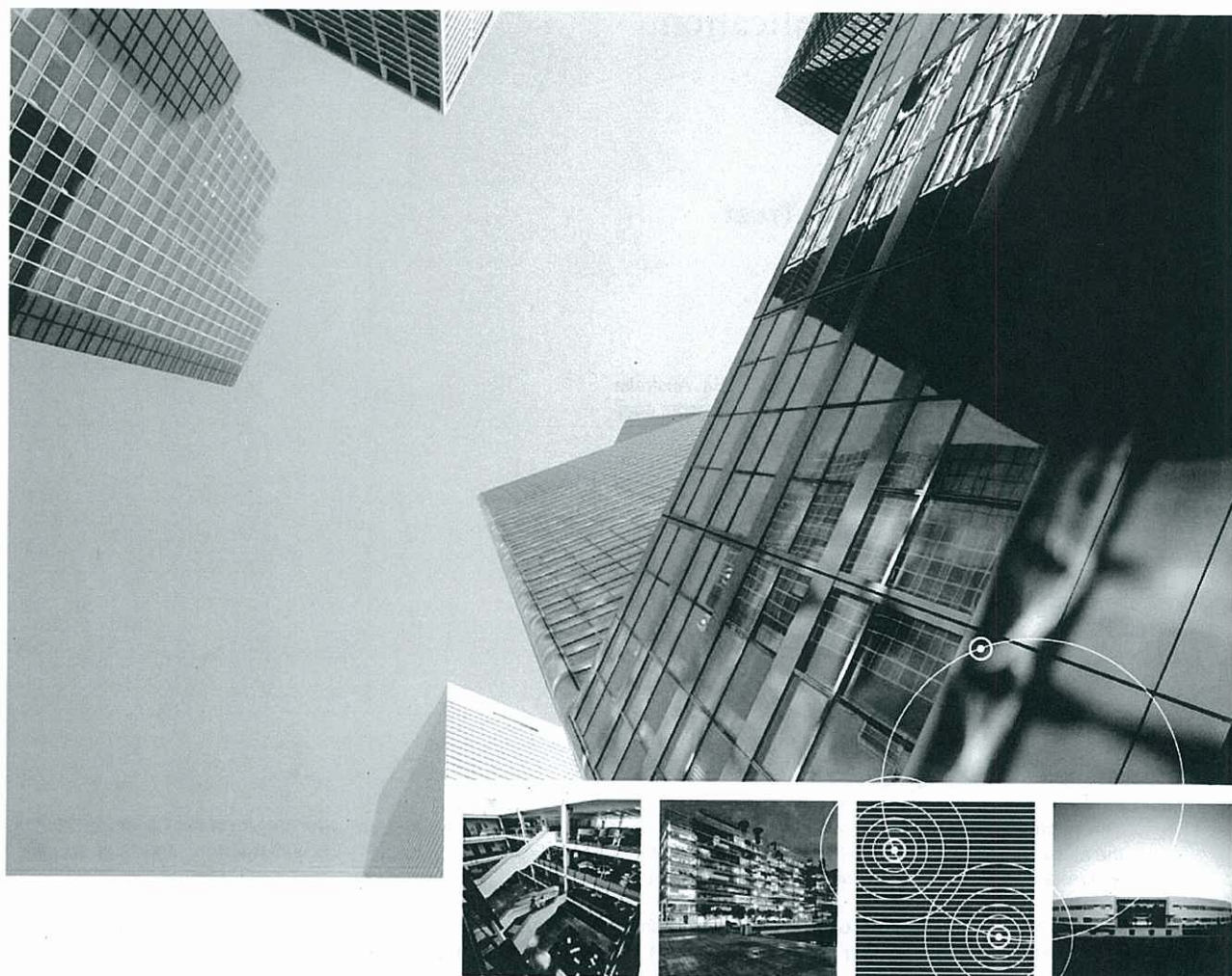




# Hamilton Harbour Development Application

## Environmental Noise Assessment

Hamilton Harbour Unit Trust

17 June 2009

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**PLANS AND DOCUMENTS**  
referred to in the ULDA  
**APPROVAL** dated 19/3/10

# Development Application

Prepared for

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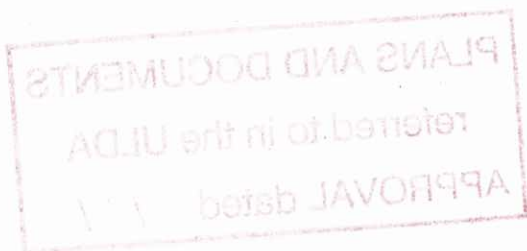
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## 1.0 Introduction

### 1.1 Project Description

AECOM (formerly Bassett Acoustics) has been commissioned to provide acoustical engineering services for the proposed development at 483 – 485 Kingsford Smith Drive (KSD), Hamilton. This project, identified as Hamilton Harbour, is a joint venture between Leighton Properties and Devine Limited. The site is bounded by KSD, Harbour Road and Hercules Street as shown in Figure 1.

The proposed development will include the design and construction of two 7-level commercial buildings, three multi-level residential buildings, a standalone retail pavilion, and two levels of basement car parking. The commercial buildings are located to the north and north-east of the site, the retail pavilion is located centrally and the residential buildings are at the southern and western ends of the site.

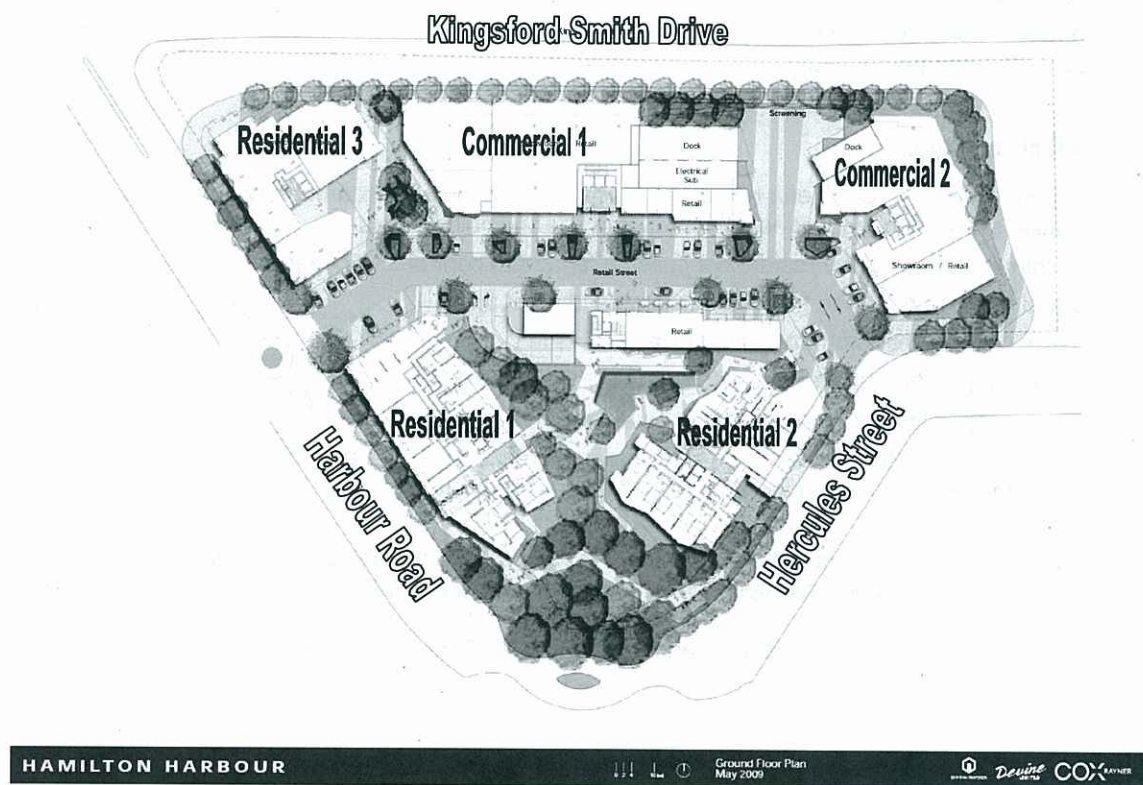


Figure 1 - Layout Sketch from the Master Plan

The proposed commercial buildings, identified as Commercial 1 at the north of the site and Commercial 2 at the north-east, consist of ground floor retail space combined with six levels of 'A Grade' base building commercial office space. Both buildings are targeting a 4.5 star NABERS Energy rating.

The proposed residential buildings, identified as Residential 1, 2 and 3, include a mix of moderate to high quality apartments. Residential 1 and 2, located at the southern end of the site, are 22 and 19 levels respectively. Residential 3, located to the west, consists of 15 levels on its east wing and 19 on its west wing, above ground floor retail space.

The development also includes two swimming pools, one being located within Residential 3 and the other located outdoors between Residential 1 and 2.

The Hamilton Harbour site is located within the Northshore Hamilton Urban Development Area (UDA). The Northshore Hamilton UDA includes land between Kingsford Smith Drive and the Brisbane River, extending from Bretts Wharf to the west and the Gateway Motorway to the east.

Development of UDA sites is controlled by the Urban Land Development Authority (ULDA). Accordingly the Development Approval (DA) will be lodged with the ULDA.

## **1.2 Critical Project Issues**

The key acoustical issues associated with the development application for the project are:

### **Commercial Buildings**

- Recommendations for criteria relating to noise intrusion and environmental noise emission
- Indicative design of the commercial base building façade to control traffic noise intrusion
- Control of noise emission from plant rooms and plant areas to meet criteria for environmental noise emission from the site

### **Residential Buildings**

- Recommendations for criteria relating to noise intrusion and environmental noise emission acoustic separation, impact noise control and internal noise levels
- Preliminary design of the residential building façade to control traffic noise
- Control of noise emission from plant rooms and plant areas
- Control of noise intrusion from plant located on site
- Acoustic separation between apartments
- Acoustic separation of common areas such as lifts to tenancies
- Control/management of noise from retail areas, cafés, restaurant, and the swimming pools which have potential to impact on the proposed residential buildings

This report recommends minimum acoustic performance criteria and indicative constructions required for the project as referenced from applicable acoustic design codes and regulations governing the site.

