Noise and Sound Services

# Proposed Community Preschool and Primary School - Noise Impact Assessment

1 Rosemead Road,
Hornsby,
NSW 2077.

January 2020

Report No. nss23149 – Final

Prepared at the Request of:-

**Daven Timms**
1A Rosemead Road
Hornsby, NSW 2077

Prepared by:-

**NOISE AND SOUND SERVICES**
**Spectrum House, 3, Cassandra Avenue, St Ives, NSW 2075**
Tel: (02) 9449 6499. Mob: 0411 648153
**E -mail:** noiseandsound@optusnet.com.au **Website:** www.noiseandsound.com.au
A member firm of the Association of Australasian Acoustical Consultants
**ABN: 7277 134 9599**

# C O N T E N T S


| | | Page |
|---|---|---|
| | **PEER REVIEW** | **1** |
| **1.** | **INTRODUCTION** | **2** |
| **2.** | **DEVELOPMENT AND SITE DESCRIPTION** | **2** |
| 2.1 | Development Description | 2 |
| 2.2 | Description of the Surrounding Environment | 3 |
| **3.** | **NOISE CRITERIA** | **3** |
| 3.1 | Hornsby Shire Council Policy and Guidelines | 4 |
| 3.2 | NSW Government Criteria | 4 |
| 3.3 | The Noise Guide for Local Government | 5 |
| 3.4 | NSW Land and Environment Court (2005) | 7 |
| 3.5 | AAAC Child Care Centre Noise Assessment | 7 |
| 3.6 | Road Traffic Noise | 8 |
| **4.** | **NOISE SOURCE MODELS** | **8** |
| 4.1 | Noise Modelling Specifications | 8 |
| 4.2 | Basic Noise Modelling Equations | 9 |
| 4.3 | Noise Model – Outdoor Play Area | 9 |
| 4.4 | Car Park Noise Emissions | 11 |
| 4.5 | On-Road Traffic Noise Model | 12 |
| **5.** | **AMBIENT NOISE MEASUREMENT** | **12** |
| 5.1 | Instrumentation | 12 |
| 5.2 | Measurement Procedure | 13 |
| 5.3 | Noise Measurement Results | 13 |
| **6.** | **NOISE GOALS AND ASSESSMENT** | **14** |
| 6.1 | Noise Goals | 14 |
| 6.2 | Noise Barrier Fence Assessment | 15 |
| 6.3 | Outdoor Play Area Assessment | 16 |
| 6.4 | Car Park Noise Assessment | 17 |
| 6.5 | On – Road Traffic Assessment | 17 |
| 6.6 | Mechanical Plant Noise | 17 |
| **7.** | **CONCLUSION** | **18** |
| **APPENDIX A – MEASURED SOUND PRESSURE LEVELS** | | **20** |
| **APPENDIX B – GLOSSARY OF TECHNICAL TERMS** | | **25** |

# PEER REVIEW

NG Child & Associates has been engaged to undertake an acoustic assessment of a proposed Preschool & Primary School development at 1 Rosemead Road, Hornsby, NSW. They have prepared a report entitled *"Acoustic Assessment Report Proposed Preschool & Primary School 1 Rosemead Road Hornsby NSW"*, dated 5 December 2019 (The Report) on behalf of Blue Gum Community School. They predict that the level of noise estimated to be generated by activities within the outdoor activity areas associated with the school facility will have no negative or non-compliant impacts on surrounding buildings, activities and individuals, subject to the implementation of their recommendations. These recommendations which includes lapped and capped timber fencing of height 1800 mm and with a minimum weighted sound reduction index ($R_w$) of 25 dBA (*sic – $R_w$ is not 'A' frequency weighted as reported by NG Child & Associates)* installed along the eastern and western boundaries of the site (their Section 6.4). However, the NG Child & Associates assessment contains some fundamental errors. The main error occurs in Table 6.10 of The Report. Here they assumed a sound reduction for the proposed acoustic perimeter fence to be the same as the $R_w$ i.e. 25 dB. This ignores the main limiting affect, with any acoustic barrier, which is diffraction (i.e. the bending, or changing in direction, as the sound waves travel around the edges of a barrier). In this case, the diffraction limits the affect of the proposed barrier to not more than 6 dB.

In Table 5.1 of The Report background sound level measurement results are given. However, these are erroneously based on the **mean** logarithmic $L_{A90}$. The Assessment Background Level (ABL) noise background level for each day should be determined by calculating the **$10^{th}$ percentile** (i.e. lowest $10^{th}$ percent) background level ($L_{A90}$) for each period. Then the Rating Background Level (RBL) for each period is the **median** value of the ABL values for the period over all the days measured. This error in The Report could give a typical overestimation of the background level by 75% in energy terms (i.e. 2 dB). Hence an underestimation of the noise impact by a similar amount on nearby residents.

In many places in The Report, the RBL is given in terms of the descriptor $L_{Aeq}$ rather than $L_{A90}$ i.e. Table 5.3, Table 6.3, pages 30 and 32. This repeated error shows a lack of understanding of the basic acoustical terms.

On page 33 of The Report it is stated "*The data summarised in Table 6.4, on the following page, was reported by RSA Acoustics and NG Child & Associates in 2015 and has since been accepted by the Acoustic Society of NSW for reference purposes."* However, as NSW consultants qualified in acoustics are aware, there is no such organisation by the name of *the Acoustic Society of NSW.*

Due to the errors in The Report a revised report, by a member firm of the Association of Australasian Acoustical Consultants (AAAC) is given below.

# 1. INTRODUCTION

Noise and Sound Services was requested by Daven Timms of 1A Rosemead Road, Hornsby, NSW 2077 to carry out a noise assessment for the proposed development of a Community School comprising of a preschool and primary school at 1 Rosemead Road, Hornsby, NSW 2077.

The purpose of the noise assessment is to provide an independent and accurate assessment, by a qualified acoustician, of the potential noise emissions from the centre. The assessment is carried out in accordance with the requirements provided by NSW Government noise guidelines.

# 2. DEVELOPMENT AND SITE DESCRIPTION

## 2.1 Development Description

The site of the Community School is proposed to be located at the far eastern end of Rosemead Road and extends through to William Street. The site has a street frontage approximately 87 metres in length to Rosemead Road, approximately 41 metres in length to William Street and occupies an area of approximately 3,623 square metres. The subject site is currently occupied by the heritage listed "Mount Errington" dwelling house, a two-storey federation mansion with extensive gardens and a former tennis court. The proposed overall hours of operation of the community school Monday to Friday will be from 7:45 am to 6:15 pm. This includes 15 minutes of time at the beginning and the end of each day for staff only.

It is understood that the proposed Blue Gum Community School facility will be for a maximum 80 children, being 32 preschool age children (3-5 year olds only) and 48 primary age children (5-12 year olds). The proposed use of the outdoor play area will be from 9:30 am to 2:45 pm (with short breaks as detailed below). The proposed times of use of the outdoor play area are:-

- 32 children in the outdoor play area from 9:30 to 10:30 am;
- 48 children in the outdoor play area from 10:40 to 11:00 am;
- 32 children in the outdoor play area from 11:15 to 12:15 am;
- 48 children in the outdoor play area from 12:30 to 01:30 pm; and
- 32 children in the outdoor play area from 2:15 to 2:45 pm;

In addition, the outdoor play area is proposed to be used for children in after school care for approximately 1 hour between the hours of 4:00 pm to 5:45 pm.

It is proposed to cater for on-site parking for a total of 12 cars plus an on-site drop-off/pick-up bay. The former tennis court is proposed to be converted to 9

car parking spaces and 3 spaces are to be located in front of the secure rear parking area and are to be allocated to staff.

## 2.2 Description of the Surrounding Environment

The site is bordered by 1A Rosemead Road to the west, with a home office and garage, within approximately 1 metre of the proposed car park as shown in Figure 1 below. To the west of the proposed outdoor play area is 52 William Street and the two-storey Adventist Aged Care facility at 48-50 William Street.

