ACOUSTIC ASSESSMENT

Proposed Subdivision & Boarding House Development

31-32 Park Avenue Kingswood NSW

Proposal for the Provision of Professional Services To:

Mr Eltin Miletic

Miletic-Mieler Development Consultants Pty Ltd

Proposal By:

NG Child & Associates

2 November 2020

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DOCUMENT CONTROL REGISTER

Project Reference	CA/20/172/2001
Project Name	Acoustic Assessment for the Proposed Subdivision and Boarding House Development at 31-32 Park Avenue Kingswood NSW
Document Title	Proposal to Undertake Acoustic Assessment: Subdivision & Boarding House Development 31-32 Park Avenue Kingswood NSW (Version 1: March 24th, 2020)
Document Reference	Park Avenue – Acoustic Assessment Proposal (Version 1) – 061020.docx
Issue Type	Electronic
Attention	Eltin Miletic

Version	Date	Document Reference	Prepared By	Checked By	Approved By
1	6 October 2020	Park Avenue – Acoustic Assessment Proposal (Version 1) – 061020.docx	NGC	HMC	NGC

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EXECUTIVE SUMMARY

This report presents an updated acoustic assessment of a proposed boarding house development in four buildings at 31-32 Park Avenue Kingswood NSW, taking into account the latest design, plans and drawings for the proposed development.

The assessment has been undertaken in accordance with relevant acoustic requirements, standards and guidelines.

KEY FINDINGS

The key findings of this assessment are that:

- In relation to acoustic matters, it is our professional opinion, based on a consideration of the various plans and drawings describing the project; subject to the adoption and implementation of the various recommendations presented in this report, and summarised below, that indoor sound levels associated with the proposed development will comply with the most stringent applicable internal noise guidelines, namely that background sound levels no greater than 35 dBA will be achievable in all bedrooms during the 10:00pm to 7:00am night-time period, and background sound levels no greater than 40 dBA will be achievable in all other habitable rooms within the development, at all times; and

- The development as proposed, once again subject to the adoption and implementation of the various recommendations presented in this report and summarised below, will have no inappropriate or non-compliant acoustic impact on any potentially affected receivers, including in particular nearby residential receivers.

RECOMMENDATIONS

The following recommendations, which are identified in the text of this report, are made to ensure the compliance of internal acoustics with the relevant guidelines and requirements:

1. **External Glazing - Windows:** Glass with a minimum acoustic rating equivalent to 6.38mm laminated glass is used in all external window and door systems on the southern or Park Avenue building facades. All other external glazing to involve glass with a minimum acoustic rating equivalent to 6 mm float glass.

2. **External Glazing – Acoustic Sealing:** External window and door frames should be sealed into façade openings using a polyurethane sealant such as “Bostik Fireban One”, or equivalent, and acoustic seals (such as Schlegel Q-Lon or equivalent) should be used to provide additional acoustic protection.

3. **Internal Walls:** Internal walls, including inter tenancy walls, should be constructed and installed in accordance with the summary details included in this report, and in accordance with relevant BCA acoustic guidelines. Inter-tenancy walls are required by relevant BCA guidelines to have an Rw + Ctr rating of at least 50 Rw dBA, and structural materials offering an Rw + Ctr greater than 50 Rw are recommended.

4. **Floors:** Floor slab construction to be of minimum 200 mm reinforced concrete with density greater than 2200 kg/m^3 with suspended plasterboard ceiling below, to achieve an Rw+Ctr in excess of 50. The use of resilient hung ceilings is recommended where hard floor finishes are proposed above the slab. For carpet floor coverings within all living spaces and bedrooms, the use of standard carpet underlay is expected to meet floor impact isolation requirements. Hard floor coverings are proposed for wet areas such as kitchens, bathrooms, and laundries. It is recommended that any ceramic tiles included in the development are laid on top of 10 mm thick “Embelton ImpactaMat” acoustic underlay (or equivalent), in order to ensure that the required floor impact isolation requirements are achieved.

5. **Services:** Internal services should be fitted with acoustic insulation as detailed in this report, and in accordance with relevant BCA requirements.

6. **BCA Requirements:** Standard BCA and other internal acoustic design and construction considerations, including but not limited to those summarised in Section 5.5.7 and Appendix A of this report, are applied to all aspects of the construction of the various residential units within the proposed development;

7. **Plant & Equipment:** Any mechanical plant and equipment required for the development will be specified and/or designed and installed such that acoustic noise emissions are consistent with the internal acoustic environments required, and that any penetrations from ductwork and/or pipework will not reduce the acoustic performance of other building design features;

8. **Noise Emissions from Plant & Equipment:** Plant and equipment used in association with the development should be selected, sited and installed so that acoustic impacts do not exceed the measured background LA90 noise level by more than 5 dBA at any property boundary.

9. **Acoustic Certification:** Appropriate certification and validation of the acoustic performance of any plant and equipment associated with the proposed development is provided prior to construction, and prior to occupation, as reasonably required;

10. **Boundary Fencing & Landscaping:** Boundary fencing with an Rw rating of 20 (minimum), such as solid form metal panel fencing, is installed on the eastern and northern property boundaries, to ensure that any noise emissions from the proposed development will not exceed existing measured background LA90 sound levels by more than 5 dBA at any residential property boundary. No specific acoustic performance is required from the fencing along the western property boundary, but a continuation of the type of fencing used on other property boundaries may be considered;

11. **Noise Management Plan – Construction:** A noise management and control plan will need to be developed and applied to the construction phase of the proposed development, in accordance with established procedures and practices; and

12. **Facility Management Plan – Ongoing Operation:** The overall management plan for the facility should include specific reference to practical and achievable noise management controls, including guidelines regarding noise management and minimisation in any communal areas associated with the proposed development.

All materials or material types mentioned in this report have been suggested solely on the basis of acoustic performance. Any other properties of these materials, including fire rating and chemical properties should be checked with the suppliers or other specialised bodies to ensure fitness for non-acoustic purposes. Any specific material brands or types mentioned in this report have been mentioned as a guide to acoustic properties, and not as a recommendation, and that a range of products may be available that can deliver the acoustic performance required.

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2 November 2020

1 INTRODUCTION

Miletic-Mieler Development Consultants Pty Ltd (Miletic-Mieler) is involved in a prospective sub-division and boarding house development at 31-32 Park Avenue Kingswood NSW.

Miletic-Mieler has engaged NG Child & Associates undertake the acoustic assessment required for the Development Application submission associated with the project.

NG Child & Associates has considerable experience in the evaluation and assessment of residential developments

Noel Child of NG Child & Associates is a suitably qualified and experienced person to undertake the various assessments required. His CV has been included for reference at Appendix E.

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

2 SITE & ASSESSMENT DETAILS

2.1 LOCATION

The location of 31-32 Park Avenue Kingswood is shown highlighted in blue in Figure 2.1 below. The direction of north is towards the top of the diagram, and an approximate indication of scale is included below.

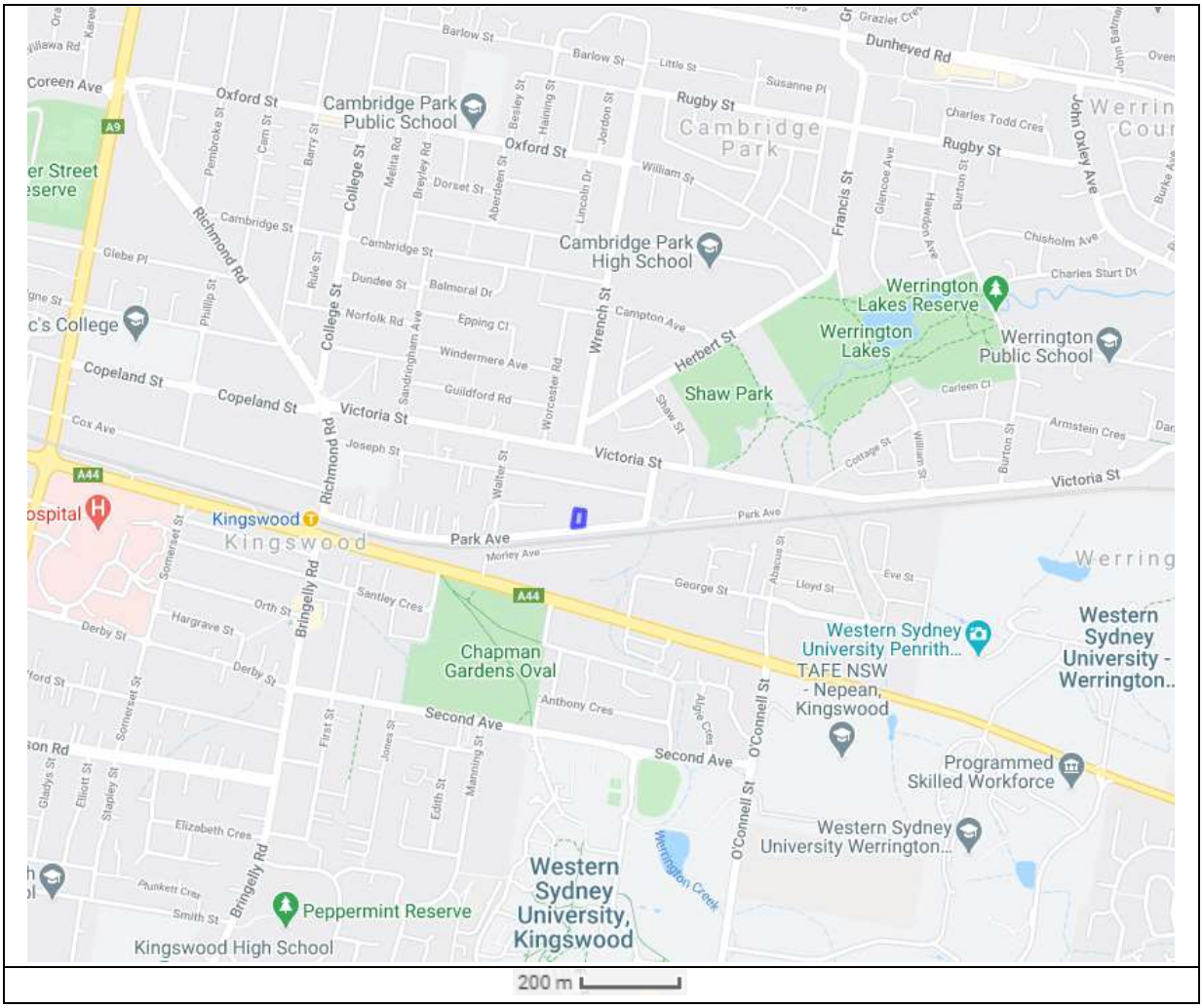

Figure 2.1 – Location of 31-32 Park Avenue Kingswood

A recent (October 1st, 2020) satellite photograph of the site is provided in Figure 2.2, below.

Figure 2.2 – Satellite Photograph of 31-32 Park Avenue Kingswood (October 1st, 2020)

The site comprises land of approximate area 1430 square metres with frontage to Park Avenue. The nearest significant thoroughfare is Park Avenue. The Great Western Highway is some 200 metres to the south.

2.2 LAND DETAILS & ZONING

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

Zoning details applicable to the site and nearby areas are provided in Figure 2.3, below, based on information available from the current Penrith Local Environment Plan.

The site is shown at the centre of the diagram. The site is zoned “R3 – Medium Density Residential”. Adjoining and nearby properties are similarly zoned.

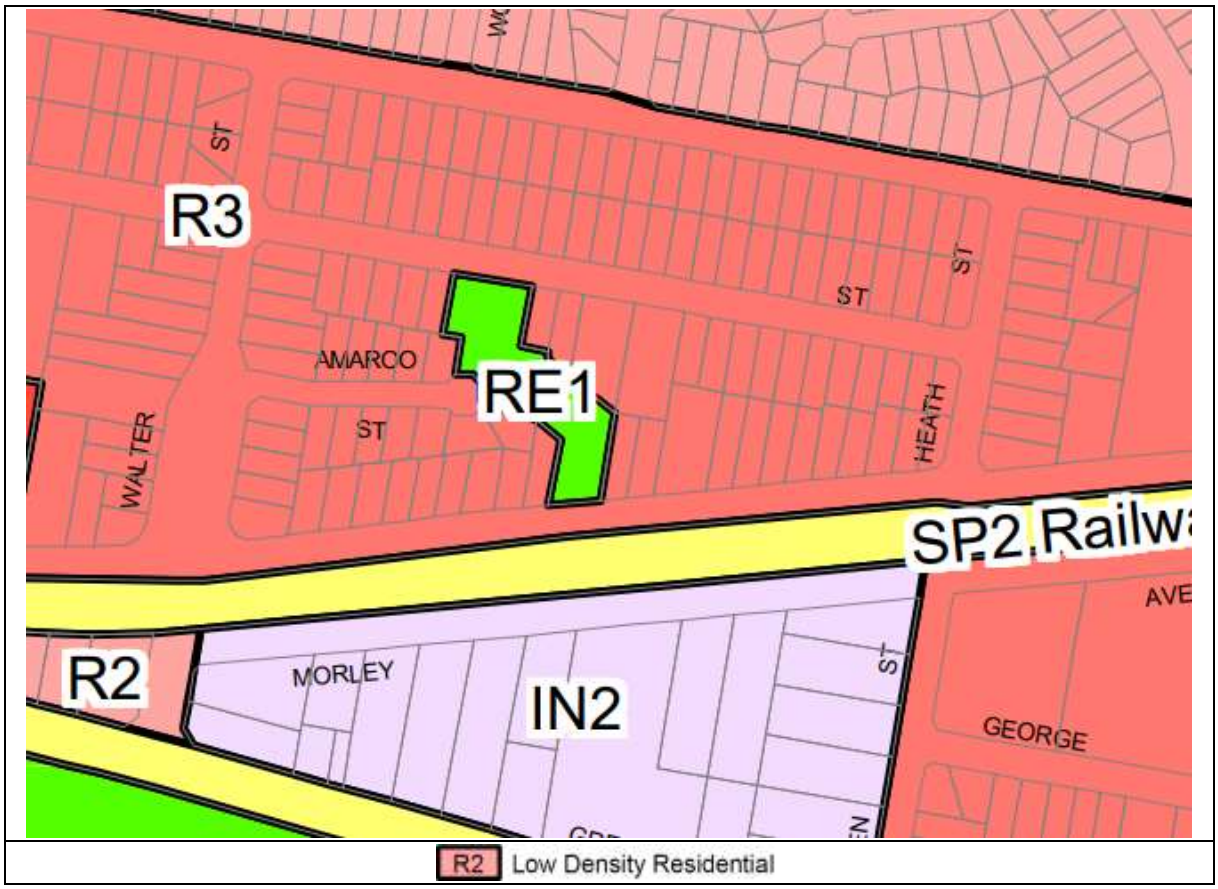

Figure 2.3 – Zoning Details

A photograph of the existing residential dwelling at the site is shown in Figure 2.4, below.