Nomenclature used in this report is detailed in Appendix A - Glossary of Acoustic Terms.

## 2.0 Existing Noise Environment

### 2.1 Noise Measurements

A noise survey was conducted at two locations on the proposed Hamilton Harbour site between Tuesday 16 September and Monday 22 September, 2008. Attended noise measurements were also undertaken at the beginning and end of logging. The purpose of this survey was to gain an understanding of the existing noise environment at the site. The measured average background noise levels are used in setting noise criteria and the measured  $L_{A10, 18hr}$  noise levels have been used to validate the road traffic noise model. The difference between the measured  $L_{Aeq 1hr max}$  and  $L_{A10, 18hr}$  noise levels is also used when assessing road noise intrusion.



Figure 2 - Noise Logging Locations

Logging location A was approximately 30 metres from KSD and 20 metres from Harbour Road on a floor pad of a demolished building which can be seen in Figure 2. Logging location B was approximately 115 metres from KSD and 15 metres from Harbour Road at the southern end of the site. Solid perimeter fencing approximately 2.4 metres in height surrounds the bulk of the site. As a result neither logger had direct line of sight to surrounding road. Accordingly the influence of road traffic on logged noise levels is lower than would be experienced without solid fencing.

The reduction in the average background noise levels will result in slightly more conservative noise emission criteria. However, it is considered that this reduction is similar to what will be experienced when Residential 3 and the two commercial buildings are constructed at the front of the site. In

addition, a reduction in the measured  $L_{A10, 18hr}$  noise levels does not impact on the validity of the forecast road traffic noise, as these barriers were included when validating the model, but were excluded when using the model to predict future road traffic noise.

## 2.2 Measured Results

The measured noise data and traces are presented in Appendix B - Noise Level Traces. The results are summarised below in Table 1.

**Table 1 - Summary of Logged Noise Levels**

| Descriptor                              | Measured Sound Pressure Level, dB(A) |                 |
|-----------------------------------------|--------------------------------------|-----------------|
|                                         | Location A                           | Location B      |
| $L_{Aeq, 24hr}$                         | 59                                   | 57              |
| $L_{A10, 18hr}$                         | 62                                   | 59              |
| $L_{A90}$ (6am-6pm), Day                | 55                                   | 53              |
| $L_{A90}$ (6pm-10pm), Evening           | 56                                   | 56              |
| $L_{A90}$ (10pm-6am), Night             | 48                                   | 48              |
| $L_{Aeq, 1hr\ max}$ (6am-6pm), Day      | 62                                   | 61              |
| $L_{Aeq, 1hr\ max}$ (6pm-10pm), Evening | 62                                   | 65 <sup>1</sup> |
| $L_{Aeq, 1hr\ max}$ (10pm-6am), Night   | 61                                   | 57              |

Note: 1. This elevated noise level is due to car park movements associated with the swimming school located on part of the subject site. This use is being discontinued to facilitate the development.

The ambient and background noise level at both logging locations was controlled by traffic noise on KSD. Sporadic road traffic along Harbour Road also contributed to the ambient noise environment. A number of aircraft movements overhead were also noted.

## 2.3 Instrumentation

The instrumentation used for measuring the ambient noise are summarised in Table 2.

**Table 2 – Noise Measurement Instrumentation**

| Instrument                                              | Serial Number |
|---------------------------------------------------------|---------------|
| Brüel & Kjær 2250 Class 1 Integrating Sound Level Meter | 2600403       |
| Rion NC-74 Sound Calibrator                             | 34483758      |
| Rion NL21 Class 2 Noise Logger                          | 00187448      |
| Rion NL21 Class 2 Noise Logger                          | 00465349      |

### 3.0 Design Criteria

The Northshore Hamilton Interim Land Use Plan specifies that the design, siting and layout of the development must address noise impacts where appropriate. However, the ULDA do not have specific noise criteria for UDA sites. The following standards, legislation and guidelines are proposed for assessing noise impacts associated with this site.

- Environmental Protection Act 1994 (Queensland).
- Environmental Protection (Noise) Policy 2008 (Queensland).
- Environmental Protection Regulation (EPR) 1998 (Queensland)
- Brisbane City Council (BCC) "Noise Impact Assessment Planning Scheme Policy" (NIAPSP)
- Building Code of Australia (BCA)
- Australian Standard AS/NZS 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.
- AS1055.1 & .2 *Acoustics – Description and Measurement of Environmental Noise* Part 1 General procedures, Part 2 Application to specific situations
- AS2021:2000 *Aircraft noise intrusion – Building siting and construction*

Strictly speaking the BCC NIAPSP does not apply to this site. However, this method of assessment is recommended for the following reasons;

- The system provides a degree of flexibility in noise assessments that is well suited to this type of development
- Use of NIAPSP provides a level of amenity commensurate with other developments in the area
- Non-compliance with NIAPSP increases the risk of future building occupants claiming the building is not 'fit for purpose' or similar claims

It should be noted that commercial buildings are not considered noise sensitive and therefore are not typically assessed against the NIAPSP in terms of noise intrusion.

#### 3.1 Environmental Noise Emission Criteria

Noise emission from the site is to be governed by the provisions of the Environmental Protection (Noise) Policy 2008, Environmental Protection Regulation (EPR) 1998, and Brisbane City Council's Noise Impact Assessment Planning Scheme Policy.

##### 3.1.1 Environmental Protection (Noise) Policy 2008

For noise emission into dwellings, commercial and retail spaces, the EPP (Noise) 2008 provides the following acoustic quality objectives, listed in Table 3.

Table 3 - EPP (Noise) 2008 Acoustic Quality Objectives at Dwellings and Commercial & Retail Spaces

| Sensitive Receptor                       | Time of Day                            | Acoustic Quality Objectives<br>(measured at the receptor) dB(A) |                            |                           |
|------------------------------------------|----------------------------------------|-----------------------------------------------------------------|----------------------------|---------------------------|
|                                          |                                        | L <sub>Aeq, adj, 1hr</sub>                                      | L <sub>A10, adj, 1hr</sub> | L <sub>A1, adj, 1hr</sub> |
| Dwelling (Outdoors)                      | Daytime and Evening                    | 50                                                              | 55                         | 65                        |
| Dwelling (Indoors)                       | Daytime and Evening                    | 35                                                              | 40                         | 45                        |
|                                          | Night                                  | 30                                                              | 35                         | 40                        |
| Commercial and Retail Activity (Indoors) | When the activity is open for business | 45                                                              | -                          | -                         |

### 3.1.2 Environmental Protection Regulation 1998 – Mechanical Plant

This noise emission is governed by the Environmental Protection Regulation 1998, clause 6Z which states:

*“An occupier of premises at or for which there is air-conditioning equipment must not use or allow the use of the equipment –*

- a) from 7am to 10pm on any day if it makes noise or causes noise to be made of more than 50 dB(A); or*
- b) before 7am or after 10pm on any day if it makes noise or causes noise to be made of more than the higher of the following-*
  - i). 40 dB(A);*
  - ii). 5 dB(A) above the background noise level.*

In practice, where the night-time criterion exceeds the daytime criterion we apply the daytime limit throughout. The noise generated by plant should be steady, broad-band noise free from annoying characteristics such as tones, rattles etc. Based on ambient noise measurements previously taken at the site, the following specific noise criteria are applicable at the boundaries of the property:

- 50 dB(A) from 7 am to 10 pm
- 50 dB(A) from 10 pm to 7am

### 3.1.3 Environmental Protection Regulation 1998 – Pool and Spa Pumps

This noise emission is governed by the Environmental Protection Regulation 1998, clause 6Y which states;

*(1) An occupier of premises at or for which there is a spa blower or a pump for a swimming pool or spa pool must not use or allow the use of the spa blower or the pump—*

- (a) before 7 a.m. or after 10 p.m. on any day if it makes audible noise or causes audible noise to be made; or*
- (b) from 7 a.m. to 7 p.m. on any day if it makes noise or causes noise to be made of more than 50 dB(A); or*
- (c) from 7 p.m. to 10 p.m. on any day if it makes noise or causes noise to be made of more than 5 dB(A) above the background noise level.*

Condition 1(a) does not apply if the noise is no more than 5 dB(A) above the background noise level. In practice, where the night-time criterion exceeds the daytime criterion we apply the daytime limit throughout. Based on noise measurements taken at the site, the following specific noise criteria are applicable for noise emission from spa pumps at the boundaries of the property;

- 50 dB(A) from 7 am to 7 pm
- 50 dB(A) from 7 pm to 10 pm
- 50 dB(A) from 10 pm to 7am

### 3.1.4 BCC - NIAPSP (Background Creep)

The NIAPSP does not regard commercial and retail spaces as noise sensitive receptors, but does consider dwellings (including hotels) as such. For noise emission into dwellings, the NIAPSP provides Table 4 as a guide for determining the appropriate noise criteria.