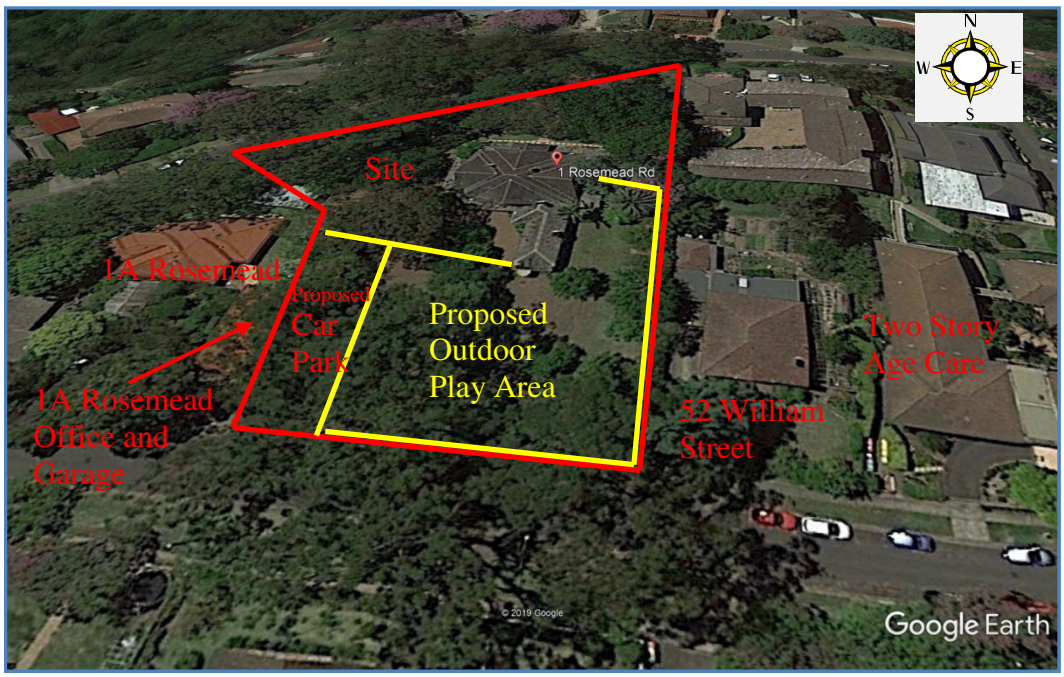



***Figure 1: Surrounding Environment of the proposed Childcare Centre. Source: Google Earth.***

## 3. NOISE CRITERIA

The objective of the noise assessment is to ensure neighbouring residential premises are not unduly affected by noise emissions from the proposed community preschool and primary school. The characteristics of noise emissions from children's schools relate to the sound of children at play, the addition of on-road traffic and potential mechanical ventilation noise.

### 3.1 Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development (2000)

Section 7.2.8 Home Industry of the Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development states:- *"Approval shall not be granted for the operation of a home industry unless it can be established to the satisfaction of Council that the $L_{Aeq}$ noise level due to noise level emissions of a continuous or semi-continuous nature from the home industry operation will not exceed the background $L_{A90}$ sound level by more than 5 dBA when measured in the immediate vicinity of the external structure of any nearby residence. Where tonality or impulsiveness can be established at the receiver location, a 5 dBA penalty shall be applied."*

### 3.2 NSW Government Criteria

The NSW Government, via the Environment Protection Authority (EPA), provide guidelines for many industrial, commercial and domestic types of noise sources. The primary aim of environmental noise control is to minimise the occurrence of offensive noise in the community. To be both effective and equitable, the determination and application of environmental noise control measures must take into account many factors for example: -

- the variation in response between individuals to any noise;
- the inherently noisy characteristics of many activities;
- the circumstances within which the noise occurs;
- the technical and economic feasibility for noise control; and
- the social worth of the activity.

Offensive noise is defined in the NSW Protection of the Environment Operations Act 1997 (POEO Act) as being noise:-

*'a) that, by reason is of its level, nature, character or quality, or the time at which it is made, or other circumstances:*
  *i. Is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
  *ii. interferes unreasonably with (or is likely to Interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*

*b) that, is of a level, nature, character or quality prescribed by the regulations or that is made at a time or in other circumstances, prescribed by the regulations.'*

The NSW Government, also state that social surveys have indicated that noise from any particular source will be audible to many people in the community when that noise exceeds the background level by more than 5 decibels (dB). The noise may have characteristics which are pleasant or unpleasant to the listener. The 5 dB over background criterion is primarily aimed at industrial or commercial machine noise or domestic machine noise such as air conditioners.

Technically the background is found from the noise level that is present for 90% of the time of the measurement periods (usually 15 minutes each) and this is known as the $L_{AF90,\ 15\ minute.}$ The source noise is found from the average of the sound energy (again usually 15 minutes samples), which is known as the $L_{Aeq,\ 15\ minute.}$ The NSW Government does not provide specific guidelines for noise from schools, play areas or childcare centres.

In suburban areas, noise from neighbour's children at play in backyards can be pleasant or in many cases it is readily tolerated. It could be considered unreasonable to adopt the 5 dB over background criterion in this situation. The noise from children at play in a community preschool and primary school differs from the domestic situation in that it is a business, carried out for commercial reasons, the children usually number many more than in a domestic situation and the age range of the children does not significantly vary over time as it would in a domestic situation.

However the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play can be pleasant, the noise levels are only generally audible during the time the children play outside, no weekend or public holiday activity is usual and community and preschool and primary schools are of considerable social worth. Hence, in a situation where outdoor playtimes are relatively short (2 hours per day), a level of 10 dB above the background could be considered to be more appropriate than the 5 dB, which is often required as a 'blanket' condition by Councils. Where the outdoor playtimes are not significantly longer than 2 hours per day, the Council could adopt a noise goal at or between 5 dB and 10 dB over the existing background noise level. Where the outdoor playtimes are significantly longer than 2 hours per day (as in this case), the Council would normally adopt a noise goal of 5 dB over the existing background noise level.

### 3.3 The Noise Guide for Local Government

The NSW Government's Noise Guide for Local Government (NGLG) provides guidelines for the assessment of offensive and intrusive noise levels. Local councils are encouraged to develop noise policies which specify intrusive noise levels and appropriate descriptors for particular activities in certain situations and locations. Such a policy could, for example, specify that noise from mechanical

plant at commercial or industrial premises that exceeds the background noise by more than 5 dB as measured over a 15-minute period ($L_{Aeq,\ 15\ minute}$) is intrusive.

The noise is assessed at the most affected point on or within the neighbouring residential property (unless that residence is more than 30 metres from the boundary). Intrusive noise is not the same as offensive noise as defined in the POEO Act 1997. Intrusive noise can represent offensive noise, but whether this is always the case depends on the source of the noise, noise characteristics and cumulative noise levels.

For non-tonal air conditioners the intrusive noise criteria can be taken as a measure of offensive noise, however sound from a childcare centre should not be automatically considered to be offensive just because it may exceed the 5 dB on background criterion. The Noise Guide for Local Government sites a typical DCP on childcare centres (section 3.1.1 Strategic planning) with reference to the following controls:-

*(a) Child-care centres must achieve an ambient noise level within the centre not exceeding 40 dB (A) within learning areas. Designated sleeping areas are to achieve a level not exceeding 35 dB(A) within the room. Designs should aim to locate sleep rooms and play areas away from the principal noise sources. Where necessary the impact of noise must be reduced by solid fencing and double glazing.*

*(b) Centres must be carefully designed so that noise is kept to a minimum and does not create an "Offensive Noise" as defined by the Protection of the Environment Operations Act 1997. Factors to consider, and which Council may require to be addressed include:*

- *Orienting the building having regard to impacts on neighbours. This may include locating play areas away from neighbouring bedrooms.*
- *Providing double-glazing of windows where necessary;*
- *Erection of noise barriers, which may include fencing types that minimise noise transmission;*
- *Insulation of external noise sources such as air conditioners;*
- *Placing restrictions on the number of children to be outdoors at any one time.*

*(c) All applications for Type B child-care centres shall be accompanied by an 'acoustic' report, prepared by a suitably qualified person addressing the above issues to Council's satisfaction;*

*(d) Overlooking of adjoining principal living areas and private open spaces must be kept to a minimum. This may be done by a number of means including appropriate building layout, landscaping or screening.*

### 3.4 NSW Land and Environment Court (2005).

The 10 dB on background noise goal has been accepted in the NSW Land and Environment Court (proceedings number 10002 of 2005). Mr Barry Murray, Acoustical Expert for the Land and Environment Court stated in his independent expert report No 05088 Version A (March 2005) Section 2:- *"In particular, the adopted criterion of background +10 dBA accords with my own view, providing that playing occurs for only part of the day, say up to 3 hours per day". S*ection 2.2 adds, *"As indicated above, I agree with the noise criterion of background noise level +10 dBA to assess the noise from children playing during part of the day".*

On 26 May 2005 proceedings number 10615 of 2004 Huntington and MacGillivray v Strathfield Municipal Council, the Judgment of Commissioner Murrell was:- *"22 I will first of all go to the issue of noise. The issue of noise is something that arose in terms of what would be an appropriate noise level. The Court has had the benefit as I said of Mr Cooper's report, and I agree that background plus ten dB(A) is appropriate for Child Care Centres, having regard to the fact that generally noise is intermittent and for limited periods."*

### 3.5 AAAC Child Care Centre Noise Assessment Technical Guideline

The Association of Australian Acoustical Consultants (AAAC) has produced the Child Care Centre Noise Assessment Technical Guideline (dated November 2009) which can be downloaded at www.aaac.org.au. Noise emissions from outdoor play areas are addressed in a similar direction as the court rulings and are as follows.

