ACOUSTIC ASSESSMENT REPORT

Proposed Community School

1 ROSEMEAD ROAD HORNSBY NSW

Report To:

Maureen Hartung OAM
Executive Director - Blue Gum Community School

c/o ANDREW MARTIN PLANNING

Proposal By:

NG Child & Associates

6 May 20020

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EXECUTIVE SUMMARY

INTRODUCTION

Andrew Martin Planning, on behalf of client Maureen Hartung OAM (Executive Director, Blue Gum Community School) is involved in the planning, design and prospective delivery of a Community School at 1 Rosemead Road Hornsby NSW.

The proposed facility will occupy an existing building at the site, suitably modified in accordance with the plans and drawings associated with the proposed development.

NG Child & Associates has been engaged to undertake an acoustic assessment of the proposed development.

The key findings and recommendations of that assessment are summarised below.

OVERALL ACOUSTIC ASSESSMENT

This report presents the results of an acoustic assessment undertaken in relation to a Community School proposed for development proposed for 1 Rosemead Road Hornsby NSW.

Key Findings:

The following is a summary of the key findings of this assessment:

1. Sound levels of less than 40 dB(A) will be achieved throughout the internal areas of the proposed educational facility, based on measured background sound levels and proposed layout and school design details as described in this report;

2. Sound levels in the range 30-35 dB(A) will be achievable within any rest areas associated with the proposed facility, based on measured background sound levels; and proposed layout and school design details as described in this report;

3. Noise levels of less than 55 dBA are projected to be achieved within the outdoor play areas associated with the proposed school;

4. The level of noise estimated to be generated by activities within the internal areas of the proposed facility is projected to be essentially contained by the building structure of the school itself, and accordingly is projected to have no negative or non-compliant impacts on surrounding buildings, activities and individuals;

5. The level of noise estimated to be generated by activities within the outdoor activity areas associated with the proposed school is projected to have no negative or non-compliant impacts on surrounding buildings, activities and individuals, subject to the implementation of the recommendations summarised below; and

6. On this basis, the acoustic performance of the proposed Community School will comply fully with the requirements of all relevant acoustic guidelines and requirements.

Recommendations:

The assessment has found that the proposed Community School will comply with the requirements of all relevant acoustic guidelines and regulations, subject to the advice provided generally in this report; adherence to normally accepted design and building practices, and the implementation of the following recommendations:

1. Double lapped timber boundary fencing of height 2100 mm and with a minimum Rw rating of 25 should be installed along the western boundary of the outdoor play area, adjacent to the school car park, as detailed in this report;

2. Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the remaining western boundaries of the site, as detailed in this report;

3. Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the southern or William Street boundary of the site, as detailed in this report.

4. Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the eastern boundary of boundary of the site, with the short section of fence between the front façade of the adjoining building progressively reducing in height to 1200mm to meet the open form black metal fence proposed for the Rosemead Road property boundary, as detailed in this report;

5. Careful supervision of all external activities associated with the school should be maintained as detailed in this report to assist in achieving the required acoustic outcomes;

6. A compact of understanding should be achieved with parents and guardian, and those dropping off and picking up children, to ensure that minimum noise driving practices are applied on streets near the school, and when using the school's driveway and car park to assist in achieving the required acoustic outcomes;

7. Validation that any plant & equipment associated with the proposed school will not have an impact greater than 5 dBA above the measured background LA90 RBL, as indicated in this report, may be provided if required prior to the issue of an Occupation Certificate for the development; and

8. A Noise Management Plan consistent with the guidelines set out in this report is prepared and included in the overall Management Plan for the school for implementation and where necessary continuous improvement.

On this basis, it is the finding of this acoustic assessment that the acoustic performance of the proposed Community School will comply fully with the requirements of all relevant acoustic guidelines and requirements.

OVERALL CONCLUSION

This report presents the results of an acoustic assessment undertaken in relation to a Community School (Preschool and Primary) proposed for development at 1 Rosemead Road Hornsby NSW.

The overall conclusion of this acoustic assessment is that:

- Subject to consideration of the various comments and implementation of the various recommendations set out in this report, as summarised above, the proposed Community School will comply with the requirements of all relevant acoustic guidelines and regulations.

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6 May 20020

1 INTRODUCTION

Andrew Martin Planning, on behalf of client Maureen Hartung OAM (Executive Director, Blue Gum Community School) is involved in the planning, design and prospective delivery of a new Blue Gum Community School at 1 Rosemead Road Hornsby NSW. The proposed site will provide for a 32 place preschool and a 48 place primary school.

The proposed development is subject to the approval of the NSW Department of Planning.

An appropriate acoustic assessment is required to accompany the Development Application (DA) submission for the project.

Andrew Martin Planning has engaged NG Child & Associates to undertake the acoustic assessment required. Noel Child of NG Child & Associates is an appropriately qualified and experienced consultant to undertake the work involved. His CV is provided for reference at Appendix D.

This document described the acoustic assessment undertaken and presents its findings and recommendations.

2 BACKGROUND

2.1 LOCATION

The general location of the proposed Community School is indicated by the road map in Figure 2.1 below.

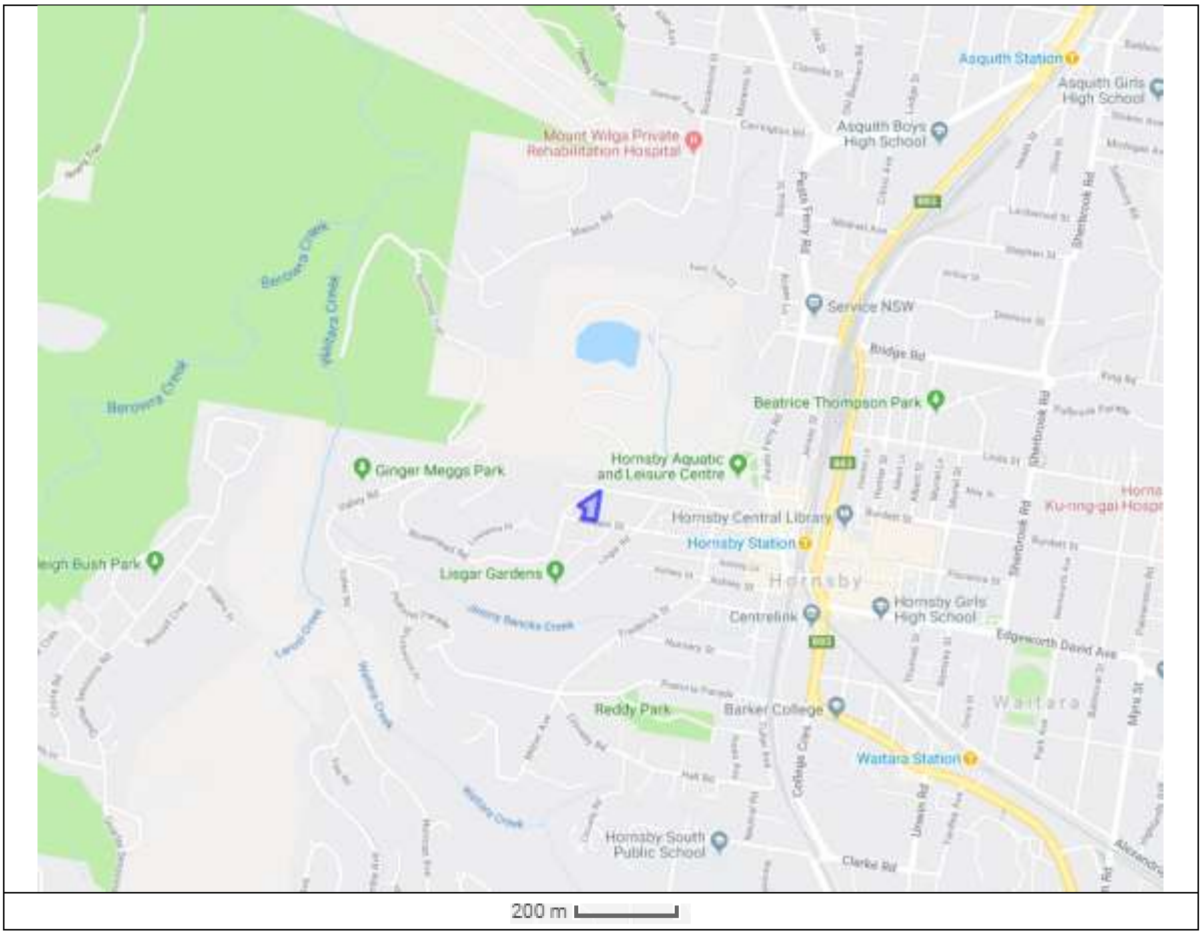


Figure 2.1 – Location of the Proposed Community School

Figure 2.2 below shows a recent (April 14th, 2020) satellite photograph of the site area.

The direction of north is towards the top of both diagrams, and the approximate scale is indicated below.

The site area is shown shaded in blue in both diagrams.

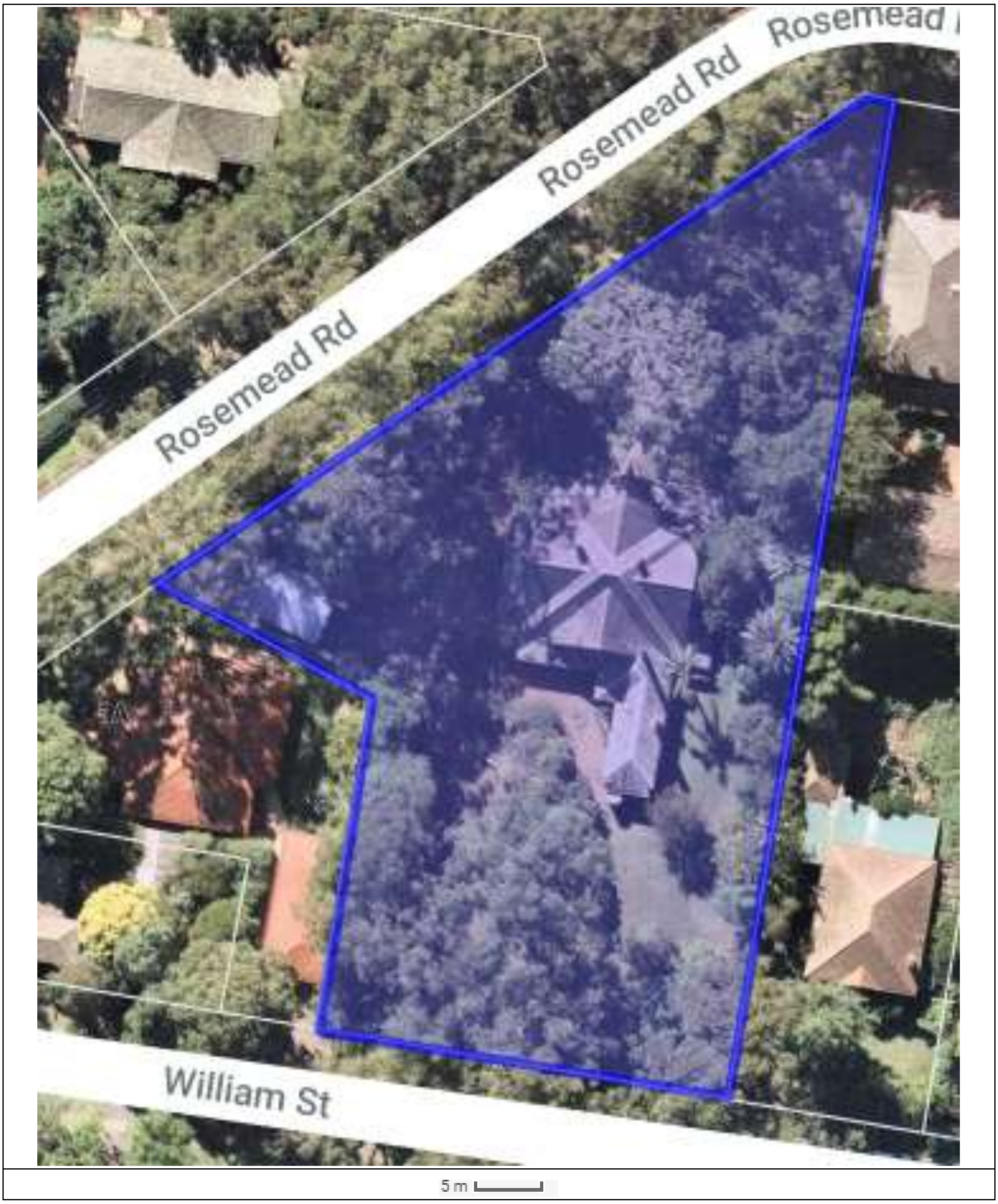


Figure 2.2 – Satellite Photograph of Site Location (April 14th, 2020)

Photographs of the site, including the current residential building at the site, are included for reference in Figures 2.3 and 2.4, on the following page.

Figure 2.3 – Site Viewed from Rosemead Road

Figure 2.4 – Site Viewed from William Street

2.2 LOCAL GOVERNMENT CONSENT AUTHORITY

The proposed site falls within the local government area of Hornsby Shire Council, and relevant local government consents and approvals regarding site and the proposed development reside with that Council.

The site is zoned "R2 – Low Density Residential", as shown in Figure 2.5 below. The Rosemead Road site is at the left-centre of the map.

Other land uses in the general vicinity include other low density residential, medium and high density residential, mixed use and public recreation.

Land in the immediate vicinity of the subject site is low density residential.

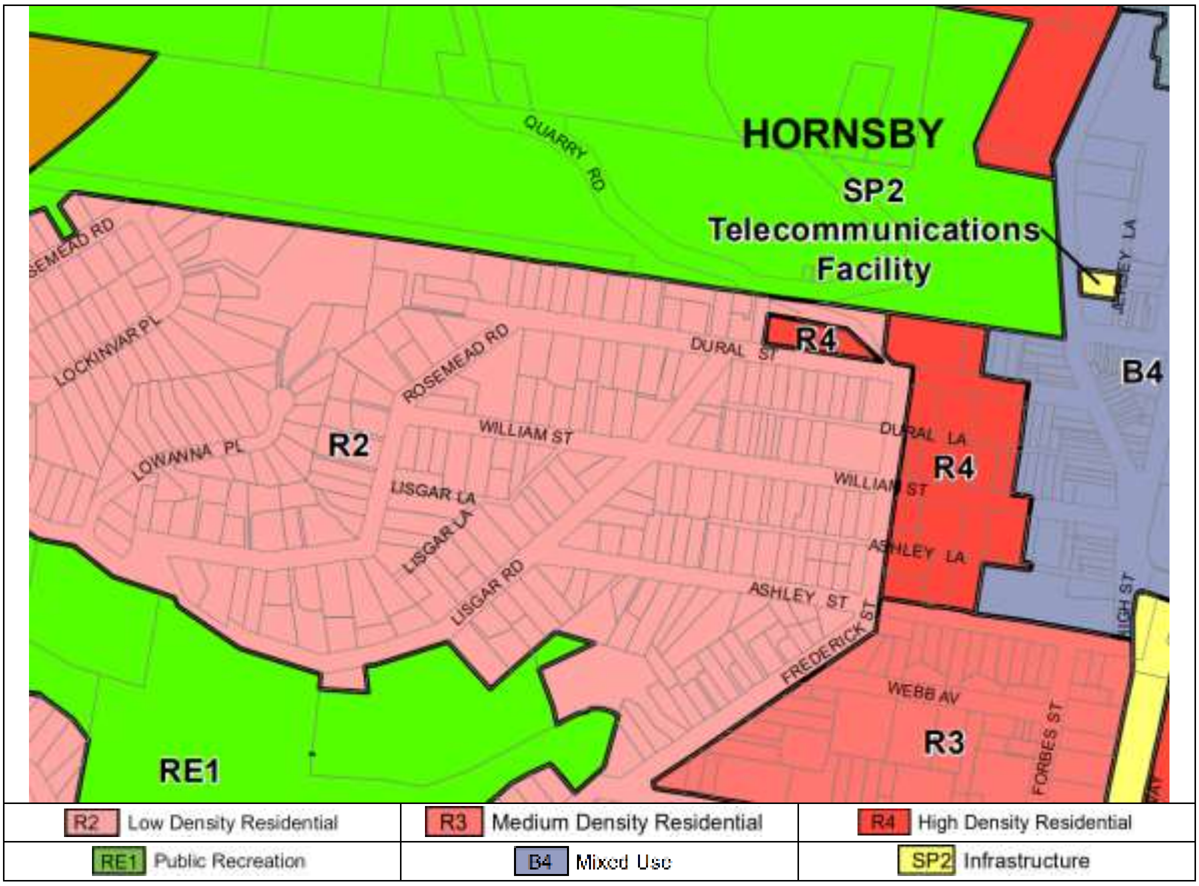


Figure 2.5 – Hornsby Shire Council Land Zoning Map

The zoning diagram shown in Figure 2.3 was sourced from the Hornsby Local Environment Plan 2013 (HELP 2013).

2.3 PROPOSED DEVELOPMENT

The proposed development is a small community school incorporating a 32 place preschool and a 48 place primary school.

A total of 80 children will be involved.

The development will involve modifications to an existing building at the 1 Rosemead Road site, as indicated by the plans and drawings provided in Figures 2.6 to 2.10 on subsequent pages, as follows:

Figure 2.6	Site & Roof Plan
Figure 2.7	Floor Plans & Sections
Figure 2.8	Elevations (House)
Figure 2.9	Elevations (Site)
Figure 2.10	Additional Details
Figure 2.11	Site Management & Stormwater Concept Plan
Figure 2.12	Landscape Plan

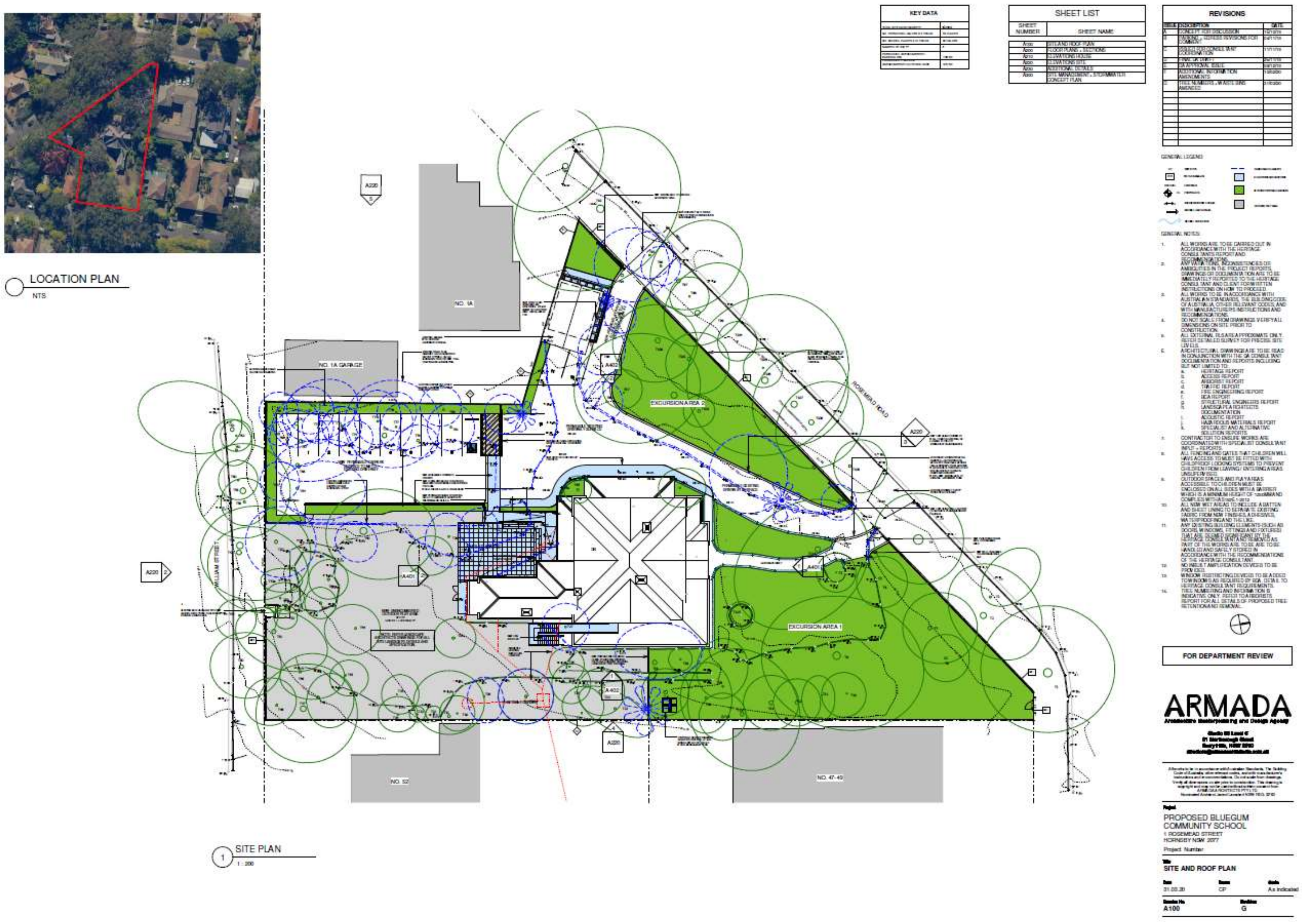


Figure 2.6 – Site & Roof Plan

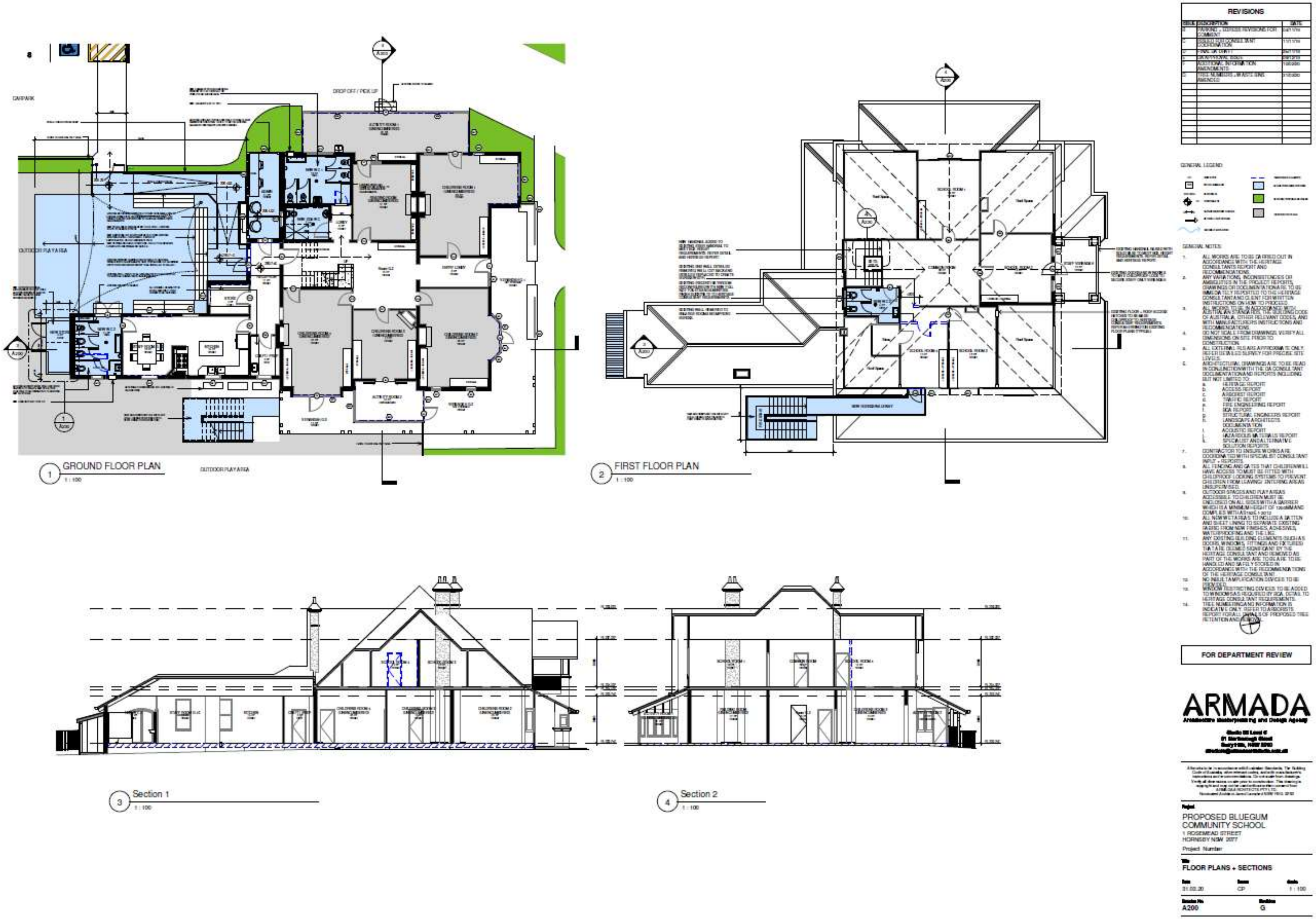


Figure 2.7 – Floor Plans & Sections

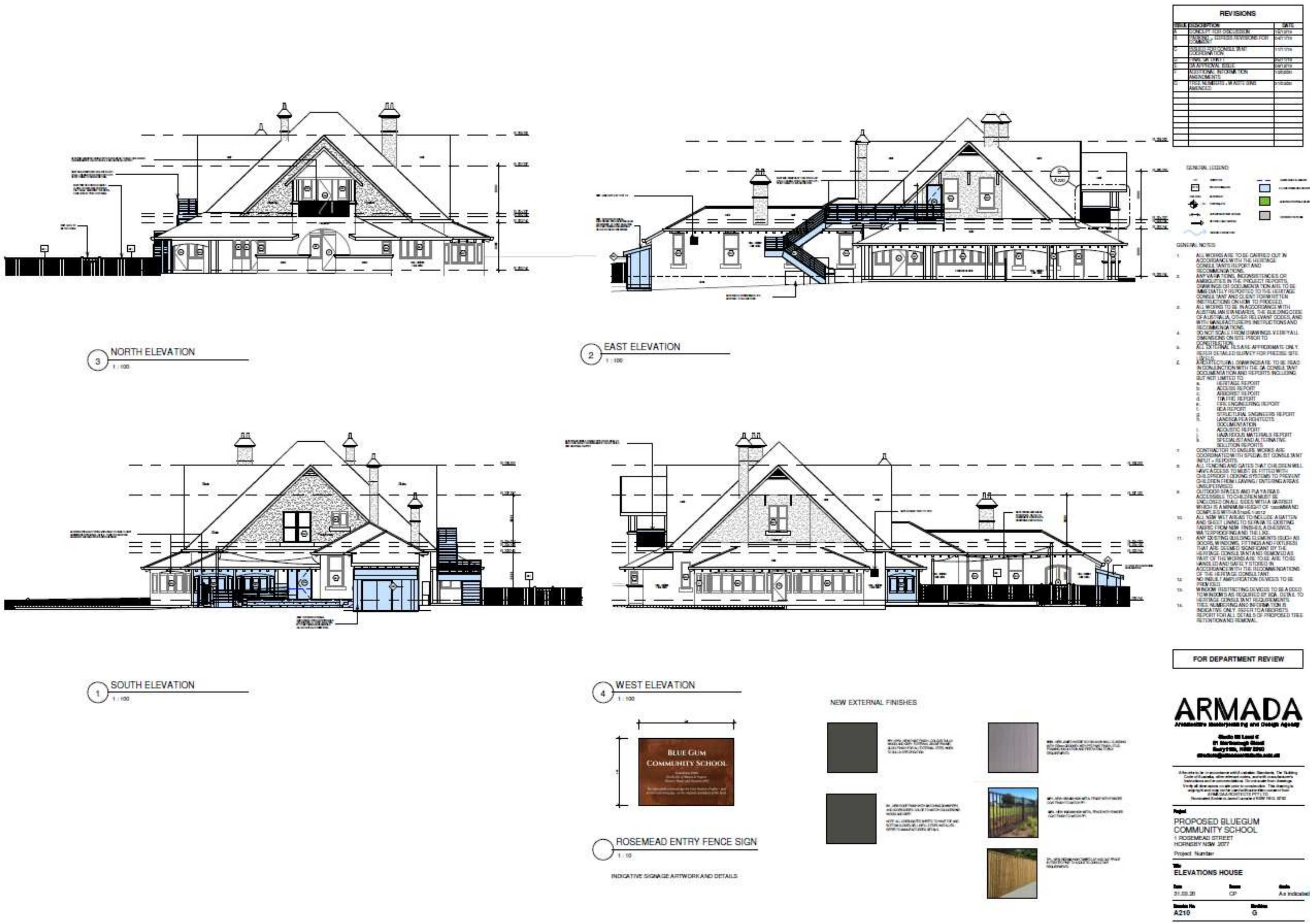


Figure 2.8 – Elevations (House)