Figure 2.4 – View of the Site from Park Avenue

3 PROPOSED DEVELOPMENT

The proposed development involves the subdivision of the existing land parcel into three lots, and the development of a boarding house on each of the three proposed lots, in accordance with the plans and drawings provided in Figures 3.1 to 3.4 on subsequent pages, as follows:

Figure 3.1 Site Plan

Figure 3.2 Floor Plan Lot 1

Figure 3.3 Floor Plan Lot 2

Figure 3.4 Floor Plan Lot 3

Figure 3.1 – Site Plan

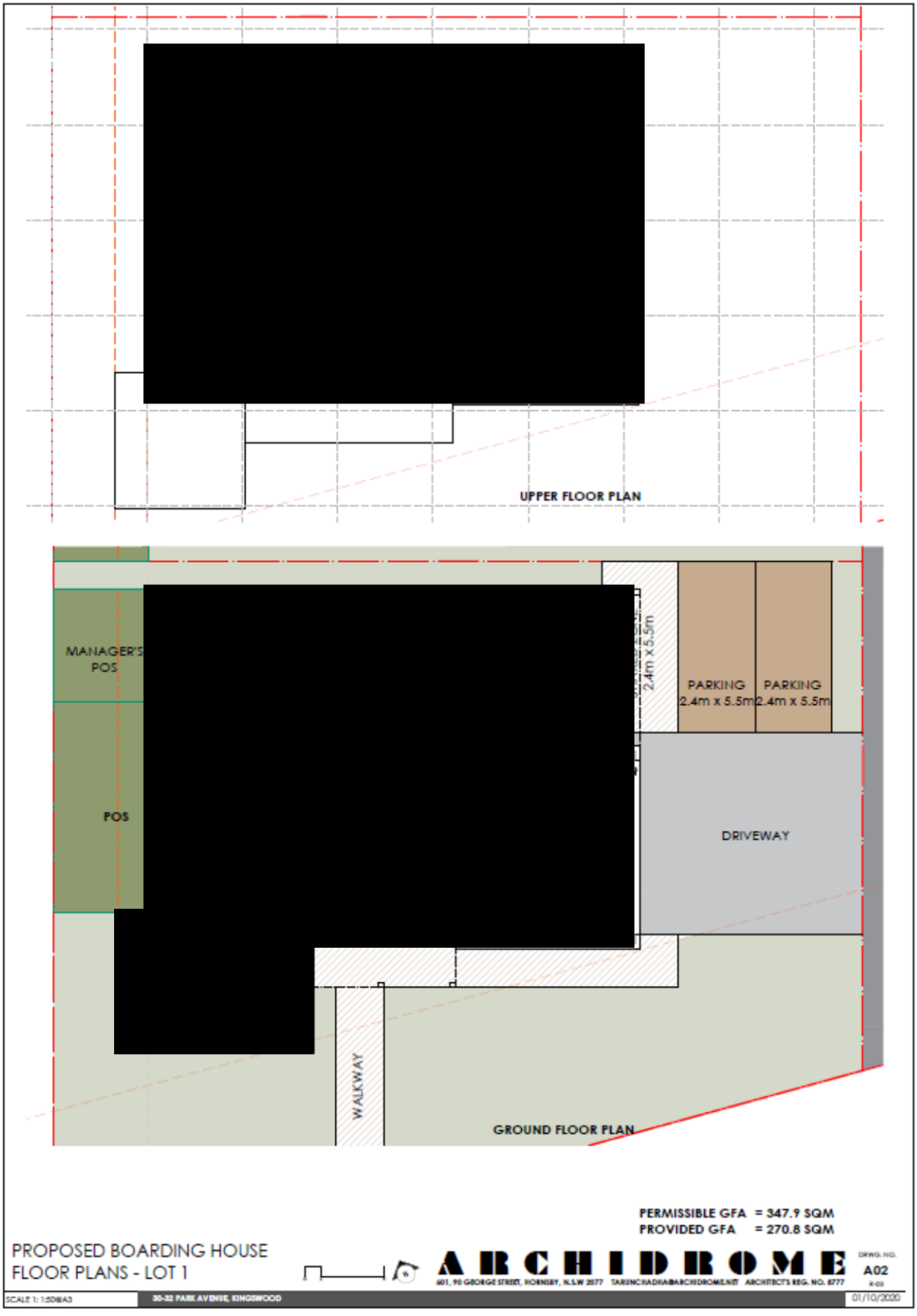

Figure 3.2 – Floor Plan Lot 1

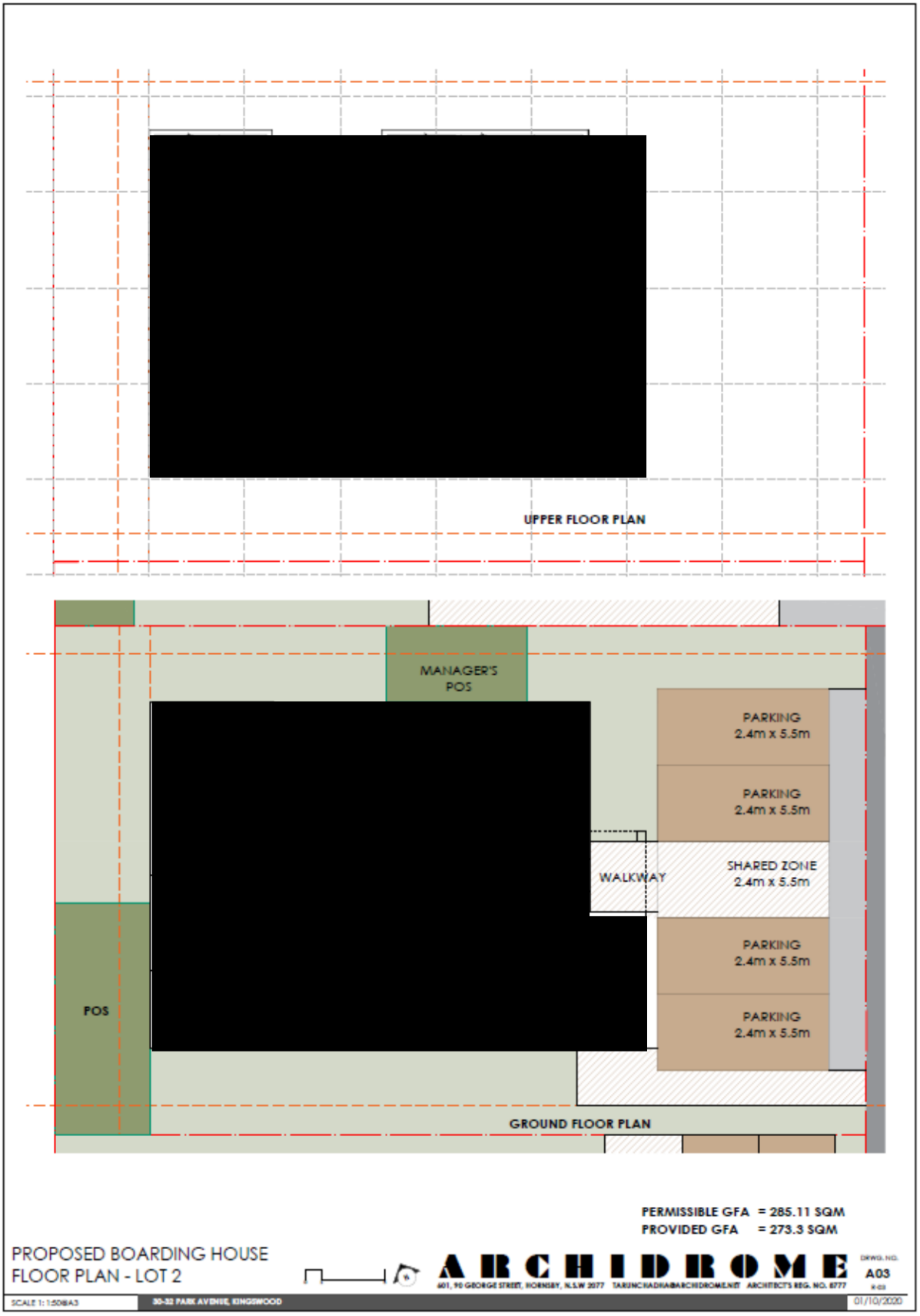

Figure 3.3 – Floor Plan Lot 2

Figure 3.4 – Floor Plan Lot 3

4 ACOUSTIC ASSESSMENT GUIDELINES

4.1 GENERAL GUIDELINES

A summary of relevant acoustic assessment and reporting guidelines has been included below, for reference.

Noise Guide for Local Government (2009), NSW Office of Environment & Heritage (OEH);
Australian Building Codes Board (ABCB) Regulation Impact Statement (August 2012);
NSW Government Department of Planning Infrastructure SEPP 2007; and
NSW Noise Policy for Industry (2017), NSW Office of Environment & Heritage (OEH).
AS 3671 Road Traffic Noise Intrusion
AS 1055 Parts 1, 2 and 3 - 1997 Acoustics - Description and Measurement of Environmental Noise
AS 2107 - 1987 Acoustics - Recommended design sound levels and reverberation times for building interiors
State Environmental Planning Policy (Infrastructure) 2007

The requirements of these guidelines have been taken into account in the assessment presented in this document.

4.2 PENRITH CITY COUNCIL

Penrith City Council guidelines in relation to boarding house developments are provided in Part D5 “Other Land Uses”, Section 5-11 “Boarding Houses” of the Penrith Development Control Plan (PDCP) 2014.

Specific requirements identified in the PDCP 2014 in relation to acoustic performance include:

(2) Built Form, Street Impact and Appearance

d) proposals must demonstrate that neighbourhood amenity will not be adversely impacted by factors such as noise and privacy.

and:

(5) Visual and Acoustic Amenity Impacts

Boarding houses are to provide:

a) Bedrooms separate from significant noise sources;
b) Sound insulation between bedrooms to provide reasonable amenity;
c) Communal areas and bedroom windows away from the main living area or bedroom windows of any adjacent buildings; and
d) Screen fencing, plantings, and acoustic barriers in appropriate locations.

These guidelines have been taken into account in the assessment presented in this document.

4.3 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 4.4 to 4.7, below.

4.4 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 5dBA.

4.5 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 INTERPRETATION OF CRITERIA

Where noise levels from industrial sources are close to or above the 5dBA maximum increment over the existing Rating Background Level, as recommended in the NSW Industrial Noise Policy, 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.

4.7 SLEEP DISTURBANCE

Intermittent noises such as trucks and loading dock activities during the nighttime period are not directly addressed by the Industrial Noise Policy. In order to minimise any risk of sleep disturbance to affected residential receivers as a consequence of operations that occur during the nighttime period (10:00pm – 7:00am), 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 5dBA 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.

4.8 NOISE FROM PLANT & EQUIPMENT

Council requires that noise from plant and equipment associated with the development will not exceed measured background sound levels at any property boundary by more than 5 dBA. This requirement has been addressed in the acoustic assessment presented in this document.

4.9 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 boarding house development:

Type of Occupancy	Noise Level dBA	Applicable Time Period
Sleeping Areas (Bedrooms)	35	Night (10 pm to 7 am)
Other Habitable Rooms (excluding garages, kitchens, bathrooms and hallways)	40	At any time

The principal sources of external noise appear to be road traffic on Park Avenue and rail traffic in the nearby western rail corridor.

However, all other potential noise sources have been considered as part of the assessment.

The effect of noise from the boarding house development on nearby receivers:

Type of Receiver	Noise Level dBA	Applicable Time Period
Nearby Residential Properties	+ 5dBA (max)	At any time
Nearby Commercial Properties	65 dBA (max)	At any time

The requirement in relation to the impact of noise associated with the apartment development on nearby residential properties is that such noise is not permitted to result in an increase of more than 5 dBA at the boundary between the apartment development and the nearest residence.

The requirement in relation to the impact of noise associated with the boarding house development on nearby commercial properties is that such noise is not permitted to result in a noise level of greater than 65 dBA at the boundary between the apartment development and any nearby commercial property.

These requirements regarding the acoustic or noise impact of the proposed residential development on nearby properties have been carefully considered as part of this acoustic assessment.

5 ACOUSTIC MEASUREMENTS

5.1 BACKGROUND SOUND LEVEL MEASUREMENTS

Unattended noise monitoring was conducted at the site between Monday 19th and Sunday 25th October 2020. Background sound monitoring for the 31 and 32 Park Avenue sites was undertaken was undertaken together.

An unattended noise monitor was installed in the rear of the 31 Park Avenue property, to measure the lower LA90 background sound levels against which acoustic impacts on the adjoining residential property at 32 Park Avenue are required to be assessed, in order to protect the acoustic amenity of residential neighbours. Attended sound level measurements were recorded at the Park Avenue site boundary in order to assess the anticipated increase in the background Leq sound measure at this location, in turn to ensure that building design and structure is appropriate to ensure that the required indoor sound levels are achieved. The two monitoring locations are indicated by “A” and “B” in Figure 5.1, below.

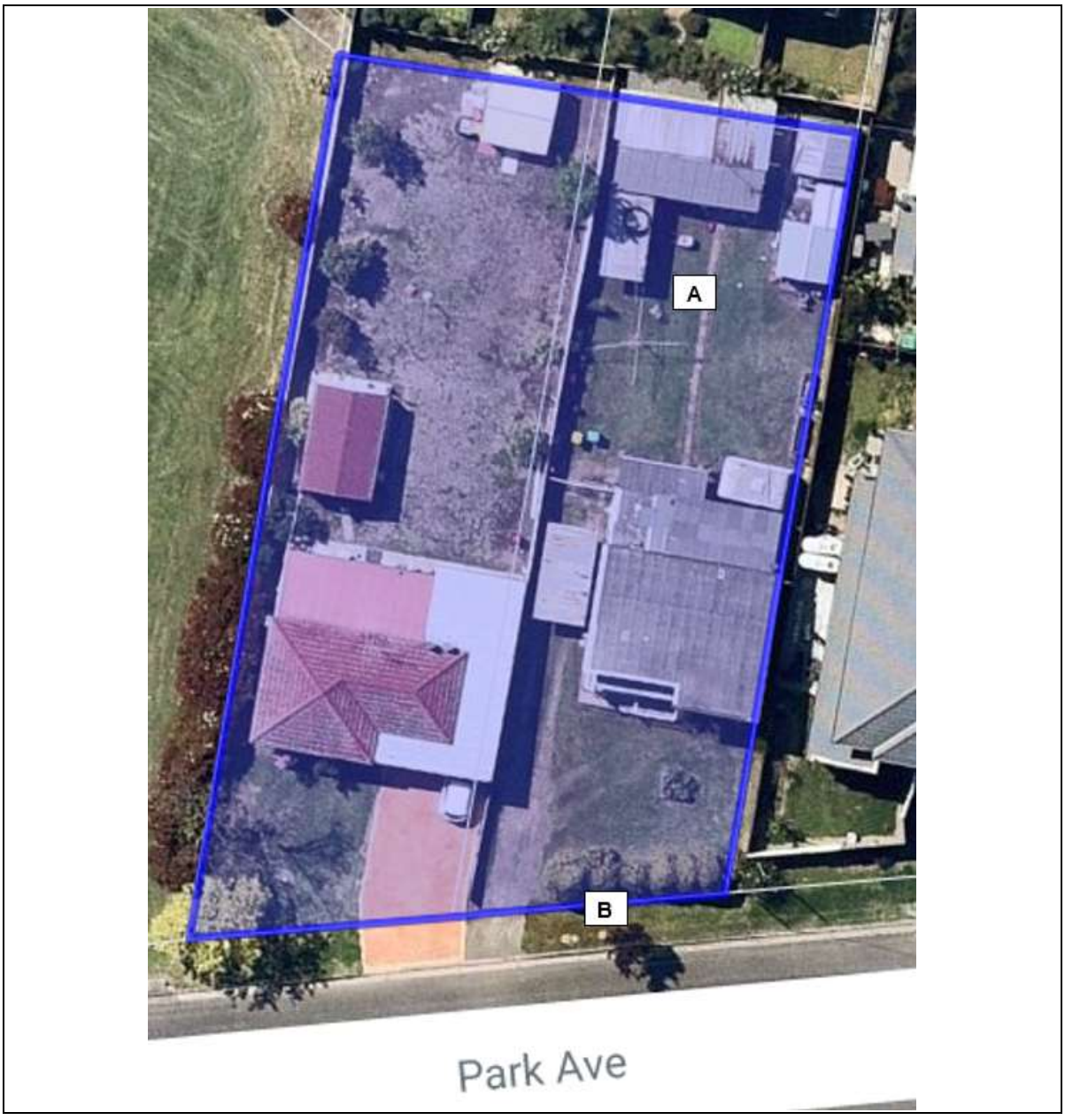

Figure 5.1 – Background Acoustic Monitoring Locations

Recording microphones were located approximately 1000 mm above ground level, in free field conditions.