*"As the duration of time that children are allowed to play outside is reduced, the overall noise impact reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration. AAAC members regard that a total time limit of 2 hours outdoor play per day (e.g. 1 hour in the morning and 1 hour in the afternoon) should allow an additional 5 dB noise impact.*

***Up to 2 hours (total) per day*** *- The $L_{eq,15\ min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.*

***More than 2 hours per day*** *- The $L_{eq,15\ min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location."*

The noise impact on children from external sources such as road, rail and aircraft are also addressed by the AAAC within the technical guideline. The relevant section is reproduced below.

***External Noise Impact on Children***

*For proposals that are located within 60 meters of an arterial road or railway line a noise assessment should be submitted with the development application.*

***Road, Rail Traffic and Industry***

*The noise level Leq,1 hr from road, rail traffic or industry at any location within the outdoor play or activity area during the hours when the Centre is operating shall not exceed 55 dB(A).*

*The noise level Leq,1 hr from road, rail traffic or industry at any location within the indoor play or sleeping areas of the Centre during the hours when the centre is operating shall not exceed 40 dB(A)."*

### 3.6 Road Traffic Noise Criteria for Land use Developments with Potential to Create Additional Traffic on Local Roads

The NSW Government has produced criteria for road traffic noise within the *'NSW Road Noise Policy'* (RNP) document dated March 2011. This provides criteria for land use developments with potential to create additional traffic on local roads (see Table 3, - Road traffic noise assessment criteria for residential land uses, page 11, point 6. of the RNP). Here the criteria for local roads Existing residences affected by additional traffic on existing local roads generated by land use developments $L_{Aeq, (1\ hour)}$ is **55 dBA** (external) for day time.

## 4. NOISE SOURCE MODELS

Noise source modelling applies to the outdoor play area and indoor play rooms. The model provides a predicted noise level to the neighbouring residential properties without the noise reduction properties of a fence.

### 4.1 Noise Modelling Specifications

The source noise has been modelled using the International Standard ISO 9613-2 (1996(E)) '*Acoustic – Attenuation of sound during propagation outdoors Part 2 General method of calculation'*. This Standard specifies methods for the description of noise outdoors in community environments. The method described in the Standard is general in the sense that it may be applied to a wide variety of noise sources, and covers the major mechanism of attenuation. The method allows for downwind propagation conditions within an angle of ± 45° of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and

wind speed between approximately 1 m/s and 5 m/s measured at a height of 3 m to 11 m above the ground.

## 4.2 Basic Noise Modelling Equations

The equivalent continuous downwind sound pressure level ($L_{Aeq}$) at each receiver point has been calculated for each noise source using the equation below:-

$$\mathbf{L_{Aeq} = L_w + D_c - A}$$

Where:

- $L_w$ is the sound power level of the noise source;
- $D_c$ is directivity correction; and
- $A$ is the attenuation that occurs during the propagation from source to receiver.

The attenuation term $A$ in the equation above is given by:-

$$\boldsymbol{A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}}$$

Where:

- $A_{div}$ is the attenuation due to geometric divergence;
- $A_{atm}$ is the attenuation due to atmospheric absorption;
- $A_{gr}$ is the attenuation due to the ground effects;
- $A_{bar}$ is the attenuation due to a barrier; and
- $A_{misc}$ is the attenuation due to miscellaneous other effects.

The last term $(A_{misc})$ generally refers to miscellaneous propagation through foliage, industrial sites and areas of houses. Due to the vicinity of the development to the neighbouring dwellings the attenuation due to atmospheric absorption, ground effects and other miscellaneous effects are of minor significance at this site.

## 4.3 Noise Model – Outdoor Play Areas

Noise models have been developed for the calculation of child sound levels from children at play in outdoor areas. This is based on sound pressure level data for one child at 1 metre as given by Karl Kryter in *'The Effects of Noise on Man'* Academic Press (1985). This model covers various types of voice in column 2 of Tables 1 below.

The estimated time of each type of voice is used to predict a 15-minute average for one child. An adjustment is made for the amount of children vocal at any one time. This is typically 35% of the number of children within the outdoor play area. Hence for 48 children (5-12 year olds) a maximum of 17 children could be

expected to be vocal at any one time. For the 32 preschool age children (3-5 year olds only) a maximum of 11 children could be expected to be vocal at any one time.

The noise level generated by the number of children is predicted initially at a distance of 1 metre. Site-specific distance attenuations to the boundaries or noise sensitive locations are then applied as shown in Tables 1 and 2 below. The centre of the children's location is taken as the centre of the outdoor play area which is approximately 20 metres from the eastern and western boundaries.

**TABLE 1 - OUTDOOR PLAY AREA – PREDICTED NOISE LEVELS TO RECEIVER LOCATIONS FROM PRIMARY AGE CHILDREN**

| **Type of voice** | **Sound Pressure Level (dBA) at 1 metre** | **Estimated time spent at each type of voice (minutes in 15)** | **Resultant sound level (dBA) 15 minute average ($L_{Aeq,\ 15\ minute}$)** |
|---|---|---|---|
| Casual | 53 | 2.8 | 46 |
| Normal | 58 | 5 | 53 |
| Raised | 65 | 6 | 61 |
| Loud | 74 | 1 | 62 |
| Shout | 82 | 0.2 | 63 |
| 15 minute Average for 1 Child at 1 metre Distance | | | 67 |
| 15 minute Average For 17 Children Vocal (Total 48 children) at 1 metre Average Distance (From 67 + 10 $\log_{10}$ (17) dB) | | | 79 |
| 15 minute Average For 17 Children Vocal (Total 48 children) at 20 metres Average Distance (West and East) Geometric Divergence (From 79 - 20 $\log_{10}$ (20/1) dB) | | | **53** |

**TABLE 2 - OUTDOOR PLAY AREA – PREDICTED NOISE LEVELS TO RECEIVER LOCATIONS FROM PRESCHOOL AGE CHILDREN.**

| Type of voice | Sound Pressure Level (dBA) at 1 metre | Estimated time spent at each type of voice (minutes in 15) | Resultant sound level (dBA) 15 minute average ($L_{Aeq,\ 15\ minute}$) |
|---|---|---|---|
| Casual | 53 | 2.8 | 46 |
| Normal | 58 | 5 | 53 |
| Raised | 65 | 6 | 61 |
| Loud | 74 | 1 | 62 |
| Shout | 82 | 0.2 | 63 |
| 15 minute Average for 1 Child at 1 metre Distance | | | 67 |
| 15 minute Average For 11 Children Vocal (Total 32 children) at 1 metre Average Distance (From 67 + 10 $\log_{10}$ (11) dB) | | | 77 |
| 15 minute Average For 11 Children Vocal (Total 48 children) at 20 metres Average Distance (West and East) Geometric Divergence (From 77 - 20 $\log_{10}$ (20/1) dB) | | | **51** |

*Note 1 - All levels rounded to the nearest whole decibel.*
*Note 2 - The model was verified with acoustical measurements taken at the Shore Preparatory School, 55 Sailors Bay Road, Northbridge in November 2003. At 8 metres a sound pressure level of 60 dBA was found to be the highest 15-minute noise level when the 30 children first entered the play area. The noise level dropped by 3 to 5 dB after the children had settled. The acoustical model was verified again when measurements were taken at an existing childcare centre at 92 – 96, Atchison Street, Crows Nest, in February 2008. Sound pressure levels ($L_{Aeq,\ 15\ minute}$) of approximately 67 dBA were measured when 25 children were at play at an average distance of approximately 3 metres from the microphone.*
*Note 3 – If groups of children are kept down to 5 – 8 in number, in different parts of the playground, this would not affect the modelled overall noise level as the one larger group.*

## 4.4 Car Park Noise Emissions

There is a proposed car parking area close to the neighbouring boundary with 1A Rosemead Road. Noise emissions from the car park are initially modeled on the measured noise levels of one car arriving, parking and departing. Noise levels measured at 3 metres are shown below in Table 3. Noise levels for cars parking and departing include the closing of car doors, starting the engine and a short period of idle.