Table 4 - NIAPSP Noise Criteria at Dwellings

| Noise area category<br>Appendix A of AS1055.2 | Permissible level of exceedance of $L_{A90,T}$ for the appropriate time of day |                                             |                                                                                                            |
|-----------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------|
|                                               | Where this is residential development                                          | Where this is not a residential development | Where the background levels already exceed the stated levels in AS1055.2 without the proposed development. |
| R1                                            | By 5 dB(A)                                                                     | N/A                                         | The development's noise contribution must still comply with the stated levels in AS1055.2                  |
| R2                                            | By 5 dB(A)                                                                     | N/A                                         |                                                                                                            |
| R3                                            | By 0 dB(A)                                                                     | By 10 dB(A)                                 |                                                                                                            |
| R4                                            |                                                                                |                                             |                                                                                                            |
| R5                                            |                                                                                |                                             |                                                                                                            |
| R6                                            |                                                                                |                                             |                                                                                                            |

The NIAPSP guidelines state that the  $L_{A90,T}$  noise levels from the site should not exceed the levels specified in Table 4. Also, as shown in the table, for scenarios where the measured background noise levels exceed the stated levels in AS 1055.2, the development's noise emission must comply with the stated levels in AS 1055.2 in an effort to avoid background noise creep.

The northern boundary of the site can be described by the R5 noise category "Areas with very dense transportation or in commercial districts or bordering industrial districts". The remainder of the site is best described by the R4 noise category "Areas with dense transportation or some commerce or industry". The corresponding average background A-weighted sound pressure levels  $L_{A90,T}$  from AS1055.2 are shown in column 4 of Table 5 below.

Table 5 – BCC Background Creep Criteria Applicable at the Site

| Location                              | Time Period | Average Background $L_{A90}$ dB(A) |          |          |
|---------------------------------------|-------------|------------------------------------|----------|----------|
|                                       |             | Measured                           | AS1055.2 | Criteria |
| Front of Site<br>(Logging Location A) | Day         | 55                                 | 60       | 55       |
|                                       | Evening     | 56                                 | 55       | 55       |
|                                       | Night       | 48                                 | 50       | 48       |
| Rear of Site<br>(Logging Location B)  | Day         | 53                                 | 55       | 53       |
|                                       | Evening     | 55                                 | 50       | 50       |
|                                       | Night       | 48                                 | 45       | 45       |

## 3.2 Noise Intrusion and Internal Design Levels

### 3.2.1 Australian Standard AS/NZS 2107:2000 – Steady State Noise

Internal noise criteria relate to traffic noise intrusion, and to air conditioning and other constant noise sources within buildings. These noise levels relate not only to the ambience of the space but also play an important role in maintaining acoustic privacy between spaces. The purpose of setting internal noise criteria is to provide a balance between rooms being too noisy (i.e. uncomfortable noise levels but good privacy), and rooms being too quiet (i.e. comfortable noise levels, but poor privacy). Furthermore the cost of achieving lower noise levels and constructing higher performance partitions and ceilings can become prohibitive and impractical.

Internal noise levels at Hamilton Harbour will be dominated by traffic noise intrusion through the façade and mechanical plant noise. The targets for total noise within each space are given in the Australian Standard, AS2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors*. The target for the overall internal noise level in the space considering all noise sources should therefore not exceed the *maximum* levels specified in Table 6.

**Table 6 – Recommended Design Sound Levels**

| Type of Occupancy/Activity                                               | Recommended Design Sound Level<br>L <sub>Aeq,T</sub> dB(A) |         | Recommended<br>Reverberation<br>Time (T), s |
|--------------------------------------------------------------------------|------------------------------------------------------------|---------|---------------------------------------------|
|                                                                          | Satisfactory                                               | Maximum |                                             |
| RESIDENTIAL BUILDINGS                                                    |                                                            |         |                                             |
| Houses and apartments near major roads—                                  |                                                            |         |                                             |
| Living Areas                                                             | 35                                                         | 45      | —                                           |
| Sleeping Areas                                                           | 30                                                         | 40      | —                                           |
| Work Areas                                                               | 35                                                         | 45      | —                                           |
| Apartment common areas (e.g. foyer, lift lobby)                          | 45                                                         | 55      | *                                           |
| OFFICE BUILDINGS                                                         |                                                            |         |                                             |
| Board and conference rooms                                               | 35                                                         | 40      | 0.6 to 0.8                                  |
| Cafeterias and food courts                                               | 45                                                         | 50      | *                                           |
| Computer rooms                                                           | 45                                                         | 50      | *                                           |
| Corridors and lobbies                                                    | 45                                                         | 50      | 0.4 to 0.6                                  |
| General office areas                                                     | 40                                                         | 45      | 0.4 to 0.6                                  |
| Private offices                                                          | 35                                                         | 40      | 0.6 to 0.8                                  |
| Public Spaces                                                            | 40                                                         | 50      | 0.5 to 1.0                                  |
| Restrooms and tea rooms                                                  | 40                                                         | 45      | 0.4 to 0.6                                  |
| Toilets                                                                  | 50                                                         | 55      | —                                           |
| Undercover car parks                                                     | 55                                                         | 65      | —                                           |
| SHOP BUILDINGS                                                           |                                                            |         |                                             |
| Show rooms                                                               | 45                                                         | 50      | *                                           |
| Small retail stores (general)                                            | 45                                                         | 50      | *                                           |
| Specialty shops (where detailed discussion is necessary in transactions) | 40                                                         | 45      | *                                           |

Note: \* Minimise Reverberation Time as far as practical

Where a specific noise has annoying characteristics such as tonality, repetitiveness, intermittency or impulsiveness an additional penalty of 5 dB(A) is applicable to the noise

### Emergency Plant

Emergency generators and similar plant operating infrequently are able to make an additional 5 – 10 dB(A) noise compared to that specified in Table 6 above. Generators used for load curtailment will need to meet the specified criteria.

### 3.2.2 BCC NIAPSP – AS2107:2000 & External Recreational Spaces

The BCC NIAPSP also references the AS/NZS 2107:2000, however it also provides recommended noise limits for external recreational spaces, refer below.

#### *B.2.3 Special Notes about Outdoor Recreation Areas*

*AS2107:2000 does not include limits for outdoor recreation areas. A reasonable level of outdoor amenity must be maintained for residential and other similar uses in areas where outdoor recreation may occur. In such areas the maximum  $L_{eq}$  in any one hour period should not exceed 60 dB(A) and the  $L_{eq}$  averaged over a 24 hour period should not exceed 55 dB(A)."*

### 3.3 Sleep Disturbance

#### 3.3.1 BCC Noise Methodologies Guideline – Sleep Disturbance

In addition to NIAPSP, the BCC have also issued the draft Noise Methodologies Guideline (NMG) January 2001, which addresses the issues raised in the NIAPSP. The relevant section of the NMG states:

##### ***D. Sleep Disturbance due to Noise Sources Other than Aircraft***

###### *D.1 Application*

*This methodology applies to noise sources operational during the night period (2200 – 0700) that are neither steady nor quasi-steady. Examples include car park noise, hammering and other short duration noise events. This method is not applicable for road traffic. This methodology is suitable for assessing both emissions and immisions.*

###### *D.2 Noise Limits*

###### *D.2.1 General*

*Research adopted by the World Health Organisation (WHO), concludes that for short duration variable noise sources the onset of sleep disturbance commences at internal  $L_{max}$  levels of 45 dB(A). Accordingly, for these noise sources measured internal maximum noise levels in area categories:*

- *R1 – R3 must not regularly exceed 45 dB(A) ; &*
- *R4 – R6 must not regularly exceed 50 dB(A)*

*Here “regularly” refers to the likelihood the noise levels would be exceeded by certain events (e.g. passing trucks) throughout the night.”*

Accordingly, as the residential portions of the site have been categorised as R4, for Residential 1 and 2, and R5, for Residential 3, the sleep disturbance criterion for Residential 1, 2 and 3 is 50 dB(A).

#### 3.3.2 Griefahn Criteria

Griefahn<sup>1</sup> developed a Noise Dose vs. Response curve for sleep disturbance from traffic noise. Her research related to noise induced awakenings from trucks in particular, with varying numbers of truck movements occurring during the night. This is useful in providing guidance as to the assessment of noise emission from one-off or occasional events that would not be considered ‘regular’ events during the night-time period.

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

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

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

<sup>1</sup> *Acoustics Australia, Vol 20, No 2, August 1992, pp. 43-47*

On this basis, any events which occur less than three times per night will be assessed against a limit of 59 dB(A)  $L_{Amax}$ .

### **3.4 Acoustic Separation Ratings**

#### **3.4.1 Internal Acoustic Separation for Commercial Base Building**

This assessment considers commercial base building only. Accordingly, internal acoustic separation advice will be limited to the building core (i.e. lifts, stairwell, amenities) only. The acoustic ratings and typical constructions required to provide speech privacy for other areas is normally part of the fit-out.

#### **3.4.2 Internal Wall Privacy and Noise Transmission Criteria for Apartments**

The Building Code of Australia (BCA) recommends minimum noise isolation treatments to limit noise transfer between spaces in residential buildings. The proposed design ratings for Hamilton Harbour will meet or exceed the current BCA provisions.

### **3.5 Summary of Criteria**

The environmental noise criteria applicable to the Hamilton Harbour development have been summarised in Table 7 below.