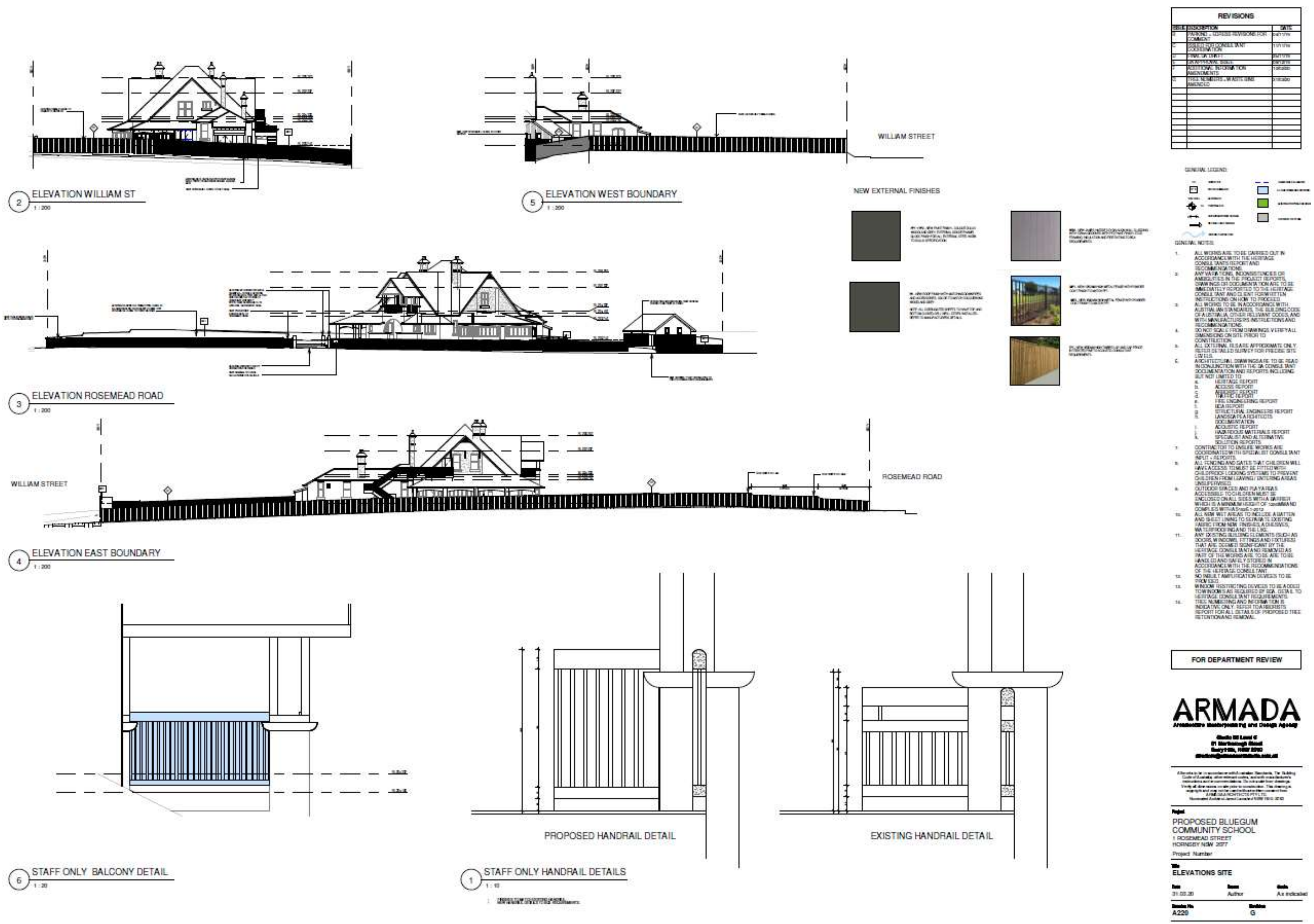


Figure 2.9 – Elevations (Site)

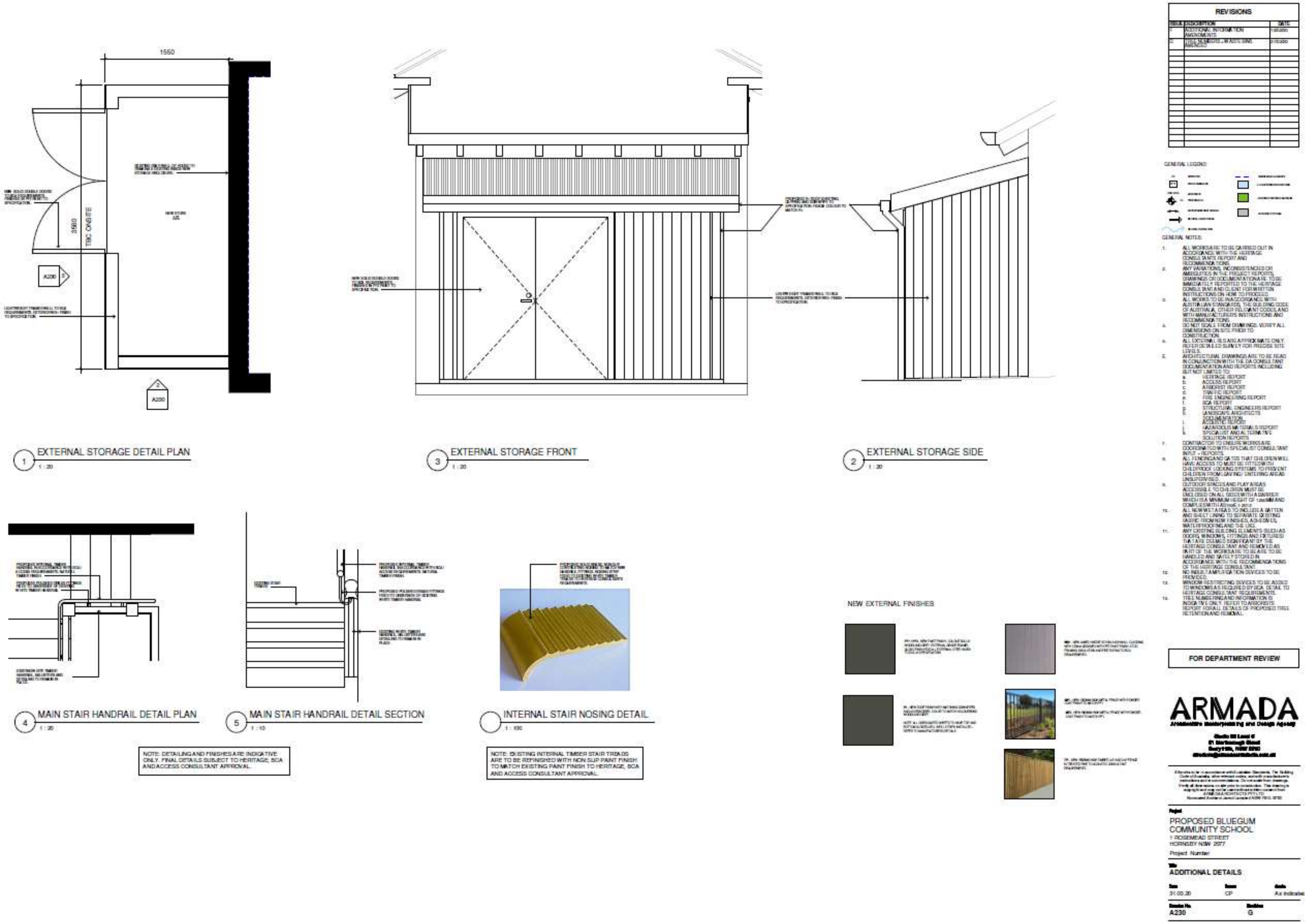


Figure 2.10 – Additional Details

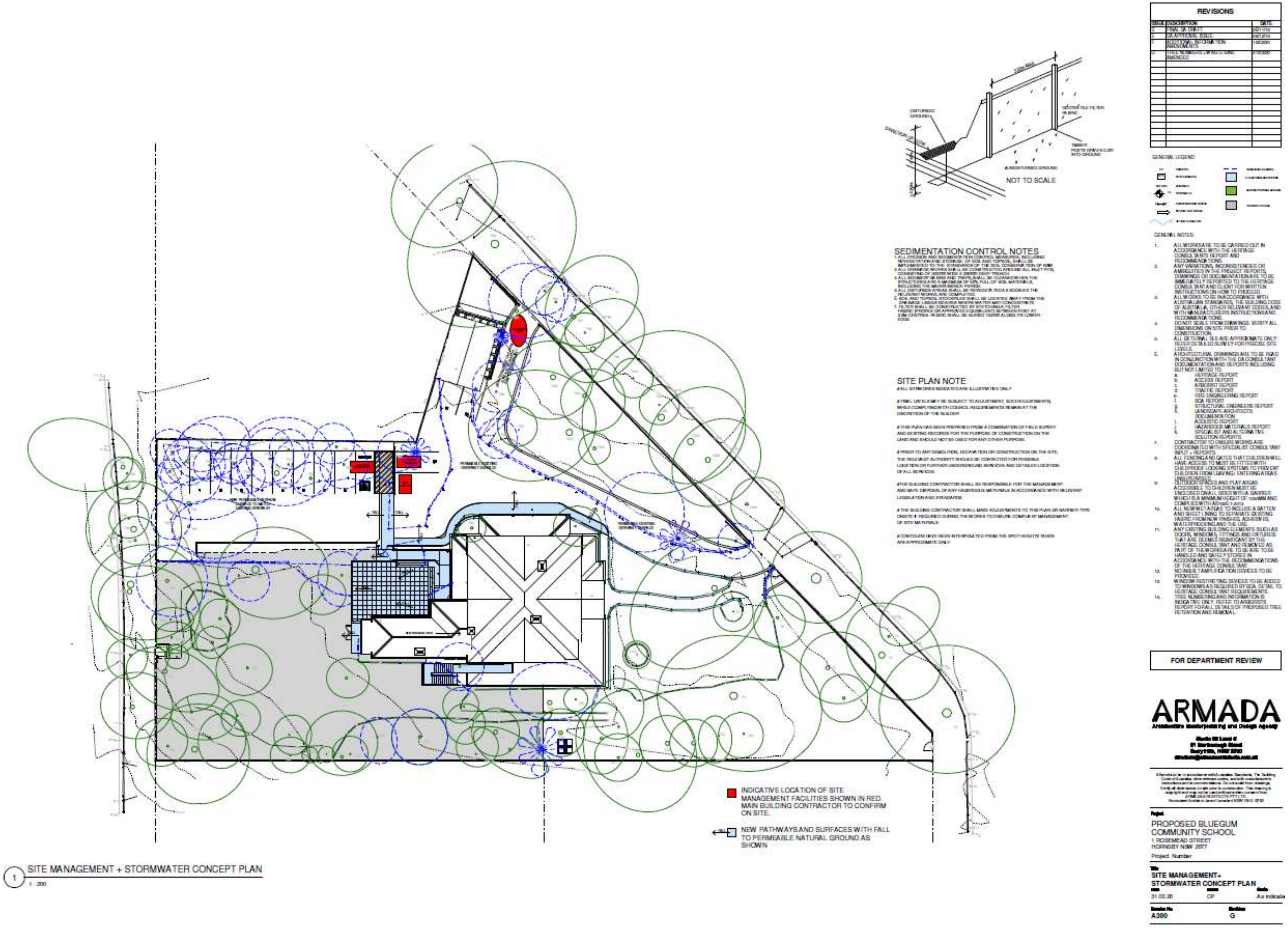


Figure 2.11 – Site Management & Stormwater Concept Plan

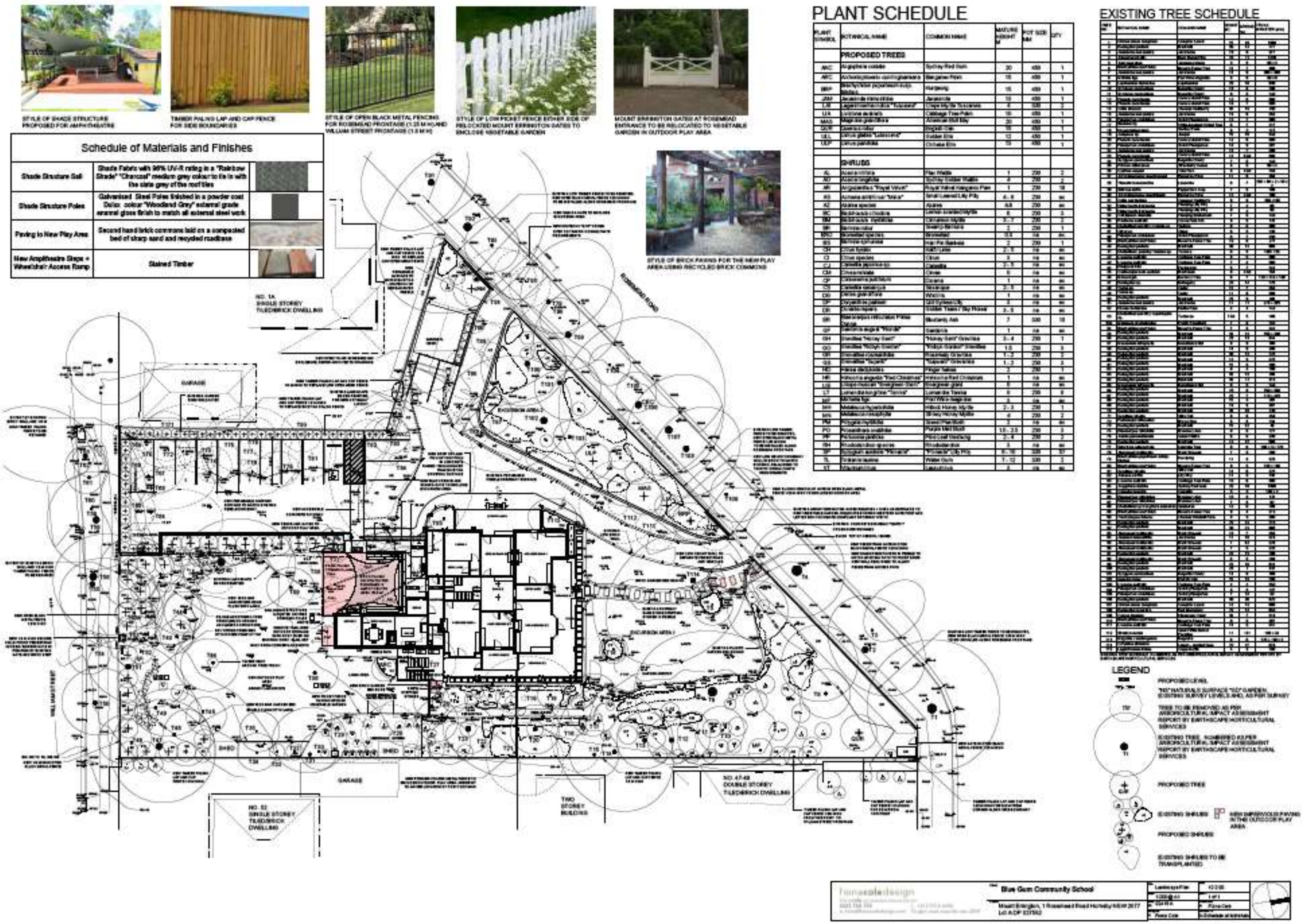


Figure 2.12 – Landscape Plan

3 BASIC NOISE & ACOUSTIC CONCEPTS

3.1 SOUND & NOISE

3.1.1 Loudness

In terms of human hearing, sound is caused by vibrations in the air, causing variations in air pressure that are detected by the ear. Noise is often described as unwanted sound. Sound pressure is measured in units called Pascals (Pa) but is generally expressed as a sound pressure level in decibels (dB). Sound consists of various frequency components called octaves. A correction factor is generally applied to combine these frequencies into a single number that most closely corresponds to the response of the human ear. When this is done, the sound pressure level is referred to as "A" - weighted, and is expressed as dB (A), or dBA. "A" - weighted units have generally been used in this report.

3.1.2 Other Sound or Noise Characteristics

The sound pressure levels discussed above provide a measure of the loudness of a noise. This is an important measure, as the loudness of a sound can be a major contributor to disturbance, or annoyance. There are a number of other aspects of a sound or noise that can also contribute to disturbance or annoyance. These include:

- **Tonal Noise** – containing a prominent frequency and characterized by a definite pitch
- **Low Frequency Noise** – containing major components within the low frequency range (20 -250 Hz) of the frequency spectrum
- **Impulsive Noise** – having a high peak of short duration, or a sequence of such peaks
- **Intermittent Noise** – the level suddenly drops to that of the background noise several times during the assessment period, with a noticeable change in noise level of at least 5 dBA

3.1.3 Adding Noise Levels

Sound pressure levels are expressed in decibels, which is a logarithmic scale able to compress the range of sound levels audible to the human ear into manageable numerical units. Because the scale is logarithmic, however, noise levels cannot be added in simple arithmetic terms. For example, 35 dB plus 35 dB does not equal 70 dB. To add two or more noise levels expressed in decibels, if the difference between the highest and next highest noise level is:

0-1dB - add **3 dB** to the higher level to give the total noise level;
2-3 dB - add **2 dB** to the higher level to give the total noise level;
4-9 dB - add **1 dB** to the higher level to give the total noise level; and
10 dB and over - the noise level is **unchanged** (i.e. the higher level is the total level)

3.1.4 Attenuation or Reduction of Noise with Distance

Noise reduces with increasing distance from the source. In the case of a point source, this attenuation with distance is governed by the following formula:

$$SPL_2 = SPL_1 - 20 \log (d_2/d_1)$$

where:

SPL_2	=	sound level a distance "2" from the source in metres (predicted)
SPL_1	=	sound level a distance "1" from the source in metres (measured)
d_2	=	distance in metres to location 2 from the source
d_1	=	distance in metres to location 1 from the source

3.2 KEY TERMS DEFINITIONS & ABBREVIATIONS

The following terms, definitions and abbreviations have been used in this acoustic assessment:

INP	Industrial Noise Policy
dBA	Decibels – a logarithmic unit commonly used to measure sound levels.
ANL	Acceptable Noise Level
ABL	Assessment Background Level - a single figure sound or noise background level representing each assessment period (daytime, evening and nighttime) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.
RBL	The Rating Background Level for each period is the median value of the ABL values for the period over all the days measured. There is therefore an RBL value for each period – daytime, evening and nighttime.
L_{Aeq}	The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is the most commonly used measure of environmental noise and road traffic noise.
$L_{Aeq, period}$	The equivalent continuous sound level for a specified period of time.
$L_{A10, period}$	The LA10 measure is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the LA10 Level for 90% of the time. This measure, recorded over a one-hour period, provides a reliable indication the repeatable maximum $L_{Aeq,\ 1hour}$ measure.
$L_{A90,}$ period	The L_{A90} measure is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} Level for 10% of the time. This measure is commonly referred to as the “background noise level”. The notation “15 minute” means that the sample period was 15 minutes.
Maximum Noise Level L_{Amax}	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

4 ASSESSMENT CONSIDERATIONS

4.1 NSW DEPARTMENT OF PLANNING INDUSTRY & ENVIRONMENT

The NSW Department of Planning Industry & Environment is the authority responsible for review and approval of the application for development of a community school at 1 Rosemead Road, Hornsby.

It is noted that the proposed development involves both primary and pre-school age children, and for that reason assessment guidelines relevant to both primary and pre-school developments have been considered.

4.2 SEPP EDUCATIONAL ESTABLISHMENTS & CHILD CARE (2017)

State Environmental planning Policy (Educational Establishments and Child Care Facilities) 2017 and the Child Care Planning Guideline apply to all development for childcare in NSW. This includes all new and existing childcare facilities.

All Development Applications must demonstrate how the development complies with:

- The National Quality Framework for Early Childhood Education and Care Facilities; and
- The relevant objectives, provisions and considerations in the SEPP and the Child Care Planning Guideline.

Typically, individual local government DCP’s do not apply where they are inconsistent with the SEPP or the guideline, except for building height, side and rear setback or car parking provisions.

All relevant provisions of the SEPP have been considered in the preparation of this acoustic assessment.

4.3 NSW CHILD CARE PLANNING GUIDELINE (2017)

The Child Care Planning Guideline : Delivering quality childcare for NSW (August 2017) supports the SEPP described in 4.2 above.

State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 (the SEPP) determines that a consent authority must take into consideration this Guideline when assessing a development application (DA) for a centre based childcare facility (“childcare facility”).

It also determines this Guideline will take precedence over a Development Control Plan (DCP), with some exceptions, where the two overlap in relation to a childcare facility.

This Guideline informs state and local government, industry and the community about how good design can maximise the safety, health and overall care of young children. At the same time, it aims to deliver attractive buildings that are sympathetic to the streetscape and appropriate for the setting while minimising any adverse impacts on surrounding areas. It will help achieve a high level of design that is practical and aligned with the National Quality Framework.

The Guideline is intended to provide a consistent statewide planning and design framework.

In terms of visual and acoustic issues, Sections 3.5 and 3.6 of the Guidelines apply, as follows;

3.5 Visual and acoustic privacy

Visual privacy is about allowing residents on adjacent properties to occupy their private space without being overlooked by childcare facilities and ensuring childcare facilities are not overlooked by neighbouring properties.

Privacy is influenced by the activities in each of the spaces where overlooking may occur, the times and frequency these spaces are being used, the expectations of occupants for privacy and residents' willingness to reduce overlooking with screening devices.

Acoustic privacy involves reducing sound transmission between activity rooms and outdoor play areas of the childcare facility and its neighbours. Design and site layout are the main ways of reducing acoustic impacts for example:

- site context and orientation of the building;
- building design including the location of public and private open spaces and the arrangement of internal spaces;
- physical relationship to surrounding uses; and
- building separation and providing physical barriers between the outdoor areas and the noise receivers.

Outdoor areas near residential uses can be designed to encourage more passive activities. Acoustic attenuation measures can be used to reduce reflected noise and once a facility is operating the installation of public address systems should be discouraged.

Considerations

Objective: To protect the privacy and security of children attending the facility.

C20 Open balconies in mixed use developments should not overlook facilities nor overhang outdoor play spaces.

C21 Minimise direct overlooking of indoor rooms and outdoor play spaces from public areas through:

- appropriate site and building layout;
- suitably locating pathways, windows and doors; and
- permanent screening and landscape design.

Objective: To minimise impacts on privacy of adjoining properties.

C22 Minimise direct overlooking of main internal living areas and private open spaces in adjoining developments through:

- appropriate site and building layout;
- suitable location of pathways, windows and doors; and
- landscape design and screening.

Objective: To minimise the impact of childcare facilities on the acoustic privacy of neighbouring residential developments.

C23 A new development, or development that includes alterations to more than 50 per cent of the existing floor area, and is located adjacent to residential accommodation should:

- provide an acoustic fence along any boundary where the adjoining property contains a residential use. (An acoustic fence is one that is a solid, gap free fence).
- ensure that mechanical plant or equipment is screened by solid, gap free material and constructed to reduce noise levels e.g. acoustic fence, building, or enclosure.

C24 A suitably qualified acoustic professional should prepare an acoustic report which will cover the following matters:

- identify an appropriate noise level for a childcare facility located in residential and other zones;
- determine an appropriate background noise level for outdoor play areas during times they are proposed to be in use;
- determine the appropriate height of any acoustic fence to enable the noise criteria to be met.

3.6 Noise and air pollution

Childcare facilities located near major roads, rail lines, and beneath flight paths are likely to be subject to noise impacts.

Other noisy environments such as industrial areas and substations may impact on the amenity and well-being of the children and staff.

The location of childcare facilities should be selected to avoid or minimise the potential impact of external sources of significant noise.

The Protection of the Environment Operations Act 1997 provides the statutory framework for managing air emissions in NSW and should be consulted when proposing facilities in or close to industrial areas.

The Protection of the Environment Operations (Clean Air) Regulation sets air emission standards for different industries.

Considerations

Objective: To ensure that outside noise levels on the facility are minimised to acceptable levels.

C25 Adopt design solutions to minimise the impacts of noise, such as:

- creating physical separation between buildings and the noise source
- orienting the facility perpendicular to the noise source and where possible buffered by other uses
- using landscaping to reduce the perception of noise
- limiting the number and size of openings facing noise sources
- using double or acoustic glazing, acoustic louvres or enclosed balconies (winter gardens)
- using materials with mass and/or sound insulation or absorption properties, such as solid balcony balustrades, external screens and soffits
- locating cot rooms, sleeping areas and play areas away from external noise sources.

C26 An acoustic report should identify appropriate noise levels for sleeping areas and other non-play areas and examine impacts and noise attenuation measures where a childcare facility is proposed in any of the following locations:

- on industrial zoned land
- where the ANEF contour is between 20 and 25, consistent with AS 2021 - 2000

- along a railway or mass transit corridor, as defined by State Environmental Planning Policy (Infrastructure) 2007
- on a major or busy road
- other land that is impacted by substantial external noise.

Objective: **To ensure air quality is acceptable where childcare facilities are proposed close to external sources of air pollution such as major roads and industrial development.**

C27 Locate childcare facilities on sites which avoid or minimise the potential impact of external sources of air pollution such as major roads and industrial development.

C28 A suitably qualified air quality professional should prepare an air quality assessment report to demonstrate that proposed childcare facilities close to major roads or industrial developments can meet air quality standards in accordance with relevant legislation and guidelines. The air quality assessment report should evaluate design considerations to minimise air pollution such as:

- creating an appropriate separation distance between the facility and the pollution source. The location of play areas, sleeping areas and outdoor areas should be as far as practicable from the major source of air pollution
- using landscaping to act as a filter for air pollution generated by traffic and industry. Landscaping has the added benefit of improving aesthetics and minimising visual intrusion from an adjacent roadway
- incorporating ventilation design into the design of the facility

Acoustic aspects of the Child Care Planning Guideline (2017) have been taken fully into account in the preparation of this Acoustic Assessment Report.

4.4 THE AAAC GUIDELINE (2013)

The Association of Australasian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment Version 2.0 (2013) provides a methodology and approach for the acoustic assessment of childcare and educational facilities.

The AAAC guidelines includes the following key topics:

Chapter 5 – Noise Criteria

Background Noise Level
Residential Receptors
Outdoor Play Area
Commercial Receptors
Traffic Noise

Chapter 6 – Sound Power Levels

Children
Mechanical Plant
Traffic

Chapter 8 - Noise Control Recommendations

Building Design

Outdoor Play Areas
Buildings and Other Structures
Boundary Fences
Limiting the Number of Children Outside
Noise Management Plan
Drop off and Pick up
Supervision

This assessment has considered the various guidelines provided by the AAAC document.