**TABLE 3 – CAR PARK NOISE EMISSIONS FROM PRIVATE CARS**

| Operation | Descriptor | Duration | Sound Pressure Level dBA | Measurement distance |
|---|---|---|---|---|
| Arriving and parking | $L_{Aeq}$ | 45 secs | 57 | 3 metres |
| Departing | $L_{Aeq}$ | 40 secs | 62 | 3 metres |

The 15 minute (900 second) energy average noise level ($L_{Aeq,\ 15\ minute}$) from one car parking and one car leaving is 49 dBA, (from $10 \log_{10} (10^{(57 - 10 \log_{10} (900/45)/10)} + 10^{(62 - 10 \log_{10} (900/45)/10)})$). For a more typical four cars parking and four cars leaving within the 15 minute time period the calculated noise level ($L_{Aeq,\ 15\ minute}$) is **55 dBA,** (from $10 \log_{10} (10^{(49/10} + 10^{(49/10)} + 10^{(49/10} + 10^{(49/10)})$).

## 4.5 On- Road Traffic Noise Model

The existing average road traffic flow is reported to be 11.5 vehicles per hour in the morning perk time of 7:00 to 9:00 am (Vargas Traffic Planning Pty Ltd, reference 19516, dated 29th November 2019). This is predicted to increase by 71 vehicles per hour for the proposed Community preschool and primary school, giving a total average of 82.5 vehicles per hour.

The road traffic noise level ($L_{Aeq,\ 1\ hour}$) during the morning peak period is calculated (Calculation of Road Traffic Noise – 1988, Department of Transport, Welsh Office. GB) to be 55 dBA currently and rising to **60 dBA** if the proposed school is to go ahead.

# 5. AMBIENT NOISE MEASUREMENTS

The existing noise environment was measured continuously for a period of 7 days by the placement of a noise logger on the eastern boundary of the site. Instrumentation, procedure and results are provided below.

## 5.1 Instrumentation

The instrumentation used for measurement of the existing environment consisted of an 'ARL' - Type 2 Environmental Noise Logger serial number 194550. This instrument conforms to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) and has an accuracy suitable for both field and laboratory use. The calibration of the logger was checked before and after the measurement period with a Brüel and Kjær acoustical calibrator model 4230 (serial no. 2445349). No significant system drift occurred over the measurement periods.

The environmental noise logger has been checked, adjusted and aligned to conform to the ARL factory specifications and issued with conformance certificate within the last 24 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O, Lindfield, NSW, Australia.

The calibrator has been checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates within the last 12 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O, Lindfield, NSW, Australia.

## 5.2 Measurement Procedure

The acoustical measurements were carried out in accordance with Australian Standards AS 1055, '*Acoustics –Description and Measurement of Environmental Noise'*, (1997). The noise logger was located on the eastern boundary of 1A Rosemead Road, approximately 1 metre in front of the existing office dwelling on the site. Ambient noise levels were continuously recorded from Monday 6th January 2019 through to Monday 13th January 2019. The $L_{AF90,\ 15\ minute}$ levels are representative of background noise levels occurring at the residential properties in the immediate vicinity.

Existing background and ambient noise levels in the area are influenced by local residential road traffic and fauna. The 'A' frequency weighting and the 'fast' time weighting were used exclusively. Noise monitoring was completed during typical representative conditions and no unusual circumstances or activities were likely to have affected the noise monitoring results.

## 5.3 Noise Measurement Results

Measured ambient noise levels are assessed according to the NSW Industrial Noise Policy in terms of $L_{Aeq}$ and $L_{AF90}$ for the time periods defined as Day: 7:00 am – 6:00 pm, Evening: 6:00 pm – 10:00 pm and Night: 10:00 pm – 7:00 am. $L_{Aeq}$ levels are the result of road traffic noise. The highest $L_{Aeq,\ 1\ hour}$ noise level is calculated from the $L_{Aeq,\ 15\ minute}$ levels for assessment of on-road traffic noise according to the NSW Road Noise Policy.

The proposed hours of operation of the centre are 7:45 am to 6:15 pm Monday to Friday, hence only day time noise levels are therefore relevant to the acoustic assessment. The recorded $L_{AF90}$ levels determine the Rating Background Level (RBL) is used for the outdoor play area assessment. The RBL is defined as the median value of the Assessment Background Level tenth percentile values for the recorded $L_{AF90}$ levels for each of the relevant monitoring periods. The tenth

percentile (lowest 10th percent) noise background level ($L_{A90}$) for representing each assessment period is referred to as the Assessment Background Level (ABL). The weekday, day time measured ABL's (January 2020) were:

- Monday 6th – 38 dBA,
- Tuesday 7th – 36 dBA,
- Wednesday 8th – 37 dBA,
- Thursday 9th – 36 dBA and
- Friday 10th – 37 dBA.

Evening and night $L_{AF90}$ and $L_{Aeq}$ noise levels are shown for completeness of the existing acoustic environment. The noise monitoring period included Saturday and Sunday. These days are removed from the data for assessment of the $L_{AF90}$ and $L_{Aeq}$ noise levels, but are included in the full statistical noise measurement results shown in graphical form in Appendix A. Removal of the data from the calculations was insignificant to the final results. The resultant RBL ($L_{AF90}$) and ambient ($L_{Aeq}$) levels for each period are summarised below in Table 4. The RBL applicable to the noise assessment for the proposed childcare centre is **37 dBA.** Removing the Saturday and Sunday also results in a RBL measurement of 37 dBA.

**TABLE 4 – SUMMARY OF EXISTING NOISE LEVELS**

| Time of Day | Rating Background Noise Levels ($L_{AF90}$) dBA | Log Average Existing Ambient Noise Levels ($L_{Aeq}$) dBA |
|---|---|---|
| Day (07:00 – 18:00) | 37 | 49 |
| Evening (18:00 – 22:00) | 34 | 47 |
| Night (22:00 – 07:00) | 31 | 46 |

*Note 1- All levels rounded to the nearest whole decibel*

## 6. NOISE GOALS AND ASSESSMENT

Noise goals for emissions from the proposed community preschool and primary school are established to ensure that the noise criteria, as specified within Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development, are achieved. $L_{Aeq,\ T}$ noise emissions from the centre are not to exceed more than 5 dBA above the background noise level ($L_{AF90,\ 15\ minute}$) when measured in the immediate vicinity of the external structure of any nearby residence. Noise emissions from the community preschool and primary school are calculated and compared to the design noise goals.

## 6.1 Noise Goals

The site-specific noise goal ($L_{Aeq,\ 15\ minute}$) from the outdoor play area and mechanical plant to the nearest, most affected, residential boundaries is **42 dBA** ('background + 5 dB', i.e. 37 + 5 dB). The noise goal ($L_{Aeq,\ 1\ hour}$) for the increase in road traffic movements is **55 dBA**, see section 3.6 above.

## 6.2 Noise Barrier Fence Assessment

The sound attenuation of noise barriers, fences or screens can be calculated using the International Standard ISO 9613-2 (1996(E)) '*Acoustic – Attenuation of sound during propagation outdoors Part 2 General method of calculation'*. Factors required for the calculation are source to barrier distance, receiver to barrier distance, screen height, source height, receiver height and barrier width. For children in outdoor play areas the source to barrier distance is highly variable, however this is taken as a distance from the central play area to the residential boundary. In any case, this distance must be consistent with the geometric divergence used in Tables 1 and 2 above; hence 20 metres is used. The calculated results show that, for a 1.8 metre high barrier the acoustic noise reduction performance is not dependent upon the weighted sound reduction index ($R_w$) but on the diffraction (i.e. the sound level going over the barrier). Hence for a typical lapped and capped fence with an $R_w$ of 23 dB (in the octave band centred on 1000 Hz - i.e. typical children sound frequency) the actual performance will be less than 5 dB. If the barrier was a 10 mm thick concrete wall with a weighted sound reduction index ($R_w$) of 37 dB (in the octave band centred on 1000 Hz) the actual performance will still be less than 5 dB. See Figure 2 below.