Table 7 – Acoustic Design Criteria Summary

| Authority                             | Item                                 | Applicable Area                                                | Descriptor                                   | Target dB(A)       |
|---------------------------------------|--------------------------------------|----------------------------------------------------------------|----------------------------------------------|--------------------|
| Environmental Noise Emission Criteria |                                      |                                                                |                                              |                    |
| EPP (Noise) 2008                      | General Environmental Noise Emission | Dwellings near the site (outdoors)                             | L <sub>Aeq</sub> , adj, 1hr Day/Evening      | 50                 |
|                                       |                                      |                                                                | L <sub>A10</sub> , adj, 1hr Day/Evening      | 55                 |
|                                       |                                      |                                                                | L <sub>A1</sub> , adj, 1hr Day/Evening       | 65                 |
|                                       |                                      | Dwellings near the site (indoors)                              | L <sub>Aeq</sub> , adj, 1hr Day/Evening      | 35                 |
|                                       |                                      |                                                                | L <sub>A10</sub> , adj, 1hr Day/Evening      | 40                 |
|                                       |                                      |                                                                | L <sub>A1</sub> , adj, 1hr Day/Evening       | 45                 |
|                                       |                                      |                                                                | L <sub>Aeq</sub> , adj, 1hr Night            | 30                 |
|                                       |                                      |                                                                | L <sub>A10</sub> , adj, 1hr Night            | 35                 |
|                                       |                                      |                                                                | L <sub>A1</sub> , adj, 1hr Night             | 40                 |
|                                       |                                      | Commercial and Retail near the site (indoors)                  | L <sub>Aeq</sub> , adj, 1hr (business hours) | 45                 |
| EPR 1998                              | Mechanical Plant Noise Emission      | Property Boundaries                                            | L <sub>Aeq</sub> , adj Day                   | 50                 |
|                                       |                                      |                                                                | L <sub>Aeq</sub> , adj Night                 | 50                 |
|                                       | Pool and Spa Pumps                   | Property Boundaries                                            | L <sub>Aeq</sub> , adj Day                   | 50                 |
|                                       |                                      |                                                                | L <sub>Aeq</sub> , adj Evening               | 50                 |
|                                       |                                      |                                                                | L <sub>Aeq</sub> , adj Nigh                  | 50                 |
| BCC - NIAPSP                          | General Environmental Noise Emission | Property Boundaries Adjoining KSD                              | L <sub>A90,T</sub> Day                       | 55                 |
|                                       |                                      |                                                                | L <sub>A90,T</sub> Evening                   | 50                 |
|                                       |                                      |                                                                | L <sub>A90,T</sub> Night                     | 45                 |
|                                       |                                      |                                                                | L <sub>Amax</sub>                            | 50/59 <sup>1</sup> |
|                                       |                                      | Property Boundaries Adjoining Harbour Road and Hercules Street | L <sub>A90,T</sub> Day                       | 55                 |
|                                       |                                      |                                                                | L <sub>A90,T</sub> Evening                   | 50                 |
|                                       |                                      |                                                                | L <sub>A90,T</sub> Night                     | 45                 |
|                                       |                                      |                                                                | L <sub>Amax</sub>                            | 50/59 <sup>1</sup> |
| Noise Intrusion Objectives            |                                      |                                                                |                                              |                    |
| BCC - NMG                             | Noise Intrusion                      | Commercial or Retail Areas                                     | No set criteria                              |                    |
|                                       |                                      | Apartment common areas (e.g. foyer, lift lobby)                | L <sub>Aeq</sub> , T                         | 55 <sup>2</sup>    |
|                                       |                                      | Living areas                                                   | L <sub>Aeq</sub> , T                         | 45 <sup>2</sup>    |
|                                       |                                      | Bedrooms                                                       | L <sub>Aeq</sub> , T                         | 40 <sup>2</sup>    |
| AS/NZS 2107:2000                      | Noise Intrusion                      | General Office                                                 | L <sub>Aeq</sub> , T                         | 45 <sup>2</sup>    |
|                                       |                                      | Retail                                                         | L <sub>Aeq</sub> , T                         | 50 <sup>2</sup>    |
|                                       |                                      | Apartment common areas (e.g. foyer, lift lobby)                | L <sub>Aeq</sub> , T                         | 55 <sup>2</sup>    |
|                                       |                                      | Living areas                                                   | L <sub>Aeq</sub> , T                         | 45 <sup>2</sup>    |
|                                       |                                      | Bedrooms                                                       | L <sub>Aeq</sub> , T                         | 40 <sup>1,2</sup>  |

Note: 1. The 50 dB(A) L<sub>Amax</sub> criterion is applicable for regular occurrences at night-time only (10 pm to 6 am). Events occurring less than three times per night will be assessed against a limit of 59 dB(A) L<sub>Amax</sub>.  
2. Mechanical services noise should be designed to be at least 10 dB(A) below these criteria

## 4.0 Description of Noise Sources

### 4.1 External Noise Intrusion

As discussed in Section 2.0, a site inspection and noise survey were undertaken to determine the existing noise environment. The noise environment surrounding the Hamilton Harbour site is characterised by high levels of road traffic noise.

The site layout is such that the commercial buildings are located along the property boundary bordering KSD and therefore provide a degree of acoustic screening for the residential buildings from road traffic noise associated with KSD, as shown in Figure 3.

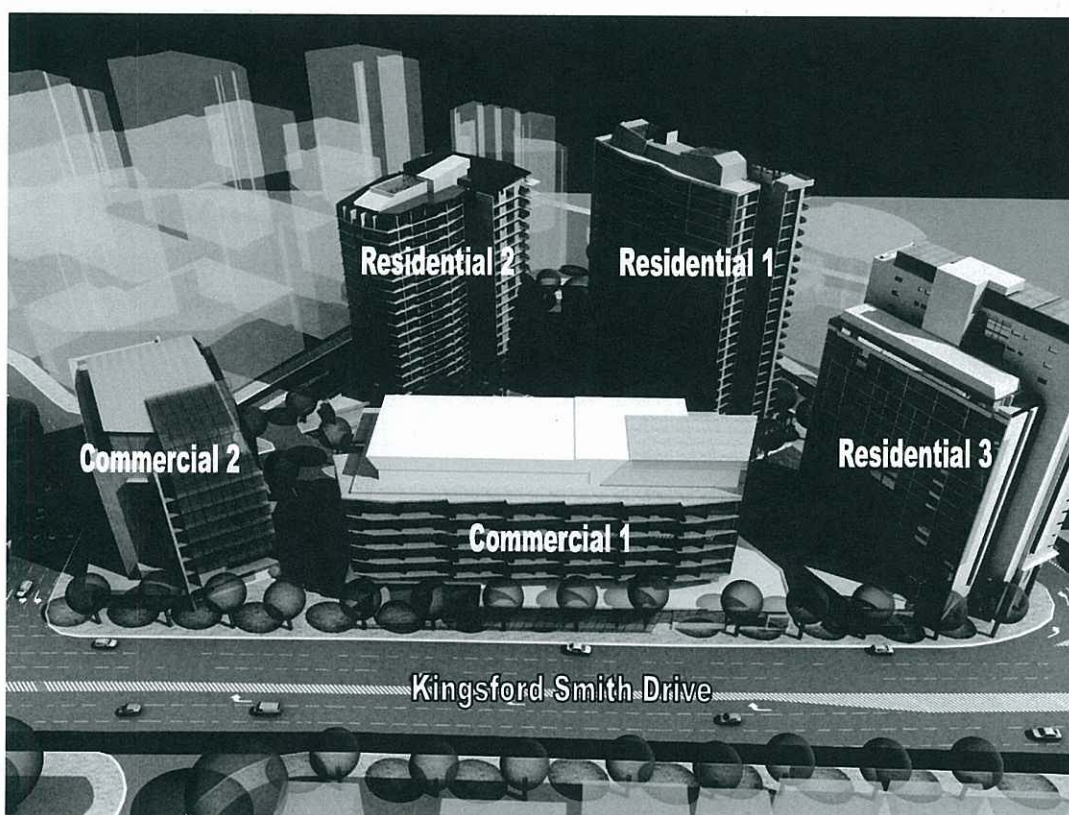


Figure 3 - 3D Mock-up from the Master Plan

#### 4.1.1 Road Traffic Noise

Kingsford Smith Drive is a four lane road which carries high traffic volumes. Accordingly, there is a potential for excessive noise levels inside spaces and at external recreation areas.

Traffic volumes along Kingsford Smith Drive are forecast to increase in the future. BCC have advised that the following traffic volumes are expected at the subject site.

Table 8 – Kingsford Smith Drive - Road Traffic Volumes

| Year | AADT  | 18 hour traffic flow <sup>1</sup> | % Heavy Vehicles |
|------|-------|-----------------------------------|------------------|
| 2007 | 69000 | 64860                             | 11               |
| 2021 | 77000 | 72380                             | 11               |

Note: 1. Assumes 18 hour traffic flow is 94% of AADT

As discussed earlier, a road traffic noise model was developed to forecast noise levels at the site for the year 2021 and these results are given in Table 9 below.

**Table 9 - Road Traffic Noise Forecasts for 2021.**

| Location                                                                           | Forecast Free Field Road Traffic Noise Level<br>dB(A) $L_{Aeq}$ (1 hour) |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Building façades fronting KSD (i.e. Commercial 1, Commercial 2, and Residential 3) | Up to 77                                                                 |
| Building façades of Residential 1 & 2                                              | Up to 65                                                                 |

From the forecasts of the road traffic noise model, it is expected that high performance double glazing systems may be required to mitigate a small number of the most exposed bedrooms of Residential 3. These requirements could be reduced by limiting the ratio of façade glazing to sensitive spaces such as bedrooms.

#### **4.1.2 Aircraft Noise**

The site falls beneath a major flight path to the Brisbane International Airport. A preliminary review indicates that the site falls outside the ANEF 20 contour. Therefore aircraft noise is not expected to be a key consideration in the design of the building façade. It is expected that this noise will be generally controlled by the façade treatments required for road traffic noise intrusion.

### **4.2 Environmental Noise Emission**

#### **4.2.1 Mechanical Plant Noise**

Mechanical plant noise has potential to impact significantly on sensitive areas of the development. It is expected that new mechanical plant associated with the development will be the main source of plant noise at the development and may require treatment. The following sources of noise may be used at the development: pumps, fans, air handling units, condensers, cooling towers, etc. In order to minimise these potential noise impacts, consideration will be given to the location and selection of plant to minimise the level of treatment required.

Noise from mechanical plant on site will be controlled to ensure noise levels at nearby noise sensitive receptors comply with the EPR requirement of 50 dB(A) for day, evening and night.