5.2 INSTRUMENTATION

The noise monitoring equipment used for these measurements was a Brüel & Kjaer 2238 noise monitoring terminal, incorporating a Brüel & Kjaer 2238 sound level meter.

The instrument was set to A-weighted, fast response, and was programmed to monitor on a continuous basis over 15-minute sampling periods, and to store sound level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

Attended measurements were recorded using the sound level meter without the weatherproof housing used for unattended measurements.

A photograph of the unattended sound monitor in place at the site is provided in Figure 5.2, below.

Figure 5.2 – Acoustic Monitor in Position at Site

5.3 ACOUSTIC PARAMETERS

5.3.1 Location A

The logger was set to measure the Lmax, LAmin, LA1, LA10, LA50, LA90, LA99 and LAeq levels of the existing sound or noise environment. The LAmax measure reflects the highest noise level recorded during each monitoring period and is indicative of maximum noise levels due to individual noise events, including road traffic on Park Avenue and other local roads, and the nearby main western rail corridor.

The LA90 level is generally adopted as the background noise level, excluding road and rail traffic noise influences. The LAeq level is the Equivalent Continuous Sound Level and has the same sound energy over the sampling period as the actual noise environment with its fluctuating sound levels. The LAeq is accepted for acoustic assessment purposes as the standard descriptor for environmental noise that is noise including influences such as road and rail traffic. The LAeq measure has been used for that purpose in this assessment. Weather during the measurement period was generally fine, and no adjustments to the measured data (to adjust for extreme meteorological conditions) were considered necessary or applied. Detailed reports of sound level measurements have been included for reference at Appendices B and C. Summaries of the key LA90 and LAeq descriptors for the seven days of the monitoring period are shown in Table 5.1, on the following page.

Table 5.1 – Background Sound Level Measurement Results (Location A)

	Mean logarithmic LA90 Daytime (7:00am to 6:00pm) *	Mean logarithmic LA90 Evening (6:00pm to 10:00pm)	Mean logarithmic LA90 Night-time (10:00pm to 7:00am)
Mon 19 October 2020	44.2042	40.2938	34.6906
Tue 20 October 2020	44.0795	43.3875	35.2417
Wed 21 October 2020	44.5063	43.7375	36.0969
Thu 22 October 2020	46.3864	43.8750	38.5028
Fri 23 October 2020	44.4292	45.2000	37.9563
5 Working Days	**44.7211**	**43.2988**	**36.4976**
Sat 24 October 2020	43.2604	45.3438	37.0375
Sun 25 October 2020	44.1667	43.4375	43.9031
2 Day Weekend	**43.7135**	**44.3906**	**40.4703**
	Mean logarithmic LAeq Day-time (7:00am to 6:00pm) *	**Mean logarithmic LAeq Evening (6:00pm to 10:00pm)**	**Mean logarithmic LAeq Night-time (10:00pm to 7:00am)**
Mon 19 October 2020	49.7604	45.7688	39.3875
Tue 20 October 2020	49.5841	46.9750	40.0000
Wed 21 October 2020	50.7875	47.3375	40.3844
Thu 22 October 2020	51.9795	48.8188	41.9750
Fri 23 October 2020	50.0313	50.8813	42.4188
5 Working Days	**50.4286**	**47.9563**	**40.8331**
Sat 24 October 2020	48.5104	49.9500	41.3000
Sun 25 October 2020	47.5479	44.9813	47.1094
2 Day Weekend	**48.0292**	**47.4656**	**44.2047**

* Sundays and Public Holidays daytime commences 8:00am

A summary of the LA90 and LAeq noise measures for the 2-day weekend and 5-day working week periods is presented in Table 5.2, below.

Table 5.2 – Noise Monitoring Summary (Location A)

	Mean logarithmic LA90 Daytime (7:00am to 6:00pm) *	Mean logarithmic LA90 Evening (6:00pm to 10:00pm)	Mean logarithmic LA90 Night-time (10:00pm to 7:00am)
5 Working Days	**44.7211**	**43.2988**	**36.4976**
2 Day Weekend	**43.7135**	**44.3906**	**40.4703**
	Mean logarithmic LAeq Day-time (7:00am to 6:00pm) *	**Mean logarithmic LAeq Evening (6:00pm to 10:00pm)**	**Mean logarithmic LAeq Night-time (10:00pm to 7:00am)**
5 Working Days	**50.4286**	**47.9563**	**40.8331**
2 Day Weekend	**48.0292**	**47.4656**	**44.2047**

* Sundays and Public Holidays daytime commences 8:00am

5.3.2 Location B

As indicated in 5.1 above, 15-minute attended sound level measurements were recorded at Location B, on the Park Avenue site boundary, to measure the higher anticipated sound levels at this location.

These comparative measurements were carried out on the morning and afternoon of Thursday and Friday October 22nd and 23rd, 2020.

Based on an average of these Location B measurements, the following sound level differential was established between Location A and Location B:

Table 5.3 – Sound Level Difference between Locations "A" and "B"

	Location "A"	Location "B"
LAeq 15-min; Daytime	X dBA	X + 6 dBA
L90 15-min, Daytime	Y dBA	X + 3 dBA

In other words, the LAeq measure was found to be 6 dBA higher at Location "B" than at "Location "A", and the LA90 measure 3 dBA higher.

5.4 REFERENCE & DESIGN BACKGROUND SOUND LEVELS (RBL'S)

The acoustic measurements described in Section 5.3 above effectively quantify external noise with the potential to impact on the proposed development, with the general acoustic background without road traffic identified by the LA90 measure, and existing road traffic noise included in the LAeq measure. In this case, daytime, evening and night-time background sound levels are all potentially relevant to the assessment.

Daytime external sound levels are relevant to the requirement to achieve a maximum sound level of 40 dBA in any habitable room within the development, at any time. The daytime Rated Background Sound Level (RBL) adopted is the highest measured at either location for any time period, and therefore conditions that achieve required indoor sound levels in the case of daytime external noise levels will also achieve these outcomes in other periods, when external sound levels are lower.

Night-time external sound levels are relevant to the requirement to achieve a maximum sound level of 35 dBA in any bedroom within the development during the night-time (10:00pm – 7:00am) period.

RBL's for this assessment project, based on the data presented in Section 5.3, are identified in Table 5.4, below.

To ensure a conservative and reliable assessment, the lower L90 sound level recorded at Location "B" has been adopted as the background criterion used to protect the acoustic amenity of neighbouring residential and other receivers.

Table 5.4 – Rated Background & Design Sound Levels

Rated Background Sound Levels for Assessment Purposes	
Daytime:	
LA90	44
LAeq	56
Evening	
LA90	44
LAeq	54
Night-time:	
LA90	36
LAeq	50

6 ACOUSTIC ASSESSMENT

6.1 INTRODUCTION

The acoustic assessment of the proposed development requires consideration of both the impacts that existing environmental sound and noise levels might have on the proposed development and its future residents and occupants, and also the likely acoustic impacts that the development and its associated activities might have on potentially affected individuals, residences and activities.

ACOUSTIC IMPACTS ON THE DEVELOPMENT

Existing external noise that will impact on the development will include:

- Human activity in the vicinity of the development;
- Operation of mechanical devices near the development;
- Noise generated by traffic on Park Avenue and other nearby roads;
- Noise generated by rail traffic operating within the nearby western rail corridor; and
- Any other existing environmental noise.

Preliminary consideration of the proposed development, and the development site, has suggested that noise generated by road and rail traffic is the primary external acoustic factor.

Consideration of the impacts of external noise on the proposed development, including actions necessary to ensure that relevant internal sound levels are achieved, is presented in Section 6.4, below.

ACOUSTIC IMPACTS OF THE DEVELOPMENT

Noise generated by the development itself will include:

- Human activity associated with the development;
- Traffic noise associated with the development; and
- Operation of any mechanical plant associated with the development.

Consideration of the acoustic impacts that the proposed development will have on neighbouring premises is presented in Section 6.6, below.

6.2 RATED BACKGROUND SOUND LEVELS

The acoustic measurements described in Section 5 of this report effectively quantify external noise with the potential to impact on the proposed development, with the general acoustic background without road traffic identified by the LA90 measure, and background noise including existing road traffic noise indicated by the LAeq measure.

In this case, daytime, evening, and night-time background sound levels are relevant.

Daytime external sound levels are relevant to the requirement to achieve a maximum sound level of 40 dBA in any habitable room within the development, at any time.

Daytime external sound levels adopted for assessment purposes are the highest measured (refer Section 5), and therefore conditions that achieve required indoor sound levels in the case of daytime external noise levels will also achieve these outcomes in other periods, when external sound levels are lower.

Night-time external sound levels are relevant to the requirement to achieve a maximum sound level of 35 dBA in any bedroom within the development during the night-time (10:00pm – 7:00am) period.

Based on the background data described in Section 5, the rated background sound levels adopted for this assessment, in accordance with relevant acoustic assessment guidelines, are as shown in Table 6.1, on the following page.

Table 6.1 – Rated Background & Design Sound Levels

Rated Background Sound Levels for Assessment Purposes	
Daytime:	
LA90	44
LAeq	56
Evening	
LA90	44
LAeq	54
Night-time:	
LA90	36
LAeq	50

These rated background levels have been rounded to the nearest whole decibel, in accordance with accepted acoustic assessment practice. The adopted Leq measures are the highest recorded during the seven-day period of continuous monitoring, on the basis that guideline criteria for sound levels within habitable rooms at the proposed residential development are required to be achieved at all times, and therefore need to take into account the highest background sound levels measured. The adopted L90 measures are the lowest recorded, in order to ensure that the acoustic amenity of neighbouring residential receivers is protected.

6.3 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 boarding houses and other residential structures.

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.

6.4 ACOUSTIC IMPACTS ON THE PROPOSED DEVELOPMENT

6.4.1 General Considerations

The proposed development will be subject to the impact of noise generated by a range of external activities, as previously described.

An important part of this assessment is to consider those potential impacts, and to ensure that acoustic amenity consistent with relevant guidelines can be achieved in the various habitable rooms and bedrooms throughout the proposed development.

6.4.2 Acoustic Implications of Design & Layout

The layout and design of the proposed development has the following acoustic implications:

- The proposed residential units will be exposed to existing and future external ambient noise through external windows and doors, but will otherwise enjoy the acoustic protection provided by the solid structural elements of the proposed buildings; and

- The proposed residential units will be acoustically shielded by current and future road traffic noise from Park Avenue and other local roads, and from rail traffic noise from the nearby western rail corridor, by a combination of building bulk; distance and the acoustic attenuation provided by external building elements including solid form external walls, and associated glazed windows and doors.

6.5 BUILDING DESIGN CONSIDERATIONS & RECOMMENDATIONS

6.5.1 Basic Construction & Noise Intrusion

The external walls of the proposed building will comprise masonry or masonry clad material.

External masonry or masonry clad walls building elements provide very effective acoustic insulation and, noise intrusion will be mainly through lighter elements such as glazed doors and windows, and potentially through the roof structure. The solid masonry external wall sections, whether solid or clad, will provide an acoustic reduction, or attenuation of at least 40 dBA (refer Appendix A), based on the known acoustic characteristics of such materials.

This in turn means that the worst case rated external environmental noise levels of 56 dBA (daytime), 54 dBA (evening) and 50 dBA (night-time) as summarised in Table 6.1 will be reduced by these structural elements to levels well below the most stringent internal noise requirement, which is in the most demanding case 35 dBA in bedrooms at night, and more typically 40 dBA in bedrooms at any time. Quite clearly, any future increases in road traffic and other external noise will be very comfortably accommodated in terms of noise levels in the internal spaces of the proposed development by any reasonable masonry based external wall systems.

The remaining building elements that will influence indoor noise levels within the residential development are the external (glazed) window and doors.

6.5.2 Projected Acoustic Impact at the External Building Facades

The acoustic implications of the proposed development design and layout are summarised in 6.5.1 above.

These implications can be quantified, and the measured rated background sound levels adjusted as appropriate, to estimate the actual acoustic impact at the exterior of the proposed development.

This information can in turn be used to determine whether the external windows and doors can deliver the required internal noise levels, and what acoustic characteristics of the windows and doors will be required to achieve that outcome.

The various acoustic adjustments involved are summarised below.

- **Distance from Park Avenue and the Rail Corridor:** Road traffic on Park Avenue and rail traffic in the nearby western rail corridor are the principal identifiable noise sources in this case, and a reduction in rated background sound levels can be expected with increased distance from these noise sources. In this case, background sound levels have been measured at two locations directly relevant to the development itself, which in turn take account of noise reduction with distance from source.

- **Acoustic Shielding from Building Bulk:** Internal spaces, including bedrooms, will enjoy a varying degree of acoustic shielding from the bulk of the proposed buildings themselves. A conservative noise reduction of 0 - 10 dBA is estimated, based on experience with similar projects, and the data presented in Appendix A. The quantum of this attenuation due to building bulk will depend on the distance of the affected residential units from the front or Park Avenue site boundary, and the associated road and rail noise sources. Once again, to ensure a conservative assessment, a conservative approach to the acoustic attenuation involved has been adopted.

- **Reflected Traffic Noise:** The roof structure and upper floor ceilings of the three proposed buildings will provide a degree of acoustic shielding to the accommodation units within. A conservative noise reduction of 6 – 12 dBA is estimated, based on experience with similar projects. To ensure a conservative assessment, the lower range has been adopted.

- **Internal Attenuation:** No noise reduction due to internal attenuation has been allowed, as the sleeping rooms and other habitable spaces are typically bounded on at least one side by an external building wall.