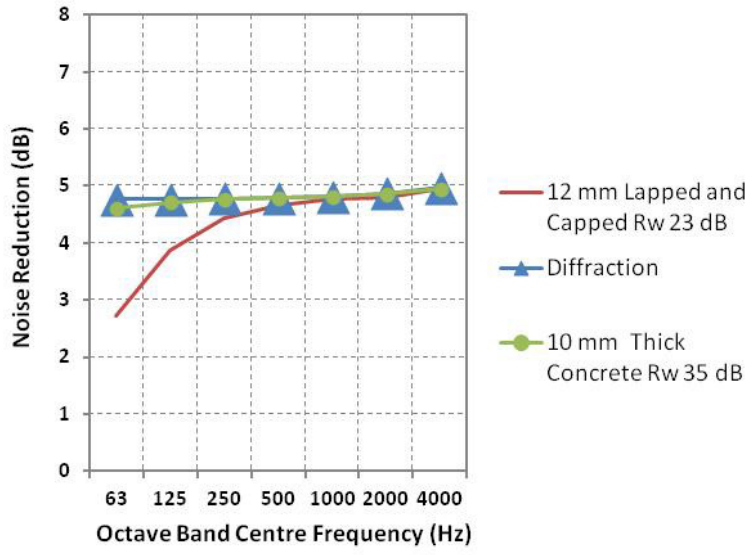



***Figure 2: Comparative Barrier Acoustic Performance for 1.8 metre Barriers at 20 metres from the Source to the Barrier.***

If it is assumed in the unlikely case that all of the children are only 5 metres from the barrier the actual performance will be less than 6 dB in the typical children sound frequency octave band centred on 1000 Hz as shown in Figure 3 below.

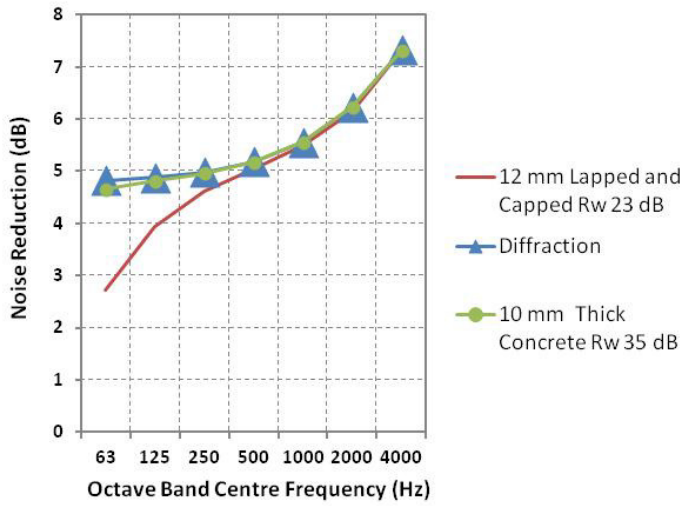



***Figure 3: Comparative Barrier Acoustic Performance for 1.8 metre Barriers at 5 metres from the Source to the Barrier.***

In addition, the effect of geometric divergence would reduce by 12 dB from 26 dB (i.e. 20 $\log_{10}$ (20/1) dB) to 14 dB (i.e. 20 $\log_{10}$ (5/1) dB).

## 6.3 Outdoor Play Area Assessment

It is shown in Tables 1 and 2 above that the noise level ($L_{Aeq,\ 15\ minutes}$) at neighbouring premises are 51 dBA to 53 dBA without taking proposed acoustic fences into account. In section 6.2 it is shown that the proposed 1.8 metre high fence will provided just less than 6 dB overall noise reduction. This noise reduction is regardless of the weighted sound reduction index ($R_w$) and is due to limitations of diffraction. Therefore the actual noise level at neighbouring premises is 45 dBA to 47 dBA taking proposed acoustic fences into account. This noise level could occur for the proposed day time periods which are in excess of 4 hours as shown in Figure 4 below.

Hence the noise criteria to be applied in this case should be 5 dB and not 10 dB over the existing background noise level of **37 dBA** therefore **42 dBA.** The predicted 15 minute average noise from the outdoor play area without a noise barrier is **53 dBA** which exceeds the 42 dBA noise goal at the most affected residential properties (i.e. 1A Rosemead Road and 52 William Street) by **11 dBA** without a noise barrier. The highest predicted 15 minute average noise level ($L_{Aeq,\ 15\ minute}$) from the outdoor play area with the proposed 1.8 metre high fence is **48 dBA**. which exceeds the 42 dBA noise goal at the most affected residential properties by **6 dBA** with a noise barrier. When the existing background noise level is low, at say 1.00 pm, the predicted noise level from the outdoor play area will exceed the background noise level by 14 dBA as shown in the Figure 4 below.

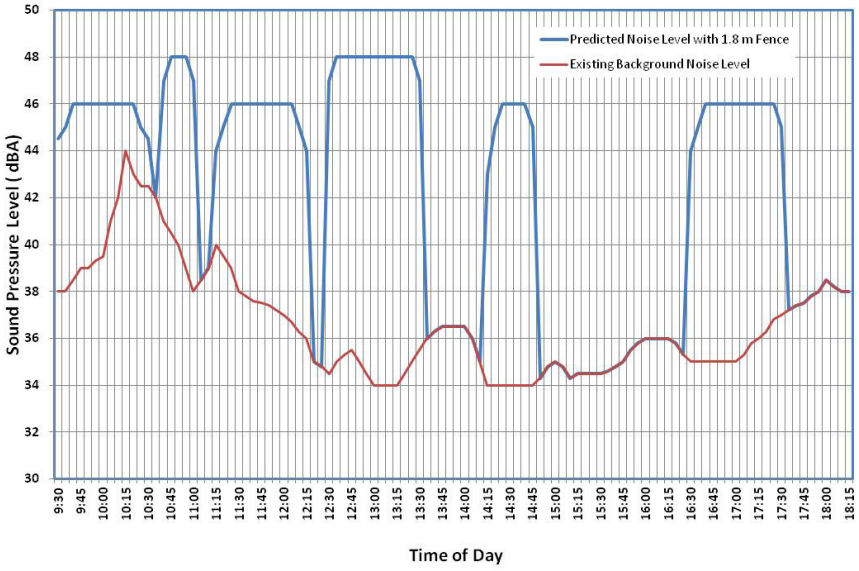



***Figure 4: Predicted Noise Levels for the Proposed Outdoor Play Area at two Neighbouring Premises with 1.8 metre Barriers, Compared to a Typical Background Noise Level.***

## 6.4 Car Park Noise Assessment

The predicted 15 minute average noise from one car parking and one car leaving is 49 dBA. For four cars parking and four cars leaving within a 15 minute time period the calculated noise level is 55 dBA without any barrier attenuation. With four cars within 2 metres of the proposed 1.8 metre high fence the calculated noise level ($L_{Aeq,\ 15\ minute}$) at the most affected residential property (i.e. 1A Rosemead Road) is **47 dBA** which exceeds the 42 dBA noise goal by **5 dBA**.

## 6.5 On-Road Traffic Assessment

Existing on-road traffic flows are reported to be 11.5 vehicles per hour from the morning peak time of 7:00 to 9:00 am (Vargas Traffic Planning Pty Ltd, reference 19516, dated 29th November 2019). This is predicted to increase by 71 vehicles per hour for the proposed community preschool and primary school, giving a total of 82.5 vehicles per hour.

The road traffic noise level ($L_{Aeq,\ 1\ hour}$) during the morning peak periods is calculated (Calculation of Road Traffic Noise – 1988, Department of Transport, Welsh Office. GB) to be **55 dBA** currently and rising to **60 dBA** if the proposed school is to go ahead. This increase of **5 dB** does not comply with the noise goals of the NSW Road Noise Policy (2011). Any increase in road traffic noise over 2 dB represents an impact that is considered unacceptable to the average person. As such, the projected increase in traffic activity as a consequence

of this development proposal will clearly have unacceptable road traffic noise implications.