Treatments to plant rooms and externally located plant to control noise emission will be determined during detailed design phases once specific plant has been selected. Techniques used to control this noise emission may consist of a combination of;

- Enclosed Plant rooms
- Silencers
- Lined ductwork
- Acoustic barriers
- Acoustic louvres
- Acoustically rated doors
- Lining of plant rooms with 50 mm 32 kg/m<sup>3</sup> acoustic insulation
- Selection of quiet plant

#### **4.2.2 Pedestrian and Retail Noise**

Noise from pedestrians on footpaths and external retail areas can potentially be audible within the commercial and residential buildings. It is expected that this noise will be generally controlled by the façade treatments required for road traffic noise intrusion.

In addition noise associated with the proposed restaurant and café areas will need to be considered, including outdoor dining. It is expected that noise from these activities will be controlled on site using a noise management plan.

#### **4.2.3 Refuse Collection**

The collection of garbage from the site may generate noise that has the potential to be considered a nuisance. The noise generated from garbage collection will typically be from: garbage trucks, lifting and placement of garbage bin, and the noise of garbage falling into the garbage collector. It is expected that refuse collection occurs during the day-time period and is no more intrusive than existing refuse collection activities in the area.

#### **4.2.4 Car Park & Driveway Use**

Noises associated with car park use such as doors slamming, idling engines, accelerating cars etc. have the potential to cause annoyance at neighbouring residential areas. The potential for noise from the car park to be considered annoying is greatest during the night. Vehicle movements associated with a commercial development are expected to occur predominantly between the hours of 8 am and 6 pm, with occasional movements between 6 am and 8 am, and between 6 pm and 8 pm. Turnover rates for commercial buildings are generally low and the amount of traffic generated on nearby roads such as KSD is negligible compared to existing traffic flows. Vehicle movements during night-time hours (i.e. between 10 pm and 6 am ) is expected to be low.

Roller doors and other access doors to car parks are to be selected and maintained to avoid squealing, slamming, banging, etc. Speed bumps, guttering, grates, etc. within car parks or on driveways are to be installed in such a fashion to not generate noise when vehicles drive over them. For example, poorly fitting metal grates in a concrete frame are to be avoided.

#### **4.2.5 Swimming Pool and Common Areas**

Noise arising from the use of the swimming pools, both the internal pool in Residential 3 and the outdoor pool, and common areas has potential to impact the proposed residential buildings, particularly late at night. Noise associated with the pools will be managed using appropriate signage and by limiting access late at night. The behaviour of tenants in common areas will be controlled by the Body Corporate.

## 5.0 Conclusions

Noise intrusion from road traffic and aircraft has been described in Section 4.1. Objectives for controlling noise intrusion into both the residential and commercial components of this development are outlined in Section 3.5. Noise intrusion to sensitive uses can be controlled to meet the nominated objectives.

Sources of potential noise emission from the site have been described in Section 4.2 of this report. Noise emission criteria have been nominated for mechanical plant, refuse collection and other activities at the site in Section 3.5. Noise emissions from these activities can be controlled to meet the nominated criteria.

Accordingly, there are no acoustic site conditions that would preclude the proposed development from complying with the appropriate noise criteria identified in this report.