6.5.3 Acoustic Attenuation Required from Glazed Elements

As indicated previously, relevant acoustic guidelines require that a maximum sound level of 40 dBA is achievable in all habitable rooms within the proposed residential development at all times, and a maximum sound level of 35 dBA (the most stringent possible requirement) or 40 dBA (more typically) is achievable in all bedrooms within the proposed residential development during designated night-time hours, that is between 10:00pm and 7:00am (refer Section 4).

Achieving the relevant indoor noise levels, as previously summarised, will require appropriate levels of sound attenuation from the external windows and doors of the building.

This attenuation will rely on the use of building materials and in particular glazing materials with the acoustic properties needed to reduce or attenuate the external noise levels impacting on the building to the required extent.

The acoustic attenuation characteristics of typical glazing options are summarised in Table 6.2, on the following page.

Table 6.2 – Typical Noise Reduction from Various Glazing Options

Glazing Option	Typical Rw Rating
Single	
3mm float glass	25
5mm float glass	26 - 27
6mm float glass	27 - 29
10 mm float glass	33 - 35
6.38 mm laminated glass	30 - 33
10.38 mm laminated glass	34 - 36
Double	
Double glazed mm – 12 mm gap – mm	30 - 35
Double glazed 6.38 mm lam – 8 mm gap – mm	35 - 40
Double window set up with 100 mm air gap	40 - 45

Sources: Pilkington's; Technical Specifications
Australian Building Codes Board (2007), *Building Codes of Australia Volume 1 and 2*, AGPS Canberra

6.5.4 Recommended Glazing Requirements

The external structural walls of the proposed building will provide more than adequate acoustic attenuation to achieve the sound levels required in the various internal building spaces, as previously indicated.

The acoustic "vulnerability" of the building is provided by the various external windows and doors, where attenuation characteristics are quite naturally lower than those that apply to the solid external walls.

Based on the analysis presented above, and to ensure that required sound internal sound levels are always achieved under all circumstances and , it is recommended that glass with acoustic qualities as a minimum equivalent to 6.38mm laminated glass is fitted to all external windows and doors on the southern or Park Avenue facades of the three proposed boarding house buildings, and that glass with minimum acoustic qualities equivalent to 6 mm float glass is used in external glazed elements on all other building facades.

The use of appropriately specified aluminium framed glazed doors, aluminium framed windows and aluminium sliding doors can provide the reduction in sound levels required.

To achieve this outcome, window frames will need to be sealed into the façade opening using a polyurethane sealant such as "Bostik Fireban One", or equivalent. The use of appropriate acoustic seals (Schlegel Q-Lon or equivalent) is essential to achieve the acoustic performance and attenuation in sound levels required.

6.5.5 Mechanical Ventilation or Air Conditioning

If windows are required to be closed to meet the internal noise criteria, consideration would need to be given to achieving compliance with the natural ventilation provisions of Australian Standard 1668.2 *The use of ventilation and air-conditioning in buildings- Ventilation design for indoor air contaminant control*, and any associated Penrith City Council requirements.

In this case, however, the relatively low measured external sound levels (refer Tables 5.1 to 5.4) indicate that these circumstances will not apply in this case.

In general, in occupancies/spaces where the use of acoustic seals is required, mechanical ventilation or air conditioning will also be involved.

Any mechanical ventilation or air conditioning system should be designed such that any penetrations from ductwork and/or pipework will not reduce the acoustic performance of external building constructions.

6.5.6 Roof or Ceiling Insulation

The recommendations set out in 6.5.4 above relate to the glazing detail required to achieve the attenuation or reduction in noise from external sources, including local road traffic, considered necessary to achieve the sound levels required in the various habitable rooms within the proposed development.

In this case, it has been assumed that roof structures associated with the three proposed buildings appear to be solid form concrete, with suspended internal ceiling below.

In these circumstances, the solid form masonry/concrete roof structure will provide all the acoustic protection required from any reflected external noise sources, and additional acoustic insulation is not required.

If framed roof structures clad with tiles or metal are used, then the type of insultation typically specified for energy management reasons will also provide the relatively low degree of acoustic insultation required.

6.5.7 Internal Acoustics for Residential Spaces

The following considerations are included for reference in relation to internal design and acoustic aspects of the various residential spaces within the proposed development:

WALLS

- All inter-tenancy walls and corridor walls to be constructed to full height to underside of floor slab and/or roof.

- Inter-tenancy wall construction to be two rows of 4mG metal studs with a minimum 20cm gap, 2 layers of 75 mm thick 11-14kg/m^3 glass wool insulation (or acoustic equivalent), within the cavity, and one layer of 13 mm thick fire rated plasterboard on the one side and 2 layers of 13 mm thick fire rated plasterboard on the other side.

- Corridor wall construction to be staggered 4mG metal studs on a 92 mm track with 1 layer of 16 mm thick fire rated plasterboard fixed to each side of the track and 110 mm thick 11- 14kg/m^3 glass wool insulation (or similar) within the cavity. Internal wall construction around bathrooms to be 13 mm fire rated plasterboard on either side of a 4mG stud.

- Lift shaft wall construction (if applicable) to be a single leaf of 150 mm thick reinforced concrete and a layer of 13 mm thick fire rated plasterboard on a 4mG metal stud with minimum 20cm air gap between studwork and concrete and 75 mm thick 11-14kg/m3 glass wool insulation (or similar) within cavity.

FLOORS

- Floor slab construction to be of minimum 200 mm reinforced concrete with density greater than 2500kg/m^3 with suspended plasterboard ceiling below, to achieve an Rw+Ctr in excess of 50.

- The use of resilient hung ceilings is recommended where hard floor finishes are proposed above the slab.

- For carpet floor coverings within all living spaces and bedrooms, the use of standard carpet underlay is expected to meet floor impact isolation requirements.

- Hard floor coverings are proposed for wet areas such as kitchens, bathrooms, and laundries. It is recommended that tiles are laid on top of 10 mm thick “Embelton ImpactaMat” acoustic underlay (or equivalent) to help ensure that floor impact isolation requirements are satisfied.

DOORS

- Entry doors to the apartments shall be a 38-40 mm solid core fire rated door with full perimeter acoustic seals, achieving Rw 30 and above. Acoustic seals shall be equivalent to “Raven PM10” for the sides and the top and equivalent to “Raven R38” drop seal at the bottom.

6.5.8 Sound Insulation Rating of Services

Ceilings over wet areas containing hydraulic piping to be constructed from a layer of 13 mmm thick plasterboard with ceiling cavity filled with 75 mm thick 11-14kg/m^3 glass wool insulation.

All penetrations in the ceilings to be acoustically sealed, including any recessed light fittings in the ceiling.

Hydraulic piping contained in ceilings above dry areas to be lagged with “Soundlag 4525C” (or equivalent).

Ceilings to be constructed from a layer of 13 mm thick plasterboard with a 75 mm thick 11-4G/m^3 glass wool insulation blanket for 500 mm either side of pipe work.

Riser construction within habitable areas to be constructed from 2 layers of 13 mm thick fire rated plasterboard on inner layer of a 4mG metal stud and 1 layer of 13 mm thick fire rated plasterboard on outer layer, with 75 mm thick 11-14kg/m^3 glass wool insulation within riser and wall cavities, with all plasterboard joints to be sealed, and the system to be appropriately reviewed to ensure compliance with fire rating requirements.

Riser construction within wet areas to be constructed from a layer of 13 mm thick fire rated plasterboard with 75 mm thick 11-14kg/m^3 glass wool insulation within riser cavity. All plasterboard joints to be sealed and the system reviewed to ensure compliance with fire rating requirements.

6.5.9 Sound Isolation of Pumps

Any point of connection between the service pipes in a building and any pumps (circulation or other) will require a flexible coupling at the point of connection.

6.6 ACOUSTIC IMPACTS OF THE PROPOSED DEVELOPMENT

The proposed development will involve a range of activities that involve the generation of noise, and that therefore have the potential to impact on nearby individuals and activities.

6.6.1 Human Activity

Human activity within the development will result in noise generation, but within normal and reasonable boundaries the magnitude of the resulting sound levels is not considered likely to have a significant impact on neighbouring receivers.

Noise generated by individual residents of the proposed development will be subject to existing regulatory limits and constraints, and any individual issues will be controlled through these mechanisms, as is the case in the community generally.

In a general sense, it is our professional opinion that noise generated by human activity within the proposed development will be secondary in acoustic impact to the dominant noise source, which is road and rail traffic.

6.6.2 Traffic Noise Generation with Development

A driveway from Park Avenue, and associated parking spaces for each of the three boarding house buildings, is proposed, as shown in the ground floor plan provided in Figure 3.1.

This driveway is proposed for the eastern boundary of the property, adjacent to an existing residential property. The proposed development will involve a total of eight car parking spaces.

The anticipated increase in vehicle movements from the subject site is not forecast to be of acoustic concern in comparison with the effect of existing and projected road traffic noise at neighbouring receivers, including residential receivers.

Noise from traffic movements on the proposed driveway and associated car parking spaces will be contained by a proposed 1800 mm acoustic fence along the eastern property boundary.

6.6.3 Mechanical Plant

Mechanical plant associated with the proposed development can have the potential to impact on neighbouring properties.

At this stage of the project, the selection of the type and location of mechanical plant associated with the proposed development has not yet been finalised. At the detailed design stage of the project the selected plant noise levels will be assessed with respect to established noise criteria.

Should any exceedances of established noise criteria be indicated, it is envisaged that standard noise control measures will be adopted to ensure that the acoustic amenity of nearby residences is maintained. Indicative engineering treatment methods that can be adopted in such circumstances include:

- Appropriate and judicious positioning of plant and equipment behind built elements to provide acoustic shielding;
- The use of acoustic screens/enclosures if required;
- The use of silencers; and
- The use of acoustically lined ductwork.

The following summary of strategies for the management of noise emissions from typical mechanical plant items associated with residential buildings of the type proposed is provided as a general guideline, based on previous professional experience.

> **Kitchen supply and exhaust fans:** These fans will be located in bulkheads ducted horizontally to the façade and will incorporate typical acoustic treatment including duct lining to the intake and discharge, use of silencers and/or acoustic louvres.
>
> **Toilet exhaust fans:** These fans will also be located in bulkhead ducted horizontally to the façade and will incorporate typical acoustic treatment including duct lining to the intake and discharge, use of silencers and/or acoustic louvres.

Accordingly, it our conclusion that with appropriate acoustic treatment, if required, items of mechanical plant as detailed above can be designed to comply with relevant mechanical plant noise objectives.

It is noted that the control and management of noise associated with mechanical plant will be required to consider potential impacts on both potential receivers external to the proposed development, and on the of the residential spaces within the proposed development itself.

6.6.4 Communal Areas

The plans of the development provide for shared communal areas. Prospective noise generated by “normal and reasonable” human activity in those spaces is considered very unlikely to impact on nearby receivers, firstly because existing external noise levels are considered likley to be the dominant acoustic influence; secondly because of the effect of the attenuation or reduction of noise with the distance from the proposed communal areas to property boundaries, and thirdly because of the acoustic attenuation that will be provided by building bulk.

However, to ensure that noise generated within any of these communal areas does not unduly impact on neighbouring balconies and other residential units within the proposed development, it is recommended that guidelines for appropriate behaviour in communal areas including the requirement for effective noise management and a 10:00 pm access limit as required by the PDCP 2014 (refer Section 4) is included in the Management Plan for the facility.

6.6.5 Facility Management Plan

It is anticipated that an overall Management Plan will be established and implemented for the proposed boarding house development, and that this Plan will provide guidelines that will in turn inform resident behaviour.

It is recommended that this Plan include appropriate reference to the need for appropriate noise management and control as part of a “good neighbour” policy, including the reference to behaviour in communal areas mentioned in 6.6.4 above.

6.6.6 Impacts at Nearby Residential Receivers

The proposed development adjoins existing residential properties along its eastern and northern boundaries.

The location of the development in relation to neighbouring residential properties is shown in Figure 6.1, below.

Figure 6.1 – Nearby Residential Receivers

Properties 1 and 2 are situated on the northern or rear side of the proposed development, and properties 3 and 4 on the eastern side, as indicated.

It is required that any noise generated by activities within the proposed development will not result in an increase of greater than 5dBA in the existing background LA90 measure (the existing background in the absence of road and rail traffic noise). In our professional opinion, the measures described in detail above that are required to ensure that indoor noise levels no greater than 35 dBA in bedroom at night, and no greater than 40 dBA in other habitable rooms at any time, will also provide an acoustic environment that will ensure that no adverse noise emissions are imposed on neighbouring residential properties. Noise generated within the various residential units will be contained by the external wall and window systems detailed above.

Noise generated by activities in any communal areas will be subject to the controls indicated in 6.6.4 and 6.6.5 above.

6.6.8 Impacts at Industrial and Commercial Boundaries

The NSW Industrial Noise Policy requires that new developments do not have an acoustic impact greater than 65 dBA at any affected industrial and commercial properties.

In this case, no commercial receivers are present in the immediate vicinity of the proposed development.

6.7 CONSTRUCTION NOISE

This assessment deals with the acoustic impacts that will apply to the proposed residential development in an ongoing sense.

It deals with the sound levels that are required to be achieved in the bedrooms and other habitable rooms within the development; indicates what measures are required to ensure that these sound levels can be achieved and confirms that these required sound levels can be achieved.

The assessment also considers the noise or acoustic impacts that the development will have on neighboring receivers and confirms that these impacts will comply with relevant acoustic guidelines.

The proposed development, if approved, will also involve a construction phase, which will be required to comply with appropriate noise control guidelines.

While construction noise falls outside the strict scope of this assessment, appropriate noise management plans and controls, in accordance with relevant local government and other guidelines, will need to be developed and applied, and this requirement can be expected to be a condition of the approval of the prospective Development Application.

6.8 STATE ENVIRONMENTAL PLANNING POLICY (INFRASTRUCTURE) 2007

State Environment Planning Policy (Infrastructure) 2007, the so called “Infrastructure SEPP” requires, in the case of a residential development adjacent to a road accommodating average daily traffic volumes of 40,000 or more, that sound levels no greater than 35 dBA will be achieved in all bedrooms during the 10:00pm to 7:00am night-time period, and sound levels no greater than 40 dBA will be achieved in all other habitable rooms within the development, at all times.

This requirement does not apply in this case, as Park Avenue does not carry this level of traffic.

However, as the site is located in relatively close proximity to a major rail corridor, internal sound levels consistent with the requirements of the Infrastructure SEPP have been adopted for this assessment.

6.9 EXTERNAL FENCING & LANDSCAPING

External fencing is proposed for the development as indicated by the red and blue lines in in Figure 6.2, on the following page.

Based on the overall findings of this assessment, no undue or non-compliant noise impacts are anticipated at any adjoining residential property boundaries.

However, to assist in providing additional surety in this regard, it is recommended that solid form boundary fencing with a minimum Rw rating of 20 is installed on the perimeter boundaries marked in red, to provide acoustic protection to neighbouring residential properties to the north and east.