### 6.6 Mechanical Plant Noise Assessment

The total combined noise emissions from mechanical equipment should not exceed a day time noise level ($L_{Aeq,\ 15\ minute}$) of 42 dBA when measured at the nearest residential boundary. If the community preschool and primary school is approved, outdoor air conditioning condenser units are likely to be installed. Assuming these are at 10 metres from the nearest neighbouring boundary, each condenser unit should be selected with a rating sound power level ($L_{WA}$) not exceeding 66 dBA (re $10^{-12}$ watts) in order to meet the design goals. Condenser units with sound power level in excess of 66 dBA will require noise amelioration measures such as longer distances from the condenser units to neighbouring boundaries, noise barriers and/or acoustic louvres. The recommendations apply to the day time period use and therefore air-conditioning should not be used during night time hours (i.e. not between 10.00 pm and 7.00 am on any day).

## 7. SUMMARY AND CONCLUSIONS

NG Child & Associates have produced an acoustic assessment for a proposed Preschool and Primary School development at 1 Rosemead Road, Hornsby, NSW 2077. They have prepared a report (The Report) entitled *"Acoustic Assessment Report Proposed Preschool & Primary School 1 Rosemead Road Hornsby NSW",* which has been peer reviewed. Due to the errors in the NG Child & Associates report this revised report has been produced.

The level of noise levels to be generated by activities associated with the proposed community preschool and primary school, i.e. the outdoor activity areas and the additional on-road traffic and traffic in the car parking area, is predicted to be non-compliant with the noise goals and all relevant acoustical guidelines, see sections 6.3, 6.4 and 6.5 above. The proposal is predicted to have negative noise impacts on all residential neighbours.

It is concluded that the proposed site is unsuitable for a community preschool and primary school development due to the potential noise goal exceedances from the outdoor play area, the additional on-road traffic and traffic in the car parking area.

| Date | Prepared by: | Status |
|---|---|---|
| 18th January 2020 | Ken Scannell MSc MAAS | Draft |
| **Date** | **Checked by:** | **Status** |
| 20th January 2020 | Mark Scannell BA MAAS | Draft |
| **Date** | **Issued by:** | **Status** |
| 21st January 2020 | Ken Scannell MSc MAAS | Draft |

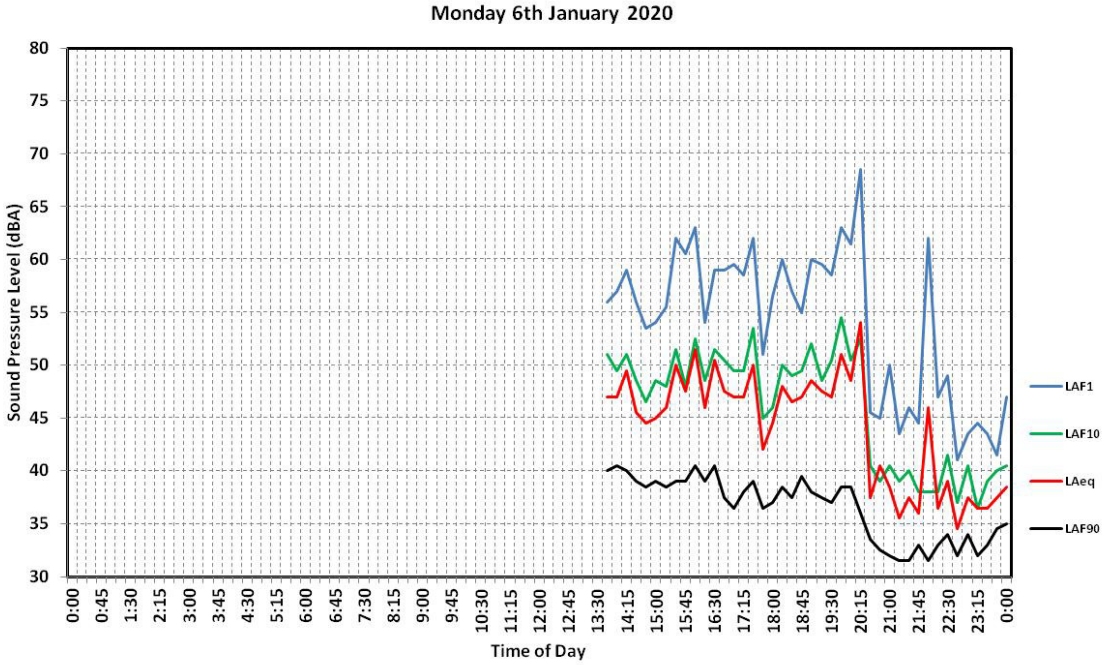
***Important Note.*** *All products and materials suggested by 'Noise and Sound Services' are selected for their acoustical properties only. All other properties such as air flows, aesthetics, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, grout or tile cracking, loading, shrinkage, smoke, ventilation etc are outside of 'Noise and Sound Services' field of expertise and* ***must be*** *checked with the supplier or suitably qualified specialist before purchase.*

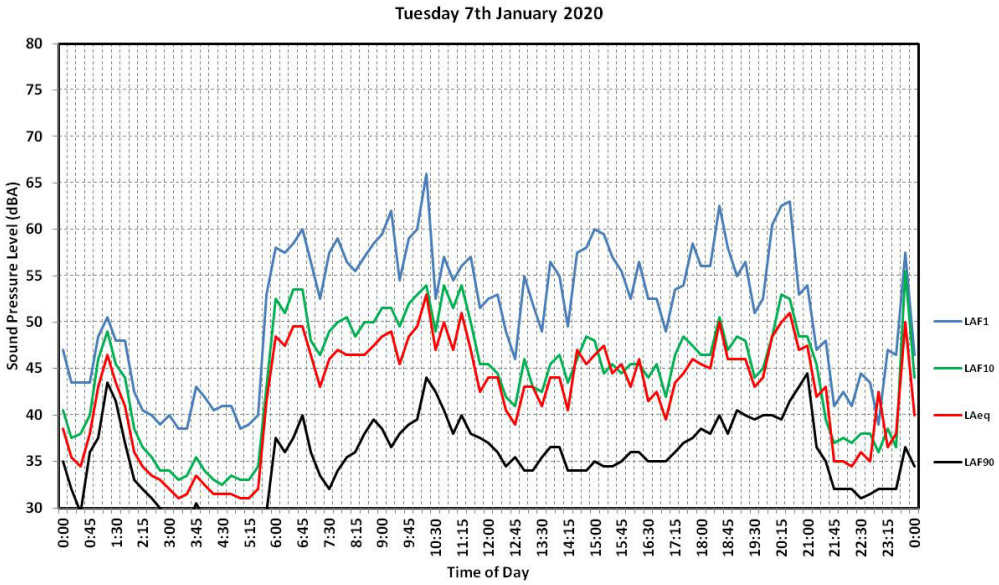
## APPENDIX A – MEASURED SOUND PRESSURE LEVELS

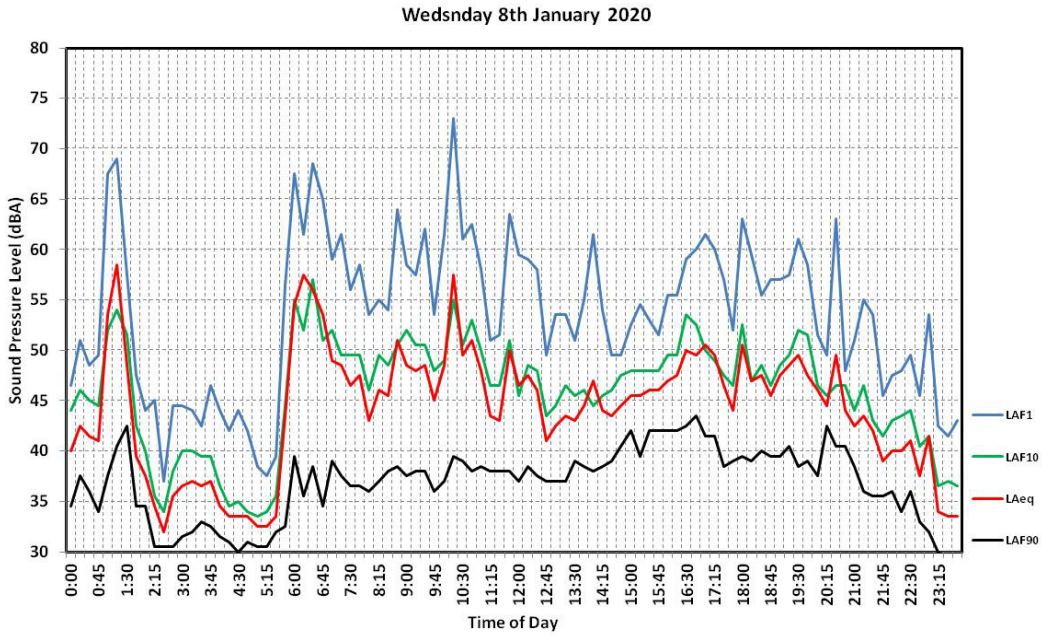
Environmental noise levels can vary considerably with time; therefore it is not adequate to use a single number to fully describe the acoustic environment. The preferred, and now generally accepted, method of recording and presenting noise measurements is based upon a statistical approach. For example, the $L_{AF10}$ noise level is the level exceeded for 10% of the time, and is approximately the average maximum noise level. The $L_{AF90}$ level is the level that is exceeded for 90% of the time, and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the "background" noise level. The $L_{Aeq}$ level represents the average noise energy during the measurement period. This level is often referred to as the 'ambient' noise level.