## Appendix A - Glossary of Acoustic Terms

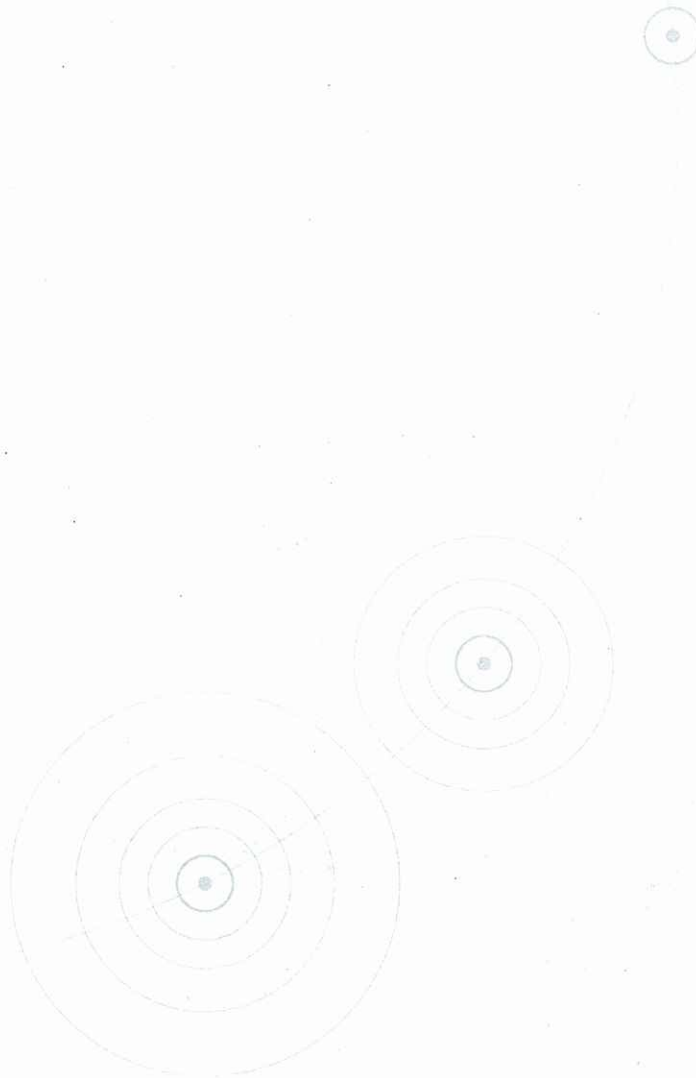
## Appendix A

## Glossary of Acoustic Terms

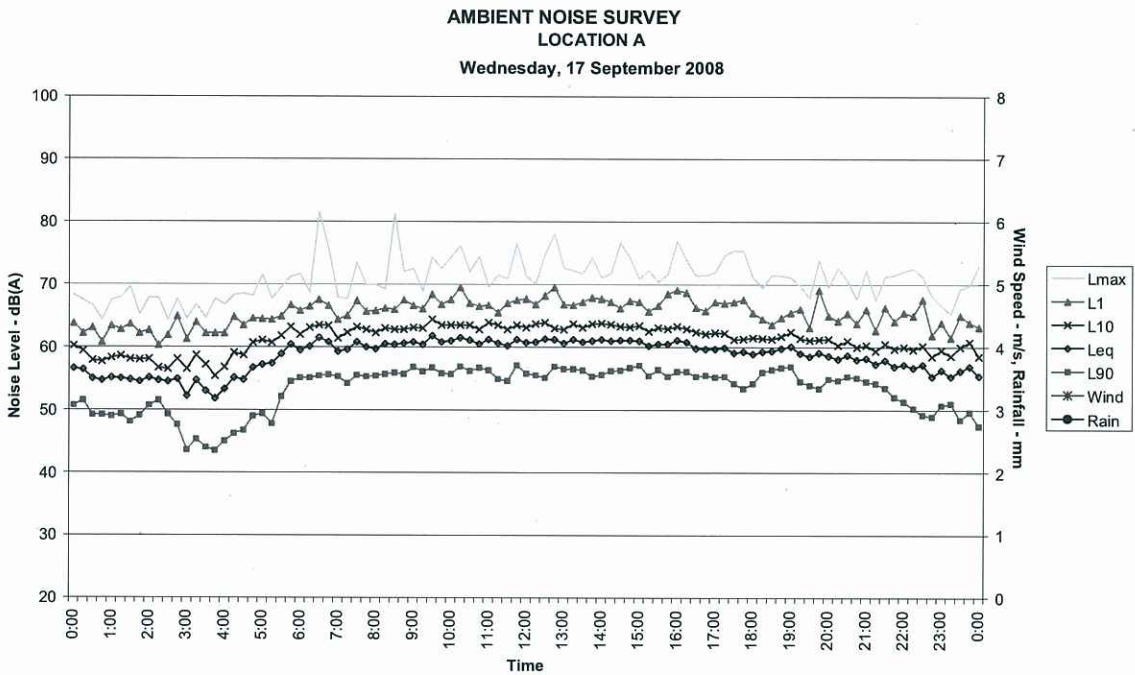
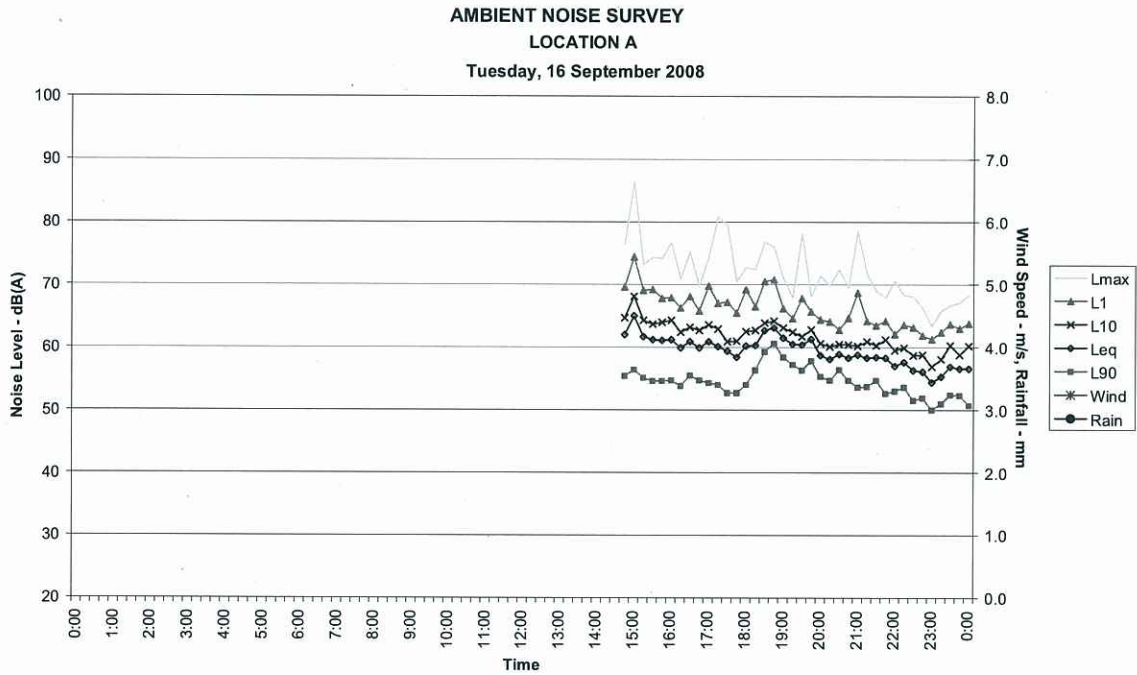
|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 'A' Weighted                    | Frequency filter applied to measured noise levels to represent how humans hear sounds.                                                                                                                                                                                                                                                                                                                                                                         |
| Ambient Sound                   | The all-encompassing sound at a point being a composite of sounds from near and far.                                                                                                                                                                                                                                                                                                                                                                           |
| Background sound                | The ambient sound in the absence of the sound under investigation.                                                                                                                                                                                                                                                                                                                                                                                             |
| dB                              | The decibel (dB) is a logarithmic unit of measurement that is commonly used to express sound pressure level. An increase of 3 dB corresponds to an approximate doubling of sound power. When applied to sound, an increase of 10dB corresponds approximately to a perceived doubling of loudness; typically 0 dB is the threshold of hearing and 120 dB is the threshold of pain.                                                                              |
| dB(A)                           | 'A' Weighted overall sound pressure level.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| D <sub>w</sub>                  | Weighted Level Difference – Single number that represents the noise reduction in sound between two adjoining enclosed spaces. The result includes the actual noise reduction for the installed partition and ceiling systems. The higher the D <sub>w</sub> , the greater the noise isolation between enclosed spaces.<br><br>D <sub>w</sub> has superseded NIC as the Australian Standard for acoustically rating room to room noise isolation. See NIC Below |
| Flanking transmission           | The transmission, between two rooms sharing a common partition, of sound generated in the air of one of them via all paths except that through the common partition.                                                                                                                                                                                                                                                                                           |
| Free field                      | A sound field in a medium of such extent that the effects of the boundaries are negligible throughout the region of interest.                                                                                                                                                                                                                                                                                                                                  |
| Frequency (Hz)                  | The human ear responds to sound in the frequency range of 20 Hertz to 20,000 Hz. A combination of sound pressure and frequency determine perceived loudness. The centre frequency of an octave is double the frequency of the lower octave. Sound measurements are usually taken at 16 one third octave bands between 50 and 5000 Hz.                                                                                                                          |
| Impact sound transmission level | In a given frequency band, between two rooms situated above the other: the average octave band sound pressure level, throughout the lower room, produced by impacts delivered by a standard tapping machine to the floor of the upper room.                                                                                                                                                                                                                    |
| Intermittent noise              | A noise whose sound pressure level suddenly drops to the background level several times during the period of observation, the time during which the level remains at a constant value different from that of the background level being of the order of 1s or more.                                                                                                                                                                                            |
| L <sub>10</sub>                 | Noise level exceeded for 10% of the measurement period. This represents the upper intrusive noise level and is often used to represent traffic/ music noise.                                                                                                                                                                                                                                                                                                   |
| L <sub>90</sub>                 | Noise level exceeded for 90% of the measurement period. This represents the background noise level excluding nearby sources.                                                                                                                                                                                                                                                                                                                                   |
| L <sub>eq</sub>                 | Energy averaged noise level over the measurement period. This measure is commonly used when comparing the criterion noise level under the Environmental Noise Regulations and for comparison with relevant standards for air conditioning noise.                                                                                                                                                                                                               |
| Masking                         | The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.                                                                                                                                                                                                                                                                                                                                                       |
| NIC                             | Noise Isolation Class – Single number that represents the noise reduction in sound between two adjoining enclosed spaces. The result includes actual noise reduction for the installed partition and ceiling systems.                                                                                                                                                                                                                                          |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NR                 | Noise Rating - Single number evaluation of the background noise level. The NR level is normally around 5 dB below the 'A' weighted noise level.                                                                                                                                                                                                                                                                                         |
| R <sub>w</sub>     | <p>Weighted Sound Reduction Index – Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single building element. The higher the R<sub>w</sub>, the greater the noise isolation between enclosed spaces.</p> <p>R<sub>w</sub> has superseded STC as the accepted Australian Standard for acoustically rating partitions or building elements. See STC Below</p> |
| Reverberation      | The persistence of sound in a space after a sound source has been stopped.                                                                                                                                                                                                                                                                                                                                                              |
| Sound Absorption   | <p>a). Reduction of intensity of sound waves on reflection</p> <p>b). The property possessed by materials, objects or media of dissipating sound energy.</p>                                                                                                                                                                                                                                                                            |
| Sound Power Level  | The total sound energy radiated from a source per unit of time. Ten times the logarithm to the base 10 of the ratio of a given power to a reference power.                                                                                                                                                                                                                                                                              |
| STC                | Sound Transmission Class - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single building element. Calculation procedures for STC are defined in AS 1276-1979. The higher the STC, the greater the noise isolation between enclosed spaces.                                                                                                               |
| Steady-state noise | A noise having negligibly small fluctuations of sound pressure level within the period of observation.                                                                                                                                                                                                                                                                                                                                  |
| Transon dent       | Acoustically transparent.                                                                                                                                                                                                                                                                                                                                                                                                               |

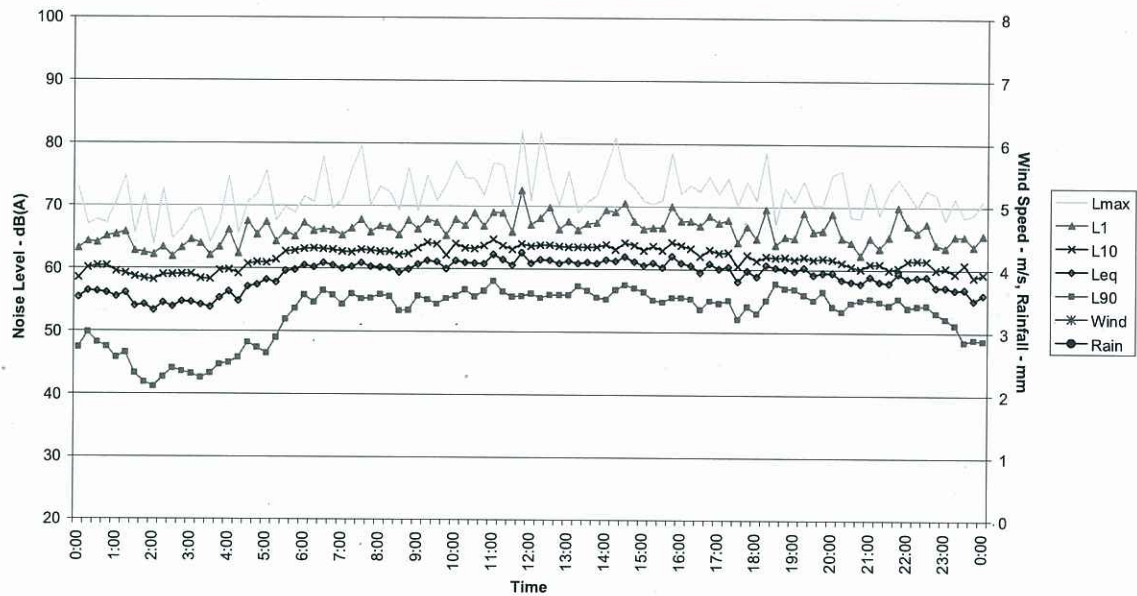
## Appendix B - Noise Level Traces



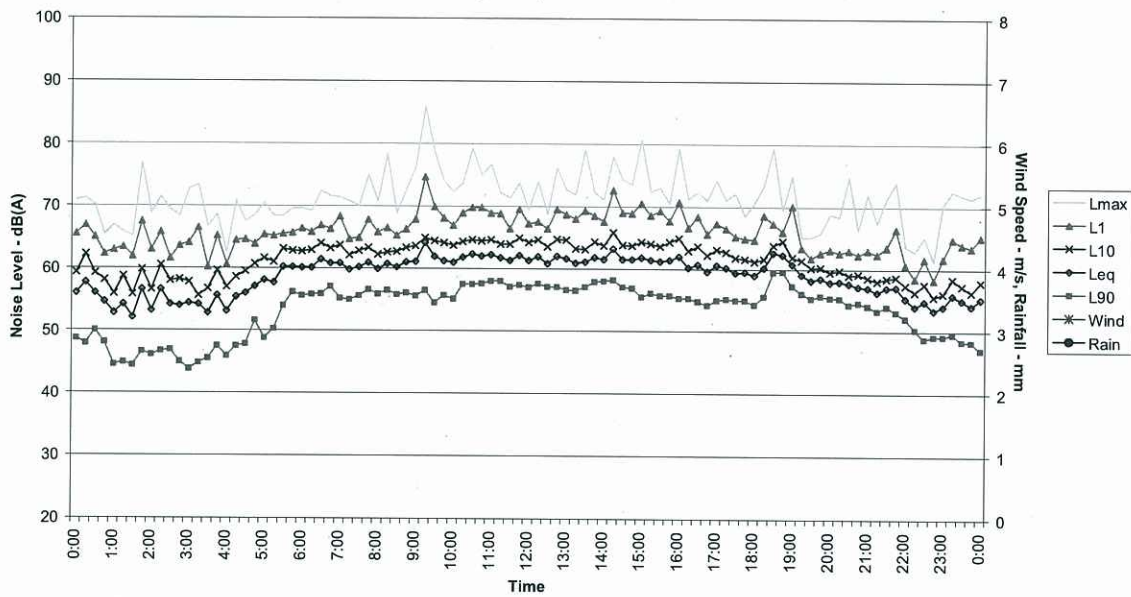
## Noise Level Traces – Logging Location A