1800 mm solid form metal panel fencing will deliver the acoustic outcome required.

No specific acoustic performance is required from fencing along the western property boundary (marked in blue), which adjoins recreational land, however a continuation of the style of 1800 mm fencing recommended for the northern and eastern property boundaries may be considered.

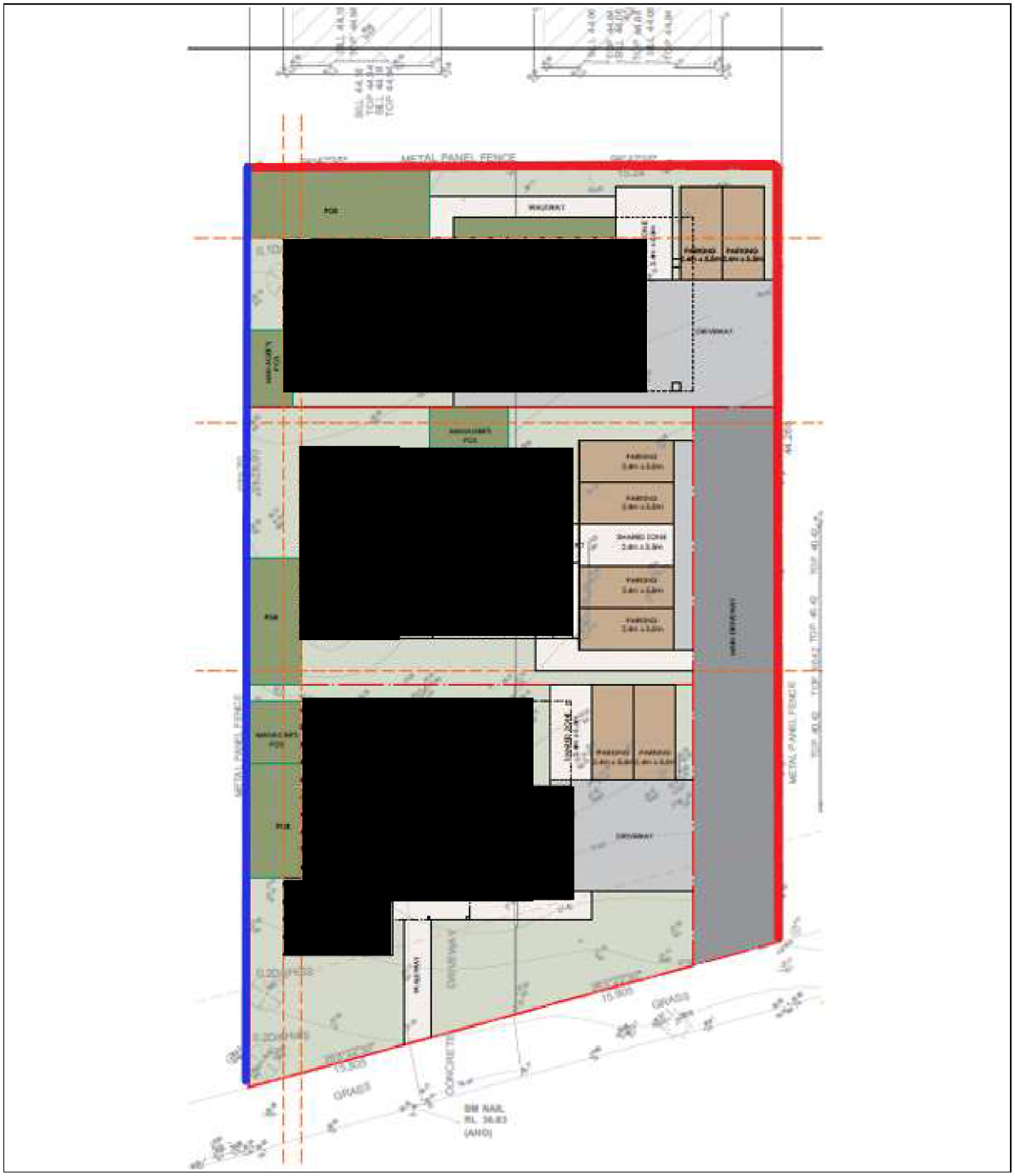

Figure 6.2 – Proposed Boundary Fencing

6.10 KEY FINDING

The key finding of this acoustic assessment is that, subject to the implementation of the various recommendations included in this report, including recommendations regarding external window and door systems, sound levels within the various residential spaces associated with the proposed development will comply with the strictest relevant acoustic guidelines and requirements, in that sound levels no greater than 35 dBA will be achieved in all bedrooms during the 10:00pm to 7:00am night-time period; sound levels no greater than 40 dBA will be achieved in all other habitable rooms within the development, at all times, and no undue or non-compliant acoustic impacts will be imposed on any neighbouring residential properties.

7 FINDINGS & RECOMMENDATIONS

This report presents an acoustic assessment of a proposed boarding house development at 30-31 Park Avenue Kingswood NSW. The assessment has been undertaken in accordance with relevant acoustic assessment protocols, standards and guidelines.

7.1 KEY FINDINGS

In relation to acoustic matters, it is our professional opinion, based on a consideration of the various plans and drawings describing the project; subject to the adoption and implementation of the various recommendations presented in this report, and summarised below, that:

- In relation to acoustic matters, it is our professional opinion, based on a consideration of the various plans and drawings describing the project; subject to the adoption and implementation of the various recommendations presented in this report, and summarised below, that indoor sound levels associated with the proposed development will comply with the most stringent applicable internal noise guidelines, namely that background sound levels no greater than 35 dBA will be achievable in all bedrooms during the 10:00pm to 7:00am night-time period, and background sound levels no greater than 40 dBA will be achievable in all other habitable rooms within the development, at all times; and

- The development as proposed, once again subject to the adoption and implementation of the various recommendations presented in this report and summarised below, will have no inappropriate or non-compliant acoustic impact on any potentially affected receivers, including in particular nearby residential receivers.

7.2 RECOMMENDATIONS

The following recommendations, which are identified in the text of this report, are made to ensure the compliance of internal acoustics with the relevant guidelines and requirements:

1. **External Glazing - Windows:** Glass with a minimum acoustic rating equivalent to 6.38mm laminated glass is used in all external window and door systems on the southern or Park Avenue building facades. All other external glazing to involve glass with a minimum acoustic rating equivalent to 6 mm float glass.

2. **External Glazing – Acoustic Sealing:** External window and door frames should be sealed into façade openings using a polyurethane sealant such as “Bostik Fireban One”, or equivalent, and acoustic seals (such as Schlegel Q-Lon or equivalent) should be used to provide additional acoustic protection.

3. **Internal Walls:** Internal walls, including inter tenancy walls, should be constructed and installed in accordance with the summary details included in this report, and in accordance with relevant BCA acoustic guidelines. Inter-tenancy walls are required by relevant BCA guidelines to have an Rw + Ctr rating of at least 50 Rw dBA, and structural materials offering an Rw + Ctr greater than 50 Rw are recommended.

4. **Floors:** Floor slab construction to be of minimum 200 mm reinforced concrete with density greater than 2200 kg/m^3 with suspended plasterboard ceiling below, to achieve an Rw+Ctr in excess of 50. The use of resilient hung ceilings is recommended where hard floor finishes are proposed above the slab. For carpet floor coverings within all living spaces and bedrooms, the use of standard carpet underlay is expected to meet floor impact isolation requirements. Hard floor coverings are proposed for wet areas such as kitchens, bathrooms, and laundries. It is recommended that any ceramic tiles included in the development are laid on top of 10 mm thick “Embelton ImpactaMat” acoustic underlay (or equivalent), in order to ensure that the required floor impact isolation requirements are achieved.

5. **Services:** Internal services should be fitted with acoustic insulation as detailed in this report, and in accordance with relevant BCA requirements.

6. **BCA Requirements:** Standard BCA and other internal acoustic design and construction considerations, including but not limited to those summarised in Section 5.5.7 and Appendix A of this report, are applied to all aspects of the construction of the various residential units within the proposed development;

7. **Plant & Equipment:** Any mechanical plant and equipment required for the development will be specified and/or designed and installed such that acoustic noise emissions are consistent with the internal acoustic environments required, and that any penetrations from ductwork and/or pipework will not reduce the acoustic performance of other building design features;

8. **Noise Emissions from Plant & Equipment:** Plant and equipment used in association with the development should be selected, sited and installed so that acoustic impacts do not exceed the measured background LA90 noise level by more than 5 dBA at any property boundary.

9. **Acoustic Certification:** Appropriate certification and validation of the acoustic performance of any plant and equipment associated with the proposed development is provided prior to construction, and prior to occupation, as reasonably required;

10. **Boundary Fencing & Landscaping:** Boundary fencing with an Rw rating of 20 (minimum), such as solid form metal panel fencing, is installed on the eastern and northern property boundaries, to ensure that any noise emissions from the proposed development will not exceed existing measured background LA90 sound levels by more than 5 dBA at any residential property boundary. No specific acoustic performance is required from the fencing along the western property boundary, but a continuation of the type of fencing used on other property boundaries may be considered;

11. **Noise Management Plan – Construction:** A noise management and control plan will need to be developed and applied to the construction phase of the proposed development, in accordance with established procedures and practices; and

12. **Facility Management Plan – Ongoing Operation:** The overall management plan for the facility should include specific reference to practical and achievable noise management controls, including guidelines regarding noise management and minimisation in any communal areas associated with the proposed development.

It should be noted that all materials or material types mentioned in this report have been suggested solely on the basis of acoustic performance.

Any other properties of these materials, including fire rating and chemical properties should be checked with the suppliers or other specialised bodies to ensure fitness for non-acoustic purposes.

It should also be noted that any specific material brands or types mentioned in this report have been mentioned as a guide to acoustic properties, and not as a recommendation, and that a range of products may be available that can deliver the acoustic performance required.

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 view of NG Child & Associates that this report presents an accurate and reliable assessment of the acoustic environment applicable at and in the immediate vicinity of the boarding house development proposed for 30-31 Park Avenue Kingswood NSW, as described in this document.

The information presented in this document has been prepared by NG Child & Associates exclusively for the use of Miletic-Mieler and its clients, and for submission to the local government consent authority or certifying authority at interest as required in relation to the proposed development.

This document should not be used for any purposes other than those of Miletic-Mieler and its clients in relation to the development described in this report.

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Principal, NG Child & Associates

2 November 2020

GLOSSARY

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

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

LA1 – The LA1 level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the LA1 level for 99% of the time.

LA10 – The LA10 level 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. The LA10 is a common noise descriptor for environmental noise and road traffic noise.

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

LA50 – The LA50 level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the LA50 level for 50% of the time.

LA90 – The LA90 level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the LA90 level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening, and night-time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (LA90) 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 night-time.

APPENDIX A

Building Code of Australia (BCA)
Summary of Internal Acoustic Requirements

Building Code of Australia (BCA)
Summary of Internal Acoustic Requirements

The Building Code of Australia (BCA) nominates various ratings for airborne noise isolation and impact noise isolation. The ratings and abbreviations used are as follows:

Rw – Weighted sound reduction index. The Rw is a typical measure for the sound insulation performance for a wall or floor system in a laboratory. The Rw in the BCA is used for the selection of appropriate construction systems.

Rw+Ctr – Weighted sound reduction index with spectrum adaptation term. The Rw+Ctr is the weighted sound reduction index with a correction factor Ctr added that helps to quantify the low frequency performance. The Rw+Ctr in the BCA is used for the selection of appropriate construction systems.

DnT, w – Weighted standardised level difference. The DnT, w is a typical measure for the sound insulation performance for a wall or floor system in a laboratory. The DnT, w in the BCA is used for the determination of airborne noise in the field.

DnT, Rw+Ctr – Weighted standardised level difference with spectrum adaptation term. The DnT, Rw+Ctr is the weighted standardised level difference with a correction factor Ctr added that helps to quantify the low frequency performance. The DnT, Rw+Ctr in the BCA is used for the determination of airborne noise in the field.

Ln, win – Weighted normalised impact sound pressure level with spectrum adaptation term. The Ln, win is a typical measure of the impact/structure borne noise between two spaces in a laboratory. A reduction in the Ln, win corresponds to an improvement in impact isolation. The Ln, win in the BCA is used for the selection of appropriate impact isolation systems.

Lent, win – Weighted standardised impact sound pressure level with spectrum adaptation term. The Lent, win is a typical measure of the impact/structure borne noise between two spaces in the field. A reduction in the Lent, win corresponds to an improvement in impact isolation. The Lent, win in the BCA is used for the determination of impact noise in the field.

The ratings used for airborne noise isolation and impact noise isolation are here defined:

FSTC – Field sound transmission class. The FSTC is a typical measure for the sound insulation performance for a wall or floor system in a building.

IIC – Impact isolation class. The IIC is a typical measure of the impact/structure borne noise between two spaces in a laboratory.

BCA sound insulation ratings applicable to this project are listed in Tables A-1 and A-2 below.

Table A-1 Sound Insulation Ratings of Walls and Floors – Class 2 or 3

Situation	Lab	Field	Impact
Apartment wall separating different sole occupancies (Same room-type each side, e.g. habitable adjoin habitable)	50 RW +Ctr	45 DnT,w+Ctr	No
Apartment wall separating a habitable room (not a kitchen) from a bathroom, sanitary compartment, laundry, or kitchen in another sole occupancy	50 RW +Ctr	45 DnT,w+Ctr	Yes
Apartment wall separating a stairway, public corridor, public lobby, or the like; or part of a different classification	50 RW	45 DnT,w	No
Apartment wall separating a plant room or lift shaft	50 RW	45 DnT,w	Yes
Apartment door to a stairway, public corridor, public lobby, or the like	30 RW	25 DnT,w	NA
Apartment floor separating different sole occupancies or a plant room, lift shaft, stairway, public corridor, public lobby, or the like; or parts of a different classification	50 RW + Ctr	45 DnT,w+Ctr	-
	62 Ln,w+Cl	62 LnT,w+Cl	-

Table A-2 Sound Insulation Ratings of Walls Services: Class 1, 2, 3 & 9c

Situation	Lab	Field	Impact
Duct, soil, waste, or water supply pipe serving or passing through more than one sole occupancy to a habitable room (not a kitchen)	40 Rw+Ctr	NA	NA
Duct, soil, waste, or water supply pipe serving or passing through more than one sole occupancy to a kitchen or non-habitable room	25 Rw+Ctr	NA	NA
Storm water pipe passing through a sole occupancy to a habitable room (not a kitchen)	40 Rw+Ctr	NA	NA
Storm water pipe passing through a sole occupancy to a kitchen or non-habitable room	25 Rw+Ctr	NA	NA

Note: Part F5.6 of the BCA requires a flexible coupling to be used at the point of connection between the service pipes in a building and any pump (not applicable to Class 1 buildings).

The City of Sydney DCP sound insulation ratings applicable to this project are listed in Table A-3 below.