For convenience, reference to the AAAC guideline has been provided in blue shaded text boxes in relevant sections of the acoustic assessment provided in this report.

4.5 NSW GOVERNMENT REQUIREMENTS & GUIDELINES

The NSW Department of Family & Community Services (DOC's) administers the *Children's Services Regulation 2004* (the *Regulation*), made under the Children and Young Persons (Care and Protection) Act 1998.

From 1 January 2012 the Children (Education and Care Services) Supplementary Provisions Regulation 2004 (formerly Children's Services Regulation 2004) was introduced under the Children (Education and Care Services) Supplementary Provisions Act 2011 No 70 to update and revise the original regulation.

This Regulation governs children's services and covers a wide range of administrative and regulatory requirements.

The regulation also deals with the physical requirements of building spaces and equipment; health and safety, administrative and general environmental requirements.

This assessment presented in this document has considered all relevant areas of the Regulation.

4.6 NOISE POLICY FOR INDUSTRY (2017)

It has been assumed as a basis for this assessment that appropriate noise criteria for the proposed development are specified in the Noise Policy for Industry (NPI) 2017 (formerly the NSW Industrial Noise Policy 2000). The noise criterion set out in the INP depends on whether existing noise levels in a given area are close to recommended amenity levels for different types of residential receiver, for example whether the receivers in question are urban, rural, near existing roads and so on. In this case, the potential receivers in question appear to be primarily residential in nature. The NPI requires that the following actions or circumstances be taken into account in the acoustic assessment of a development of the type proposed:

- Identify the existing level of noise, or noise background
- Determine what weather conditions should be used when predicting noise background
- Assess noise levels that will be involved with the various aspects of the proposed development
- Assess noise from the proposed development at residential receivers
- Assess noise from the proposed development at industrial/commercial receivers
- Apply the urban/industrial interface amenity category, if required
- Identify the appropriate receiver amenity category
- Apply amenity criteria in high traffic noise areas

- Take into account any cumulative noise from multiple developments
- Identify which of the amenity or intrusive criteria apply
- Take into account maximum noise levels during shoulder periods
- Consider the tonality - sliding scale test
- Apply duration correction, if required
- Sleep disturbance
- Present the results of the acoustic assessment in appropriate report form

Further comments on some of these assessment criteria are included in Sections 4.6.1 to 4.6.4, below.

4.6.1 Intrusiveness Criterion

As set out in the various reference guidelines listed above, where existing noise levels are low, noise levels from a proposed new (or changed) operation are limited by the intrusiveness criterion.

In such cases, the L_{Aeq} noise level resulting from the impact of any new or substantially changed operation should not exceed the Rating Background Level (RBL) applicable to the residential receivers in question by more than 5 dBA.

4.6.2 Amenity Criterion

The amenity criterion sets an upper limit to control the L_{Aeq} noise level from all industrial sources for daytime, evening and nighttime periods, respectively. In accordance with the relevant acoustic criteria and guidelines listed, "maximum" recommended incremental noise levels for these periods are all 5 dBA higher than the "acceptable" levels mentioned in the various NSW acoustic guidelines.

4.6.3 Interpretation of Criteria

Where noise levels from industrial sources are close to or above the 5 dBA maximum increment over the existing Rating Background Level, as recommended in the NSW Noise Policy for Industry, then the amenity criterion, which incorporates a sliding scale to set limits, becomes relevant.
The sliding scale prevents the overall noise level exceeding the acceptable level as a result of a new noise source. The amenity criterion also needs to consider the possibility of other developments which may affect aggregate noise levels in any given situation.

4.6.4 Sleep Disturbance

In order to minimise any risk of sleep disturbance to affected residential receivers as a consequence of operations that occur during the nighttime period (10:00 pm – 7:00 am), the NSW Office of Environment & Heritage (OEH) recommends that:

> *Sleep disturbance is assessed as the emergence of the $L_{A\ (1\ minute)}$ level above the $L_{A90\ (15\ minute)}$ level at the time. Appropriate screening criteria for sleep disturbance are determined to be an $LA1_{(I\ minute)}$ level 15 dBA above the Rating Background Level (RBL) for the nighttime period.*

This approach to the assessment of sleep disturbance has been discussed with the NSW OEH by the author of this assessment proposal.

The NSW OEH has confirmed that this is the correct and accepted way to undertake the assessment of sleep disturbance.

In this case, the operating hours of the proposed centre will be within the prescribed "daytime" period for acoustic assessment purposes that is between 7:00 am and 6:00 pm Monday to Friday.

4.7 SUMMARY OF ACOUSTIC GUIDELINES & REQUIREMENTS

Taking into account all relevant guidelines, the acoustic conditions that will be required to be demonstrated in relation to the proposed development are as follows:

The effect of noise from external sources on the Community School development:

Preschool/ Primary School Location	Noise Level dBA	Applicable Time Period
Internal Areas of the Community School	40 [1]	At any time
Outdoor areas of the Community School	55 [1]	At any time

[1] Leq 1 hour basis

While childcare guidelines typically require noise levels below 40 dBA in all internal areas, a further objective of 35 dBA for noise levels achievable in any sleep or rest areas associated with the facility has been adopted for this assessment.

While the principal sources of external noise in this case appears to be road traffic on local roads, the assessment methodology used ensures that all other potential noise sources have been taken fully into account in the assessment.

The effect of noise from the Community School development on nearby receivers:

Type of Receiver	Noise Level dBA	Applicable Time Period
Nearby Residential Properties	+ 5 dBA (max) versus RBL [1]	At any time
Nearby Commercial Properties	65 dBA max [2]	At any time

1 RBL = Rated Background Sound Level
2 NSW Noise Policy for Industry

In this case, surrounding properties are predominantly residential in nature,

The requirement in relation to the impact of noise associated with the proposed school on nearby residential properties is that such noise is not permitted to result in an increase of more than 5 dBA above existing background LA90 sound levels measured at the boundary between the development and the nearest residential boundary, and also that noise impact complies with any other specific guidelines.

Noise impacts due to activities and operations associated with the development are required to be no greater than 65 dBA at any affected commercial premises, however in this case no commercial premises were noted in the vicinity of the proposed school.

It is noted that the assessment of noise impacts is required to be based on measurements over a 15-minute period, and this approach has been adopted in the assessment presented in this document.

4.8 OVERALL SCOPE & METHODOLOGY

The assessment of noise in relation to preschools, child-care centres and schools involves two primary considerations. These are firstly, the potential impacts of external noise sources on the conduct and well-being of the proposed school, and the children and staff involved, and secondly, the potential impact of sounds generated by the school and its activities on nearby activities and individuals.

The acoustic environment at the proposed Community School has been assessed in the following way:

ESTABLISH THE ACOUSTIC BACKGROUND

Background acoustic measurements at the proposed development site have been recorded based on seven days continuous, unattended monitoring of all key acoustic parameters.

These measurements have in turn been used to provide the basis for a thorough acoustic assessment, in accordance with the requirements of Hornsby Shire Council, and those of the NSW Government, including relevant provisions of the NSW EPA Industrial Noise Policy.

Sound level measurements were recorded with a Brüel & Kjaer 2238E Type 1 (Class 1) integrating sound level meter.

The instrument was calibrated before and after measurements, in accordance with relevant acoustic standards and procedures. The sound level meter was also calibrated by a NATA certified laboratory prior to its use in the assessment.

The measurement equipment used, and methodologies employed comply with Australian Standard AS 1259.2-1990 "Acoustics – Sound Level Meters – Integrating – Averaging", and AS 1055 "Acoustics – Description and Measurement of Environmental Noise". The microphone of the recording device was located in free field conditions - that is away from reflective facades or objects.

This approach to the assessment of noise complies with the requirements of Australian Standard AS 3671/1989 in respect of external noise, and AS/NZS 2107 in respect of noise levels within buildings, and also complies with Australian Standard AS 1259.2-1990 "Acoustics – Sound Level Meters – Integrating – Averaging", and AS 1055 "Acoustics – Description and Measurement of Environmental Noise".

NOISE IMPACTS <u>ON</u> THE PROPOSED COMMUNITY SCHOOL (PRESCHOOL & PRIMARY)

The representative sound level measurements described above were used to provide an assessment of likely noise levels applicable in the outside areas of the proposed school.

Prospective indoor noise levels, which will be lower, have been calculated and assessed from this external noise data, taking into account the indicative design and noise attenuation (reduction) characteristics of the proposed centre, and the construction materials proposed.

The key assessment criteria, both in respect of external and internal noise levels, are whether or not background noise levels are likely to have an undue impact on the operation of the school and the well-being of the children, and whether background noise levels are likely to impede on effective communication between supervising staff, teachers and the children.

The assessment has considered whether internal noise levels at the proposed centre will comply with the maximum level of 40 dB (A) required by relevant assessment criteria, and where appropriate has provided advice regarding structural and design considerations relevant to achieving this internal sound level requirement.

NOISE IMPACTS <u>FROM</u> THE PROPOSED COMMUNITY SCHOOL (PRESCHOOL & PRIMARY)

An assessment has been undertaken to quantify the likely noise impacts caused by the school, using historical data for noise levels associated with the activities of children at schools and educational facilities, and applying this data to the number of children involved in the proposed Community School [32 x preschool (3-5 years) and 48 x primary (6-12 years)].

This aspect of the assessment considers whether or not noise emissions from the school will comply with relevant, and to the extent necessary has considered any design on operational requirements necessary to achieve such compliance.

5 ACOUSTIC BACKGROUND

5.1 INTRODUCTION

Two of the most important considerations in the acoustic assessment of educational facilities are the effect of surrounding noise sources on the school and its occupants, and the effect of any noise generated by the facility itself, its occupants and its operations, on nearby residents and any other potentially sensitive receivers. The assessment of acoustic issues in turn requires an understanding and clear definition of the existing acoustic environment at the site under consideration. This section of the report describes the measurement of the acoustic background at the site.

5.2 MEASURES OF LOUDNESS OF SOUND & NOISE

5.2.1 General

In terms of human hearing, sound is caused by vibrations in the air, causing variations in air pressure that are detected by the ear. Noise is often described as unwanted sound. Sound pressure is measured in units called Pascals (Pa) but is generally expressed as a sound pressure level in decibels (dB).

Sound consists of various frequency components called octaves. A correction factor is generally applied to combine these frequencies into a single number that most closely corresponds to the response of the human ear. When this is done, the sound pressure level is referred to as "A" - weighted, and is expressed as dB (A), or dBA. "A" - weighted units have been used in this report.

5.2.2 Noise Descriptors

The following standard noise descriptors have been used in this assessment:

$L_{Aeq,\ 15min}$	continuous equivalent sound pressure level over a 15-minute period
$L_{Amax,\ 15\ min}$	maximum sound pressure level over 15 minutes
$L_{Amin,\ 15\ min}$	minimum sound pressure level over 15 minutes
$L_{AF90,\ 15min}$	sound pressure level exceeded for 90% of a 15-minute period

Review of AAAC Guidelines

The noise descriptors used in this assessment are consistent with those described in the AAAC (2013) guideline.

5.3 ASSESSMENT

5.3.1 General Approach

The general approach to this assessment has been twofold.

Firstly, to estimate the sound levels that would apply within the proposed school; to determine whether these sound levels are consistent with those required at such a facility, and if relevant to consider any design or noise management measures that might be required to ensure appropriate sound or noise levels throughout the proposed facility.

Secondly, to estimate the levels of sound or noise likely to be generated by activities associated with the proposed school and assess the prospective acoustic impact of the proposed facility on nearby receivers.

The existing acoustic environment at the site is relevant to both considerations.

This section of the report describes the method used to measure the existing or background acoustic environment and presents and explains the results of those measurements.

5.3.2 Instrumentation

The sound level measurements used in this assessment were recorded with a Brüel & Kjaer 2237A integrating sound level meter.

The instrument was calibrated before and after measurements, in accordance with relevant acoustic standards and procedures. Calibration drifts of less than 0.2 dB (A) were recorded.

The sound level meter used had been calibrated by a NATA certified laboratory three weeks prior to its use in this assessment.

The measurement equipment and methodologies employed in this assessment comply with Australian Standard AS 1259.2-1990 "Acoustics – Sound Level Meters – Integrating – Averaging", and AS 1055 "Acoustics – Description and measurement of environmental noise".

Review of AAAC Guidelines

> The instrumentation used to measure the background sound levels used in this assessment is consistent with the requirements described in the AAAC (2013) guideline.

5.3.3 Background Sound Level Measurements

The acoustic data necessary to complete the assessment was obtained as follows:

- Reference background sound levels were measured by continuous, unattended noise monitoring conducted over a seven-day period between Monday October 21st and Sunday October 27th, 2019, in accordance with relevant acoustic assessment guidelines and protocols.

- The sound level recording monitor was located in a representative location at the site, as shown in Figure 5.1, below.

- External background sound level measurements were recorded at an elevation of 1.5 metres above ground level in free field conditions, as required by relevant acoustic assessment guidelines and protocols. Weather conditions during the monitoring period were essentially clear and fine, with low prevailing winds, with no excessive rain during the monitoring period. Meteorological conditions were not considered to be such as to distort the background sound level measurements.

The measurement location is marked "A" in Figure 5.1, on the following page.

Figure 5.1 – Background Sound Level Measurement Location

Review of AAAC Guidelines

The method of measuring background sound levels used in this assessment is consistent with the approach described in the AAAC (2013) guideline.

5.3.4 Results

The results of the background sound level measurements from the site are summarised in Table 5.1, on the following page.

Full details of the unattended background sound level measurements, including daily sound level graphs, have been included for reference at Appendix A. The raw data obtained from these background sound level measurements has been included at Appendix B.

Table 5.1 - Background Sound Level Measurement Results

	Mean logarithmic L_{AF90} Daytime (7:00am to 6:00pm) *	**Mean logarithmic L_{AF90} Evening (6:00pm to 10:00pm)**	**Mean logarithmic L_{AF90} Night-time (10:00pm to 7:00am)**
Mon 21 October 2019	41.2591	38.3500	34.1417
Tue 22 October 2019	36.9159	40.5188	39.5259
Wed 23 October 2019	37.3432	41.0188	33.5556
Thu 24 October 2019	39.1685	37.9375	33.6688
Fri 25 October 2019	38.2500	39.3000	32.4594
5 Working Days	**38.5873**	**39.4250**	**34.6702**
Sat 26 October 2019	43.2889	38.1250	31.4000
Sun 27 October 2019	36.8426	36.1750	29.5969
2 Day Weekend	**40.0657**	**37.1500**	**30.4984**
	Mean logarithmic L_{Aeq} Day-time (7:00am to 6:00pm) *	**Mean logarithmic L_{Aeq} Evening (6:00pm to 10:00pm)**	**Mean logarithmic L_{Aeq} Night-time (10:00pm to 7:00am)**
Mon 21 October 2019	48.3682	42.7438	39.5786
Tue 22 October 2019	45.9182	46.5188	37.0661
Wed 23 October 2019	45.3909	46.0063	38.5389
Thu 24 October 2019	47.1926	44.3125	37.5281
Fri 25 October 2019	46.4229	44.1250	37.0250
5 Working Days	**46.6586**	**44.7413**	**37.9473**
Sat 26 October 2019	52.6241	46.3375	37.1125
Sun 27 October 2019	46.3444	44.0438	33.9375
2 Day Weekend	**49.4843**	**45.1906**	**35.5250**

* Sundays and Public Holidays daytime commences 8:00am

A summary of the L_{AF90} and L_{Aeq} noise measures for the 2-day weekend and 5-day working week periods, as used in this assessment, is presented in Table 5.2, below.

Table 5.2 – Noise Monitoring Summary

	Mean logarithmic L_{AF90} Daytime (7:00am to 6:00pm) *	**Mean logarithmic L_{AF90} Evening (6:00pm to 10:00pm)**	**Mean logarithmic L_{AF90} Night-time (10:00pm to 7:00am)**
5 Working Days	**38.5873**	**39.4250**	**34.6702**
2 Day Weekend	**40.0657**	**37.1500**	**30.4984**
	Mean logarithmic L_{Aeq} Day-time (7:00am to 6:00pm) *	**Mean logarithmic L_{Aeq} Evening (6:00pm to 10:00pm)**	**Mean logarithmic L_{Aeq} Night-time (10:00pm to 7:00am)**
5 Working Days	**46.6586**	**44.7413**	**37.9473**
2 Day Weekend	**49.4843**	**45.1906**	**35.5250**

* Sundays and Public Holidays daytime commences 8:00am

The proposed preschool and primary school will operate on an essentially daytime basis, corresponding with the working day “day-time” measurements shown in Table 5.2 above, that is between 7:00am and 6:00pm working days, Monday to Friday.

Accordingly, the Rated Background Sound Levels (RBL's) adopted for this assessment, in accordance with relevant acoustic assessment guidelines, are as shown in Table 5.3, below.

In accordance with standard assessment practice, these RBL's have been rounded to the nearest whole number.

Table 5.3 – Rated Background Sound Levels

Rated Background Sound Levels for Assessment Purposes (dBA)	
L_{AF90}	**39**
L_{Aeq}	**47**

Review of AAAC Guidelines

Chapter 5 of the AAAC (2013) guideline provides the following specific comments in relation to the measurement of background noise levels:

> *Background Noise Level*
>
> *The background noise level should be measured using a continuous noise logger for a period of at least five consecutive weekdays. If the Child Care Centre is proposed to operate on Saturday and/or Sunday, these days should also be included. At least three of those days must not be affected by adverse weather. Meteorological data may be measured on site or accessed from the nearest Bureau of Meteorology weather station, within 30 km.*
>
> *Logger Location The noise logger should be located to measure the background noise level at the most affected residential receiver locations. If this location is not possible, the acoustical consultant shall select another suitable and equivalent location. Instrumentation*
>
> *The existing background noise level shall be measured using acoustical instrumentation which conforms to Australian Standard AS IEC 61672.1-2004 'Electroacoustics – Sound Level Meters – Specifications' as a class 1 or class 2. Acoustical instrumentation that conforms to AS 1259.2- 1990 'Acoustics - Sound Level Meters – Integrating – Averaging', Type 1 or 2 may also be used.*

The measurement of background sound levels in this assessment has complied with these criteria.

6 ACOUSTIC ASSESSMENT

6.1 SOUND TRANSMISSION RATINGS

The Building Code of Australia (BCA) requires that building elements have certain levels of insulation from airborne noise and impact sound.

Regulatory guidelines require that certain maximum sound or noise levels be achieved, or achievable, within the internal spaces of preschools/ childcare centres.

The weighted sound reduction index (Rw) is the measure used to describe the acoustic performance of the various building elements making up a construction system.

Rw is a single number quantity for the airborne sound insulation rating of building elements.

As the acoustic performance of a material or construction improves, the higher the Rw value will be.

Rw ratings are determined by laboratory tests of a specimen of the construction system. The specimen is fixed within a frame to form the wall between two test chambers.

A high noise level is generated in one room and the difference in sound level between the source room and the receiver room represents the transmission loss through the test specimen.

The measurements are conducted over a range of sound frequencies. The Rw rating is then determined by comparing the results with reference curves.

Correction factors (C and Ctr) can be added to Rw to take into account the characteristics of particular sound spectra and indicate the performance drop of the wall in the corresponding sound frequency range.

The correction factor C relates to mainly mid to high frequency noise. The correction factor Ctr relates to lower to medium frequency noise.

The weighted sound reduction index is quoted as Rw(C, Ctr), where C and Ctr are correction factors representing different noise sources.

For example, if a wall is measured as Rw 54(-1,-4) the value of the index when the lower frequency correction factor (Ctr) is applied is:

$$Rw + Ctr = 54 + (-4)$$
$$Rw + Ctr = 50$$

In practice, small gaps and cracks which permit even minor air leakage will provide a means for sound transmission, leading to lower field performance.

This degradation in acoustic performance should be recognised, and an appropriate allowance made when selecting a tested system to achieve a particular Rw rating when installed.

The sound transmission class (STC) was the method that was used previously to measure acoustic performance.

The requirements of the BCA have changed to comply with international regulations and Rw is now used.

The STC was based on different criteria and did not include any correction factors.

6.2 IMPACT OF AMBIENT NOISE ON THE PROPOSED DEVELOPMENT

6.2.1 Indicative Sound Levels

Projected "Internal" Sound Levels – General Indoor Areas

Sound levels within the proposed school will be influenced by the ambient external sound levels as indicated by the rated background sound levels as summarised in Table 5.3 in the previous section, which will be subject to attenuation or reduction by the external and internal structural features of the development (refer Figures 2.6 - 2.10), and proposed fit-out detail.

The proposed school will involve both indoor and outdoor activity areas and spaces as shown in Figures 2.6 to 2.10, as part of the educational facility proposed at the site.

External car parking will be provided in a car park to be located in the south-western portion of the site, with ingress and egress from and to Rosemead Road, as shown in Figures 2.6 and 2.9.

Acoustic protection to the internal spaces of the proposed facility will be provided by the external masonry structural walls and glazed elements of the building, together with internal dividing walls associated with the proposed construction, and the various floor and wall finishes used.

The structure of the school building comprise double brick external walls; a timber framed slate clad roof, and glazed window and door elements.

The proposed development will involve relatively minor modifications to the existing building at the site, as indicated in Figure 2.7.

These modifications will not significantly vary the existing acoustic integrity of the structure.

Sound Transmission through Structures

The structural elements of buildings (walls, windows, doors etc) reduce the level of sound. The degree of sound reduction varies from material to material.

The weighted sound reduction index (Rw) is the measure used to describe the acoustic performance of the various building elements making up a construction system, as described in 6.1 above.

The Rw rating is measured in decibels (dB) and in effect indicates the reduction that is achieved when noise passes through a given material.

If the noise outside is 70 dB and inside it is 40 dB, the structural element (wall, window, door etc) is said to have an Rw rating of 30.

As mentioned in 6.1, structural imperfections mean that this nominal level of noise reduction is not always achieved, and a degree of conservatism is required.

Acoustic Qualities of Solid Walls

Typically, solid form external wall elements have Rw sound reduction (or attenuation) ratings in excess of 35 dBA, and in the case of double brick elements in excess of 50 dBA.

This means that the maximum rated external sound level in this case, which is 47 dBA (refer Table 5.3), can readily be reduced to the desired maximum indoor sound levels of 40 dBA maximum (general areas) and 35 dBA objective maximum in any required rest or "quiet" by the effect of external walls, and in the case of internal spaces by the combined effect of external walls and internal structural elements.

The sound reduction or Rw ratings of typical external and internal wall structures are shown in Table 6.1, on the following page.

Table 6.1 - Sound Reduction Capabilities of Typical Walls

Wall Type	Rw
Single layer of 1/2″ drywall on each side, wood studs, no insulation (typical interior wall)	33
Single layer of 1/2″ drywall on each side, wood studs, fiberglass insulation	39
External brick veneer (single brick; timber frame, dry wall internal lining)	42
4″ Hollow CMU (Concrete Masonry Unit)	44
6″ Hollow CMU (Concrete Masonry Unit)	46
8″ Hollow CMU (Concrete Masonry Unit)	48
Double brick	>50

Source: Harris CM, "Noise Control in Buildings: A Practical Guide for Architects and Engineers"

Note: Rw ratings for walls exclude the effect of doors and windows, which need to be separately considered

As shown above, the acoustic qualities of the solid façade elements are generally more than adequate to reduce external sound levels to the levels required internally.

The rated external background LAeq sound level (background including traffic noise) in this case, based on continuous monitoring, is 47 dBA.

A very conservative estimate of 30 dBA for the sound reduction capability of external walls would reduce this maximum daytime external Rated Background Sound Level of 47 dBA to substantially below the required indoor sound level of 40 dBA (and the objective level of 35 dBA adopted for any rest or “quiet” areas).

External Windows & Doors

The most acoustically “vulnerable” elements of the external building facades are the glazed windows and doors.

Glazed construction elements (windows and doors) provide lower levels of sound attenuation (or reduction) than solid structural elements such as walls.

The indicative acoustic reduction effects provided by various glazing options available for the doors and windows fitted to the facades of the proposed childcare centre are shown in Table 6.2, below.

Table 6.2 – Acoustic Attenuation due to Glazing

Glazing Type	Sound Attenuation *
10.38 mm laminated	35
6.38 mm laminated	31
10 mm float	33
6 mm float	27
4 mm float	22

* Based on specifications provided by Pilkington Glass

The maximum rated external background sound level (RBL) in this case, based on continuous monitoring is 47 dBA (refer Table 5.3, above).

The sound level required to be achieved within the general internal spaces of the proposed centre, with windows and doors closed, is 40 dBA maximum. The objective sound level adopted for any internal rest or “quiet” areas is 35 dBA.

To achieve these internal sound levels, with a reasonable margin for error and variation, glazing with a minimum effective sound attenuation capability of 20 dBA is considered appropriate.

In this case, an examination of existing external glazed elements, primarily windows, indicates that float glass with thicknesses between 4 and 6 mm is in place.

Glazing of this type satisfies the acoustic performance required, and accordingly no modification to the existing glazing at the premises is considered necessary in order to achieve the acoustic performance and compliance required.

This outcome results from the low background sound levels at the site.

Review of AAAC Guidelines

Chapter 8 of the AAAC (2013) guideline provides the following specific recommendations in relation to noise control:

> *Where the predicted level of noise exceeds the criteria at the noise assessment location, noise control measures shall be implemented to ensure compliance.*
>
> *The following indicative noise controls may be used to achieve compliance with the noise criteria.*
>
> *Site-specific controls should be recommended in the Child Care Centre noise assessment.*
>
> *Building Design*
>
> *The design of the childcare centre should aim to locate sleep rooms and outdoor play areas away from external noise sources.*
>
> *Where feasible, building designs should be based on a "U" shaped or "L" shaped layout, with outdoor play areas positioned such that the building structures act as a noise barrier.*
>
> *Maximise the separation between the active outdoor play area (as opposed to passive activities such as painting, drawing etc) and the façade of any neighbouring residential premises.*
>
> *Ensuring operable windows of the childcare centre and external play areas do not have a direct line of sight to neighbouring noise sensitive areas.*
>
> *Locate access ramps away from neighbouring sensitive premises where possible.*
>
> *Include low noise features such as self-closing gates with soft closure hinges, selection of low noise air-conditioning condensers, minimize the use of speed humps and ensure car park surfaces and access ways are smooth.*

In this case, the existing building design achieves the noise level criteria applicable, and accordingly no further site-specific noise control measures are proposed in relation to design issues.

6.2.2 Projected Internal Sound Levels

Projected "Internal" Sound Levels – General Areas

On the basis of the external glazing conditions described above, sound levels projected to apply in the general indoor areas of the proposed centre, as a consequence of external acoustic influences, are summarised in Table 6.3 n the following page.

Table 6.3 – Forecast Sound Levels: General Internal Areas

Projected Sound Level	Typical Daytime
Rated External Sound Level (RBL)	47 L_{Aeq} (dBA $_{Leq, 1 hour}$)
Less Estimated 30 (dBA) Attenuation due to Glazing	-20 (dBA)
Projected Internal Sound Levels	<35 L_{Aeq} (dBA $_{Leq, 1 hour}$)

Internal sound levels below 40 dBA satisfy relevant acoustic amenity requirements and guidelines applicable to childcare centres.

Internal sound levels below 35 dBA satisfy the additional objective of 35 dBA maximum adopted for this assessment for any rest and "quiet" areas that may be associated with the development.

As demonstrated below, the acoustic effect of internal walls will further reduce these already acceptable sound levels in the internal areas associated with the school.

It is noted that the degree of conservatism built into this acoustic projection also provides protection against any occasional peak external noise events that may occur from time to time.

Projected "Internal" Sound Levels – Indoor Sleeping & Cot Rooms

A background indoor sound level of less than 35 dBA has been projected for the general internal areas of the proposed preschool (refer Table 6.3, above).