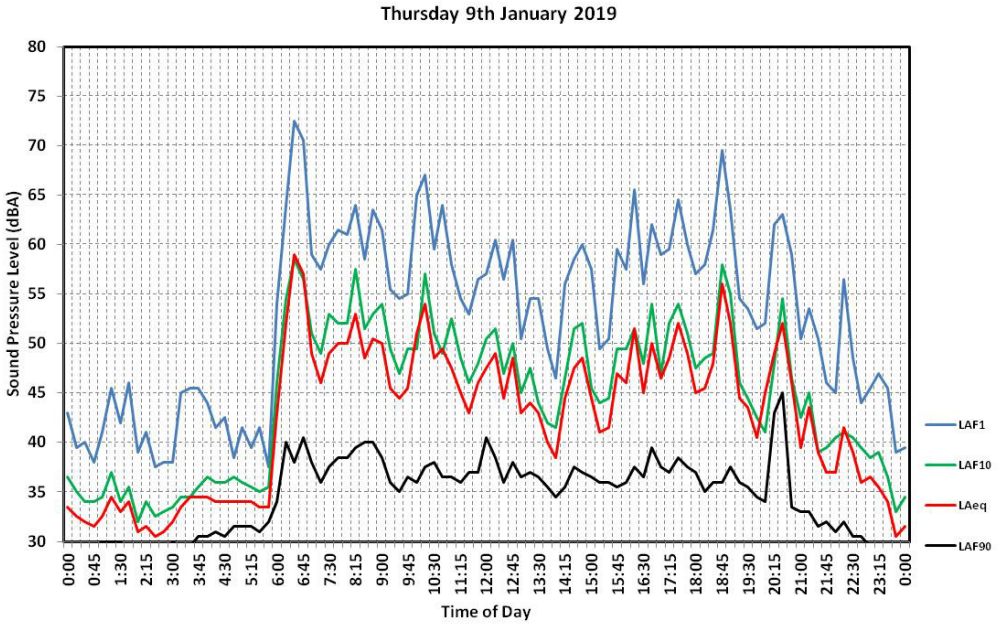
The measurements results from ambient noise monitoring are shown below. Details of the measurement procedure are given in Section 5 above.

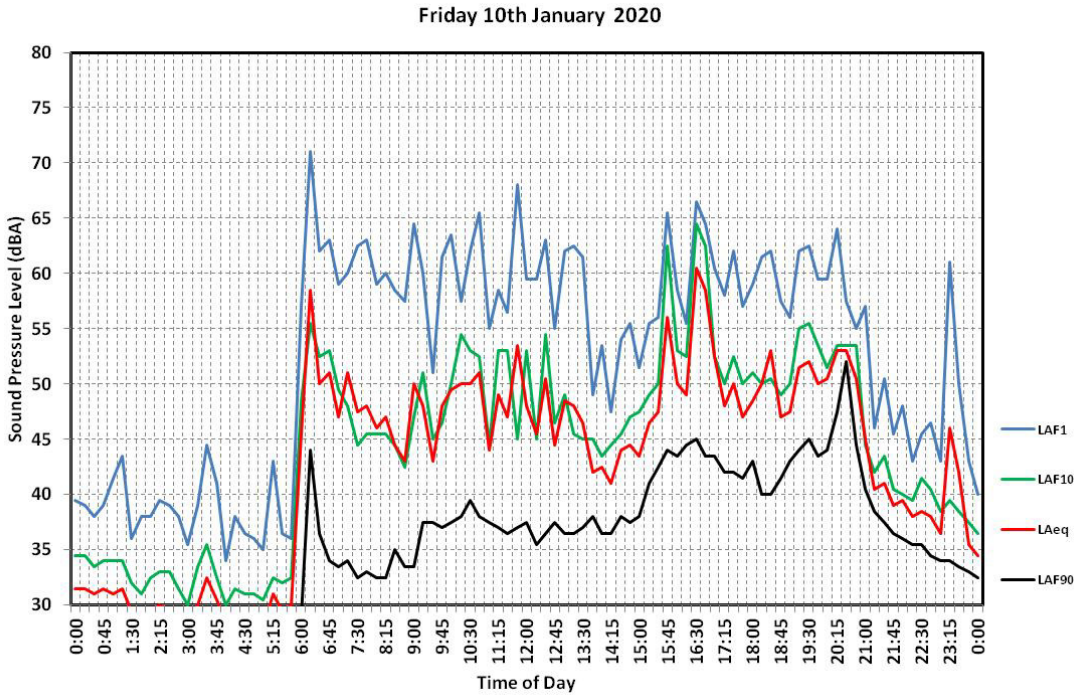
**East Boundary - Logged Ambient Noise Levels**
1A Rosemead Road, Hornsby NSW 2074
Monday 6th January 2019 to Monday 13th January 2019