Table A-3 Sound Insulation Ratings of Walls and Floors

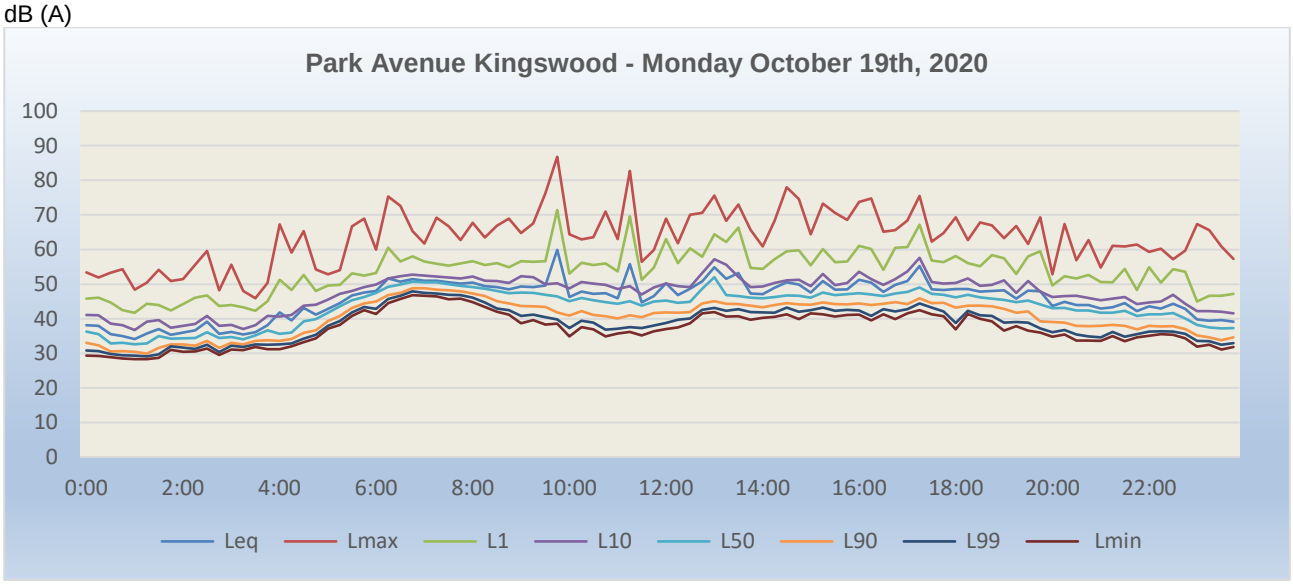
Situation	Lab	Field	Impact
Apartment wall separating different sole occupancies (Same room-type each side, e.g. habitable adjoin habitable)	NA	50 FSTC	No
Apartment wall separating a habitable room (not a kitchen) from a bathroom, sanitary compartment, laundry, or kitchen in another sole occupancy	NA	55 FSTC	Yes
Apartment wall separating a stairway, public corridor, public lobby, or the like; or part of a different classification	NA	50 FSTC	No
Apartment floor separating different sole occupancies (Same room-type each side, e.g. habitable adjoin habitable)	NA	50 IIC	
	NA	50 FSTC	
Apartment floor separating a habitable room (not a kitchen) from a bathroom, sanitary compartment, laundry, or kitchen in another sole occupancy	NA	55 FSTC	NA
Apartment floor separating different sole occupancies or a plant room, stairway, public corridor, hallway, or the like	NA	50 IIC	-

APPENDIX B

Background Noise Monitoring Data - Location A

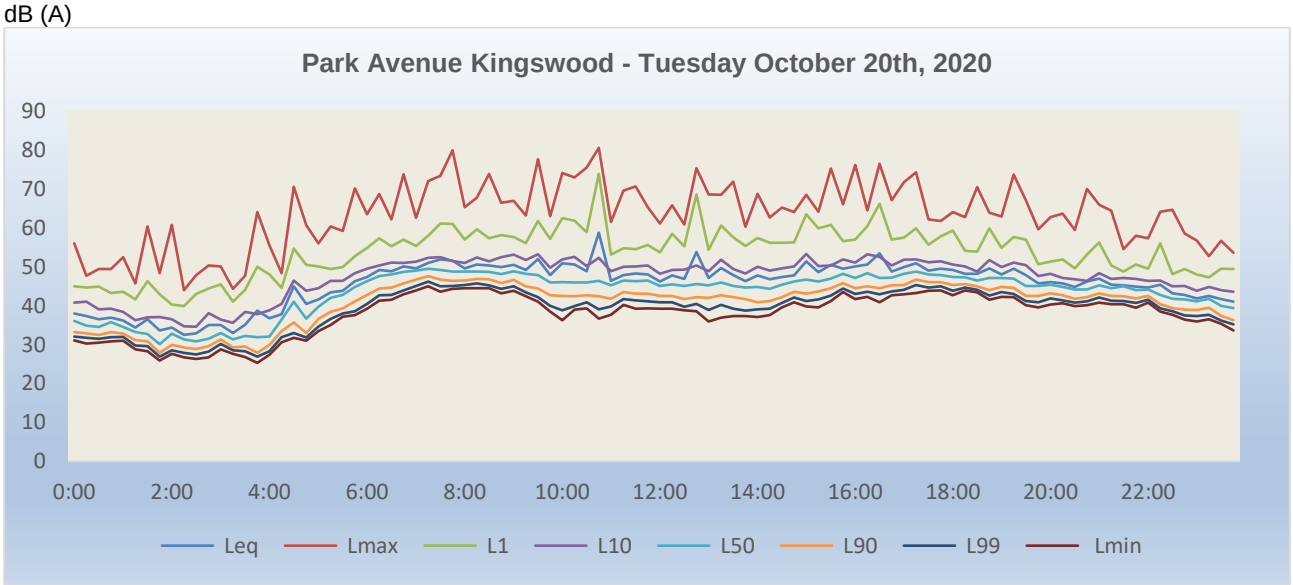
Monday October 19th, 2020

dB (A)



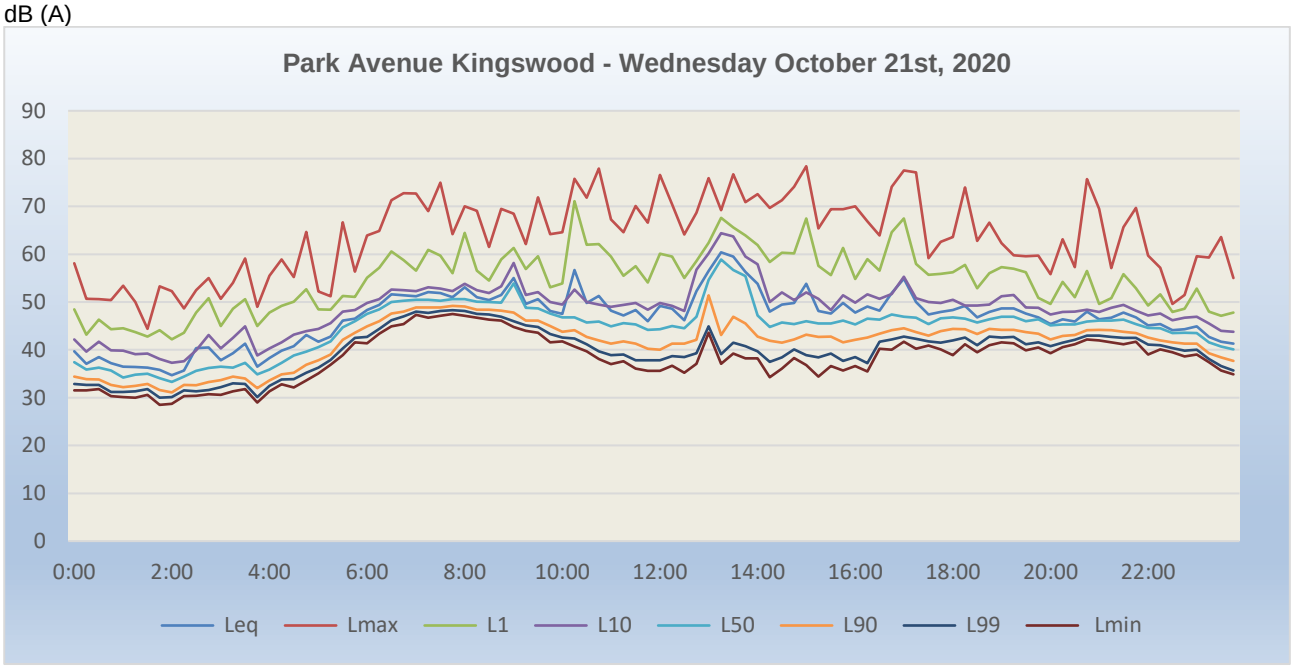
Tuesday October 20th, 2020

dB (A)



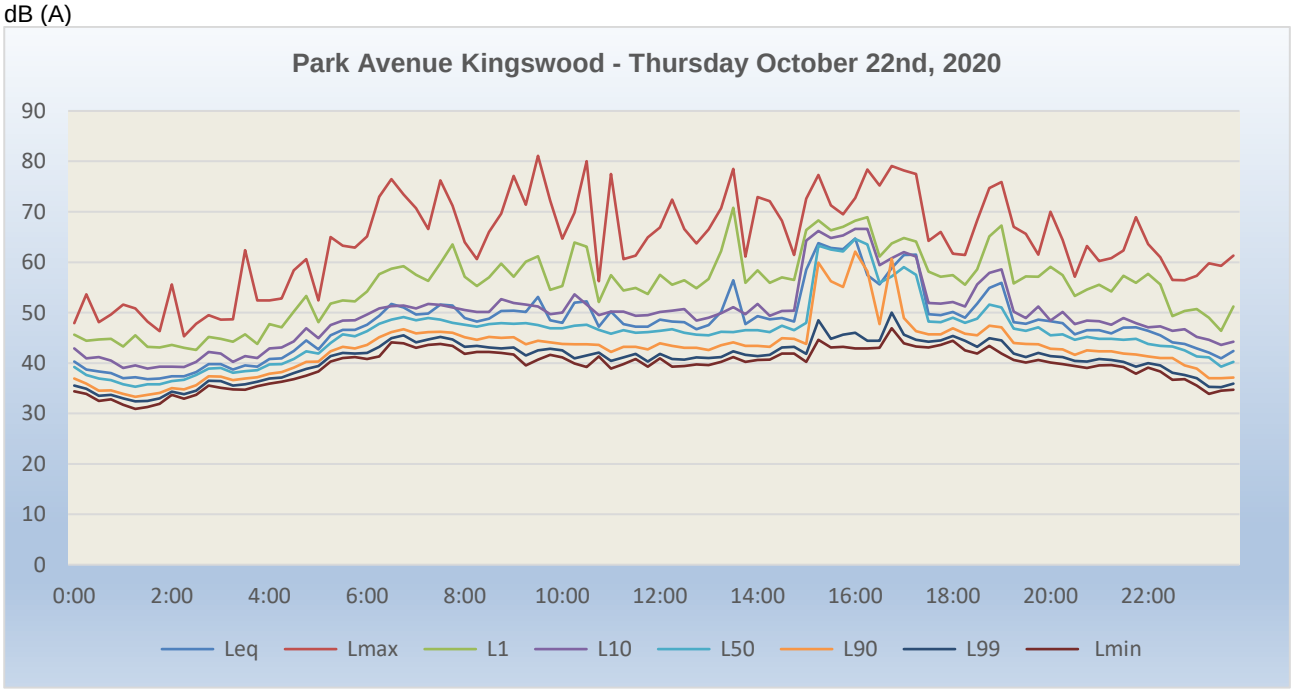
Wednesday October 21st, 2020

dB (A)



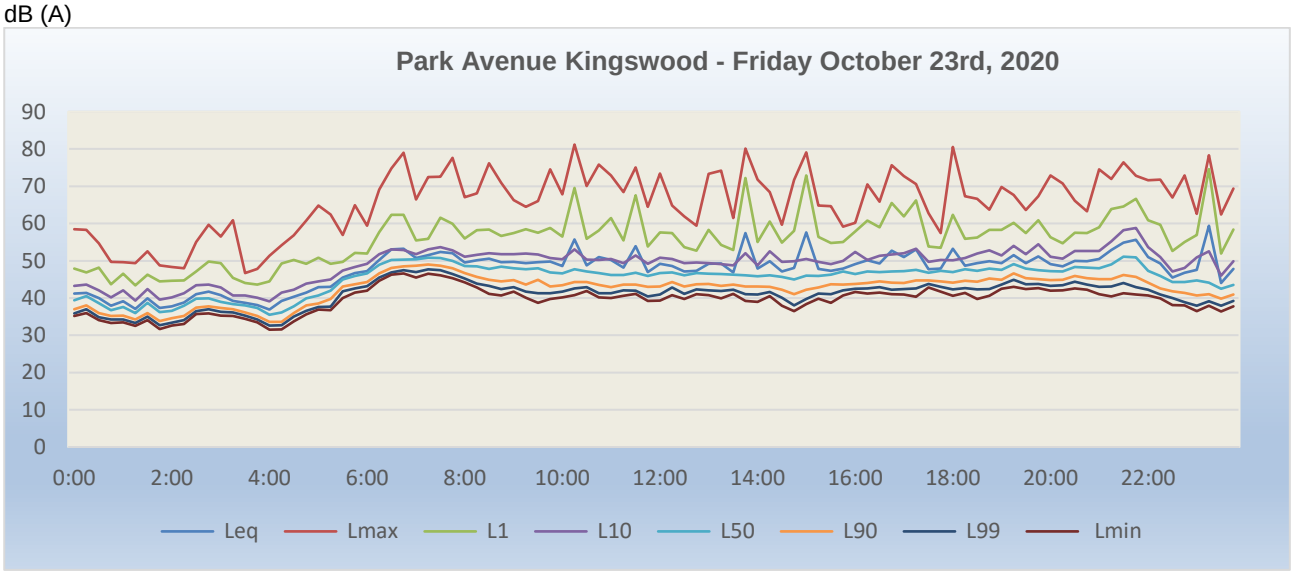
Thursday October 22nd, 2020

dB (A)