Taking variation into account, this projected sound level can conservatively be considered to deliver a minimum background acoustic range of 35–40 dBA for the general interior areas of the proposed centre, under all external circumstances.

Any internal rest or "quiet" areas associated with the development will be subject to further acoustic attenuation from external noise influences due to the internal walls, and the acoustic effect of the internal the fit out proposed, including floor finishes.

Other internal play areas will also be further acoustically shielded from external sound by internal walls associated with the existing building (refer plans and drawings provided in Section 2).

These projected sound levels, which have been calculated on a conservative basis and take into account variation in background sound levels, indicate that sound levels of less than 40 dBA will be achieved within the general indoor areas of the centre, and sound levels of less than 35 dBA will be achieved in any rest or "quiet areas associated with the facility, consistent with relevant and adopted acoustic guidelines.

6.2.3 Outdoor Play Areas

It is proposed that outdoor play areas will be located on the south-eastern (rear) side of the proposed school building.

As previously indicated, a Rated Background Sound Level of 47 dBA LAeq has been determined. On this basis, the required sound level of 55 dBA within the proposed outdoor play areas will be achieved.

6.2.4 Road Traffic & Car Park Noise

The measured LAeq RBL of 47 dBA includes the effect of existing environmental noise, including road traffic on Rosemead Road and William Street.

The additional effect of noise generated by vehicles accessing the proposed car park is considered unlikely to significantly change this measured RBL, and subject to sensible and normally anticipated driving behaviour within the car park, no acoustic impact on the proposed facility, over and above those considered in 6.2.2 and 6.2.3 above, is anticipated.

6.2.5 Summary: Implications of Estimated Noise Levels

General Indoor Areas

Typical maximum ambient sound levels in the general indoor areas of the proposed centre are estimated to be in the range 35 – 40 dBA.

This assessment demonstrates that sound levels in the general interior spaces of the proposed preschool and primary school will satisfy the typical criterion of 40 dBA applicable to preschools, schools and childcare centres.

Outdoor Play Areas

Background noise levels in the outdoor play areas will be less than 55 dBA, based on the measured RBL for the site.

Review of AAAC Guidelines

The effects of ambient external noise levels on the proposed childcare centre have been considered in accordance with the general principles described in the AAAC (2013) guideline.

The proposed centre structure and design has been assessed to comply with relevant acoustic guidelines.

6.3 IMPACT OF SOUND FROM THE SCHOOL ON SURROUNDING PREMISES

The potential impact of sound from external sources on activities within the proposed Community School has been considered in 6.2 above.

A second important acoustic consideration is that of the potential impact of noise from the proposed school on nearby individuals and activities.

6.3.1 Measured Sound Pressure Levels of Children at Play

Data Measured in a Sydney CBD Childcare Centre

The assessment of noise impacts from the centre on external and nearby receivers requires an estimate of the sound levels generated by the activities of children within the proposed school.

The data summarised in Table 6.4, on the following page, was recorded in the play area of a Sydney CBD childcare centre, at a time when children were permitted to play without close supervision, at distances of between 2 and 5 metres from the recording microphone.

The data was recorded and reported by RSA Acoustics.

Table 6.4 – Indicative Sound Pressure Levels of Children at Play

	Octave Band Centre Frequencies Plus A-weighted Level								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**A**
Descriptors	**Linear Sound pressure levels plus the Overall A-weighted Sound Level**								
$L_{max, 15 min}$	85	86	85	82	92	95	86	74	98
$L_{01, 15mi}$	73	73	71	72	79	79	70	61	83
$L_{10, 15min}$	66	66	63	66	71	70	62	52	75
$L_{90, 15minutes}$	55	56	55	57	58	56	51	41	62
$L_{min, 15 min}$	49	49	48	48	48	47	42	34	53
$L_{eq, 15 min}$	64	64	62	63	68	68	61	50	73

This data is considered to provide a realistic estimate of the noise generated by children playing within a childcare centre and is considered to provide a conservative estimate of the noise likely to be generated within the outdoor play areas at the proposed school.

Association of Australian Acoustical Consultants (AAAC) Guideline

However, it is noted that the Association of Australian Acoustical Consultants (AAAC) Guideline for Acoustic Assessment states that:

- 10 children aged between 0-2 years typically produce a sound pressure level of 77-80 dBA, and
- 10 children aged 3-6 years 84-90 dBA.

It is possible for children at play to generate sound levels of this magnitude, however it is considered that sound levels of these magnitudes are very much at the upper end of the expected range.

For example, sound levels in the range 84 – 90 dBA equate to noise associated with the following activities (refer Appendix C):

Pneumatic Drill	90 dBA
Heavy Truck, 40 km/h	87 dBA - 90 dBA
Motor Car	80 dBA
Motor Bikes (2-Wheel)	70 dBA – 92 dBA

Typical maximum sound levels of 70 – 75 dBA have been assumed for the outdoor play area in this assessment, but the higher sound levels identified by the AAAC Guideline referenced above have been taken into account as a contingency.

Review of AAAC Guidelines

Chapter 6 of the AAAC (2013) guideline provides the following specific recommendations in relation to the sound power levels associated with children at play:

> *The effective sound power level (Lw) of various noise sources should be assumed for a proposed Child Care Centre. The Lw of children playing varies widely depending on the age of the children and the activity that the children are engaged with.*
>
> *The Lw of mechanical plant and traffic can normally be predicted with accuracy depending on the type of plant, location and/or number and type of vehicles.*

Children

The noise level of boys and girls are assumed to be very similar and therefore are not differentiated in this guideline. A typical range of effective sound power levels for groups of 10 children playing is given below in Table 1 for guidance.

Table 1 – Effective Sound Power Levels for groups of 10 children playing

10 Children aged 0 to 2 years	77 to 80 dB(A)
10 Children aged 2 to 3 years	83 to 87 dB(A)
10 Children aged 3 to 6 years	84 to 90 dB(A)

To calculate the effective sound power level for a specific number of children, the following formula shall be used:

Effective Sound Power Level for 'n' children = Effective Sound Power Level for 10 children + 10 log (n/10)

These guidelines have been considered in relation to the noise levels likley to be generated by children at play, and in particular in relation to activities associated with the outdoor play areas.

6.3.2 Measured Sound Pressure Levels of Primary School Age Children at Play

The information presented in 6.3.1 above relates to pre-school age children, that is children aged up to six years.

As the proposed Community School will also accommodate primary school age children aged up to twelve years, background data regarding the noise levels generated by this age cohort during outside play and activities is also relevant to this assessment.

Two publicly available studies have been considered:

- Carrying Out Noise Assessments for Proposed Educational Facilities (Scannell & Harwood; November 2006); and
- Beardall Primary School Hucknall: Noise Impact Assessment Nottinghamshire County Council; June 2013).

The 2006 study found as follows:

Table 1. An example of the predicted noise levels for children at play

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
Casual	53	2.8	46
Normal	58	5	53
Raised	65	5	60
Loud	74	2	65
Shout	82	0.2	63
15 minute Average for 1 Child at 1 metre			68
15 minute Average for 12 Children at 1 metre Average Distance (From 68 + 10 $\log_{10}$ (12) dB)			79
15 minute Average for 12 Children at 5 metres (From 79 - 20 $\log_{10}$ (5/1) dB)			65

These results indicate 15-minute average acoustic impacts from groups of twelve primary school age children of 65 dBA at a distance of 5 metres from the site boundary, or a “worst case” impact of between 65 and 70 dBA right at the boundary.

The UK 2013 study indicated a noise level of 66.5 dB 15 metres from the boundary of a playground containing 200 primary school age children.

Adjusting this finding for the smaller cohort involved in this case, and for an outcome at the site boundary, an acoustic impact in the range 65 – 70 dBA is again indicated.

Several other studies have been reviewed and have been found to provide very similar results.

On this basis, the “worst case” acoustic impact from a group of 48 primary school age children in the outdoor play and activity area of the proposed school is estimated for assessment purposes to be between 65 and 70 dBA.

6.3.3 Acoustic Impact from the Community School

The indoor and outdoor areas of the Preschool/Primary Outdoor Play Area are shown for convenient reference in Figure 6.1, on the following page.

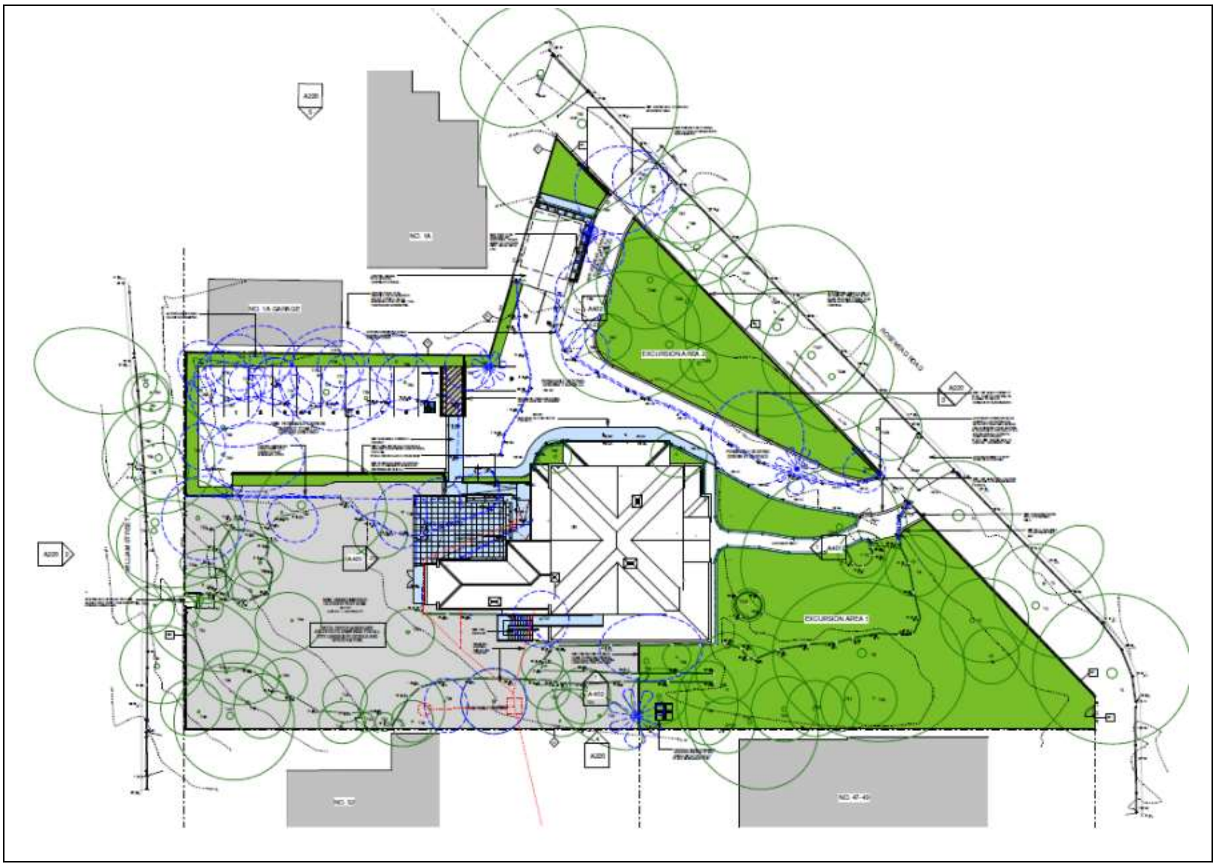


Figure 6.1 – Indoor & Outdoor Play Areas

Noise Emissions from Indoor Activities

Noise generated within the school building itself will be reduced or attenuated by the internal and external structural elements of the building.

Section 6.2 above indicates a conservative minimum noise reduction or attenuation of 40 dBA applies to outside noise passing through the building façade to the general interior spaces of the building. This process also applies in reverse.

Noise generated by activities within the centre is also attenuated or reduced by the building structure by 40 dBA in terms of impact outside the building.

Assuming maximum typical noise levels in the range 70 – 75 dBA during periods of play within the indoor play areas at the school, (this is conservative – and represents perceived noise levels between two and three times that of typical adult conversation) the maximum acoustic impact of internal noise immediately outside the school, and at adjoining property boundaries, is indicated in Table 6.5, on the following page).

Table 6.5 – Effect of Internally Generated Noise outside the Centre

Detail	Projected Noise Level
Worst Case Noise due to Activities within the Centre	70 - 75 dBA
Less 30 dBA Attenuation due to Structure (Conservative)	-40 dBA
Projected Acoustic Impact Outside the Centre	30 - 35 dBA

This projected noise impact of 30 - 35 dBA due to internal activity within the school complies with the strictest applicable requirement, that is that noise associated with the school should not result in an increase of greater than 5 dBA over existing background sound levels at any affected residential boundary, as shown in table 6.6, below.

Table 6.6 – Acoustic Impact of Internal Play Areas at Adjoining Residential Boundaries

Outdoor Area	Noise Level (dBA)	Attenuation due to Structures (dBA)	Maximum Impact at Boundary (dBA)	Allowable Impact * (RBL + 5 dBA)	Comply
Level 2					
Indoor Areas	70 - 75	40	30 - 35	44 *	YES

"Allowable noise impact is the L90 RBL plus 5 dBA, that is 39 + 5 = 44 dBA

Review of AAAC Guidelines

Chapter 5 of the AAAC (2013) guideline requires that noise emissions from indoor activities at the site shall not exceed the background noise level by more than 5 dB at the assessment location.

Compliance with that requirement has been demonstrated above in relation to indoor play areas and activities.

Acoustic Impact from Outdoor Play Areas

To assess potential noise impacts from children in the outdoor activity areas of the school, the indicative schedule of the attendance of children by age group in the outdoor areas of the school, provided by Blue Gum Community School based on past experience and summarised in table 6.7 on the following page, has been adopted for assessment purposes.

Table 6.7 – Indicative Involvement in Outdoor Play & Activities by Age Group

Time Range	Age Groups in Outdoor Areas
9:30 - 10:30 am	Preschool outdoor play time (16 - 32 children)
10:40 - 11:00 am	Primary morning tea and outdoor play (maximum 48 children)
11:15 - 11:45 am	Preschool outdoor (16 - 32 children)
11:45 -12:15 pm	Preschool lunch outside (32 children)
12:30 - 1:30 pm	Lunch time for primary (maximum 48 children)
2:15- 2:45 pm	Afternoon outdoor play Preschool (16 - 32 children)
4:00 - 5:45 pm	Use of outdoor space for those children (mix Preschool and Primary) attending after school care - approximately 1 hour of this two hour window would be spent outside

The reference data presented in 6.3.1 and 6.3.2 above indicates that a maximum acoustic impact of between 70 and 75 dBA Leq can be anticipated at the boundaries of the outdoor play and activity area, which particularly on the eastern site boundary correspond with the closest residential receiving boundaries.

Details regarding outdoor play areas associated with the proposed school is described in the plans and drawings provided in Section 2, as summarised in Figure 6.1.

In terms of acoustic impacts from the proposed facility on external receivers, the key limiting requirement is that the existing background LA90 RBL at any adjoining residential receiver should not be exceeded by more than 5 dBA as a result of noise emissions from the childcare centre. Relevant guidelines also allow for a maximum period of two hours each day where the measured background may be exceeded by up to 10 dBA, although to help ensure acoustic compliance at neighbouring residential boundaries, this assessment has been prepared on the basis of a 5 dBA increase over background.

The outdoor play and activity areas will be situated on the rear or south-eastern side of the proposed centre.

Acoustic impacts on potentially affected residential receivers are considered in Section 6.3.3 below.

Typical maximum noise levels generated within play areas have been assessed as being 70-75 dBA measured at distances of between 2 and 5 metres from individual groups of children at play. (refer Section 6.3.1 above).

Noise generated by activities in the outdoor play area will be attenuated or reduced by several mechanisms prior to impact at adjoining residential boundaries. These mechanisms include:

- ❑ Supervision and management influences to minimise noise generation;
- ❑ Reduction due to distance (refer 3.1.4);
- ❑ Reduction due to natural and artificial external surfaces; and
- ❑ Reduction due to the acoustic qualities of fencing at residential boundaries.

The measured L_{AF90} RBL is 39 dBA, which must not generally be exceed by more than 5 dBA in the case of residential receivers, or by more than 10 dBA for maximum periods of two hours each day. This means that a maximum attenuation of (70-75) – 44 dBA, or 31 dBA maximum, is required in the case of residential receivers subject to immediate acoustic impact.

As noted, this maximum attenuation requirement can be reduced by 5 dBA to 26 dBA for maximum periods of two hours each day.

Supervision and Management Control

It is noted that the assumed reference sound level range of 70-75 dBA is based on noise generated by groups of children playing without supervision. In our professional opinion, effective management and supervisory control is a key factor in the minimisation of noise emissions from outdoor play activities (refer 6.3.10 “Noise Management Plan”)

Reduction due to Distance

The proposed community school appears to enjoy relatively generous space and area in relation to the number of children proposed. This will enable supervisory staff to ensure that groups of children in the outdoor areas are well spaced, and to ensure that concentrations of noisy activity close to neighbouring residential boundaries can be avoided.

Section 3.1.4 provides the equation that determines noise reduction with distance:

$$SPL_2 = SPL_1 - 20 \log (d_2/d_1)$$

where:

SPL_2	=	sound level a distance “2” from the source in metres (predicted)
SPL_1	=	sound level a distance “1” from the source in metres (measured)
d_2	=	distance in metres to location 2 from the source
d_1	=	distance in metres to location 1 from the source

On this basis, a noise source of 70 dB (equivalent to double the level of normal conversation) is reduced by distance as follows

At 10 metres	reduced by 14 dB
At 15 metres	reduced by 18 dB
At 20 metres	reduced by 20 dB

It is noted from figure 6.1 that the proposed car park area provides a distance “buffer” of approximately 17 metres between the outdoor play area and the residential boundary with 1A Rosemead Road to the immediate west of the proposed community school, greatly facilitating the management of noise impacts from outdoor play activities at that boundary.

Reduction due to Acoustic Fencing

In this case, the acoustic fences or barriers to the outdoor play and activity area will also constitute the boundary fencing for that area of the site.

It is noted that for other regulatory reasons, acoustic fencing around childcare centres and schools is typically required to be at least 1800 mm high.

It is noted that boundary fencing in other areas of the site is not subject to any specific acoustic performance requirements associated with outdoor play area noise.

The northern site boundary to Rosemead Road and the southern site boundary to William Street are separated from residential receivers by those thoroughfares.

To facilitate noise management, acoustic boundary fencing is proposed for the majority of the eastern site boundary, with the exception of the short length between the front facade of the adjoining building and Rosemead Road.

Car park noise adjacent to the southwestern site boundary has been considered separately. (refer 6.3.5).

Table 6.8 on the following page identifies the acoustic qualities associated with the various acoustic fence options.

Table 6.8 – Acoustic Qualities of Boundary Structural Elements

Material/Structural Element	Sound Reduction
2100 mm Laminated Glass Acoustic Fence/Barrier (10.38 mmm Glass)	30 - 35 dBA [1]
1800 mm Laminated Glass Acoustic Fence/Barrier (10.38 mmm Glass)	28 - 33 dBA [1]
2100 mmm Double Lapped Timber Fence	25 – 30 dBA [2]
1800 mmm Double Lapped Timber Fence	22 - 27 dBA [2]
2100 mm Timber or Metal Framed Solid Panel Acoustic Fence	27- 32 dBA [3]
1800 mm Timber or Metal Framed Solid Panel Acoustic Fence	25 – 30 dBA [3]

Sources & References:
1 Viridian Glass, as example
2 Screenwood Australia, as example
3 Fencescape Fencing Australia, as example

In this case, residential receivers adjoin the outdoor play area along portions of the eastern and western site boundaries.

The total noise reduction required to be provided in these locations is identified in Table 6.9, on the following page.

Table 6.9 – Minimum Sound Reduction Required for Outdoor Play Areas

Noise Level	L_{A90} RBL + 5	Attenuation Required
70 – 75 dBA	44 - 49 dBA *	21-26 dB

* Allowable noise impact is the L_{A90} RBL plus 5 dB, that is 39 + 5 = 44 dB generally, and L_{A90} RBL + 10 dB, that is 39 + 10 = 49 dB for a maximum of two hours each day

In our professional opinion, the minimum acoustic protection required to ensure that external activities associated with the proposed school will not unduly impact on surrounding and adjoining receivers, in particular residential receivers, will involve the following measures:

- External boundary fencing along the eastern site boundary (excluding the section between the front façade of the adjacent building and Rosemead Road) comprising 1800mm double lapped timber fencing with an Rw rating of 22 – 27;
- External boundary fencing along the section of the western site boundary adjacent to the proposed car park area comprising 2100mm double lapped timber fencing with an Rw rating of 25-30;
- External boundary fencing along the balance of the western site boundary comprising 1800mm double lapped timber fencing with an Rw rating of 22-27;
- The reduction in sound with distance, based on the fact that the average play activities within the outdoor play area in question will be some distance from the eastern and western residential boundaries;
- The “buffer” distance provided by the proposed car park between the outdoor play area and portion of the western residential boundary;
- The effect of management and supervision on minimising noise emissions (refer 6.3.9 & 6.3.10); and
- The actual and perceived acoustic effects of landscaping along the eastern boundary (refer Section 4.3; NSW Child Care Planning Guideline (2017); Condition C25.

The acoustic protection provided by this combination of construction elements, distance, supervisory control and landscaping elements is summarised in Table 6.10, on the following page.

Table 6.10 – Sound Reduction due to Control Mechanisms

Outdoor Play Area		**Potential Sound Reduction**
	Control Mechanism	
	Supervisory Control	5-10 dB
	Distance (assumes minimum average of 5-10 metres)	8-14 dB
	Landscaping Elements	3-5 dB
	Perimeter Double Lapped Timber Acoustic Fence	15-20 dB
	Aggregate Effect	**31 – 49 dB**

Acoustic performance due to activities within the outdoor play areas, taking into account the aggregate effects of the treatments described in Table 6.10 above, is summarised in Table 6.11, below.

Table 6.11 – Acoustic Impact of External Play Areas at Adjoining Residential Boundaries

Outdoor Area	Noise Level (dBA)	Attenuation due to Control Mechanisms (dB)	Maximum Impact at Boundary (dB)	Allowable Impact * (RBL + 5 dB)	Comply
Outdoor Play Areas	70 - 75	31 - 44	44	39 - 44	YES

* Allowable noise impact is the L90 RBL plus 5 dBA, that is 39 + 5 = 44 dBA

It is noted that this assessment is conservative and allows for variations in noise emission levels that might arise. Acoustic compliance at the residential boundaries relies only on achieving the lower end of the assessed sound reduction range.

On this basis, double lapped timber boundary fencing will be required on the eastern and western external boundaries of the site as shown in Figure 6.2, on the following page.

It is noted that while this form of acoustic fencing is not required along the southern or William Street site boundary, it has been included to achieve visual consistency.

It is also noted that a section of 2100mm double lapped timber fence is proposed for the western site boundary, adjacent to the proposed car park area.

In addition to reducing noise from the outdoor play area, fencing along the car park serves the important purpose of minimising noise transfer from activities associated with car parking, and the drop of and pick up of children.

On the basis that vehicles would park close to this fence line, an 1800mm double lapped timber fence was originally proposed. It is now intended that a 1000mm path will be located between the car parking spaces and the boundary fence. As the acoustic performance of this section of fence is reduced with the distance of the noise source (car parking and associated activities) from the fence, and to ensure a safe and conservative acoustic outcome, an increase in the height of this section of fence, and therefore its acoustic performance, has now been included.

It is acknowledged however that the consistent use of 1800mm fencing may be preferred for other reasons, including consistency with the design character of other existing fences and fence heights in the area, and it is noted that the inclusion of this section of 2100mm fence is precautionary, and that in our professional opinion acoustic compliance at the adjoining residential boundary could be achieved using 1800mm double lapped timber fencing.

Recommended fencing, including acoustic fencing, is shown in Figure 6.2, on the following page.

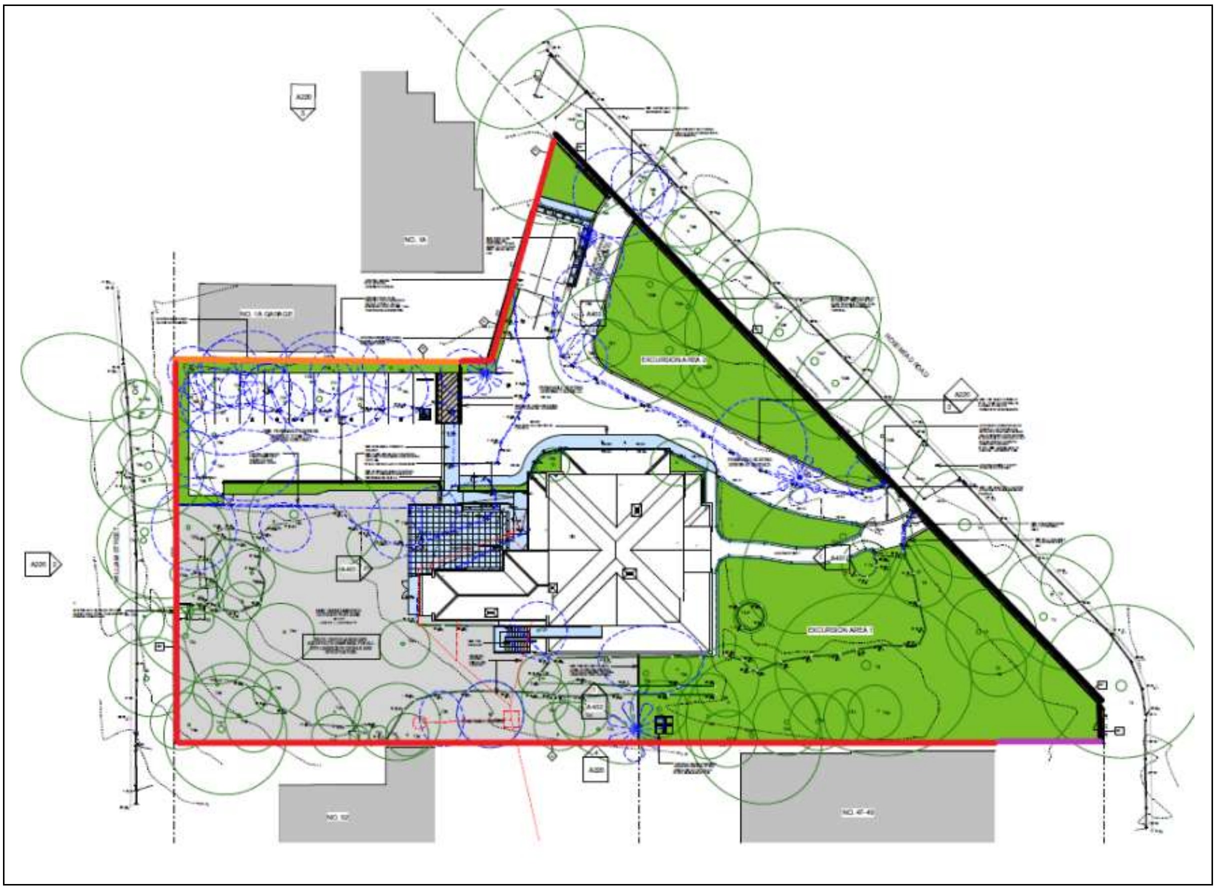


Figure 6.2 – Recommended Acoustic Boundary Fencing

Legend:	orange line	2100mm double lapped timber fencing
	red line	1800mm double lapped timber fencing
	purple line	double lapped timber fencing reducing from 1800mm to 1200mm
	black line	1200mm open black metal fence

Fence styles are illustrated in Figures 6.3 and 6.4, below, and on the following page.