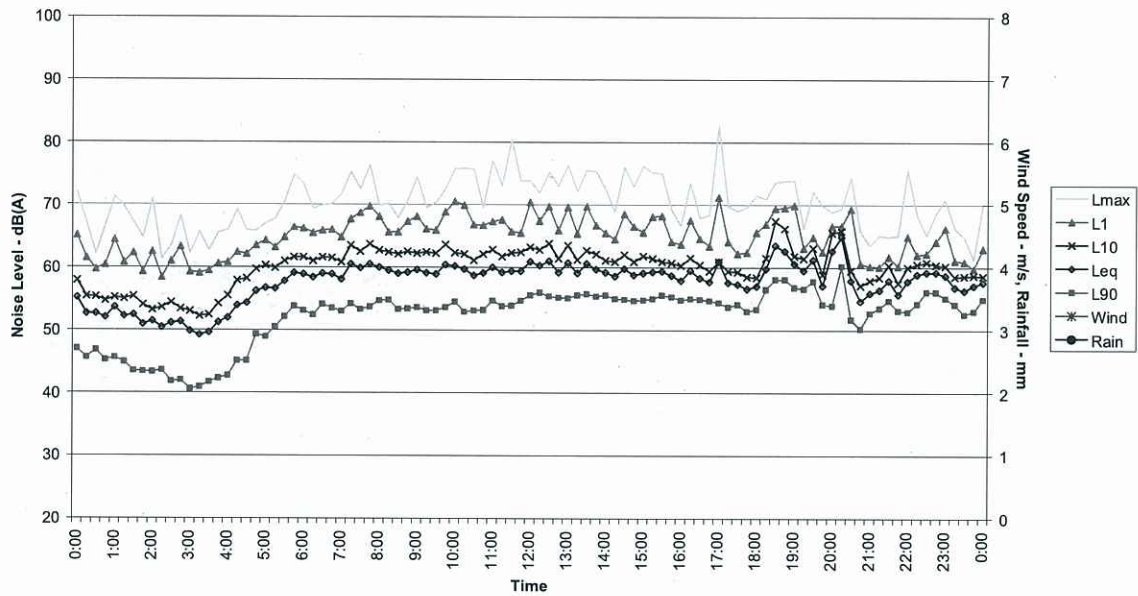
**AMBIENT NOISE SURVEY  
LOCATION A  
Thursday, 18 September**



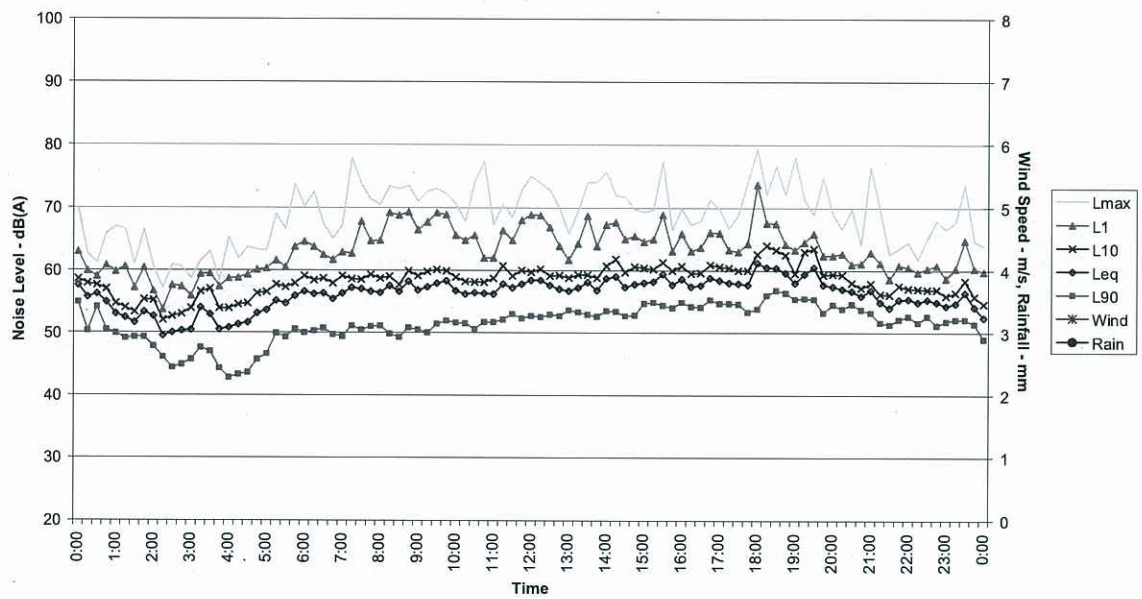
**AMBIENT NOISE SURVEY  
LOCATION A  
Friday, 19 September 2008**