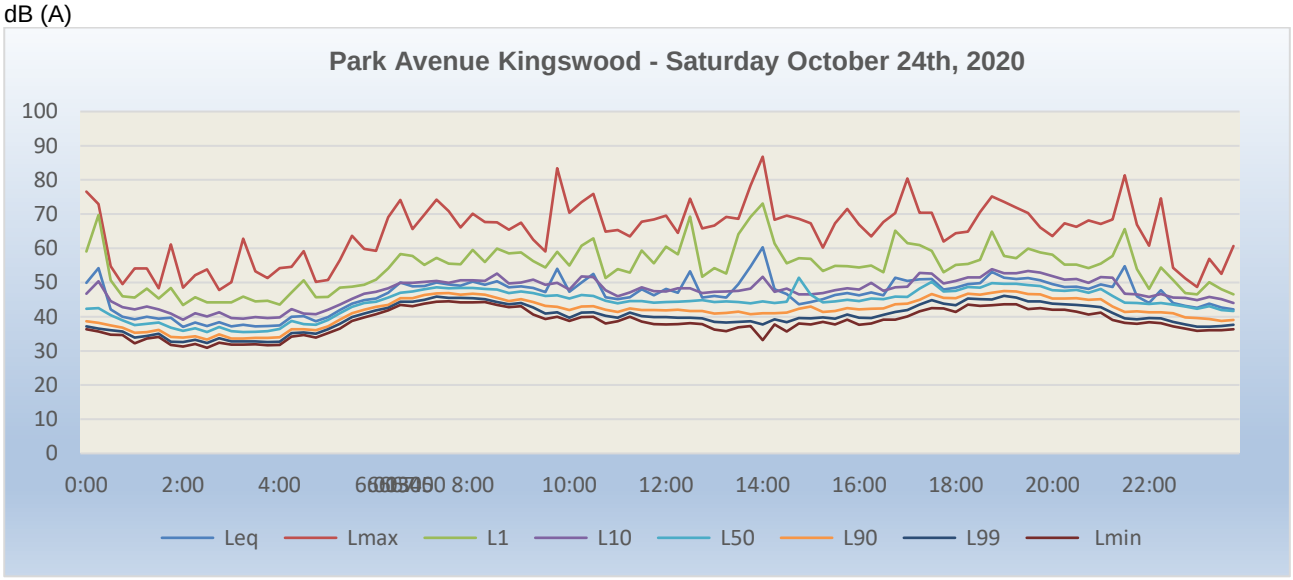
Friday October 23rd, 2020

dB (A)



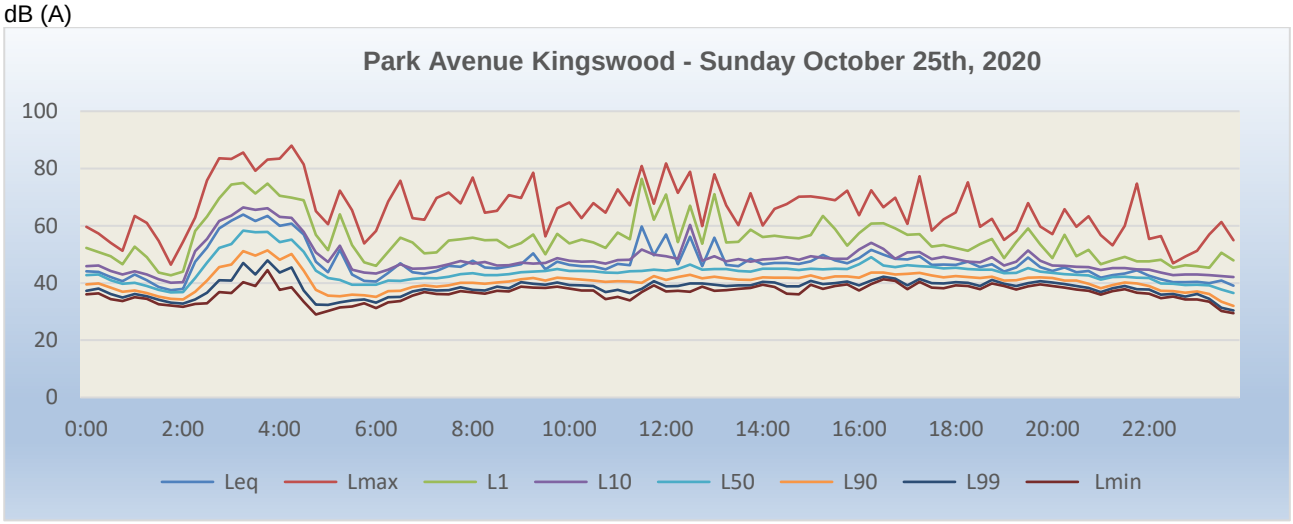
Saturday October 24th, 2020

dB (A)



Sunday October 25th, 2020

dB (A)



30-31 Park Avenue Kingswood NSW
Summary of Background Noise Monitoring Data – Location A

	Leq			Lmax			L1			L10		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Monday 19 October 2020	49.7604	45.7688	39.3875	68.3854	62.8625	56.4750	58.0625	54.0938	47.2031	51.1500	47.8438	41.5281
Tuesday 20 October 2020	49.5841	46.9750	40.0000	68.7386	63.9688	56.4583	58.5955	53.7125	47.8361	50.9614	48.6250	42.1500
Wednesday 21 October 2020	50.7875	47.3375	40.3844	69.6542	63.8938	54.6406	59.4500	54.0438	47.6000	52.3271	49.0625	42.7250
Thursday 22 October 2020	51.9795	48.8188	41.9750	70.1068	65.1875	56.5944	59.6705	57.5813	48.6167	53.6068	50.8125	43.9528
Friday 23 October 2020	50.0313	50.8813	42.4188	69.2646	69.7125	58.5156	58.5896	59.3438	50.0313	50.9563	53.0500	44.2656
Weekday Average	**50.4286**	**47.9563**	**40.8331**	**69.2299**	**65.1250**	**56.5368**	**58.8736**	**55.7550**	**48.2574**	**51.8003**	**49.8788**	**42.9243**
	Leq			Lmax			L1			L10		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Saturday 24 October 2020	48.5104	49.9500	41.3000	68.9708	69.1375	56.2406	57.6583	57.5688	48.1313	48.9708	51.1813	43.0250
Sunday 25 October 2020	47.5479	44.9813	47.1094	68.3396	62.0813	64.3125	56.6583	51.6063	55.5063	56.6583	51.6063	55.5063
Weekend Average	**48.0292**	**47.4656**	**44.2047**	**68.6552**	**65.6094**	**60.2766**	**57.1583**	**54.5875**	**51.8188**	**52.8146**	**51.3938**	**49.2656**

	L50			L90			L99			Lmin		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Monday 19 October 2020	47.2021	43.8750	37.3125	44.2042	40.2938	34.6906	42.1500	37.5688	33.4344	40.6063	36.1625	32.3688
Tuesday 20 October 2020	46.9250	45.6188	37.9278	44.0795	43.3875	35.2417	42.2136	42.1438	33.8194	40.7023	41.1063	32.6722
Wednesday 21 October 2020	48.0542	46.0688	38.5844	44.5063	43.7375	36.0969	42.0708	42.1625	34.7375	40.3917	40.8625	33.5500
Thursday 22 October 2020	49.8364	46.7938	40.6361	46.3864	43.8750	38.5028	43.0909	41.9813	37.2583	41.6386	40.6188	36.1694
Friday 23 October 2020	47.3146	48.2375	40.3156	44.4292	45.2000	37.9563	42.6854	43.3375	36.6469	41.2542	41.5875	35.5875
Weekday Average	**47.8664**	**46.1188**	**38.9553**	**44.7211**	**43.2988**	**36.4976**	**42.4422**	**41.4388**	**35.1793**	**40.9186**	**40.0675**	**34.0696**
	L50			L90			L99			Lmin		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Saturday 24 October 2020	45.9813	47.7750	39.4688	43.2604	45.3438	37.0375	41.4167	43.5000	35.6844	39.8104	41.6063	34.5531
Sunday 25 October 2020	48.3354	46.7375	49.5344	44.1667	43.4375	43.9031	41.0979	40.9250	39.5594	37.3875	38.1563	34.4375
Weekend Average	**47.1583**	**47.2563**	**44.5016**	**43.7135**	**44.3906**	**40.4703**	**41.2573**	**42.2125**	**37.6219**	**38.5990**	**39.8813**	**34.4953**

APPENDIX C

Unattended Background Sound Level Monitoring
Raw Data

Table B1 – Raw Noise Monitoring Data (19-25 October 2020)

Date	Time	Leq	Lmax	L1	L10	L50	L90	L99	Lmin
19/10/2020	0:00	49.9	76.6	59.1	46.7	42.3	38.7	37.2	36.3
		54.2	72.9	69.7	50.4	42.5	38.2	36.5	35.7
		42.1	54.8	50.6	44.6	40.4	37.4	36	34.7
		40	49.5	46	42.8	38.9	36.8	35.7	34.6
		39.2	54.1	45.6	42.1	37.5	35.3	33.9	32.2
		40	54.1	48.2	43	37.9	35.5	34.4	33.6
		39.4	48.3	45.3	42.1	38.3	36.1	35	34.1
		39.7	61.1	48.4	40.9	36.8	34.1	32.7	31.7
	2:00	37	48.5	43.4	39.1	35.9	33.9	32.6	31.3
		38.3	52.1	45.7	41	36.6	34.3	33.2	32
		37.3	53.8	44.2	40.1	35.5	33.3	32.3	30.9
		38.4	47.8	44.2	41.3	37	34.8	33.7	32.4
		37.2	50.1	44.2	39.6	35.8	33.6	32.8	31.8
		37.6	62.8	45.9	39.4	35.5	33.6	32.8	31.8
		37.2	53.3	44.5	39.9	35.6	33.8	32.8	31.9
		37.3	51.3	44.7	39.6	35.8	33.8	32.6	31.6
	4:00	37.4	54.2	43.5	39.8	36.4	34	32.7	31.7
		40	54.6	47.1	42.2	38.8	36.3	35.2	34.2
		40.2	59.2	50.6	40.9	37.8	36.3	35.4	34.6
		38.7	50.2	45.7	40.7	37.6	36	35	33.9
		39.9	50.7	45.8	42	39	37.2	36.3	35.2
		41.9	56.5	48.5	43.5	41	39.1	37.9	36.5
		43.8	63.7	48.8	45.2	42.9	41	39.9	38.8
		44.8	59.8	49.3	46.7	44	42	40.9	39.8
	6:00	45.3	59.3	50.8	47.3	44.4	42.9	41.8	40.7
		47	69.1	54.1	48.3	45.6	43.4	42.6	41.8
		50	74.1	58.3	49.9	47	45.4	44.4	43.4
		48.9	65.6	57.8	49.9	47.4	45.4	44.4	43.1
		49	69.8	55.1	50.2	48	46.3	44.9	43.8
		50	74.2	57.2	50.5	48.6	46.8	45.9	44.4
		49.4	70.9	55.5	49.9	48.3	46.9	45.5	44.5
		49.1	66.1	55.3	50.6	48.4	46.4	45.5	44.2
	8:00	50.3	70.1	59.5	50.6	48.4	46.7	45.4	44.2
		49.3	67.7	56	50.5	48.1	46.4	45.1	44.3
		50.4	67.6	59.9	52.6	47.9	45.5	44.3	43.4
		48.6	65.4	58.5	49.7	46.9	44.6	43.6	42.8
		48.9	67.5	58.8	50	47.4	45.1	44	43.1
		48.4	62.5	56.3	50.8	46.9	44.3	42.7	40.6
		47.2	59.1	54.4	49.3	46.1	43.2	40.9	39.3
		54	83.4	59	49.9	46.2	42.9	41.3	40
	10:00	47.3	70.4	55	47.9	45.3	41.9	39.7	38.8
		50	73.5	60.8	51.8	46.3	43	41.2	39.9
		52.5	75.9	62.9	51.6	46.1	43.1	41.3	40
		45.7	64.9	51.3	47.7	44.7	42	40.3	38
		45.1	65.3	53.9	46	43.9	41.4	39.7	38.7
		45.7	63.5	52.9	47.1	44.6	42.4	41.2	40
		48	67.8	59.4	48.6	44.6	41.9	40.2	38.6
		46.2	68.4	55.6	47.5	44.1	41.9	39.9	37.8
	12:00	48.1	69.6	60.5	47.4	44.3	41.8	39.9	37.7
		47	64.5	58.2	48.3	44.4	42	39.7	37.8
		53.3	74.5	69.3	48.3	44.6	41.7	39.7	38.1
		45.6	65.8	51.7	46.9	44.8	41.7	39.5	37.8
		46.1	66.7	54.2	47.3	44.3	40.9	38.5	36.2

		45.6	69.2	52.6	47.4	44.5	41.1	38.3	35.8
		49.5	68.6	64.1	47.6	44.3	41.5	38.5	36.9
		54.7	78.4	69.2	48.2	43.9	40.7	38.7	37.3
	14:00	60.3	86.8	73.1	51.7	44.5	41	37.7	33.1
		48	68.3	61.4	47.3	44	41	39.2	37.7
		46.6	69.6	55.6	48.2	44.4	41.2	38.4	35.7
		43.6	68.6	57.1	46.5	51.4	42.3	39.6	38
		44.3	67.3	56.9	46.5	46.4	43	39.5	37.7
		45.1	60.2	53.4	46.9	44.2	41.4	39.8	38.5
		46.3	67.3	54.9	47.7	44.5	41.7	39.4	37.7
		46.9	71.5	54.8	48.3	44.9	42.5	40.6	39.1
	16:00	46.2	66.9	54.4	47.9	44.6	42.1	39.7	37.6
		47.1	63.5	55	49.9	45.3	42.3	39.6	38
		46.2	67.7	53	47.6	45.1	42.4	40.5	39.1
		51.4	70.3	65.2	48.6	45.9	43.6	41.4	39.1
		50.5	80.4	61.5	48.8	45.8	43.8	41.9	40.1
		50.9	70.4	60.9	52.8	48.2	44.9	43.5	41.6
		51	70.4	59.3	52.6	50.2	46.6	44.8	42.5
		47.9	62	53	49.7	47.4	45.5	43.8	42.4
	18:00	48.5	64.4	55.1	50.5	47.6	45.4	43.3	41.4
		49.5	64.9	55.4	51.5	48.7	46.7	45.3	43.5
		49.8	70.6	56.6	51.5	48.5	46.4	45.1	43.2
		53.1	75.2	64.9	53.9	49.8	47	45	43.3
		51.4	73.6	57.8	52.7	49.6	47.5	46.1	43.6
		51	71.9	57.1	52.7	49.6	47.4	45.6	43.6
		51.3	70.3	59.9	53.4	49.2	46.6	44.5	42.2
		50.6	66.1	58.8	52.9	49	46.5	44.5	42.5
	20:00	49.5	63.6	58.1	51.9	47.7	45.3	43.8	42
		48.7	67.3	55.2	50.8	47.6	45.3	43.6	42
		48.8	66.3	55.2	51	47.8	45.4	43.4	41.5
		48.1	68.2	54.2	49.9	47	44.9	43.2	40.6
		49.4	67.1	55.5	51.6	48.1	45.1	42.8	41.2
		48.7	68.4	57.8	51.4	46.1	43	41.1	39
		54.8	81.4	65.6	46.7	44.1	41.4	39.5	38.2
		46	66.9	53.9	46.5	44	41.6	39.2	37.9
	22:00	44	60.8	48.1	45.8	43.7	41.3	39.6	38.4
		47.7	74.6	54.4	46.6	44	41.3	39.5	38.1
		44	54.3	50.7	45.6	43.5	41	38.5	37.2
		43.2	51.2	46.9	45.5	43	39.8	37.7	36.5
		42.6	48.7	46.5	44.8	42.3	39.6	37.1	35.9
		43.8	56.9	50.1	45.8	43.1	39.3	37.1	36
		42.7	52.5	48	45.1	41.9	38.8	37.3	36
		42.1	60.7	46.5	44	41.7	39	37.6	36.3
20/10/2020	0:00	44.1	59.6	52.3	45.9	42.7	39.5	37.3	36
		43.9	57.3	50.8	46.1	43	39.9	38	36.4
		42.1	54	49.3	44.2	41	38.4	36.1	34.4
		40.6	51.3	46.6	43	39.7	36.9	34.9	33.7
		43	63.4	52.7	44.1	40.1	37.4	36.1	35
		41	61	49	43	39	36.5	35.4	34.5
		38.6	54.7	43.6	41.3	37.6	35.3	34.1	32.6
		37.5	46.4	42.7	40.1	36.7	34.5	33.1	32.1
	2:00	37.9	54.4	44	40.3	36.8	34.2	32.8	31.7
		47.4	62.9	58.2	51.1	41.8	36.9	34.3	32.7
		52.4	75.8	63.2	55.4	47.1	40.9	36.6	32.9
		59.1	83.6	69.6	61.7	52.2	45.6	41	36.8
		61.8	83.3	74.4	63.5	53.6	46.4	40.9	36.5