Figure 6.3 – Double Lapped Timber Fence

Figure 6.4 – Open Form Black Metal Fence

Review of AAAC Guidelines

Chapter 8 of the AAAC (2013) guideline provides the following comment in relation to boundary fencing:

> *The standard height for a boundary fence is 1.8 metres. Higher fences that are solid and free from visible gaps will reduce the noise impact for ground floor receptors. The local council should provide guidance on the allowable height of fences.*
>
> *In some cases where higher fences are required, the fence may consist of a combination of a 'standard height fence' plus a transparent 'top' to allow sunlight to pass through.*
>
> *Alternatively, a standard height fence plus an angled cantilevered top to the total required height may be constructed to reduce the noise impact and overall boundary height.*
>
> *All external pedestrian gates should be fitted with appropriate door closers to provide a slow and regulated closing of the gate to prevent the generation of impact sound.*

These points have been considered in the development of the boundary fencing recommendation provided above.

Acoustic Implications of the Numbers of Children in the Outdoor Play Area

The levels of noise generated by outdoor play activities needs to take into account the numbers of children involved in those play activities.

The reference data provided in Section 6.3.1 above was based on the measurement of peak noise from groups of children playing without close supervision in a Sydney CBD childcare centre.

Data was recorded at distances of between 2 and 5 metres from the playing group, and therefore provides a reasonably immediate and maximum measure of the noise emissions that might be expected to be experienced at a boundary fence as a result of children playing close to that fence or boundary.

The data presented in 6.3.1 related to individual play groups of five to eight children, in an outdoor playground containing approximately 40 children, playing in separate groups of between five and eight children. This data indicates a maximum typical noise impact of 70 – 75 dBA measured at distances between 2 and 5 metres.

Data (also presented in 6.3.1 above) from the Association of Australian Acoustical Consultants (AAAC) Guideline for Acoustic Assessment (2013) presents slightly higher maximum noise levels from groups of ten children involved in unsupervised play. This data is understood to be based on measurements at two metres from the playing group.

A typical maximum noise level of 75 dBA measured at a distance of two metres from the source play group has been adopted for this assessment.

AAAC guidelines involve consideration of the numbers of children in the outdoor play area at any time, and whether restrictions on numbers are indicated in order to achieve relevant acoustic performance.

The following key factors are considered to apply to the question of noise generated by activities in the outdoor play area, and to the numbers of children involved:

- ❑ Noise emission data from sub-groups of between five and eight children in a total play group population of forty children has been considered;
- ❑ Noise emissions are estimates, and are subject to individual situations and circumstances;
- ❑ The effectiveness of supervision and control is very important in managing and minimising noise emissions from outdoor play activities;
- ❑ A precautionary approach is appropriate to ensure compliance with reasonable and permissible noise impacts at affected residential receiving boundaries; and
- ❑ An appropriate response and control mechanism is required to ensure that appropriate noise levels are maintained.

To ensure that required acoustic performance is achieved and maintained, the following controls and procedures are recommended;

1. That, on a precautionary basis, the maximum numbers of children in the outdoor play area at any one time is limited to a maximum forty-eight (48), consistent with the maximum number of primary school age children in the outdoor area during morning tea and lunch time (refer Table 6.7);
2. That careful supervision of outdoor play is observed, particularly in terms of noisy play and activity, and that staff intervene to control any excessively or unduly noisy activities (consistent with the "*Effect of Management and Supervision*" described in 6.3.9, below);
3. That if undue noise is noted in the outdoor play area, or if complaints are received from neighbours, then appropriate action to rectify the situation is to be taken by teachers and staff . However, it is noted that subject to effective supervision and performance, corrective action in relation to noise is considered unlikely to be necessary, due to the relatively low numbers of children involved; and
4. That these procedures are included in a concise Noise Management Plan, that should in turn be incorporated in the overall Plan of Management to be prepared for the school.

It is noted that acoustic issues associated with the numbers of children in the outdoor play area at any one time are very much subject to individual circumstances. It is also noted that the relatively generous outdoor area available at the proposed location will allow supervising teachers and staff to position groups of children in such a way as to minimise noise, and in particular to minimise the presence of a particular noise source close to any affected residential boundary.

Our professional experience has been that facilities of the type and scale addressed in this report can operate without the generation of undue noise levels and with acoustic compliance, in the absence of a specific restriction on the numbers of children at play in outdoor play areas.

In practice it has been our experience that effective supervision and good operating procedures are the key factors in ensuring that undue noise is managed and effectively minimised.

In our opinion, the guidelines and procedures summarised above provide an appropriately precautionary approach and will ensure acoustic performance and compliance.

It is noted that the AAAC (2013) guideline indicates that:

> *The number of children within the Centre or playing in the outdoor play area at any one time may be limited to reduce the noise impact.*
>
> *A reduction in the number of children by half will reduce the noise impact by approximately 3 dB.*

Acoustic Impact from Excursion Areas 1 & 2

The primary source of outdoor noise is considered to be the outdoor play area toward the south, or rear of the property as discussed above.

It is also proposed that two areas shown as “Excursion Area 1” and “Excursion Area 2” in Figures 2.6 and 6.1, marked in the western and eastern portions of the front or Rosemead Road area of the site, will be used for supervised outdoor educational activities.

However, it is not unreasonably assumed that the noise emissions from such structured, controlled and supervised educational activities will be significantly lower than the noise emissions associated with general play.

For assessment purposes, it has been assumed that maximum noise levels equivalent to normal adult conversation will typically apply, with noise levels 50% higher than adult conversation applicable from time to time. This is assessed as placing the typical noise generated during supervised outdoor excursion lessons at between 65 and 68 dBA.

The control mechanisms applicable include noise reduction due to distance from residential boundaries; supervisory control to ensure that noise levels during excursion lessons are limited at maximum to fifty percent higher than adult conversation (by the teacher’s perception); attenuation due to landscaping elements, and attenuation provided by the 1800mm double lapped timber acoustic boundary fencing proposed for the eastern and western residential boundaries.

Taking these controls into account, the acoustic impact due to the two excursion areas at the eastern and western residential boundaries is assessed in Tables 6.12 and 6.13 below.

Table 6.12 – Excursion Area Sound Reduction due to Control Mechanisms

Outdoor Play Area		**Potential Sound Reduction (dB)**
	Control Mechanism	
	Supervisory Control	Maintains 65 – 68 dBA (maximum)
	Distance (assumes minimum average of 5-10 metres) [1]	8-14 dB
	Landscaping Elements [2]	3-5 dB
	Perimeter Double Lapped Timber Acoustic Fence [3]	15-20 dB
	Aggregate Effect	**26 – 39 dB**

Acoustic performance due to supervised lessons in the two excursion areas, taking into account the aggregate effects of the treatments described in Table 6.12 above, is summarised in Table 6.13.

Table 6.13 – Acoustic Impact of Excursion Areas at Adjoining Residential Boundaries

Outdoor Area	Noise Level (dBA)	Attenuation due to Control Mechanisms (dB)	Maximum Impact at Boundary (dB)	Allowable Impact * (RBL + 5dB)	Comply
Outdoor Play Areas	65 - 68	26-39	42	44	YES

* Allowable noise impact is the L90 RBL plus 5 dBA, that is 39 + 5 = 44 dBA

6.3.4 Residential Receivers

The position of the school in relation to residential neighbours is shown in Figure 6.5, below.

Residential receivers are present to the immediate east and west and south of the site (Locations 1, 2 & 2), and to the north and south on the opposite sides of Rosemead Road and William Streets respectively (Locations 4 & 5).

In the case of the residential receivers situated on the opposite sides of Rosemead Road and William Street, road traffic noise and distance are significant attenuating (reducing) influences.

The potentially affected residential receivers are considered to be those to the immediate east and west of the proposed development.

Subject to the use of appropriate structural features and acoustic fences, distance effects and effective supervision, it has been demonstrated above that:

- noise generated within the outdoor play and activity area will be effectively contained; and
- noise impacts at adjoining residential boundaries will comply with relevant acoustic guidelines.

Figure 6.5 – Location of Residential Receivers

Review of AAAC Guidelines

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

Outdoor play areas should be located to minimise the noise impact on adjoining neighbours. For 'green field' sites consideration should be given to surrounding the outdoor play area with the school building either totally or partially where practical.

Consideration should be given to noise minimisation related to hard-paved areas and pathways within the children's play area to reduce the reverberant noise levels.

Buildings and other structures such as storage sheds or covered shade areas may be incorporated into the outdoor play area to provide acoustic shielding.

The acoustic assessment and projected outcomes presented in this report are consistent with the requirements of the AAAC (2013) guideline.

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

Outdoor play areas should be located to minimise the noise impact on adjoining neighbours. For 'green field' sites consideration should be given to surrounding the outdoor play area with the school building either totally or partially where practical.

Consideration should be given to noise minimisation related to hard-paved areas and pathways within the children's play area to reduce the reverberant noise levels.

Buildings and other structures such as storage sheds or covered shade areas may be incorporated into the outdoor play area to provide acoustic shielding.

The acoustic assessment and projected outcomes presented in this report are consistent with the requirements of the AAAC (2013) guideline.

6.3.5 Motor Vehicle Noise

Car Park Noise

Noise will be generated by cars arriving and departing the proposed car park area, particularly during the drop off and pick up of children.

Noise emissions from these operations will vary, however the following assumptions have been made:

- Typical vehicle movement frequency of four arrivals and four departures per 15-minute period;
- Duration of each parking and departure 30 – 45 seconds;
- Sound pressure level arriving 56-58dBA; and
- Sound pressure level departing 60- 52 dBA.

Primary noise control mechanisms include:

- the acoustic boundary fence to be located adjacent to the car parking spaces; and
- exercise of care and noise minimisation by drivers.

With regard to the acoustic boundary fence, it is noted that a 1000mm pathway will now be required between the car parking spaces and the acoustic boundary fence.

For this reason, and to ensure acoustic compliance at the neighbouring residential boundary, an increase in the height of the double lapped timber fence along this boundary section from the 1800mm originally proposed to 2100mm has been recommended (refer 6.3.3 above).

In terms of driver behaviour, this will need to be addressed through the Noise management Plan for the proposed school (refer 6.3.10).

Subject to the effective implementation of these two controls, noise associated with the drop off and pick up of children from the centre is not expected to impose a noise burden of greater than 5 dB above the measured L_{AF90} RBL background level of 39 dBA at any potentially affected residential boundary.

Review of AAAC Guidelines

Chapter 8 of the AAAC (2013) guideline provides the following comment in relation to the drop-off and pick-up of children:

> *Noise control measures should be implemented to minimise adverse impacts to neighbours caused by car doors slamming and the sound of parents and children arriving or departing the Centre.*
>
> *Such measures could include the judicious positioning of arrival and departure access points away from residential property boundaries, the appropriate placement of buildings constructed on site to shield the noise or the provision of acoustic fencing or landscaping.*

These requirements have been taken into account in the design of the centre, and the preparation of this acoustic assessment.

Traffic on Local Roads

The traffic report prepared for the proposed development by Vargas Traffic Planning Pty Ltd indicates that the proposed school will result is a local road traffic increase from 12 vehicles per hour to of 71 vehicles per hour during the morning peak period.

The importance of minimising road traffic noise is acknowledged, and it is recommended that this concern is addressed by the inclusion of a specific protocol in the Noise Management Plan for the facility, seeking the cooperation of parents and others accessing the centre by way of appropriate driving practices on approaching and departing the facility.

Review of AAAC Guidelines

Chapter 5 of the AAAC (2013) guideline provides the following comment in relation to motor vehicle noise:

> *Traffic noise on local roads generated by vehicles associated with the childcare centre arriving and leaving the site (for example vehicles travelling on public roads) shall comply with $L_{eq,\ 1\text{-}hour}$ 50 dB(A) at the assessment location.*

The acoustic assessment and projected outcomes presented in this report are consistent with the requirements of the AAAC (2013) guideline

6.3.6 Industrial & Commercial Receivers

The NSW Noise Policy for Industry (2017) requires that the impact of any commercially or industrially sourced noise, in this case the noise from the proposed community school, must not exceed 65 dBA at any existing industrial or commercial boundary. In this case, no industrial or commercial premises are present in the immediate vicinity of the proposed school, which is located in a residential neighbourhood.

Review of AAAC Guidelines

Chapter 5 of the AAAC (2013) guideline provides the following comment in relation to acoustic impacts at industrial & commercial receptors:

> *The $L_{eq,\ 15min}$ noise level emitted from the Child Care Centre shall not exceed 65 dB(A) when assessed at the most affected point at or within any commercial property boundary*

In this case, no such receptors are present, and as indicated above the relevant criterion does not apply.

6.3.7 Mechanical Plant

The impact of typical mechanical plant projected to be associated with the school has been assessed, and it is considered that acoustic impacts of significantly less than 5dBA above the measured background LA90 RBL will be achieved at all property boundaries.

It is noted that no outdoor air conditioning condenser units are proposed, and that accordingly no impact from such plant will apply.

However at the time of preparing this assessment no final plan had been developed for the types and locations of plant and equipment to be used within the school building.

He nature of the structural walls and glazed external elements of the existing building, which have been reviewed in .2 above, indicate that it is highly unlikely that any significant acoustic impact from the types of indoor plant and equipment likley to be used at the school will be experienced outside the building.

If required, this outcome can be confirmed by acoustic certification prior to the issue of an Occupation Certificate (OC) for the school.

6.3.8 Acoustic Impacts Generally

In our professional opinion, due to the relatively low level of sounds projected to be generated by activities associated with the proposed facility, and the various attenuation or noise reduction factors involved, and subject to the recommendations made in this report, there is very little likelihood that the proposed school will cause any undue acoustic impacts on nearby receivers.

6.3.9 General Acoustic Considerations

Sound generated by the activities of children at the proposed school will be additional to background, ambient sound levels.

However, these incremental sound levels will be subject to the following management and control:

> **Structural Attenuation:** Sound levels generated within the proposed school will be subject to attenuation by the materials associated with the construction and fit-out of the facility, such as wall and flooring finishes. It is considered reasonable to assume that a measurable reduction in noise impact will be achieved by this means.

Effect of Management and Supervision: It is also considered reasonable to assume that sound generated by the activities of children playing in play areas at the proposed school will be subject to minimisation and control as a result of appropriate management and supervisory protocols.

These factors will provide additional acoustic management and minimisation controls.

It is noted that the following factors will help minimise noise generated by activities associated with the proposed school, and will contribute to the overall strategy that has been developed, and described in the report, to ensure that no undue or non-compliant acoustic impacts are experienced at neighbouring residential boundaries:

No Public Address System: No public address system will be installed or used at the school.

No School Bell: No school bell will be installed or used.

No Outdoor Speakers: No outdoor speakers will be installed or used

No External Amplification Systems: No provision will be provided for the use of an amplified sound system in the external areas of the school, and any use of music or recorded sound during playtime will be strictly controlled to ensure that no undue impacts are caused.

No Unreasonable Community Use of School Facilities: On any occasions when the facility may be used outside the typical opening hours neighbours would be notified in advance, and care would be taken to ensure that any such use did not involve the imposition of undue or non-compliant acoustic impacts at neighbouring property boundaries.

Review of AAAC Guidelines

Chapter 8 of the AAAC (2013) guideline provides the following comment in relation to supervision.

The Centre should always be properly supervised in order to limit the noise emission.

The requirement for effective management and supervision has been incorporated into this acoustic assessment.

6.3.10 Noise Management Plan

The proposed facility is adjoined to the east and west by existing residential properties.

For this reason, it is important that the various controls required to ensure the effective management and minimisation of noise impacts on neighboring properties is formalised in the form of a concise, plain language noise management plan.

This noise management plan should be incorporated into the overall Management Plan for the proposed school, and should include but not be limited to the following issues:

- Separate daily programs for both the warmer and cooler months in order to regulate the total time spent outdoors and indoors, and assist in the management and minimisation of noise;
- Contact phone numbers for the overall facility manager or director should be made available to neighbours to facilitate communication and to resolve any neighbourhood issues that may arise due to operation of the school;
- Details of the typical number of children anticipated to be present in the outdoor play area (refer Table 6.7);

- Details of any limitations recommended on the total time spent outside in the play area each day in order to meet the noise criteria (refer 6.3.2 above);

- Details of plans and procedures to ensure that the behaviour of children is monitored and modified as required by adequately trained teachers and childcare workers, to assist in ensuring compliance with overall noise guidelines

- A procedure to ensure that parents and guardians are informed regarding the importance of noise minimisation when entering the site, and dropping off or picking up children;

- Procedures as required to ensure that staff control the level of their voices while outside;

- Liaise withy parents and guardians to ensure that those dropping of an picking up children drive as quietly as practicable on the public roads in the vicinity of the school, and minimise noise impact will entering and departing the proposed car park area.

Review of AAAC Guidelines

Chapter 8 of the AAAC (2013) guideline provides specific recommendations in relation to the inclusion of an appropriate Noise Management Plan in the overall Centre Management Plan.

The recommendations made above are consistent with this requirement.

6.4 SUMMARY DISCUSSION

This report presents a carefully considered acoustic assessment of a proposed community school at 1 Rosemead Road, Hornsby NSW.

The nature of the exiting building to be used as part of the proposed facility, as detailed in this report, clearly indicates that requisite internal background sound levels will be readily achieved, and that sound generated by activities within the school will have no significant impact at site boundaries

This assessment also indicates that sound generated by outdoor play and other activities at the school will have no undue or non-compliant impact on neighbouring properties.

The key noise control mechanisms that will ensure this outcome are:

- Moderation and minimisation of noise levels by effective planning and supervision or outdoor activities;

- The availability of sufficient space to provide flexibility in the positioning of outdoor activities, and to avoid concentrations of activity near neighbouring boundaries;

- The effect of distance resulting from the above point in reducing sound levels at property boundaries;

- The use of appropriate and acoustically effective boundary fencing to contribute to noise minimisation;

- The encouragement of a cooperative approach from those dropping off and picking up children from the school to minimise noise generated on nearby roads; the school driveway, and within the school, car park; and

- The reflection of these control mechanisms in an appropriate, plain language Noise management Plan to form part of the overall management plan for the school.

6.5 RECOMMENDATIONS

On the basis that vehicles would park close to this fence line, an 1800mm double lapped timber fence was originally proposed. It is now intended that a 1000mm path will be located between the car parking spaces and the boundary fence. As the acoustic performance of this section of fence is reduced with the distance of the noise source (car parking and associated activities) from the fence, and to ensure a safe and conservative acoustic outcome, an increase in the height of this section of fence, and therefore its acoustic performance, has now been included.

It is acknowledged however that the consistent use of 1800mm fencing may be preferred for other reasons, including consistency with the design character of other existing fences and fence heights in the area, and it is noted that the inclusion of this section of 2100mm fence is precautionary, and that in our professional opinion acoustic compliance at the adjoining residential boundary could be achieved using 1800mm double lapped timber fencing.

Based on the assessment presented above, the proposed school will comply with all relevant acoustic guidelines and requirements, subject to the adoption and implementation of the following recommendations:

- Double lapped timber boundary fencing of height 2100 mm and with a minimum Rw rating of 25 should be installed along the western boundary of the outdoor play area, adjacent to the school car park, as detailed in this report;
- Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the remaining western boundaries of the site, as detailed in this report;
- Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the southern or William Street boundary of the site, as detailed in this report.
- Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the eastern boundary of boundary of the site, with the short section of fence between the front façade of the adjoining building progressively reducing in height to 1200mm to meet the open form black metal fence proposed for the Rosemead Road property boundary, as detailed in this report;
- Careful supervision of all external activities associated with the school should be maintained as detailed in this report to assist in achieving the required acoustic outcomes;
- A compact of understanding should be achieved with parents and guardian, and those dropping off and picking up children, to ensure that minimum noise driving practices are applied on streets near the school, and when using the school's driveway and car park to assist in achieving the required acoustic outcomes;
- Validation that any plant & equipment associated with the proposed school will not have an impact greater than 5 dBA above the measured background LA90 RBL, as indicated in this report, may be provided if required prior to the issue of an Occupation Certificate for the development; and
- A Noise Management Plan consistent with the guidelines set out in this report is prepared and included in the overall Management Plan for the school for implementation and where necessary continuous improvement.

6.6 COMPARISON WITH THE NOISE LEVELS OF COMMON ACTIVITIES

Appendix C provides a comparison of the noise levels projected to apply at the proposed school with those associated with a range of common activities.

These comparisons suggest that the sound levels forecast to be associated with the proposed facility will be comparable with the sound levels associated with a range of accepted community activities, and subject to implementation of the and recommendations and controls included in this assessment report, are considered extremely unlikely to cause offence, nuisance or harm.

7 OVERALL ACOUSTIC ASSESSMENT

7.1 KEY FINDINGS

This report presents the results of an acoustic assessment undertaken in relation to a Community School proposed for development proposed for 1 Rosemead Road Hornsby NSW.

The following is a summary of the key findings of this assessment:

1. **Sound levels of less than 40 dB(A) will be achieved throughout the internal areas of the proposed educational facility, based on measured background sound levels and proposed layout and school design details as described in this report;**

2. **Sound levels in the range 30-35 dB(A) will be achievable within any rest areas associated with the proposed facility, based on measured background sound levels; and proposed layout and school design details as described in this report;**

3. **Noise levels of less than 55 dBA are projected to be achieved within the outdoor play areas associated with the proposed school;**

4. **The level of noise estimated to be generated by activities within the internal areas of the proposed facility is projected to be essentially contained by the building structure of the school itself, and accordingly is projected to have no negative or non-compliant impacts on surrounding buildings, activities and individuals;**

5. **The level of noise estimated to be generated by activities within the outdoor activity areas associated with the proposed school is projected to have no negative or non-compliant impacts on surrounding buildings, activities and individuals, subject to the implementation of the recommendations summarised below; and**

6. **On this basis, the acoustic performance of the proposed Community School will comply fully with the requirements of all relevant acoustic guidelines and requirements.**

7.2 RECOMMENDATIONS

The assessment has found that the proposed Community School (Preschool and Primary) will comply with the requirements of all relevant acoustic guidelines and regulations, subject to the advice provided generally in this report; adherence to normally accepted design and building practices, and the implementation of the following recommendations:

1. **Double lapped timber boundary fencing of height 2100 mm and with a minimum Rw rating of 25 should be installed along the western boundary of the outdoor play area, adjacent to the school car park, as detailed in this report;**

2. **Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the remaining western boundaries of the site, as detailed in this report;**

3. **Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the southern or William Street boundary of the site, as detailed in this report.**

4. **Double lapped timber boundary fencing of height 1800 mm and with a typical Rw rating of 25 should be installed along the eastern boundary of boundary of the site, with the short section of fence between the front façade of the adjoining building progressively reducing in height to 1200mm to meet the open form black metal fence proposed for the Rosemead Road property boundary, as detailed in this report;**

5. **Careful supervision of all external activities associated with the school should be maintained as detailed in this report to assist in achieving the required acoustic outcomes;**

6. **A compact of understanding should be achieved with parents and guardian, and those dropping off and picking up children, to ensure that minimum noise driving practices are applied on streets near the school, and when using the school's driveway and car park to assist in achieving the required acoustic outcomes;**

7. **Validation that any plant & equipment associated with the proposed school will not have an impact greater than 5 dBA above the measured background LA90 RBL, as indicated in this report, may be provided if required prior to the issue of an Occupation Certificate for the development; and**

8. **A Noise Management Plan consistent with the guidelines set out in this report is prepared and included in the overall Management Plan for the school for implementation and where necessary continuous improvement.**

8 AUTHORISATION & LIMITATIONS

NG Child & Associates has based this report on the data, methods and sources described herein. Subject to the limitations described within the report, it is the professional opinion of NG Child & Associates that this report provides an accurate and reliable measure of background acoustic levels and acoustic performance regarding the Community School proposed for development at 1 Rosemead Road Hornsby NSW, as described in this report.