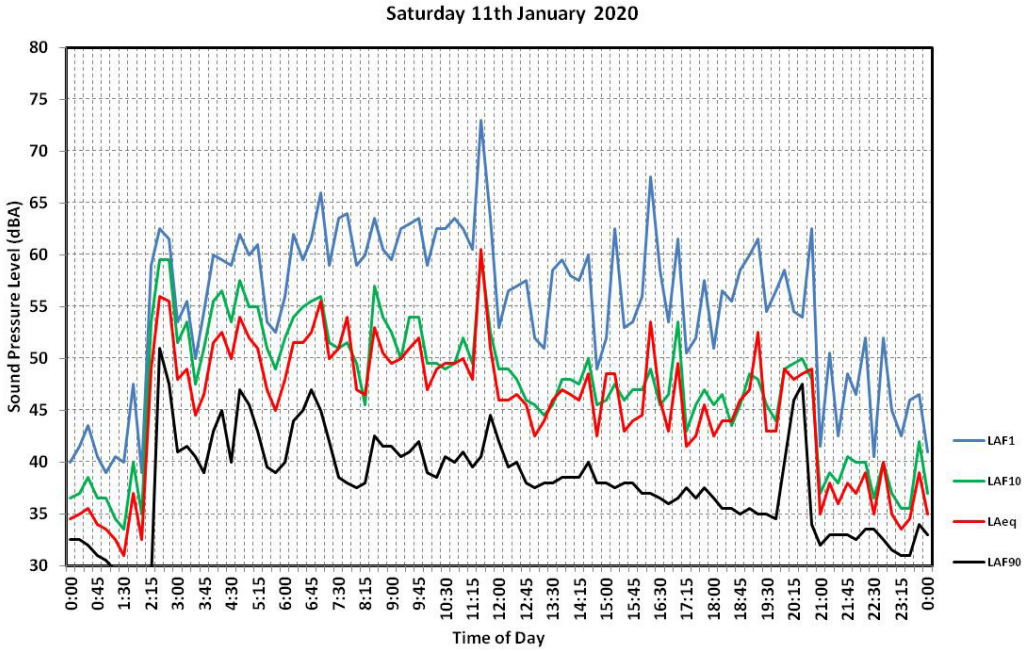


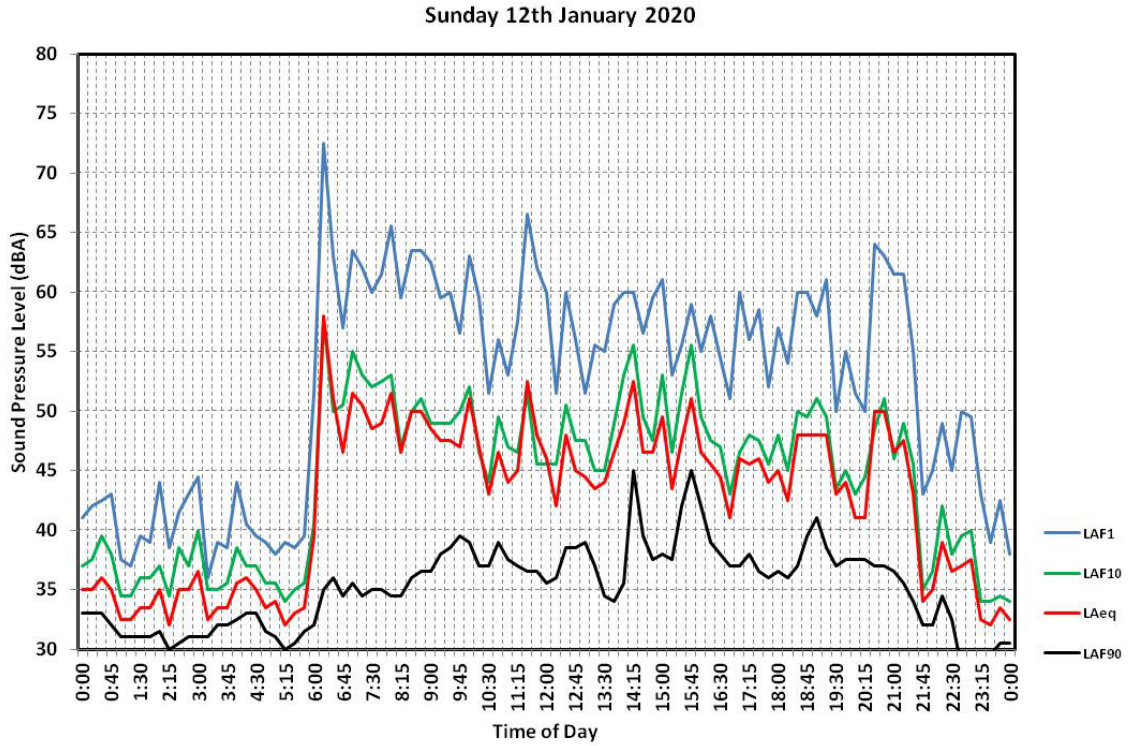

Tuesday 7th January 2020
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time of Day
LAF1
LAF10
LAeq
LAF90

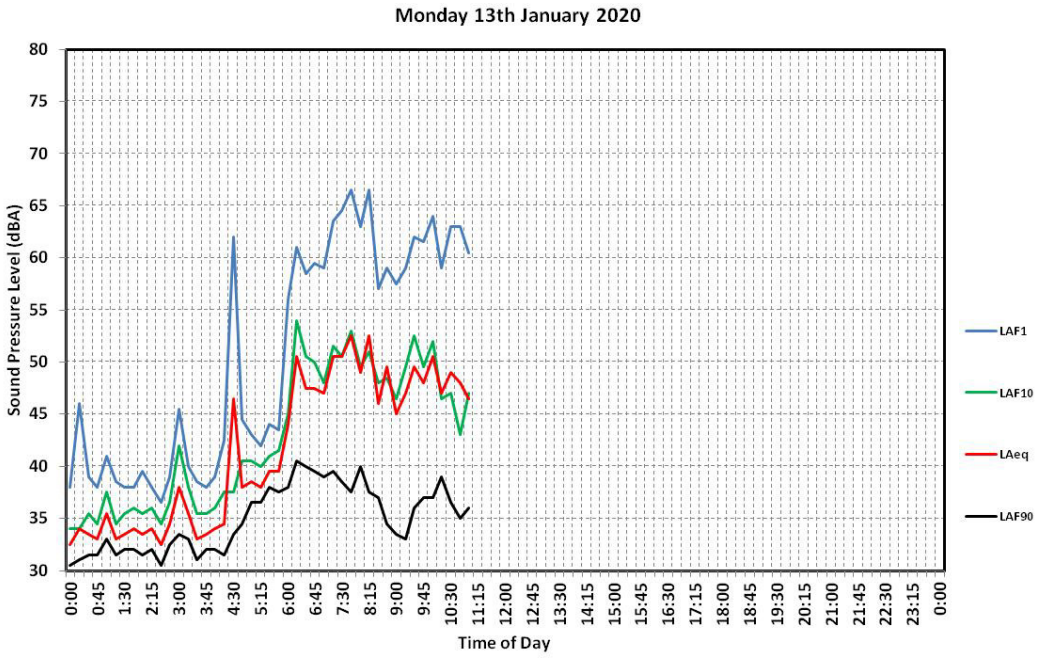

Wedsnday 8th January 2020
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
Time of Day
LAF1
LAF10
LAeq
LAF90


Thursday 9th January 2019
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time of Day
LAF1
LAF10
LAeq
LAF90


Friday 10th January 2020
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time of Day
LAF1
LAF10
LAeq
LAF90


Saturday 11th January 2020
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time of Day
LAF1
LAF10
LAeq
LAF90


Sunday 12th January 2020
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time of Day
LAF1
LAF10
LAeq
LAF90


Monday 13th January 2020
Sound Pressure Level (dBA)
80
75
70
65
60
55
50
45
40
35
30
0:00
0:45
1:30
2:15
3:00
3:45
4:30
5:15
6:00
6:45
7:30
8:15
9:00
9:45
10:30
11:15
12:00
12:45
13:30
14:15
15:00
15:45
16:30
17:15
18:00
18:45
19:30
20:15
21:00
21:45
22:30
23:15
0:00
Time of Day
LAF1
LAF10
LAeq
LAF90

# APPENDIX B – GLOSSARY OF TECHNICAL TERMS

**'A' Frequency Weighting –** The most widely used sound level frequency filter is the A scale, which roughly corresponds to the inverse of the 40 dB (at 1 kHz) equal-loudness curve. Using this filter, the sound level meter is less sensitive to very high and, in particular, very low frequencies. Sound pressure level measurements made with this filter are commonly expressed as **dBA.**

**Acoustic Fence** – A fence which has enough mass to reflect a significant amount of sound and has no holes or gaps (including at the base).

**Ambient Sound** – The all-encompassing sound associated with that environment being a composite of sounds from many sources, near and far.

**Assessment Background Level (ABL)** – The tenth percentile value of the recorded $L_{A90}$ level for each day, evening and night period.

**Background Noise Level ($L_{AF90,\ T}$) –** A statistical parameter used for assessments of constantly varying noise levels. The $L_{AF90}$ is the 'A' frequency weighted noise level that is exceeded for 90 % of the measurement period, 'T'. The measurement period is normally 15 minutes. The background noise is therefore the lowest noise level that occurs for 1.5 minutes in any 15 minute period.

**Decibel (dB) –** The logarithmic ratio of any two quantities and relates to the flow of energy (power). A scale used in acoustical measurement related to power, pressure or intensity. Expressed in dB, relative to standard reference values.

**Energy Average Noise Level ($L_{Aeq,\ T}$) –** The $L_{Aeq}$ noise level is also known as the equivalent continuous sound pressure level. This is the 'A' frequency weighted logarithmic average of the sound energy of the measurement time 'T'. When measured over a 15 minute time period the symbol $L_{Aeq,\ 15\ minute}$ is used. This is the standard descriptor used for source noise measurements and ambient noise measurements.

**Percentile Level ($L_{90}$, $L_{10}$, etc)** – A statistical measurement giving the sound pressure level which is exceeded for the given percentile of a specified time period, e.g. $L_{90}$ is the level which is exceeded for 90% of a measurement period.

**Rating Background Level (RBL)** – The median value of the tenth percentile value (ABL) for the recorded $L_{AF90}$ levels for each day, evening and night period over the complete 7 days or more of noise monitoring. The tenth percentile is also referred to as the Assessment Background Level (ABL).

**Sound Pressure Level (SPL) –** 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure of 20 micro Pascals.