**AMBIENT NOISE SURVEY  
LOCATION A  
Saturday, 20 September 2008**



**AMBIENT NOISE SURVEY  
LOCATION A  
Sunday, 21 September 2008**

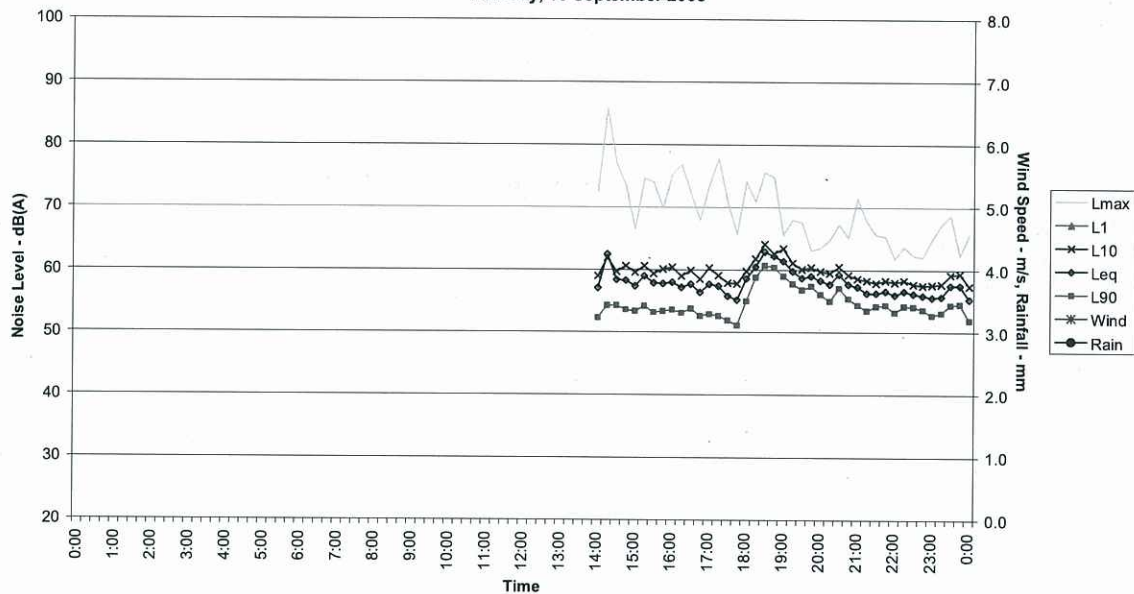


**AMBIENT NOISE SURVEY  
LOCATION A  
Monday, 22 September 2008**

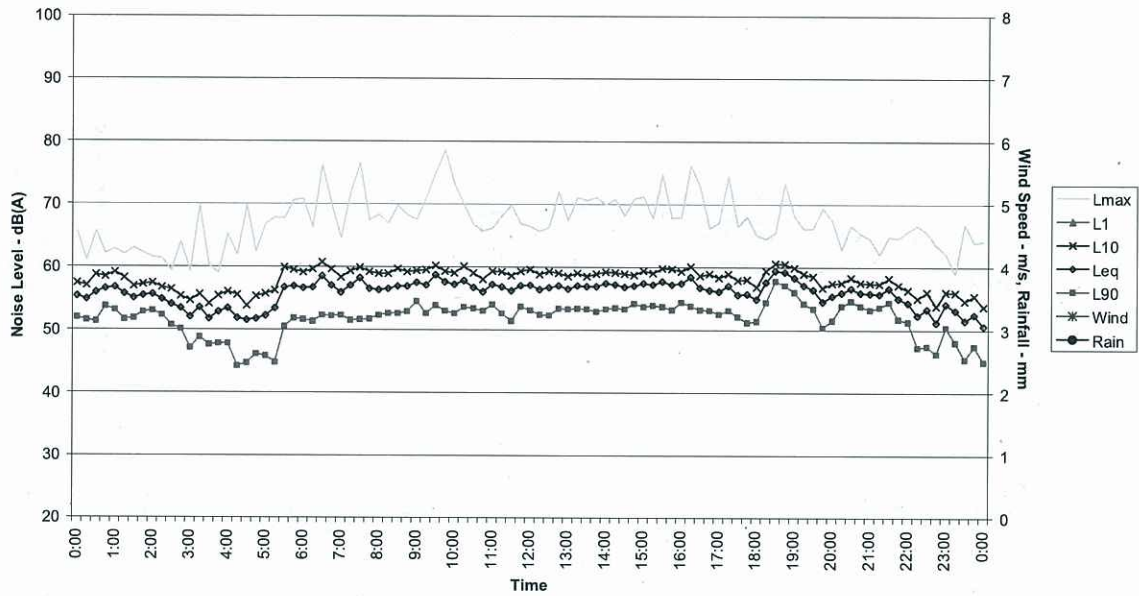


**Noise Level Traces – Logging Location B**

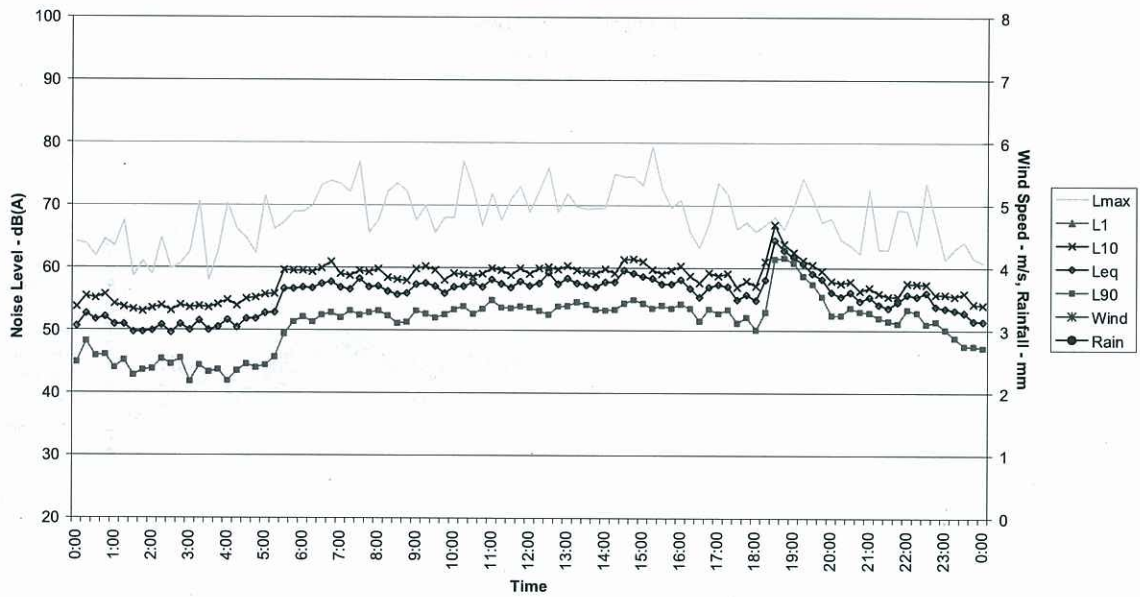
**AMBIENT NOISE SURVEY  
LOCATION B  
Tuesday, 16 September 2008**



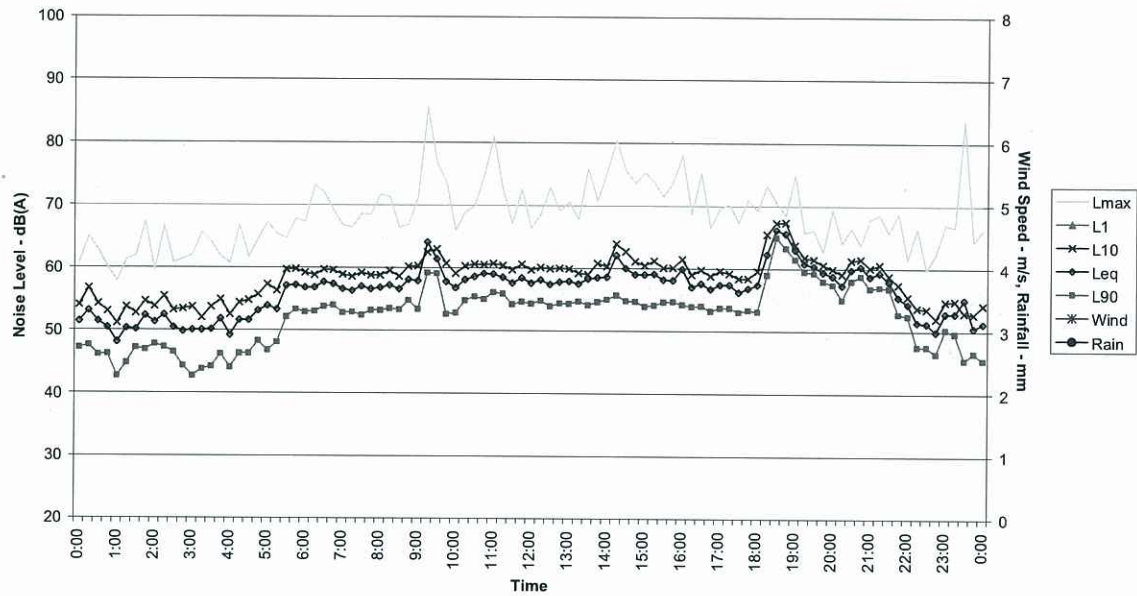
**AMBIENT NOISE SURVEY  
LOCATION B  
Wednesday, 17 September 2008**



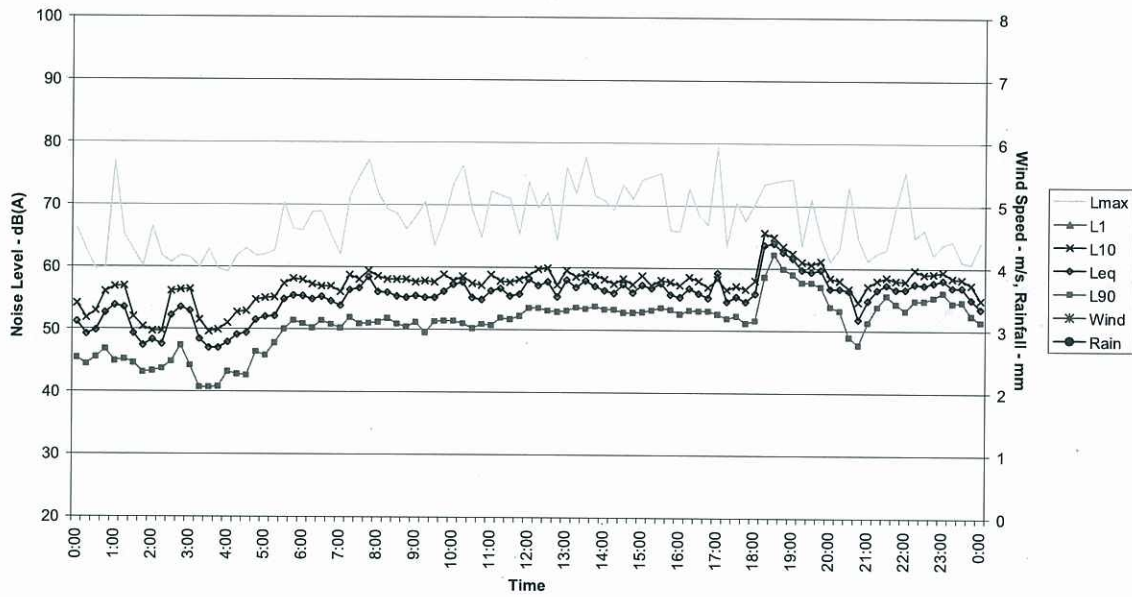
**AMBIENT NOISE SURVEY  
LOCATION B  
Thursday, 18 September**



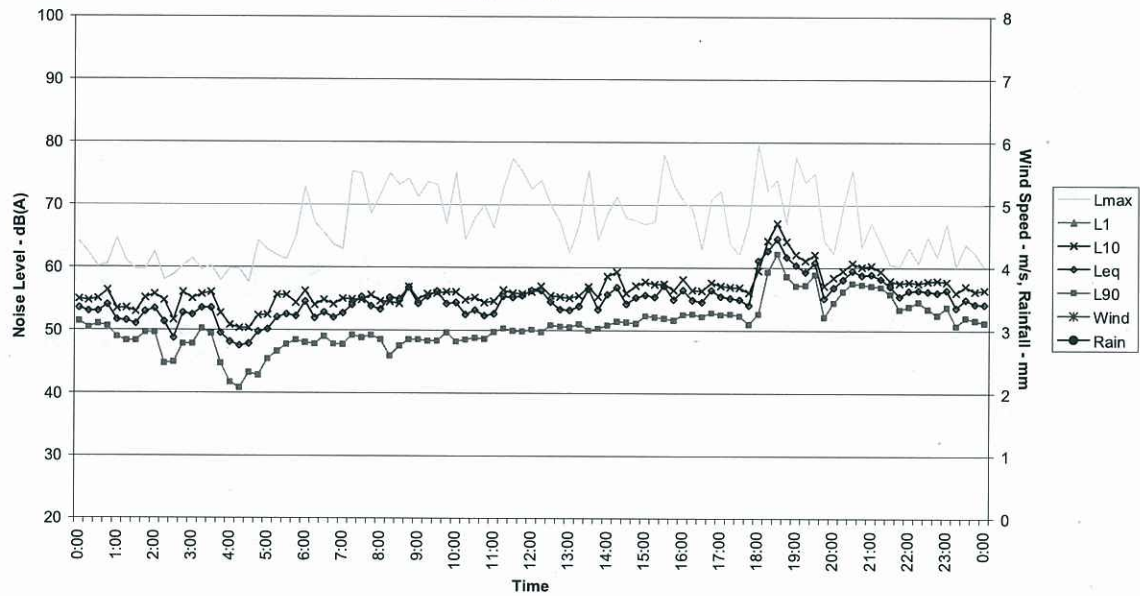
**AMBIENT NOISE SURVEY  
LOCATION B  
Friday, 19 September 2008**



**AMBIENT NOISE SURVEY  
LOCATION B  
Saturday, 20 September 2008**



**AMBIENT NOISE SURVEY  
LOCATION B  
Sunday, 21 September 2008**



**AMBIENT NOISE SURVEY  
LOCATION B  
Monday, 22 September 2008**