Noel Child BSc (Hons) ME PhD
Visiting Fellow, Engineering
University of Technology, Sydney
Principal, NG Child & Associates

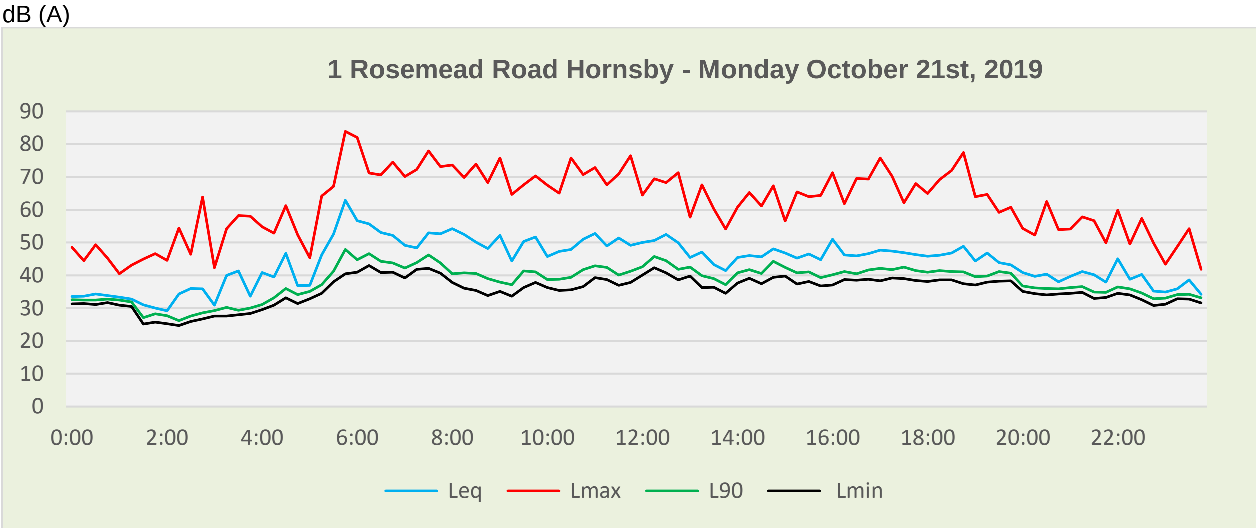
6 May 20020

APPENDIX A

Background Acoustic Measurements

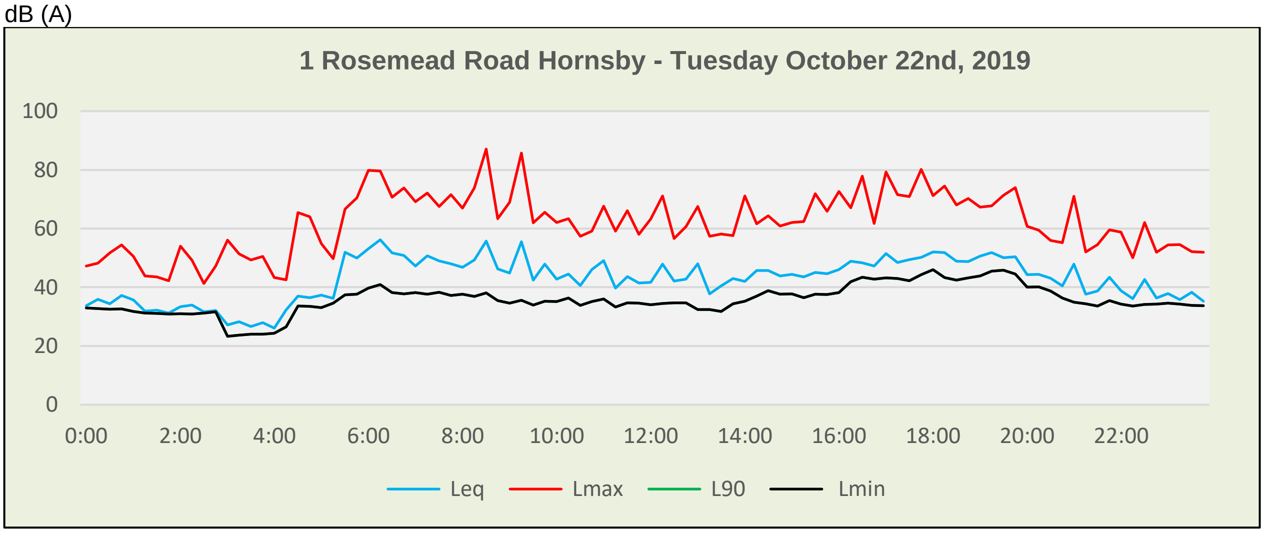
Monday October 21st, 2019

dB (A)



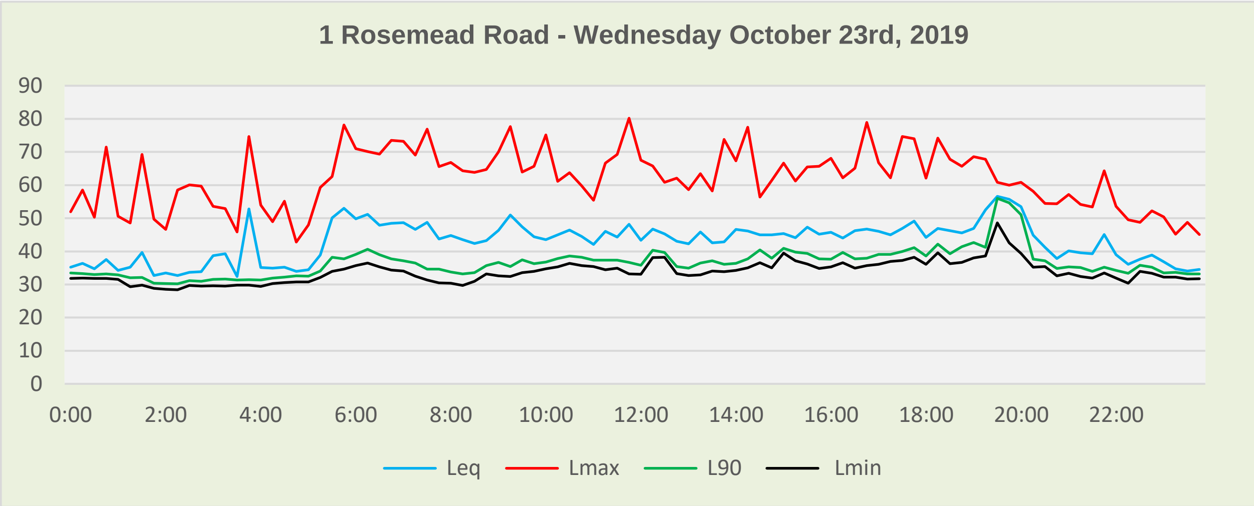
Tuesday October 22nd, 2019

dB (A)



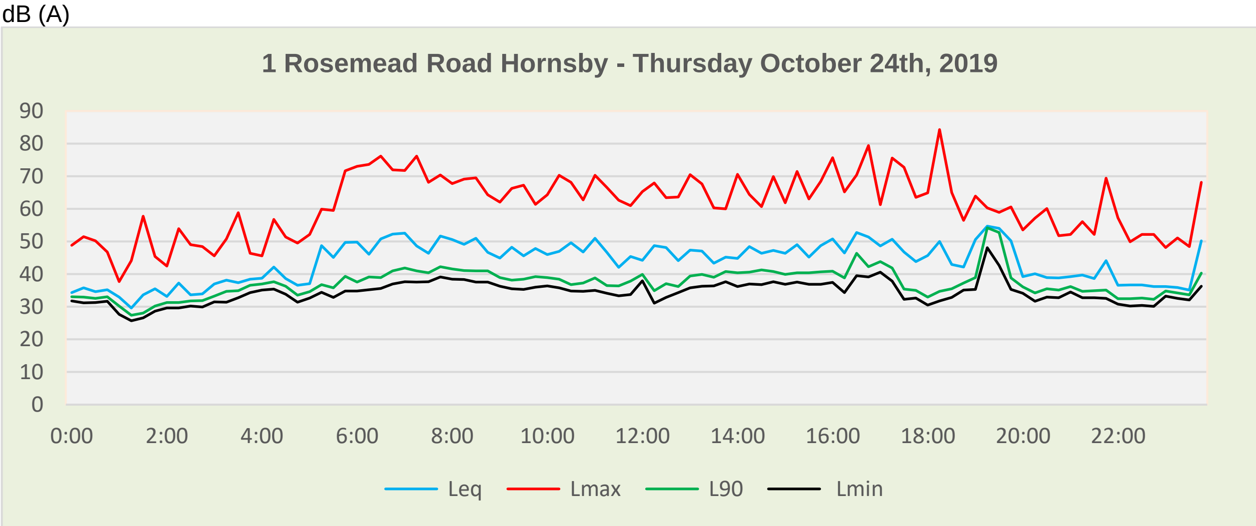
Wednesday October 23rd, 2019

dB (A)

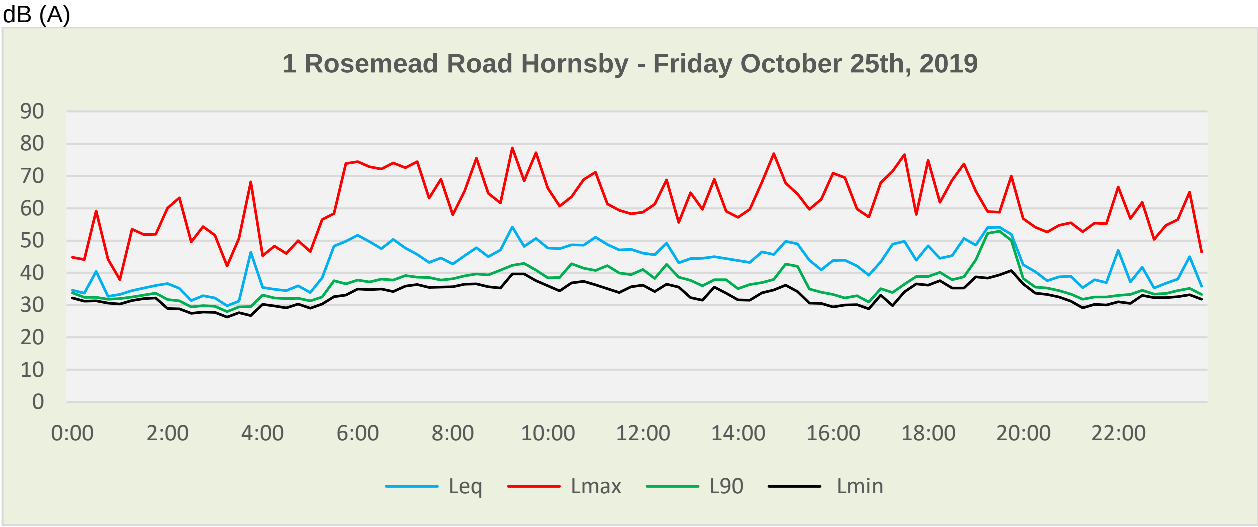


Thursday October 24th. 2019

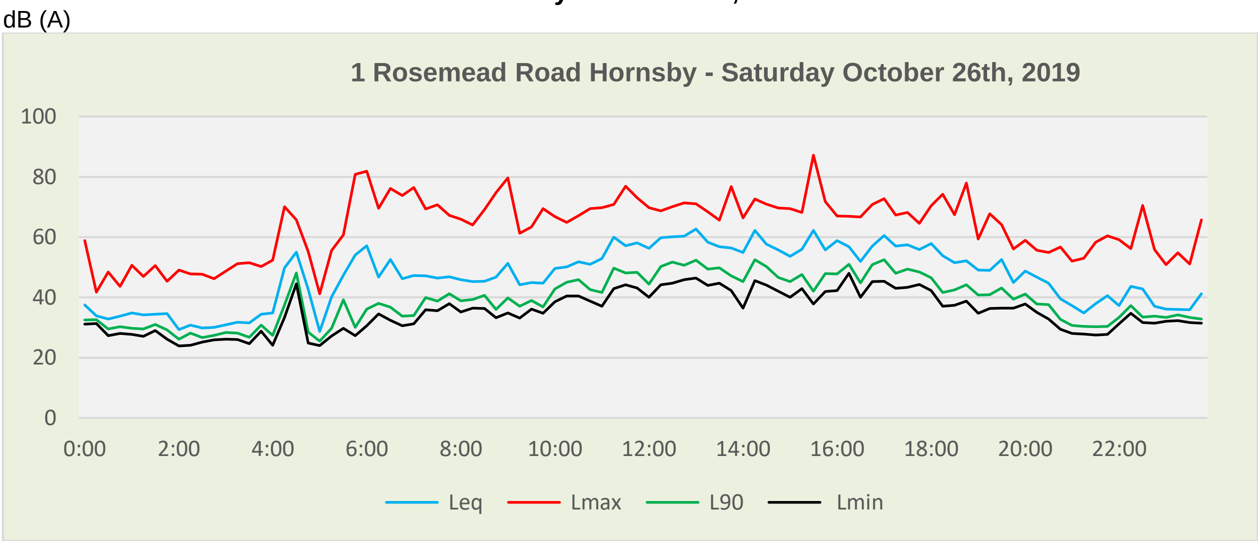
dB (A)



Friday October 25th, 2019

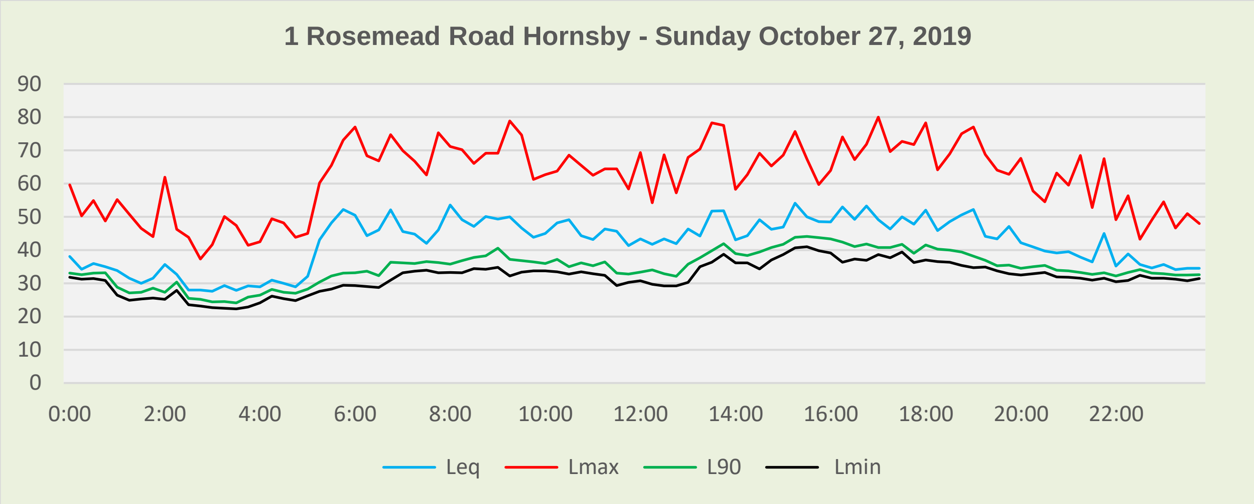


Saturday October 26th, 2019



Sunday October 27th, 2018

dB (A)



1 Rosemead Road Hornsby NSW
Summary of Background Noise Monitoring Data

Table A1 – Summary of Continuous Noise Monitoring Data

	Leq			Lmax			L90			Lmin		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Monday 21 October 2019	48.3682	42.7438	39.5786	67.9818	60.8688	54.5808	41.2591	38.3500	34.1417	37.9295	36.1063	31.9446
Tuesday 22 October 2019	45.9182	46.5188	37.0661	66.8364	64.5625	54.9254	36.9159	40.5188	39.5259	36.9159	40.5188	32.4446
Wednesday 23 October 2019	45.3909	46.0063	38.5389	66.7455	61.4938	56.3583	37.3432	41.0188	33.5556	34.5682	36.8938	31.4806
Thursday 24 October 2019	47.1926	44.3125	37.5281	66.5167	60.4313	51.6094	39.1685	37.9375	33.6688	35.9259	34.7500	31.5688
Friday 25 October 2019	46.4229	44.1250	37.0250	66.1854	60.5750	53.4531	38.2500	39.3000	32.4594	34.4896	34.8938	30.4344
Weekday Average	46.6586	44.7413	37.9473	66.8531	61.5863	54.1854	38.5873	39.4250	34.6702	35.9658	36.6325	31.5746
Saturday 26 October 2019	52.6241	46.3375	37.1125	69.1370	61.7063	53.8938	43.2889	38.1250	31.4000	38.6426	34.0938	28.8781
Sunday 27 October 2019	46.3444	44.0438	33.9375	66.8370	65.6438	50.1625	36.8426	36.1750	29.5969	33.4352	33.6125	27.4938
Weekend Average	49.4843	45.1906	35.5250	67.9870	63.6750	52.0281	40.0657	37.1500	30.4984	36.0389	33.8531	28.1859

APPENDIX B

Sound Level Monitoring: Raw Data

Table B1 – Raw Noise Monitoring Data (21-27 October 2019)

Date	Time	Leq	Lmax	L1	L10	L50	L90	L99	Lmin
21/10/2019	0:00	33.5	48.6	34.9	34.3	33.3	32.6	32.4	31.3
		33.6	44.5	34.9	34.5	33.2	32.5	32.4	31.4
		34.3	49.4	35.1	34.3	33.1	32.5	32.3	31.1
		33.8	45.3	35.5	34.8	33.6	32.8	32.6	31.7
		33.4	40.5	34.6	34.2	33.3	32.5	32.1	30.9
		32.8	43.1	34.4	33.8	32.5	31.9	31.7	30.5
		31	45	33.6	33	31.6	27.1	26.8	25.2
		30	46.6	32.1	31.3	29.7	28.3	27.9	25.7
	2:00	29.2	44.6	31	30.3	28.7	27.7	27.1	25.3
		34.3	54.4	41.6	40.4	28.2	26.2	26	24.7
		36	46.4	42.9	41.6	30.4	27.6	27.3	25.9
		35.9	63.9	41.4	39.9	31.2	28.6	28.2	26.7
		30.9	42.3	33.4	32.3	30.5	29.3	29	27.6
		40	54.2	47.1	43.6	31.7	30.2	29.7	27.6
		41.4	58.2	47.9	42.9	30.9	29.4	29.2	28
		33.6	58	37.2	34.6	31.4	30	29.8	28.4
	4:00	40.9	54.8	48.6	43.9	33.2	31.1	30.9	29.5
		39.5	52.9	45.1	43.3	36.1	33.2	32.5	30.9
		46.7	61.3	54.7	47.5	38.9	36	35.6	33.2
		36.9	52.4	40.2	38.6	35.8	34.1	33.6	31.4
		37	45.4	40.1	38.7	36.4	35.1	34.6	32.9
		46.2	64.2	52.2	49.7	40.6	37.2	36.6	34.5
		52.6	67.1	59.3	57.3	47	41.3	40.5	38
		62.9	83.9	69.3	65.1	54.7	47.9	46.4	40.5
	6:00	56.7	82	59.9	57.9	50.7	44.8	43.5	41
		55.7	71.2	61	60.1	52.2	46.6	46	43
		53.1	70.6	59.6	58	48.2	44.3	43.8	40.9
		52.2	74.5	57.3	54.6	47.8	43.8	43	41
		49.2	70.1	53.2	50.6	45.2	42.2	41.5	39.2
		48.4	72.3	52.7	50.5	45.6	43.9	43.5	41.8
		53	77.9	57.1	55	51	46.2	45.1	42.1
		52.7	73.2	57.4	55.3	49.1	43.8	42.9	40.7
	8:00	54.2	73.7	55.1	50.8	43.8	40.5	39.8	37.8
		52.5	69.8	58.6	55.3	45.9	40.8	39.9	36.1
		50.1	73.9	54.4	52.2	46.3	40.6	39.6	35.4
		48.2	68.3	54.1	52	44.8	39	37.9	33.8
		52.2	75.8	58.4	54.3	43.3	37.9	37.3	35.1
		44.4	64.7	49.3	47.5	41.7	37.2	36.7	33.6
		50.3	67.6	55.3	51.9	46.9	41.4	39.8	36.3
		51.7	70.3	56.9	54.2	46.6	41.1	40.1	37.8
	10:00	45.7	67.5	50.2	48.2	43	38.7	38.2	36.3
		47.3	65.1	52.2	47.7	42.2	38.8	38	35.4
		47.9	75.8	52.9	51.2	44.1	39.4	38.4	35.6
		51	70.7	54	50.4	44.8	41.7	41.1	36.6
		52.8	72.9	59	54.9	46.8	42.9	42.1	39.3
		49	67.6	54.3	51.4	46	42.4	41.3	38.7
		51.4	70.9	55.8	50.8	44.8	40.1	39.3	37
		49.2	76.5	54.5	52.8	45	41.3	40.3	37.8
	12:00	50	64.5	55.5	54.1	46.7	42.6	41.4	40.1
		50.6	69.5	55	53.5	48.7	45.7	45.4	42.3
		52.5	68.3	56.5	55.3	51.8	44.5	43.5	40.8
		49.9	71.3	55.4	52.9	45.5	41.8	41.1	38.6

		42.3	58.6	47.3	45.8	39.3	34.9	34.3	32.7
		45.9	63.5	50.9	48.3	41.4	36.5	35.6	32.9
		42.6	58.2	48	45.9	40.1	37.1	36.4	34.1
		41.5	54.1	46.6	45	39	37.2	36.7	34.5
	14:00	45.5	60.8	49.5	48.3	44.4	40.8	39.8	37.6
		46	65.3	49.2	48.3	45.1	41.7	41	39.1
		45.6	61.2	49.6	48.3	44.3	40.6	39.6	37.5
		48.1	67.3	51.9	50.5	47.1	44.3	43.3	39.4
		46.8	56.6	51.6	49.9	45.4	42.4	41.5	39.8
		45.3	65.5	48.8	47.7	44.5	40.8	39.8	37.4
		46.5	64	50.6	49.4	45.1	41.1	40.4	38.1
		44.8	64.4	48.9	47.8	43	39.3	38.6	36.8
	16:00	51	71.3	55	51.5	45.2	40.2	39.2	37.1
		46.2	61.8	50.7	49.2	44.5	41.2	40.6	38.7
		45.9	69.6	48.5	47.2	43.5	40.5	40	38.5
		46.6	69.4	49.6	48.6	45	41.6	40.9	38.8
		47.7	75.8	50.5	49.2	45.5	42.1	40.6	38.3
		47.4	70.2	50.4	49.1	45.8	41.7	41	39.2
		46.9	62.1	51.5	50	45.6	42.5	41.5	39
		46.3	68	49.4	48.6	45.3	41.5	40.9	38.4
	18:00	45.8	65	49.8	48.5	44.8	41	40.2	38.1
		46.1	69.2	49.3	48.5	44.7	41.5	40.6	38.6
		46.8	72	49.4	47.8	43.9	41.2	40.7	38.6
		48.9	77.5	51.7	49.3	44.4	41.1	39.9	37.5
		44.4	64	48.9	47.4	42.1	39.6	39.2	37.1
		46.8	64.7	50.4	47.3	42.5	39.8	39.4	37.9
		43.9	59.2	47.2	45.8	42.2	41.2	40.9	38.2
		43.2	60.8	47	45.4	42.1	40.7	40.5	38.3
	20:00	40.9	54.3	45.8	43.8	38.5	36.8	36.5	35.1
		39.7	52.3	44.8	43.3	37.4	36.2	35.9	34.4
		40.4	62.5	46.3	43.2	37.4	36	35.6	34
		38	53.9	41.8	39.4	36.9	35.9	35.7	34.3
		39.7	54.1	43.8	41.6	37.6	36.3	36	34.5
		41.2	57.8	46.2	44.4	38.3	36.6	36.3	34.8
		40.2	56.7	45.3	43.8	36.7	34.9	34.5	33
		37.9	49.9	41.6	40.7	36.3	34.8	34.5	33.3
	22:00	45.1	59.9	52.9	44.6	38.2	36.5	36.2	34.5
		38.8	49.6	42.7	41	38	35.9	35.5	34
		40.3	57.4	45.3	41.7	36.4	34.6	34.1	32.6
		35.2	49.8	38.5	36.9	34.1	32.9	32.7	30.8
		34.9	43.4	37	36.4	34.7	33.1	32.7	31.2
		35.9	48.8	38.4	37.3	35.2	34.1	34	32.9
		38.6	54.2	43.5	41.1	35.6	34.2	34.1	32.8
		34.2	41.8	35.7	35.2	34	33.2	33	31.6
22/10/2019	0:00	33.7	47.2	35.1	34.6	33.6	33	32.9	31.5
		35.9	48.2	40.5	37.5	33.8	32.8	32.7	31.3
		34.4	51.7	36	34.7	33.3	32.5	32.3	30.7
		37.2	54.4	39.8	36.7	33.7	32.6	32.3	30.7
		35.7	50.5	39.5	37.1	32.9	31.8	31.6	30.2
		31.9	43.9	33.3	32.8	31.7	31.2	31.1	29.8
		32.2	43.5	33.6	33.2	31.8	31.1	30.9	29.7
		31.2	42.2	31.9	31.7	31.2	30.9	30.8	29.7
	2:00	33.4	54	35.2	34	32	31	30.9	29.9
		33.9	49.2	39.9	33.3	31.3	30.9	30.8	29.8
		31.7	41.3	32.5	32.2	31.7	31.2	31.1	30.2
		32.1	47.3	32.8	32.6	32.1	31.7	31.6	22.6

		27.2	56.1	27.6	26.5	24.2	23.3	23.2	21.8
		28.3	51.4	32.7	32	25.7	23.7	23.4	22
		26.6	49.3	28.6	27.2	25.1	24	23.8	22
		27.9	50.5	32.8	30.4	25.5	24	23.8	22
	4:00	26.1	43.3	28.3	27.2	25.4	24.4	24.2	22.8
		32.3	42.6	37.7	36.5	28.7	26.5	26.2	24.5
		37	65.5	38.6	37.6	35.5	33.6	33.3	31.5
		36.5	64	38.2	37.3	35.1	33.5	33.2	31.6
		37.3	54.9	40.7	37	34.6	33.1	32.6	30.8
		36.2	49.8	38.5	37.5	35.7	34.6	34.2	32.4
		51.9	66.7	58.4	56.3	47.9	37.4	36.7	34.3
		50	70.5	56.3	52.7	41.5	37.6	37	35
	6:00	53.1	79.8	59.1	54.5	43.2	39.7	39.1	36.2
		56.2	79.6	64.2	61.1	46.6	40.9	40.1	36.4
		51.7	70.7	59.9	53.5	42.5	38.2	37.6	35.5
		50.8	73.9	57.4	54.8	42.6	37.8	37.4	34.6
		47.2	69.2	53.2	48.9	41.3	38.2	37.6	35.6
		50.7	72.1	57.5	54.6	42.9	37.6	37.1	34.9
		49	67.5	54.4	53.1	44.6	38.3	37.5	35.2
		48	71.6	52.9	48.4	41.3	37.2	36.6	34.7
	8:00	46.8	67	53.4	49.5	41.9	37.7	37.1	34
		49.3	73.8	54.4	50.8	41.9	36.9	36.3	33.9
		55.8	87.1	54.7	51.7	43.5	38.1	37.1	33.9
		46.3	63.4	53.4	50.4	40.7	35.5	34.9	32.1
		44.8	68.9	50.4	48.1	40.2	34.6	33.9	31.5
		55.5	85.7	51.1	47.9	40	35.6	34.7	31.8
		42.5	62	49.4	46.4	37.3	33.9	33.6	31.7
		47.9	65.6	54.8	49.6	41.6	35.3	34.2	32.4
	10:00	42.8	62.1	48.1	46.7	39.3	35.1	34.4	32.1
		44.5	63.4	49.3	48.5	41.9	36.4	35.6	33.4
		40.6	57.4	46.1	44.5	36.1	33.8	33.3	31.8
		46	59.1	52.2	50.5	41	35.2	34.5	31.9
		49.1	67.6	53.8	50.1	43.6	36	35.1	31.9
		39.7	59.1	45.5	42.8	35.7	33.3	33	31.6
		43.7	66.1	48.1	44.2	37.7	34.7	34.5	32.9
		41.5	58	46.5	43.5	37.2	34.6	34.3	32.7
	12:00	41.7	63.3	46.6	43.8	36.1	34.1	33.9	32.6
		47.9	71.1	50.3	46.8	37.7	34.5	34.1	32.1
		42.1	56.6	47	44.6	40.4	34.7	34.3	32.8
		42.8	60.7	47.3	45.3	40.5	34.7	34.2	32.7
		48	67.5	52	46.3	35.5	32.4	31.8	29.8
		37.8	57.4	43.4	41.1	34.8	32.4	32.2	30.4
		40.5	58.2	46.2	43.1	35.9	31.8	31.4	30.1
		43	57.6	47.9	45.8	40.3	34.4	33.6	31.9
	14:00	42	71.1	46.7	44.6	37.4	35.3	35	33.5
		45.7	61.6	50.5	48.4	42.4	37	36.5	34.8
		45.7	64.4	50.9	48.4	42.4	38.9	37.9	36
		43.9	60.9	49.3	46.7	40.6	37.6	37.1	35.6
		44.4	62.1	48.5	47.1	41.9	37.8	36.5	34.7
		43.5	62.4	48	45.8	41.3	36.5	36.1	34.8
		45.1	71.9	49.6	47.7	41.3	37.7	36.7	34.8
		44.6	65.9	50	47.9	41.3	37.5	37.1	35.4
	16:00	46.1	72.7	49.7	48.3	43.7	38.2	37.1	35.2
		48.9	67.1	53.2	51.3	46.8	41.9	40.7	37.6
		48.3	77.9	50.4	49.4	46.2	43.4	43	39.5
		47.2	61.7	50.9	49.4	46.2	42.8	42	39.5

		51.5	79.3	53.6	52.1	46.7	43.2	42.2	39.1
		48.4	71.6	52.1	50.7	46.4	43	41.8	38.3
		49.4	70.9	54.3	52.9	46.8	42.2	41.6	39.4
		50.2	80.2	52.7	51.2	47.7	44.3	43.8	41.8
	18:00	52	71.2	54.6	53	49.3	46	45.1	43.2
		51.8	74.5	53.9	51.5	47.9	43.3	42.1	39.6
		48.9	68.1	53.5	52	47.2	42.4	41.6	39.6
		48.8	70.2	51.9	50.9	46.6	43.2	42.5	40.3
		50.6	67.3	55.9	53.9	48.5	43.9	42.7	39.3
		51.8	67.7	55.7	54	48.9	45.5	45	42.8
		50.1	71.3	52.7	51.5	48	45.8	45.1	42.7
		50.4	74	52.9	51.2	46.5	44.5	44	41.6
	20:00	44.3	60.8	48.3	47.5	43	40.1	39.2	36.8
		44.4	59.5	48.3	46.7	42.6	40.2	39.6	37.9
		43.1	56	48.5	46.5	40.2	38.7	38.3	36.8
		40.5	55.2	44.7	42.8	39	36.3	35.7	33.8
		47.9	71	48.8	45.8	37.4	34.9	34.5	33
		37.6	52	42	39.7	35.5	34.4	34.2	32.6
		38.7	54.6	44.5	42.4	35.8	33.6	33.2	31.6
		43.4	59.6	50.1	45.8	37.9	35.5	35.2	33.7
	22:00	38.8	58.8	41.3	40.3	35.9	34.3	34	32.7
		36.1	50.1	38.6	37.2	35	33.6	33.4	31.7
		42.7	62.1	48.7	41.4	35.3	34.2	33.9	32.6
		36.3	51.9	39.6	38	35.1	34.3	34.1	32.7
		37.9	54.4	43.1	40.2	35.6	34.6	34.3	32.7
		35.8	54.5	38.1	36.6	35	34.3	34.2	32.9
		38.3	52.2	44	40.9	34.9	33.8	33.5	32.3
		35.3	51.9	37.4	36.6	34.7	33.7	33.5	32.1
23/10/2019	0:00	35.2	51.9	36.9	35.9	34.4	33.5	33.3	31.8
		36.4	58.5	35.8	35.2	34	33.3	33.1	31.9
		34.7	50.3	37.4	35.9	33.8	33	32.9	31.8
		37.5	71.5	35.1	34.5	33.7	33.2	33.1	31.8
		34.2	50.6	35.9	35.2	33.8	32.9	32.7	31.5
		35.2	48.6	38.2	37.4	34.7	32	31.6	29.3
		39.7	69.3	38.7	37.1	33.5	32.1	31.8	29.8
		32.7	49.7	34.9	34.1	32.1	30.4	30	28.8
	2:00	33.5	46.6	37	36.1	31.9	30.3	30	28.5
		32.7	58.5	34	33.3	31.5	30.2	30	28.4
		33.7	60.1	34.7	34	32.1	31.2	31	29.7
		33.9	59.7	36.3	34.9	32.4	31	30.8	29.5
		38.7	53.6	44.4	42.4	35.5	31.5	31.1	29.6
		39.3	52.9	47.3	44	33.2	31.6	31.3	29.5
		32.4	45.9	34.1	33.6	32.1	31.3	31	29.8
		52.8	74.7	49.9	39.4	32.6	31.4	31.1	29.8
	4:00	35.1	54	41.2	38.3	32.9	31.3	30.9	29.4
		34.9	48.9	39.8	37.4	33.4	31.9	31.6	30.3
		35.2	55.1	37.7	35.6	33.3	32.2	32	30.6
		34	42.8	35.9	35.4	33.8	32.6	32.4	30.8
		34.4	48	36.7	35.4	33.5	32.5	32.3	30.8
		38.9	59.3	44	40.1	35.9	34.1	33.8	32.1
		50.1	62.6	55.4	54.4	47.6	38.2	36.9	34
		53	78.2	59.4	54.9	43.4	37.7	37	34.6
	6:00	49.8	71	55.5	52.8	43.8	39.1	38.3	35.7
		51.2	70.1	56.5	54.5	46.3	40.6	39.7	36.5
		47.9	69.4	54.6	51.7	43.1	39	38.1	35.3
		48.5	73.5	52.8	49.1	41.3	37.7	37.2	34.3

		48.7	73.2	53.5	50.2	42.5	37.1	36.4	34.1
		46.6	69.1	51.8	48.7	39.8	36.5	35.7	32.5
		48.8	76.9	52.3	50	40.4	34.6	33.9	31.3
		43.7	65.6	48.4	46.7	40.3	34.6	33.5	30.5
	8:00	44.8	66.8	48.8	46.7	38.5	33.8	32.9	30.4
		43.5	64.3	49.6	47.5	38	33.2	32.4	29.7
		42.4	63.8	48.2	46.4	37.5	33.6	33.2	31
		43.2	64.7	48.7	46.3	39	35.7	35.3	33.2
		46.3	70	51	49	40.9	36.7	36.1	32.6
		51	77.7	53.1	48.2	38.6	35.4	34.5	32.4
		47.4	63.9	54.3	51.2	42.6	37.4	36.6	33.6
		44.4	65.7	50.9	47.4	38.9	36.3	35.9	34
	10:00	43.5	75.2	47.4	45.7	38.8	36.8	36.3	34.7
		45	61.1	50.5	48.9	41.1	37.8	37.4	35.3
		46.4	63.7	51.2	48.3	42.3	38.6	38	36.4
		44.5	59.8	51.3	48	41	38.2	37.6	35.7
		42.1	55.4	47.3	45.2	40.1	37.3	36.8	35.4
		46	66.6	50.8	47.2	40.8	37.3	36.6	34.4
		44.3	69.3	49.2	45.6	40.1	37.3	36.6	34.9
		48.2	80.2	49.3	46.9	40.7	36.7	35.8	33.2
	12:00	43.3	67.5	48.6	46.7	38.9	35.8	35.3	33.1
		46.7	65.8	50.7	48.7	43.8	40.3	39.8	38.1
		45.3	60.8	50.2	48.2	43.1	39.7	39.4	38.2
		43	62.1	47.7	46.4	41	35.4	34.7	33.3
		42.3	58.6	47.3	45.8	39.3	34.9	34.3	32.7
		45.9	63.5	50.9	48.3	41.4	36.5	35.6	32.9
		42.6	58.2	48	45.9	40.1	37.1	36.4	34.1
		42.9	73.8	46.5	44.1	38.9	36.1	35.7	33.9
	14:00	46.6	67.3	53.5	48.6	39.6	36.4	35.8	34.2
		46.1	77.5	47.7	44.7	40.4	37.7	37	35
		45	56.4	49.7	48.2	43.2	40.4	39.9	36.6
		45	61.4	50.5	47.4	41.8	37.9	37.1	35
		45.4	66.6	49.1	47.6	43.8	40.9	40.6	39.5
		44.1	61.2	48	46.9	42.6	39.8	39.3	37.1
		47.3	65.5	51.2	49	43.8	39.4	38.6	36.2
		45.2	65.7	49.6	47.9	42.5	37.7	36.8	34.8
	16:00	45.8	68.1	50.2	47.6	41	37.6	37	35.3
		44	62.2	48.2	46.6	42.8	39.7	38.8	36.6
		46.2	65.1	52.9	50.7	41.1	37.7	36.8	34.9
		46.7	78.9	49	46.2	40.4	37.9	37.5	35.7
		46	66.7	51.8	49	41.7	39.1	38.5	36.1
		45	62.2	49.5	47.8	42.9	39.1	38.7	37
		46.9	74.7	49.2	47.2	42.7	40	39.4	37.2
		49.1	74	54.1	49.9	44.9	41.1	40.4	38.2
	18:00	44.2	62.1	49.1	47.4	42.1	38.6	38.1	36.1
		46.9	74.2	49.3	48	44.1	42.2	41.6	39.6
		46.2	67.8	51.5	49.3	42.6	39.3	38.3	36.3
		45.6	65.7	49.7	47.7	43.9	41.4	40.3	36.7
		46.9	68.6	51.7	49.9	43.9	42.7	41.9	38
		52.5	67.8	56.8	56	49	41.2	40.6	38.6
		56.6	60.8	57.7	57.4	56.7	56	55.8	48.6
		55.7	60	56.9	56.6	55.7	54.7	54.4	42.6
	20:00	53.5	60.8	55.1	54.9	53.9	51.1	43.3	39.4
		44.9	58.1	52.8	48.9	41.3	37.6	37.1	35.2
		41.2	54.5	46	44.5	39.1	37.1	36.8	35.4
		37.8	54.4	42.1	39	36	34.8	34.5	32.6

		40.1	57.2	44.5	42.2	37.6	35.3	34.9	33.4
		39.6	54.2	44.2	42.2	37.1	35.1	34.6	32.4
		39.3	53.4	45	43.6	36	34	33.6	31.9
		45.1	64.3	47.7	45.3	37.6	35.2	34.9	33.5
	22:00	39	53.6	44.6	42.3	36.2	34.2	33.9	31.9
		36.1	49.5	40.3	36.9	35.1	33.4	32.9	30.4
		37.6	48.8	39.8	39	37	35.8	35.6	34
		38.9	52.2	43.8	42.8	36.9	35.2	34.9	33.4
		36.9	50.4	41.6	38.8	34.6	33.5	33.3	32.2
		34.7	45.2	36.4	35.7	34.4	33.7	33.5	32.2
		34.1	48.8	35.8	35.2	33.9	33.2	33	31.6
		34.5	45.1	36.6	35.8	34	33.2	33.1	31.7
24/10/2019	0:00	35.3	49.9	37	35.7	33.9	33	32.9	31.7
		34.3	48.8	36.4	35.4	33.8	33.1	32.9	31.8
		35.8	51.5	40.7	37	33.9	33	32.7	31.2
		34.6	50.2	37	35.4	33.5	32.6	32.5	31.3
		35.2	46.8	39.4	36.2	34.1	33.1	32.9	31.7
		33	37.7	34.8	34.4	33.3	30.2	29.7	27.7
		29.6	44.1	32.2	31.3	28.9	27.4	27.1	25.7
		33.6	57.7	31.3	30.6	29.1	28.1	27.9	26.6
	2:00	35.5	45.4	43	38.9	32	30.2	29.9	28.6
		33.2	42.5	35.8	35.1	32.6	31.3	31	29.6
		37.3	53.9	43	41.5	32.5	31.3	31	29.6
		33.6	49	35.1	34.2	32.9	31.8	31.5	30.2
		33.9	48.4	36.2	34.9	33	31.9	31.7	29.9
		37	45.6	40.3	39.4	36.4	33.3	32.9	31.5
		38.2	50.8	43	40.8	36.9	34.7	34.2	31.4
		37.4	58.8	39.6	39	36.7	34.9	34.5	32.8
	4:00	38.4	46.4	40.8	40.1	37.9	36.6	36.2	34.3
		38.7	45.6	40.7	40	38.3	37	36.7	35.1
		42.2	56.8	46	42.4	39.1	37.7	37.3	35.4
		38.6	51.4	40.9	39.9	38	36.3	35.9	33.8
		36.6	49.5	40.9	38	35	33.5	33.2	31.4
		37.1	52.2	39.5	38.5	36.3	34.6	34.3	32.7
		48.7	59.9	53.6	52.7	47	36.8	36.3	34.4
		45.1	59.5	51.5	50.3	39.4	35.8	35.3	32.9
	6:00	49.7	71.7	56	53.3	44.3	39.3	38.1	34.8
		49.8	73	54.9	50.5	41.3	37.6	37	34.8
		46.1	73.6	50.2	48.2	42.3	39.1	38.4	35.2
		50.8	76.2	56.2	52.6	43	38.9	38.4	35.6
		52.3	72	57.3	56.3	50	41	40	37
		52.6	71.8	56.5	56.1	50.3	41.9	40.8	37.7
		48.6	76.2	52.7	50.4	45	41	40.4	37.6
		46.4	68.1	50.5	49.3	44.6	40.4	39.8	37.7
	8:00	51.7	70.4	56.1	53.6	46.6	42.3	41.9	39.1
		50.6	67.7	56.4	53.9	46	41.6	40.7	38.4
		49.1	69.1	55.9	52.7	44.6	41.1	40.6	38.3
		51	69.5	55	51.7	45.3	41	40.4	37.6
		46.7	64.3	50.8	49.8	45.1	41	40.3	37.6
		44.9	62.1	49.2	47.9	42.9	38.9	38.3	36.3
		48.2	66.3	52.3	48.2	42.2	38.2	37.6	35.5
		45.6	67.3	51.3	49.1	42.3	38.4	37.5	35.3
	10:00	47.9	61.4	55.1	53.2	42.6	39.2	38.5	36
		46	64.3	51.4	48.9	42.8	38.9	38.3	36.4
		47	70.3	52.6	49.2	43.2	38.4	37.6	35.8
		49.6	68.1	55.9	53.9	43	36.8	36.5	34.8

		46.8	62.7	53.9	52.6	41	37.3	36.9	34.7
		51	70.3	56.3	53.2	43.8	38.8	37.6	35
		46.7	66.6	54.2	48.4	41.4	36.5	36.1	34.1
		42.1	62.6	46.4	45.4	39.9	36.4	35.5	33.4
	12:00	45.4	61	50.6	49.1	42.5	37.9	36.9	33.7
		44.2	65.3	48.2	46.8	42.3	39.9	39.6	38
		48.7	67.9	53.4	49.7	40.2	34.9	33.4	31.1
		48.1	63.4	52.4	51.5	44.4	37.1	36	32.9
		44.1	63.6	50	47.4	40.3	36.2	35.6	34.3
		47.4	70.5	52.1	49.1	42.6	39.4	38.6	35.8
		47.1	67.6	52.3	50.8	44.2	39.9	39	36.3
		43.3	60.3	46.9	46.1	42.1	39	38.4	36.4
	14:00	45.2	60	48.8	47.6	43.9	40.8	40.2	37.7
		44.8	70.6	48	46.8	43	40.4	39.7	36.2
		48.4	64.4	54.4	52.3	45.5	40.6	39.8	37
		46.4	60.7	50.8	49.3	44.9	41.3	40.4	36.8
		47.3	69.9	52.2	48.7	43.5	40.8	40.2	37.7
		46.4	61.9	51.7	49.7	43.6	39.9	39.3	36.9
		49	71.5	54.9	51.8	44.1	40.4	39.5	37.6
		45.2	63	49.1	47.8	43.4	40.4	39.8	36.9
	16:00	48.7	68.4	55.4	52.4	44.2	40.7	39.9	36.9
		50.8	75.7	56.5	54	46	40.9	40	37.5
		46.5	65.2	51.3	49.8	43.5	38.8	37.7	34.3
		52.8	70.4	57	55.7	51.5	46.4	45	39.5
		51.4	79.4	57.4	54.7	46.3	42.3	41.5	39.1
		48.6	61.3	53	51.5	47.4	43.8	42.8	40.6
		50.7	75.6	55.2	53.7	47.6	41.9	41.1	37.9
		46.8	72.7	51.9	47.1	39.7	35.4	34.8	32.3
	18:00	43.8	63.5	49	45.8	38.5	35	34.6	32.7
		45.7	64.9	48.8	45.2	36.9	33	32.4	30.5
		50	84.3	49.6	47.2	39.8	34.7	34	31.8
		43	65	48.4	46.1	39.6	35.5	35	32.9
		42.2	56.5	47	45.2	39.9	37.3	36.9	35.1
		50.6	63.9	55.2	54.6	45.7	38.9	38.2	35.3
		54.7	60.3	55.6	55.4	54.7	54.2	54	48.1
		54	58.9	55.2	54.9	54.1	52.8	52.4	42.7
	20:00	50.2	60.6	53.4	52.9	50.9	38.8	37.5	35.3
		39.2	53.5	43.6	41.7	37.6	36.1	35.8	34.1
		40.1	57.2	45.3	43.1	37.3	34.2	33.9	31.7
		38.9	60.1	43	41.4	37.3	35.5	35	33
		38.8	51.8	43.2	41.1	37.4	35.1	34.8	32.8
		39.2	52.2	43.7	41.7	37.6	36.2	35.9	34.5
		39.7	56.1	44.5	42.1	36.9	34.7	34.3	32.8
		38.6	52.2	42.9	41.4	36.9	34.9	34.5	32.8
	22:00	44.1	69.4	44.5	40.5	37	35.1	34.9	32.6
		36.6	57.3	39	37.3	34.4	32.5	32.2	30.8
		36.7	49.9	42.5	38.6	34.3	32.5	32	30.2
		36.7	52.2	41.9	38.3	34.3	32.7	32.3	30.4
		36.2	52.2	39.5	37.3	35	32.3	31.8	30.1
		36.2	48.1	37.9	37.5	35.9	34.8	34.6	33.3
		35.9	51.1	37.7	36.5	35.1	34.2	34	32.6
		35.1	48.4	36.9	36.2	34.7	33.6	33.4	32.1
25/10/2019	0:00	34.6	44.8	36	35.6	34.5	33.8	33.6	32.2
		33.7	44.1	35.3	34.9	33.5	32.4	32.2	31.2
		40.4	59.2	47.7	42.3	33.1	32.4	32.2	31.3
		32.7	44.2	33.9	33.5	32.5	31.8	31.7	30.6

		33.3	37.9	34.9	34.4	33.1	32	31.7	30.3
		34.5	53.5	34.8	34.2	33.2	32.5	32.4	31.4
		35.3	51.8	37.4	36.1	34.2	33.1	32.9	32
		36.1	51.9	39.2	37.2	34.7	33.7	33.4	32.2
	2:00	36.7	60.1	38	36.9	33.9	31.7	31.4	28.9
		35.2	63.2	37.3	36.4	33.5	31.3	31	28.8
		31.4	49.6	33.2	32.7	30.9	29.4	28.9	27.5
		32.9	54.3	35.4	34.3	32.2	29.8	29.4	27.9
		32.2	51.6	34.5	33.6	31.7	29.6	29.2	27.8
		29.8	42.1	32.2	31.4	29.4	28	27.8	26.3
		31.2	50.7	33.3	32.8	30.8	29.4	29	27.7
		46.4	68.2	47.5	37.5	31.6	29.5	29	26.8
	4:00	35.5	45.3	38.1	37.3	34.9	33.1	32.3	30.2
		34.9	48.3	37.9	36.9	34.5	32.2	31.7	29.7
		34.5	46	37.8	36.8	33.9	32	31.7	29.1
		36	50	40.1	37.5	34.3	32.1	31.6	30.3
		33.9	46.6	37.1	35.8	32.9	31.3	30.8	29
		38.5	56.5	45.3	40.5	34.5	32.5	32	30.3
		48.3	58.4	52.9	52	47.2	37.6	36.2	32.6
		49.8	73.8	53.2	50.4	41.8	36.6	35.5	33.1
	6:00	51.6	74.4	57.2	52.4	43.4	37.8	36.9	35
		49.7	72.9	54.5	52	42.3	37.2	36.7	34.8
		47.5	72.2	50.6	48.3	41.2	38.1	37.4	35
		50.4	74	56.4	52.6	43.1	37.8	37.2	34.2
		47.7	72.6	53.4	49.9	42.7	39.2	38.4	35.9
		45.7	74.4	48.6	47.2	41.9	38.7	38.2	36.4
		43.2	63.1	47.3	45.8	41.4	38.6	38.1	35.5
		44.6	69	48.7	46.9	41	37.8	37.4	35.6
	8:00	42.7	58	47	45.7	41.1	38.2	37.6	35.7
		45.3	65.3	49.9	48.2	42.6	39.1	38.4	36.5
		47.8	75.5	51.3	48.4	43.4	39.7	38.9	36.6
		45	64.6	48.2	47.2	43.5	39.4	38.2	35.7
		47.1	61.7	51.5	49.8	45.5	40.8	39.3	35.3
		54.2	78.7	56.2	51	45.6	42.3	41.7	39.7
		48.2	68.5	52.3	51.1	46.7	42.9	42.1	39.7
		50.7	77.2	51.8	50	45.2	40.8	40	37.6
	10:00	47.7	66.2	52.1	50.9	45.4	38.5	37.8	36
		47.5	60.7	52	51.1	45.9	38.6	37.7	34.4
		48.7	63.5	53.6	51.6	46.4	42.8	41.9	36.9
		48.6	68.9	52.5	51	46.3	41.4	40.6	37.4
		51	71.2	55.5	52.6	45.6	40.7	39.4	36.3
		48.8	61.4	52.9	51.9	47.5	42.2	40.2	35.1
		47.1	59.4	51.4	50.2	46.1	39.9	38.4	33.9
		47.3	58.3	51.7	50.5	45.8	39.5	38.4	35.7
	12:00	46.1	58.8	50.4	49.1	44.8	41	39.9	36.2
		45.6	61.3	51.2	49.5	43.1	38.3	37	34.2
		49.2	68.8	53.2	50.7	45.8	42.6	41.3	36.5
		43.1	55.6	47.2	46.3	41.8	38.7	38.1	35.6
		44.4	64.8	48.5	47	42.4	37.7	36.8	32.3
		44.5	59.7	49.7	48.4	42.7	36	35	31.5
		45	69	48.5	46.9	41.7	37.9	37.5	35.6
		44.4	59.1	49	47.9	42.4	37.9	36.6	33.7
	14:00	43.8	57.2	48.6	47.5	41.7	35.1	34.3	31.6
		43.2	59.7	47.6	45.8	40.8	36.4	35	31.5
		46.5	68.1	51.6	48.3	41.6	37	36	33.8
		45.7	76.9	48.4	46.9	41.5	38	37.2	34.7

		49.8	67.8	54.7	52.4	45.7	42.7	41.5	36.2
		49	64.4	55.3	52.2	45.9	42	40.7	34.2
		43.9	59.7	48.8	47.4	41.5	35	33.9	30.6
		40.9	62.7	46.3	44.4	38.1	34	33.1	30.5
	16:00	43.8	70.9	49.2	46.6	38.1	33.3	32.6	29.4
		43.9	69.5	49.9	45.9	37.2	32.2	31.6	30
		42.1	59.8	48.4	46.3	37.4	32.9	32.3	30.1
		39.3	57.3	45.5	43.4	34.6	30.9	30.5	28.8
		43.4	67.9	48.6	46.5	39.4	35.1	34.6	33.1
		48.9	71.5	55.7	48.6	38.5	33.9	33.1	29.8
		49.8	76.6	52.8	48.5	40.4	36.5	36	34.1
		43.9	58.1	48.2	47.1	42.4	38.9	38.4	36.6
	18:00	48.4	74.8	53.3	50.9	43.4	38.9	38.5	36.2
		44.5	61.9	48.7	46.9	42.6	40.1	39.5	37.6
		45.3	68.7	48.4	46.4	40.7	37.9	37.6	35.3
		50.7	73.7	50.7	48.6	42	38.8	38	35.3
		48.6	65.3	51.9	51.1	48.2	44	43.3	38.8
		54	59	55.5	55.2	54.2	52.2	51.1	38.4
		54.1	58.8	55.4	55.1	54.1	52.9	52.5	39.4
		51.9	70	53.2	52.9	51.9	50.1	49.1	40.7
	20:00	42.5	56.8	45.9	44.7	41.5	38.3	38	36.6
		40.3	54.1	44.8	42.1	38.5	35.6	35.1	33.7
		37.6	52.6	41.3	39	36.5	35.3	35	33.3
		38.8	54.7	43.4	41	36.4	34.5	34.2	32.5
		39	55.5	44.2	41.9	35.7	33.4	32.9	31.2
		35.4	52.7	38.9	37.2	34	31.8	31.2	29.1
		37.9	55.4	43.2	40.7	34.6	32.5	32	30.2
		37	55.2	41.4	39.4	34.8	32.5	32.2	30
	22:00	47	66.6	50.1	44.2	35.5	33	32.6	31
		37.2	56.8	41.1	39.6	35.1	33.3	32.9	30.5
		41.7	61.9	45.8	42.1	35.9	34.6	34.4	33
		35.3	50.4	37.1	35.5	34	33.4	33.3	32.3
		36.8	54.7	39.8	38.7	34.7	33.6	33.4	32.3
		38.1	56.5	43.2	40	35.7	34.5	34.2	32.6
		45	65	49.3	44.4	36.3	35.2	35	33.2
		35.9	46.5	39.3	38.2	35.1	33.3	33	31.8
26/10/2019	0:00	37.5	58.8	38.8	35.6	33.4	32.5	32.3	31.1
		33.9	41.7	36.7	35.3	33.4	32.6	32.5	31.3
		32.8	48.4	37	35.7	31.3	29.5	29.1	27.3
		33.8	43.7	39	36.7	32.1	30.3	29.6	28
		34.8	50.7	39.2	37.4	32.1	29.7	29.3	27.7
		34.2	47	38.7	36.7	32.9	29.5	28.8	27.1
		34.4	50.6	37.5	36.8	33.8	31	30.6	29
		34.6	45.4	38.6	37.5	33.6	29.2	28.4	26.1
	2:00	29.3	49.1	32.5	31.7	28.5	26.1	25.6	23.9
		30.8	47.8	33	32.2	30.6	28.2	27.2	24.1
		29.9	47.7	31.7	31.2	27.8	26.7	26.5	25.2
		30.1	46.2	32.1	30.6	28.5	27.4	27.1	25.9
		30.9	48.7	33.8	32.9	30.3	28.4	28.1	26.1
		31.8	51.2	35.4	33.9	30.5	28.2	27.8	26
		31.6	51.5	34.6	33.3	29.1	26.8	26.5	24.7
		34.4	50.2	37.8	36.9	33.9	30.8	30.4	28.8
	4:00	34.8	52.4	41.5	38.3	31.4	27.4	26.3	24.1
		49.8	70.1	55.2	51	41.8	37.5	36.5	33.4
		55	65.7	60.1	58.7	52.5	48.1	46.5	44.5
		42.7	55.2	50.1	47.1	35.6	28.5	27.9	24.9

		28.7	41.2	33	31.4	27.4	25.5	25.1	24
		40.2	55.5	48.2	45.2	33.2	29.8	29.2	27.2
		47.4	60.7	52.6	50.9	45.6	39.2	37.2	29.8
		54.1	80.8	58.4	55	36	30.1	29.7	27.3
	6:00	57.1	81.9	62.4	57.2	41.5	36.1	35.4	30.6
		46.7	69.6	53.4	49.6	41.5	38	37.3	34.5
		52.6	76.1	54.1	49.8	40.5	36.8	35.6	32.4
		46.2	73.8	50	45.7	37.5	33.8	33	30.6
		47.3	76.5	50.2	46.7	39.1	34	33.2	31.2
		47.2	69.4	52.2	49	44.3	39.9	39.1	35.9
		46.4	70.7	50.8	48.4	42.9	38.8	38.3	35.6
		46.8	67.2	50.7	49.6	44.9	41.2	40.6	37.9
	8:00	45.9	66	49.9	48.6	43.1	38.9	38.2	35.2
		45.3	64	49.3	47.7	42.3	39.3	38.6	36.4
		45.4	69.1	48.9	47.7	44.2	40.7	39.7	36.3
		46.7	74.8	51.6	48.5	40.2	36	35.4	33.3
		51.3	79.7	57.1	51.4	44.8	39.8	38.9	34.8
		44.2	61.3	48.9	47.4	41.8	37.1	36.1	33.1
		44.9	63.4	49.6	47.6	41.8	39	38.4	36.1
		44.7	69.5	48.9	46.3	40.1	36.9	36.4	34.7
	10:00	49.6	66.8	54.8	53.1	47.3	42.8	41.8	38.6
		50.1	64.9	54.5	53	48.8	45	43.7	40.5
		51.8	67.1	56.9	54.7	49.6	45.9	45	40.5
		51	69.5	57.6	54.1	47.3	42.6	41.4	38.8
		52.9	69.8	60.3	57.4	47.4	41.6	40.4	37.1
		60	70.8	66	63.7	56.3	49.7	48.3	42.9
		57.1	76.9	62.9	60.7	52.8	48.1	47.2	44.2
		58.1	73.1	64.1	62.1	53.4	48.3	47.1	43.1
	12:00	56.3	69.8	63.7	61.3	48.9	44.4	43.3	40.1
		59.8	68.7	65.5	64.2	56.7	50.2	48.8	44.2
		60.1	70.1	65.4	64.3	57.7	51.7	49.8	44.7
		60.3	71.4	67	64.1	56.7	50.7	49.5	45.9
		62.7	71	68.6	67.2	59.8	52.4	50.9	46.4
		58.3	68.4	64.2	62.2	55.9	49.4	47.8	44
		56.8	65.6	61.7	60.2	55.3	49.8	48.6	44.7
		56.4	76.8	60	57.4	51.6	47.2	46.3	42.3
	14:00	54.9	66.4	60.6	58.3	52	45.3	44	36.4
		62.2	72.6	67.9	66	59.5	52.5	50.9	45.6
		57.7	70.9	62.8	61.2	55.2	50.2	48.7	44.1
		55.8	69.7	62.9	58.2	50.8	46.6	45.3	42.1
		53.6	69.5	58.9	57.6	51.1	45.3	43.6	40
		56	68.2	61.7	60.3	53.5	47.6	46.3	42.9
		62.2	87.2	62.2	59.9	50.3	42.1	40.9	37.8
		55.8	71.8	61.2	59.6	53.2	47.9	45.6	42
	16:00	58.8	67	64	62.9	56.6	47.8	45.7	42.3
		56.8	66.9	61	59.7	55.6	51	50.1	48
		51.9	66.7	56.7	54.8	50.1	44.8	43.8	40
		57	70.8	61.7	59.9	55.3	50.9	49.8	45.2
		60.5	72.8	66.2	64.4	57.3	52.5	51	45.4
		57	67.3	63.1	61.6	53.9	48	46.4	43
		57.5	68.2	62.3	60.9	55.2	49.4	47	43.3
		55.9	64.6	60.9	59.4	54.1	48.4	47.5	44.3
	18:00	57.9	70.4	63.5	61.7	53.7	46.5	45.5	42.3
		53.9	74.2	60.8	58.4	48.8	41.6	39.9	37.1
		51.5	67.4	56.8	55.4	49.4	42.5	40.6	37.4
		52.2	78	56.9	55	49.6	44.2	42.6	38.8

		49.1	59.4	54.5	53.2	46.5	40.8	39.1	34.7
		49	67.8	54	52	45.6	40.9	40.1	36.3
		52.6	64.1	57.9	55.8	50.5	43.1	41.4	36.4
		44.9	56.1	50.4	48	42.9	39.4	39	36.4
	20:00	48.8	58.9	54.8	53.4	45	41.1	40.4	37.8
		46.7	55.7	52.4	50.9	44.2	37.8	37	35.1
		44.7	54.9	49.8	47.8	42.1	37.6	36	32.8
		39.5	56.7	45.1	43.4	36.2	32.7	32.2	29.4
		37.3	52	42.2	40.4	34	30.7	30	28
		34.8	53	39.5	37.5	32.6	30.4	29.9	27.8
		37.9	58.3	42	38.6	33.5	30.3	29.8	27.5
		40.6	60.4	47.4	43	32.6	30.4	30	27.7
	22:00	37.3	59.2	42	39.7	35.8	33.4	33.1	31.2
		43.7	56.2	48.4	47	42	37.3	36.6	34.7
		42.8	70.5	40.4	38.4	35.8	33.5	33.2	31.7
		37.1	55.9	40.9	38.7	35.3	33.8	33.3	31.5
		36.1	50.9	39.3	37	34.4	33.4	33.2	32.1
		36	54.8	37.9	36.9	35.3	34.2	34	32.3
		35.9	51.1	39	37.6	34.7	33.4	32.9	31.7
		41.2	65.7	39.3	36	33.6	32.8	32.6	31.4
27/10/2019	0:00	38.1	59.6	39.3	36.5	34.1	33.1	32.9	31.8
		34.2	50.3	36	35.5	33.7	32.6	32.4	31.2
		36	54.9	37.1	36	33.9	33.1	32.9	31.4
		35	48.7	36.7	36	34.5	33.2	32.7	30.9
		33.8	55.2	36.5	35.1	30.6	28.8	28.3	26.4
		31.5	50.8	34.3	32	29.1	27.1	26.7	24.9
		30	46.5	31.9	30.8	28.8	27.3	27	25.3
		31.5	44	35.2	33.8	30.4	28.5	28.1	25.6
	2:00	35.7	61.9	33.2	32.1	29.3	27.3	26.9	25.2
		32.7	46.2	34.8	34.3	32.4	30.4	29.9	27.9
		28	43.8	30.3	29.1	27.3	25.5	25.1	23.5
		28	37.3	31.2	30.2	27.3	25.2	24.9	23.2
		27.6	41.6	31.6	29.6	26.4	24.4	24	22.7
		29.3	50.1	31.1	28.9	26	24.5	24.2	22.5
		27.9	47.4	32.9	29.9	25.7	24.1	23.8	22.3
		29.2	41.4	33.5	31.3	28	25.9	25.4	22.9
	4:00	28.9	42.5	31.7	30.9	28	26.4	26	24.1
		31	49.4	34	33	30.3	28.2	27.9	26.1
		30	48.2	32.8	31.7	29.1	27.3	27	25.4
		28.9	43.8	31.5	30.8	28.4	27	26.8	24.8
		32.1	45	35.9	33.9	30.5	28.3	27.8	26.2
		43.1	60.2	50.4	47.8	34	30.4	30	27.6
		48.2	65.5	55.6	52.8	39.5	32.2	31.6	28.3
		52.2	73.1	58.2	52.5	39.6	33.1	32.5	29.4
	6:00	50.5	77	53	50	39.6	33.2	32.5	29.3
		44.3	68.4	49.2	45.4	37.1	33.6	32.3	29
		46.1	66.8	54.2	50.4	37	32.3	31.9	28.7
		52.1	74.7	59.3	50.5	39.2	36.3	35.7	31
		45.6	69.9	52.7	49.6	38.3	36.1	35.8	33.2
		44.8	66.7	51.5	48.3	38.6	36	35.4	33.6
		42	62.6	46.4	44.4	38.6	36.5	36	33.9
		46.1	75.3	51.6	48.1	39.1	36.2	35.5	33.2
	8:00	53.6	71.2	60.5	56.8	41.1	35.8	35.2	33.3
		49.1	70.2	53	49.5	41.1	36.8	35.9	33.2
		47.1	66.1	52.9	50.2	43.9	37.8	37	34.4
		50.1	69.1	55	51.5	43.6	38.3	37.1	34.2

		49.3	69.1	56.2	52.6	44.1	40.6	39.4	34.8
		50	78.9	54.6	50.7	42.2	37.2	36.1	32.2
		46.6	74.6	51.5	47.8	40.8	36.8	35.9	33.4
		43.8	61.3	49.8	46.6	39.4	36.4	35.7	33.7
	10:00	45	62.7	50.9	48.3	39.3	36	35.4	33.7
		48.2	63.8	55.2	52.4	43	37.2	36.4	33.5
		49.1	68.6	56.3	52	41	35	34.5	32.8
		44.3	65.5	50.1	47.7	40	36.1	35.6	33.5
		43.2	62.5	48.4	46.2	39.8	35.3	34.9	32.9
		46.3	64.4	52.1	50	42.4	36.4	35.5	32.4
		45.7	64.4	51.6	48.5	39.6	33.1	32.1	29.3
		41.3	58.4	47.8	45.6	36.8	32.8	32.3	30.3
	12:00	43.4	69.3	48.4	46.1	37	33.4	32.9	30.8
		41.7	54.2	47	45.5	39.3	34	33	29.7
		43.4	68.7	47.8	45.7	37.6	32.9	31.8	29.2
		41.9	57.2	48.8	45.8	35.9	32.1	31.5	29.2
		46.3	67.9	50.5	47.9	40.3	35.8	34.7	30.3
		44.2	70.4	48.3	46.3	40.6	37.7	37.1	35
		51.7	78.3	55.6	53	45.6	39.8	38.9	36.3
		51.8	77.5	55.7	51.1	45.8	41.9	41.3	38.7
	14:00	43.1	58.3	47	45.5	42.1	38.9	38.2	36.1
		44.3	62.7	49.4	47.7	42.1	38.4	37.7	36.1
		49.1	69.1	52.1	50.2	44.8	39.4	38	34.3
		46.2	65.3	50.9	49.1	44.2	40.8	39.3	37
		46.9	68.6	50.5	49.4	45.8	41.7	41.1	38.6
		54.1	75.7	56.1	52.1	47.7	43.8	43.1	40.7
		50	67.4	54.1	52.6	47.7	44.1	43.5	41
		48.6	59.7	53	51.7	46.9	43.7	42.3	39.8
	16:00	48.5	63.9	53	51.7	46.8	43.4	42.4	39.1
		53	74	55.2	52.2	47.3	42.4	40.8	36.3
		49.2	67.2	54.9	53	46.8	41.1	40.4	37.3
		53.3	71.8	58.5	55.9	48.2	41.8	40.8	36.9
		49.1	80	52.5	51	45.5	40.8	40.3	38.6
		46.3	69.6	50.2	48.3	43.8	40.8	39.9	37.7
		50	72.7	53.3	51.2	45.5	41.7	41	39.4
		47.8	71.7	52.1	48.8	43.3	39	38.4	36.2
	18:00	52	78.3	57.7	55.4	46.8	41.5	40.3	37
		45.9	64.1	50	48.4	43.8	40.3	39.3	36.5
		48.6	68.9	54.3	50	43.8	40	39	36.3
		50.6	75	57.4	52.2	44	39.4	38.7	35.4
		52.2	77	60.1	55.8	42.2	38.2	37.3	34.7
		44.1	68.8	50.1	46.6	39.3	36.9	36.5	34.9
		43.4	64	50.5	44.5	37.2	35.3	35	33.7
		47.1	62.8	53.7	50.8	39.3	35.5	35.1	32.9
	20:00	42.2	67.6	47.4	45.5	36.4	34.5	34.2	32.5
		41	57.8	45.2	42.4	37	35	34.8	32.9
		39.7	54.5	44.2	42.7	37.3	35.4	35.1	33.3
		39.1	63.2	44.3	40.8	35.3	33.9	33.6	31.9
		39.5	59.5	44.9	42.6	35.4	33.7	33.4	31.8
		37.9	68.5	40.8	39.4	34.4	33.3	33	31.5
		36.4	52.8	41.1	37.9	34.1	32.7	32.4	31
		45	67.5	51.4	43.9	34.5	33.2	33	31.5
	22:00	35.2	49.1	39.9	37.2	33.8	32.2	31.9	30.5
		38.8	56.3	44.8	41.5	35.5	33.3	32.6	30.9
		35.7	43.3	37.6	37.1	35.6	34.1	33.8	32.4
		34.6	49	36.6	35.4	33.8	33.1	32.8	31.5

		35.7	54.5	39.7	36.7	33.7	32.9	32.8	31.5
		34.1	46.6	36.1	35.2	33.3	32.5	32.4	31.2
		34.5	51	36.5	35.3	33.3	32.5	32.3	30.8
		34.5	48	36.8	34.8	33.3	32.6	32.4	31.4

APPENDIX C

Acoustic Comparisons

1 Rosemead Road Hornsby NSW

Sound Levels Projected at the Community School Compared to Common Noise Events

NOISE LEVEL (dB)		THE LEVEL OF COMMON SOUNDS	PROJECTED SITE NOISE	
			OUTDOOR	INDOOR
	Threshold of Pain			
140		Jet Engine (25 metre distance) – 140 dB		
130				
120		Jet Take-Off (100 metre distance) – 120 dB		
	Extreme			
110		Rock Band		
		Chainsaws at 25 metres (104dB – 107dB) Jet Flyover at 400 metres - 105dB		
100				
	Very Noisy			
90		Pneumatic Drill		
		Heavy Truck, 40km/h, 7m distance (87dB - 90 dB) Motor Car at 7 (80dB) Motor Bikes (2-Wheel) 70dB – 92dB)		
80				
	Noisy	Average Street Traffic (40km/h, 7 metre distance)		
70				
		Lawn Mower at 30 metres 70dB Vacuum Cleaner at 3 metres - 67dB Normal Speech at 1 metre - 65dB Business Office (60dB – 65dB)		
60		Inside an Average Residence- 60dB		
	Moderate	Large Business Office 60dB (55dB – 65dB)		
50		Dishwasher – Next Room 50dB		
		Typical Living Room at Night (40dB – 45dB)		
40				
	Quiet			
		Library (30dB – 34dB)		
30		Soft Whisper at 2 metres 30dB		
		Typical Bedroom at Night (25dB – 30dB) Concert Hall Background 24dB		
20		Slight Rustling of Leaves 20dB		
	Almost Silent	Broadcast & recording Studio 16 dB		
10				
0	***Silent***	Threshold of Human Hearing		

(yellow)	External Sound Levels (dBA, LAeq)	(blue)	Internal Sound Levels (dBA, LAeq)

(Source: Australian Acoustic Association; NG Child & Associates)

APPENDIX D

Noel Child
Summary of Qualifications, Capability & Experience

1 PERSONAL DETAILS

Full Name: Noel George CHILD
Profession: Consultant in Environmental Assessment and Management
Date of Birth: 6th December 1946
Nationality: Australian
Experience: > 30 Years
Address: 22 Britannia Road, Castle Hill, NSW, 2154
Contact: **Phone**: 61 2 9899 1968 **Fax**: 61 2 9899 1797 **Mobile:** 0409 393024

2 CAPABILITY AND EXPERIENCE - SHORT SUMMARY

Noel Child is a successful and experienced commercial and technical professional with over 30 years' experience in a variety of senior level appointments and assignments, within both the corporate and private sectors, with a particular focus on strategic, infrastructure and environmental applications.

Noel's experience includes senior management at both the State and National levels in the Australian petroleum industry, and a number of senior consultancies for both government and corporate clients. His record reflects the ability to develop and achieve positive commercial outcomes through effective planning and communication; critical and objective analysis; and quality task completion and delivery at both the personal and team level.

His management responsibilities have included transport, environmental, safety, and general operational activities at a national level, while his formal professional training includes strategic management, environmental, engineering and business disciplines. He has undertaken a number of senior corporate appointments with distinction and been successfully involved in the ownership and operation of a major petroleum distribution and marketing company in regional Australia. More recently, working through his own businesses Environment Australia and NG Child & Associates, he has applied his knowledge and experience in the areas of strategic management, infrastructure development, energy and the environment on a consultancy and contractual basis to a number of private and public-sector clients, both nationally and internationally.

Noel has had post-graduate training in several technical and commercial disciplines, and provides specialised teaching input, by invitation, to post graduate engineering and business management courses conducted by the Faculties of Business and Engineering at Sydney's University of Technology. He has strong affiliations with a number of international corporations and agencies and has worked closely with both the regulators and the regulated in a number of aspects of environmental management, assessment and performance. He has also been recognised as an independent expert on engineering, and environmental issues by the Land and Environment Court of NSW.

Noel has a detailed understanding of environmental engineering and associated processes and has specific experience and expertise in the fields of acoustics, air quality, electromagnetic field assessment, electrolysis and stray current assessment, contaminated site assessment, and liquid and solid waste management. He also provides post graduate teaching input on environmental engineering issues to post graduate courses at the University of Technology, Sydney, and La Trobe and Monash Universities in Melbourne.

3 EDUCATION, QUALIFICATIONS AND AFFILIATIONS

BE, PhD (Chemical Engineering), UNSW, Sydney
Master of Business Studies, University of New South Wales, Sydney
B.Sc. (Hons) Applied Chemistry (Environmental), University of Technology, Sydney
Graduate Diploma (Environmental Engineering and Management), UNSW, Sydney
Qualified Environmental Auditor, Standards Australia
Member, Royal Australian Chemical Institute, 1972/2020
Member, Institution of Engineers, Australia, 1972/2020
Member, Clean Air Society of Australia and New Zealand, 1992/2020
Member, Australian Natural Gas Vehicle Council, 1996/2004
Executive Director, Australasian Natural Gas Vehicles Council, 2003/2004
Visiting Fellow, Institute for Sustainable Futures, UTS, 1995/2002
Research Fellow, Faculty of Civil & Environmental Engineering, UTS, 1996/2020
Research Associate, New York Academy of Sciences, 2000/2020

4 RECENT ASSIGNMENTS & EXPERIENCE

Kaunitz Yeung Architecture (2016) – Electromagnetic field and air quality assessments of a childcare centre development project at 60 Dickson Avenue Artarmon NSW.

Australian Consulting Architects (Current) – Electromagnetic, stray current and electrolysis assessments of development projects a Field Place Telopea; Windsor Road Vineyard; Camden Valley way Horningsea Park and others.

Futurespace/Renascent (Current) – Environmental assessment of proposed childcare centre development at Waterloo Road Macquarie park and Cleveland Street Strawberry Hills, including general environmental, acoustic assessment, air quality and electromagnetic field assessment.

Thyssen Transrapid Australia (Current) – Adviser on technical and operational issues associated with the development and construction of a high-speed magnetic levitation train systems within the People's Republic of China, and elsewhere, including electrolysis, electromagnetic and stray field effects.

Trumen Corporation (Current) – Environmental assessment, including acoustic and contamination assessment and certification, of mixed use and childcare centre development projects at Waine Street Freshwater, Fitzroy Street Marrickville, and at Huntley Street Alexandria, NSW.

Commonwealth Bank (Current) – Environmental assessment, including general, acoustic, air quality, electromagnetic field and wind impact assessment, of a new childcare centre development to be located on Level 2 of Darling Park Power 2, Sussex Street, Sydney.

First Impressions Property – Environmental assessment of a proposed childcare centre at Ralph Street Alexandria NSW, including Preliminary (Stage 1) Site Contamination Assessment, and Electromagnetic Field Assessment.

LEDA Holdings – Environmental Assessment of a proposed childcare centre at 32 Cawarra Road Caringbah NSW, including general environmental, acoustic, air quality and electromagnetic field assessments.

Universal Property Group (Current) – Environmental assessment of a proposed multi building, multi-level residential development at Garfield Street, Wentworthville NSW, including general environmental, site and soil contamination and preliminary geotechnical assessments.

McCormack (Current) – Stage 2, 3 and 4 Environmental Site Assessment of 7,9 & 11 Bayard Street, Mortlake, NSW as part of the process of assessing the site for medium density residential development and obtaining a site audit statement confirming the suitability of the site for this purpose. Work inclusive of the assessment of all relevant environmental impacts.

Gundagai Meat Processors (Current) – Review and enhancement of solid and liquid waste processing and management systems at GMP's Gundagai abattoir, including the on-site treatment of waste streams from meat processing and other operations.

Campbelltown City Council (Current) – Peer review of acoustic assessments submitted to Campbelltown City Council regarding assessment of the acoustic impacts of proposed developments including a major truck maintenance facility and the expansion of Macarthur Square shopping centre, including the conduct of noise measurements.

Brenchley Architects (2009 - Current) – Acoustic assessments of proposed residential and commercial developments at Elizabeth Street Sydney; Spit Road Mosman, Botany Road Waterloo, Cranbrook Street, Botany and Bellevue Hill Road, Bellevue Hill NSW.

BJB Design (2009 - Current) – Acoustic, air quality and odour assessments of residential and commercial developments at Botany Road, Botany and Cranbrook Street Botany.

Bovis Lend Lease (Current) – Environmental assessment of a major development site at Darling Walk, Darling Harbour NSW, including a detailed review of air quality, electromagnetic field and acoustic issues for review by the NSW Department of Planning.

Penrith City Council (2012/13) – Preparation of the Penrith City Council response to the NSW Government Long Term Transport Plan, including consideration of transport and associated environmental issues affecting the Penrith Local Government Area.

Harry Azoulay & Michael Bell Architects (2012) – Assessment of the environmental impacts on and from a proposed childcare and early learning centre at Chatswood, NSW. Assessments lodged with and adopted by Willoughby City Council.

Wollondilly Shire Council (2012) – Preliminary environmental assessment and review of the proposed development of a second Sydney airport at Wilton, including a preliminary assessment of acoustic impacts.

White Horse Coffee (2011) – Air quality and odour assessment regarding a boutique coffee roasting and drying operation at 7/3-11 Flora Street, Kirrawee, and NSW.

Sydney Skips & Galaxy Waste (Current) – Environmental assessment of a proposed waste recycling facility to be located on a potentially contaminated site at Stephen Road, Botany, NSW, including a detailed review of all relevant engineering and environmental issues, and the preparation of relevant documentation including assessment reports for review by Botany City Council.

Michael Bell Architects & Clients (2004 to Current) – Assessment of the environmental impacts, including acoustic impacts, associated with various childcare centre applications in suburban Sydney, and the Sydney CBD, including the development of plans for the management and control of such impacts.

ABC Learning Centres Pty Ltd (2005 - Current) – Provision of professional services re the environmental assessment of prospective childcare centre developments, including issues relating to acoustics, air quality, odour, soil, and groundwater contamination.

NSW Roads & Traffic Authority (2004 to Current) – Review of international technologies, systems & applications in relation to the treatment of motor vehicle exhaust emissions and associated air pollution within and discharged from road tunnels, in accordance with the conditions of approval for the M5 East Motorway

Federal Airports Corporation (1995/1996) – Preliminary environmental and ground transport studies for the proposed Sydney West Airport, including consideration of all relevant environmental issues.

Isuzu-GM (2003 to Current) – Representations to Environment Australia and the Department of Transport and regional Services regarding the emission performance standards of Japanese sourced medium and heavy natural gas trucks, with the aim of having the current Japanese emission standard accepted within the Australian design Rule 80 series of vehicle emission standards.

City of Sydney (2005 - 2007) – Assessment of air quality and odour issues associated with a proposed redevelopment of craft studios and associated facilities at Fox Studios, Moore Park, Sydney, and review of air quality monitoring stations in the Sydney CBD area, in part as a basis for monitoring the air quality and potential health cost impacts of transport congestion and modes.

Warren Centre for Advanced Engineering, University of Sydney (2000 to 2003) – Contribution to the report "Sustainable Transport for Sustainable Cities", a major government and private enterprise funded study into the future sustainability of transport in Sydney and adjoining regions, including in particular a review of associated environmental issues. Study received the 2003 Bradfield Award for Engineering Excellence from the Australian Institute of Engineers.

United Kingdom Department of the Environment (1994) – Contribution to the development of revised environmental guidelines for air, soil and groundwater water quality.

United States Environmental Protection Agency (1994) - Contribution to an international team developing strategies for the control and management of air pollution in seven major US cities.

5 CORPORATE EXPERIENCE

NG Child & Associates

- **1992--Present**, Managing Principal - Responsible for all aspects of the conduct of a private engineering and environmental consultancy, including administration, marketing, team coordination and technical and professional delivery.

Western Fuel Distributions Pty Limited, Australia

- **1984-92** Managing Principal. - Responsible for all aspects of the management and development of one of the largest private petroleum distributorships then operating in Australia, with a peak annual sales volume of 70 million litres, turnover of $30 million per annum, a direct staff of thirty, and a network of some 40 retail and wholesale agency outlets. This position included direct personal accountability for all aspects of storage, distribution and environmental performance.

Caltex Oil Australia Limited

- **1982-84** General Manager, Marketing and Operations. Responsible for the management and operation of Caltex Australia's marketing, storage, warehousing, distribution, environmental and safety functions, including seaboard terminal and marine operations.
- **1980-82** National Consumer Marketing Manager. Responsible for Caltex Australia's national consumer, industrial and distributor marketing activities.

Golden Fleece Petroleum Limited

- **1977 - 1980** Manager Operations, NSW. Responsible for the overall management of the distribution, warehousing, seaboard terminal and lubricant production activities of Golden Fleece Petroleum in New South Wales, including environmental, occupational health and safety matters.

Esso Australia Limited

- **1976-77** SA Manager, Marketing and Operations. Responsible for all aspects of the management of Esso's petroleum, lubricant and LPG storage, distribution and marketing throughout South Australia.
- **1975-76** Refinery Manager. Responsible for all engineering, operational and environmental aspects of the joint Esso/Mobil refinery at Port Stanvac in South Australia.
- **1975** Manager, Process Operations, Port Dixon Refinery, Malaysia. Six-month special assignment at the Esso Petroleum Refinery, Port Dixon, Malaysia.
- **1971-75** Senior Analyst, Logistics and Corporate Strategy Departments, Esso Sydney Head office.

6 SOME REPORTS & PUBLICATIONS

- **High Speed Rail – Benefits for the Nation,** Keynote address at the UNSW Institute of Environmental and Urban Studies International High Speed Rail Seminar, August 2013.
- **High Speed Trains in Australia: Connecting Cities and Energising Regions**; with the Hon Peter Nixon AO, October 2010.
- **Sydney's High Residential Growth Areas: Averting the Risk of a Transportation Underclass**, World Transport & Environmental Forum, Reims France, June 2006.
- **The M5 East Road Tunnel: Implications for Ventilation, Air Quality and Emission Treatment Systems**, International Road Transport and Tunneling Forum, Graz Austria, May 2006.
- **Transport Fuels in Australia: The Folly of Australia's Increasing Reliance on Imported Crude Oil**, Submission to the Australian Senate Rural and Regional Affairs and Transport Committee Inquiry into Australia's Future Oil Supply and Alternative Transport Fuels, February 2006.
- **The Japan 2003 CNG Emission Standard & the Emission Performance of the Isuzu 4HF-1-CNG: The Case for Acceptance under ADR80**. Submission on behalf of Isuzu GM Australia to the Commonwealth Department of Transport and Regional Services, June 2004.
- **M5 East Freeway: A Review of Emission Treatment Technologies, Systems and Applications**, NSW RTA and NSW Department of Planning, April 2004.
- **Future Directions: Challenges & Opportunities in the Australian CNG Vehicle Industry**, ANGVC, December 2002
- **High Speed Rail in Australia: Beyond 2000** (with the Hon Peter Nixon), November 2000
- **Review of Options for the Treatment or "Filtration" of Tunnel Gases and Stack Emissions**, City of Sydney. January 2003
- **A Comparative Analysis of Energy and Greenhouse Performance: Austrans Ultras Light Rail System**, Bishop Austrans Limited, January 2003
- **Engineering and Environmental Aspects of Enclosing the Cahill Expressway Cutting**, City of Sydney, May 2001.
- **M5 East Motorway: Proposed Single Emission Stack at Turrella – Review of Air Quality Impacts and Consideration of Alternative Strategies**, Canterbury City Council, February 1999

7 PERSONAL & PROFESSIONAL REFERENCES

- The Hon Peter Nixon AO, Former Federal Transport Minister
- John Black, Professor Emeritus of Civil & Transport Engineering, University of NSW
- Mr Stephen Lye, Development Manager, Trumen Corporation, Sydney.
- Mr Peter Han, Project Director, Commonwealth Bank, Sydney
- Mr Michael Bell, Principal, Michael Bell Architects, Sydney.
- Mr Barry Babikian, Brenchley Architects
- Mr Luke Johnson, Assistant General Manager, Wollondilly Shire Council
- Mr Bernie Clark, Chief Executive, Thyssen Australia
- Mr Alan Ezzy, Former Chairperson, NSW Flood Mitigation Authority.
- Professor Vigid Vigneswaran, Faculty of Civil & Environmental Engineering, University of Technology, Sydney.
- Mr Merv Ismay, General Manager, Holroyd City Council, Sydney NSW
- Dr Jack Mundey, Past Chairman Historic Houses Trust, Environmentalist
- Alex Mitchell, Journalist

Noel G Child
6 May 20020

ATTACHMENT A
Client Reference List

Acre Woods Childcare Pty Ltd
Australian Commonwealth Environmental Protection Agency
Australian Consulting Architects
Australian Federal Airports Corporation
Australian Federal Department of Transport and Regional Development
Bovis Lend Lease
Brenchley Architects
Campbelltown City Council
Canterbury City Council, Sydney, NSW
Commonwealth Banking Corporation
Environment Protection Authority of NSW
Exxon Chemical
Fairfield City Council, Sydney, NSW
First Impressions Property
FreightCorp, Sydney, NSW
Futurespace
GM - Isuzu
Guangxi Environment Protection Bureau
Gundagai Meat Processors
Hong Kong Department of the Environment
Hornsby and Ku-ring-gai Councils, Sydney, NSW
John McCormack
Kaunitz Yeung Architecture
LEDA Holdings
Michael Bell Architects
Minter Ellison
Mobil Oil Australia, Associated
NSW Roads & Traffic Authority
Ove Arup & Partners
Qantas Airways
Queensland Ports Corporation
Renascent
Salibeau Pty Ltd
Shell Australia
Sinclair Knight Merz
Skouras and Mabrokardatos
Southern Sydney Regional Organisation of Councils (SSROC)
State Rail Authority of NSW
Stephen Davidson Property Investments
Sydney Skips & Galaxy Waste
The City of Sydney
The Western Sydney Alliance of Mayors
Thyssen Krup Transrapid Australia
Tom Howard QC
Trumen Corporation
UK Department of the Environment
United States Environment Protection Agency
University of Technology, Sydney
Warren Centre for Advanced Engineering, University of Sydney
Waverley Council, Sydney, NSW
Western Sydney Parklands Trust