		63.9	85.6	74.9	66.4	58.3	51.1	47	40.3
		61.7	79.2	71.3	65.6	57.7	49.6	43	38.9
		63.4	83.1	74.7	66.1	57.8	51.4	47.9	44.5
	4:00	60	83.5	70.5	63.1	54.3	48.1	43.7	37.6
		60.7	88	69.8	62.8	55.2	50.1	45.4	38.5
		57	81.4	68.9	57.9	50.9	44.3	37.4	33.5
		47.5	65.1	56.8	50.7	44.3	37.6	32.5	29
		43.8	60.5	51.5	47.3	41.7	35.6	32.3	30.2
		51.6	72.3	64	53	41.1	35.4	33.3	31.5
		43	65.5	53.3	44.6	39.4	35.9	33.9	31.8
		40.7	53.8	47.2	43.7	39.4	35.7	34.3	32.9
	6:00	40.5	58.2	46	43.3	39.4	35.1	33.1	31.2
		43.5	68.5	50.9	44.6	40.9	37.2	35	33.2
		46.9	75.7	55.8	46.6	40.7	37.3	35.1	33.7
		43.8	62.6	54.2	45	41.4	38.6	37	35.6
		43.2	62.1	50.4	45.1	41.8	39.2	37.8	36.8
		44.2	69.7	50.7	45.5	41.6	38.7	37.4	36.2
		46	71.6	54.8	46.5	42.2	39.2	37.5	36
		45.7	67.8	55.3	47.7	43.1	40.1	38.5	37.2
	8:00	47.8	76.8	55.8	46.8	43.4	40.1	37.6	36.7
		45.4	64.5	54.9	47.3	42.8	39.7	37.4	36.3
		45.1	65.2	55.1	46.1	42.7	40.2	38.7	37.3
		45.8	70.7	52.4	46.2	43.1	40.5	38.2	37.1
		46.5	69.7	53.9	47.1	43.8	41.3	40.3	38.7
		50.3	78.5	57	46.8	44	41.7	39.7	38.4
		44.8	56.3	50	47	44.2	40.8	39.4	38.3
		47.4	66.1	57.2	48.7	44.9	41.9	40.2	38.7
	10:00	46.3	68.1	53.8	47.8	44.2	41.5	39.3	38.1
		45.9	62.7	55.2	47.5	44.2	41.2	39.2	37.4
		45.8	67.9	54.2	47.6	44.1	40.9	39	37.4
		44.8	64.6	52.3	46.8	43.6	40.4	36.8	34.4
		46.7	72.7	57.6	48	43.5	40.6	37.6	35.2
		46.2	67.1	55.3	48.1	44.1	40.5	36.5	33.9
		59.8	80.9	76.4	51.7	44.2	40.1	37.9	36.8
		49.7	67.7	62.1	49.9	44.6	42.4	40.6	39.2
	12:00	56.9	81.8	70.9	49.4	44.3	41.1	38.8	37
		46.5	71.5	54.3	48.4	44.9	42.1	38.9	37.3
		56.2	78.9	67	60.3	46.4	42.9	39.8	36.9
		45.9	59.9	53.7	47.8	44.7	41.6	39.8	38.7
		55.8	78	71	49.3	44.9	42.2	39.4	37.3
		46.3	67.1	54.2	47.6	44.9	41.6	38.9	37.5
		45.9	60.2	54.4	48.3	44.2	41.2	39.2	37.9
		48.4	71.4	58.6	47.5	44	41.1	39.2	38.3
	14:00	46.6	60.1	56.1	48.2	45	42	40.4	39.4
		47	65.9	56.5	48.4	45	41.9	40.2	38.6
		47	67.6	56	49	45	41.9	38.8	36.3
		46.7	70.2	55.6	48.1	44.5	41.8	38.8	36
		47.6	70.3	56.7	49.4	45	42.6	40.7	39.4
		49.8	69.7	63.4	48.8	44.8	41.5	39.6	37.9
		47.9	68.9	58.9	48.5	45	42.3	40	39
		46.9	72.3	53	48.4	44.9	42.3	40.5	39.5
	16:00	48.7	63.7	57.4	51.7	46.5	41.9	39.2	37.4
		51.6	72.4	60.7	54	49	43.6	40.8	39.6
		49.9	66.5	60.9	51.9	46.1	43.6	42.2	41.3
		48.4	69.8	59.1	48.5	45.5	43	41.5	40.7
		48.2	60.6	56.8	50.7	46.2	43.2	39.2	37.8

		49.3	77.3	57.1	50.8	45.9	43.5	41.4	40.4
		46.3	58.3	52.7	48.3	45.7	42.6	40	38.4
		46.4	62.2	53.3	49.1	45.1	42	39.8	38.2
	18:00	46.3	64.7	52.3	48.3	45.3	42.4	40.3	39.2
		47.4	75.2	51.2	47.5	44.9	42.1	40.1	38.9
		45.6	59.6	53.6	47.2	44.6	41.7	38.9	37.8
		46.5	62.4	55.4	49	44.6	42.2	41.1	39.9
		44	55.1	48.7	46.1	43.4	40.9	39.7	38.9
		45.4	58.3	54.3	47.5	43.5	41	39	37.7
		48.9	67.9	59.1	51.4	45.2	41.9	40	38.8
		45.6	59.8	53.5	47.8	44	42	40.6	39.5
	20:00	44.2	57.1	48.7	46.1	43.5	41.7	40.2	38.9
		45.4	65.8	56.8	46	43.1	40.9	39.6	38.4
		43.8	59.6	49.4	45.7	42.9	40.8	38.9	37.7
		44.2	63.3	51.6	45.5	42.6	39.7	38.3	37.3
		41.9	56.7	46.5	44.5	41.2	38.2	36.8	35.9
		42.8	53.1	47.9	45.2	42.1	39.3	38.2	37.2
		43.3	60	49.1	45.2	42.2	40.2	39	37.8
		44.4	74.7	47.6	44.8	41.9	39.8	37.8	36.6
	22:00	42.5	55.4	47.6	44.7	41.8	39	37.7	36.3
		41.3	56.4	48.1	43.6	39.9	37.3	35.9	34.7
		40.3	46.9	45.3	42.7	39.7	37.2	36.1	35.3
		40.3	49.2	46.2	43	39.3	36.6	35.3	34.2
		40.4	51.3	45.9	43	39.4	37	36.1	34.3
		40	56.9	45.3	42.7	39.2	36.1	34.5	33.5
		40.9	61.3	50.6	42.4	37.7	33.5	31.3	30.2
		39.1	54.9	47.9	42.1	36.5	32	30.4	29.5
21/10/2020	0:00	38.1	53.4	45.8	41.1	36.3	33	30.8	29.3
		37.9	51.9	46.1	41	35.5	32.3	30.6	29.2
		35.5	53.3	44.7	38.6	32.8	30.5	29.8	28.9
		35	54.3	42.5	38.1	33	30.6	29.4	28.5
		34.1	48.4	41.7	36.7	32.6	30.4	29.3	28.3
		35.7	50.4	44.3	39.1	32.8	29.9	29.1	28.3
		37	54.1	43.9	39.6	35	31.5	29.7	28.7
		35.3	50.9	42.4	37.4	34.2	32.6	32	31
	2:00	36	51.4	44.2	37.9	34.3	32.6	31.6	30.4
		36.6	55.6	46.1	38.5	34.4	32.2	31.3	30.5
		39.1	59.6	46.7	40.8	36.1	33.6	32.5	31.4
		35.6	48.2	43.7	37.9	34.4	31.5	30.3	29.5
		36.2	55.6	43.9	38.2	34.7	33	32.2	31.1
		35.4	48	43.3	37	34	32.6	31.8	30.9
		36.1	45.9	42.3	38.1	35.2	33.6	32.6	31.8
		38.1	50.3	45.1	40.8	36.6	33.8	32.5	31.2
	4:00	41.8	67.3	51.3	40.6	35.6	33.6	32.6	31.2
		39.5	59.1	48.3	41.1	36	34.1	32.8	32
		43.1	65.3	52.6	43.8	39.2	35.9	34.2	33.2
		41.2	54.2	48	44	39.9	36.6	35.3	34.3
		42.8	52.8	49.6	45.5	41.7	39.3	37.9	37.1
		44.5	54	49.8	47.2	43.6	40.8	39.3	38.2
		46.7	66.7	53.1	48	45.3	43.1	41.8	40.8
		47.6	68.9	52.5	49.1	46.3	44.4	43.4	42.5
	6:00	48	60	53.2	49.9	47.5	45	42.8	41.4
		51.6	75.3	60.5	51.6	49.2	46.8	45.7	44.5
		50.7	72.6	56.5	52.3	49.9	47.5	46.6	45.7
		51.4	65.3	58	52.7	50.7	48.8	47.9	46.8
		51	61.7	56.5	52.5	50.5	48.8	47.5	46.6

		51	69.2	55.9	52.2	50.5	48.4	47.3	46.4
		50.5	66.7	55.3	51.9	50	48.2	46.9	45.6
		50.1	62.7	56	51.6	49.5	47.9	46.8	45.8
	8:00	50.4	67.7	56.6	52.2	49.1	47.3	46.1	44.8
		49.4	63.5	55.5	51	48.7	46.5	44.7	43.4
		49.1	66.9	56.1	50.9	48	45.1	42.9	42
		48.5	68.9	54.9	50.3	47.4	44.4	42.5	41.2
		49.3	64.8	56.6	52.3	47.6	43.7	40.8	38.7
		49.1	67.5	56.4	52	47.5	43.6	41.2	39.6
		49.6	76.2	56.6	50	46.9	43.4	40.4	38.3
		59.9	86.8	71.4	50.2	46.4	41.8	39.8	38.6
	10:00	46.3	64.4	53	48.8	45.1	40.9	37.3	34.9
		47.8	62.9	56.2	50.6	46	42.2	39.4	37.6
		47.2	63.6	55.5	50.1	45.3	41.1	38.9	36.9
		47.4	71	56	49.8	44.8	40.7	36.8	34.9
		45.9	63	53.7	48.6	44.3	40.1	37.1	35.7
		55.8	82.7	69.6	49.4	45.1	41	37.6	36.2
		44.7	56.4	51.3	47	43.8	40.4	37.3	35.2
		46.5	59.9	54.8	49	45	41.6	38	36.4
	12:00	50.2	68.9	63	50.1	45.2	41.8	38.8	37
		46.8	61.8	56.1	49.4	44.6	41.7	39.7	37.5
		48.7	70	60.3	49.1	44.9	41.9	40.1	38.7
		50.8	70.6	57.9	53.2	48.7	44.4	42.6	41.5
		54.9	75.6	64.4	57.2	52	45.1	43.1	41.9
		51.5	68.3	62.2	55.6	46.8	44.3	42.3	40.6
		53.2	73	66.3	52.1	46.5	44.2	42.7	40.7
		47.3	65.7	54.7	49.1	46.1	43.8	41.9	39.7
	14:00	47.1	60.9	54.4	49.3	45.9	43.3	41.8	40.2
		48.9	68.3	57.2	50.3	46.3	43.9	41.7	40.5
		50.5	78	59.5	51.1	46.7	44.5	43.2	41.3
		49.9	74.6	59.8	51.3	46.6	44.1	42	39.9
		47.6	64.4	55.4	49.4	46.1	44	42.5	41.5
		50.9	73.3	60.1	52.9	47.6	44.7	43.2	41.3
		48.4	70.6	56.3	49.7	46.8	44.2	42.3	40.6
		48.5	68.6	56.5	50.3	47.1	44.1	42.6	41.1
	16:00	51.3	73.7	61.1	53.6	47.4	44.4	42.4	41.2
		50.4	74.8	60.1	51.4	47	43.9	40.8	39.5
		47.7	65.1	54.1	49.8	46.5	44.3	42.7	41.3
		49.8	65.6	60.5	51.4	47.3	44.8	42.1	39.9
		50.9	68.4	60.7	53.7	47.7	44.2	42.7	41.5
		55.2	75.5	67.2	57.6	49	45.9	44.4	42.5
		48.5	62.3	56.8	50.6	47.2	44.5	43.2	41.3
		48.3	64.8	56.3	50.1	46.9	44.6	42.1	40.7
	18:00	48.6	69.3	58.1	50.3	46.2	43.2	38.8	36.9
		48.6	62.7	56.1	51.6	46.9	43.8	42.3	41.4
		47.8	67.8	55.1	49.5	46.2	43.8	41	40
		48	67	58.4	49.8	45.8	43.6	40.8	39.2
		48.2	63.3	57.5	51.1	45.4	42.8	38.9	36.5
		45.8	66.8	52.9	47.5	44.8	41.7	39	37.8
		48.1	61.6	58	50.9	45.2	42.1	38.9	36.5
		47.9	69.3	59.5	47.8	44.1	39.2	37.2	36
	20:00	43.7	52.8	49.6	46.3	43	39	36.1	34.8
		44.9	67.4	52.3	46.5	43.1	38.9	36.7	35.4
		43.9	56.9	51.6	46.6	42.4	37.9	35.4	33.7
		43.9	62.7	52.6	46	42.4	37.8	34.9	33.7
		42.9	54.8	50.6	45.3	41.7	37.9	34.6	33.6

		43.3	61.1	50.5	45.8	41.7	38.2	36.2	35
		44.5	60.9	54.4	46.3	42.3	37.9	34.8	33.5
		42.2	61.4	48.3	44.2	40.8	36.9	35.5	34.6
	22:00	43.6	59.3	54.9	44.7	41.3	37.9	36.3	35.1
		42.9	60.2	50.4	45	41.3	37.7	36.4	35.5
		44.3	57.2	54.3	46.9	41.6	37.8	36.3	35.3
		42.8	59.7	53.6	44.3	40.1	37	35.6	34.3
		39.8	67.4	45	42.2	38.2	35.2	33.6	31.9
		39.4	65.6	46.6	42.2	37.5	34.6	33.5	32.5
		39.6	60.9	46.6	42	37.2	33.8	32.5	31.1
		39.1	57.3	47.2	41.5	37.3	34.6	32.9	31.8
22/10/2020	0:00	38	56	45	40.8	36.1	33.2	32.1	31.1
		37.3	47.7	44.7	41	34.9	32.9	31.7	30.3
		36.5	49.4	44.9	39.1	34.5	32.5	31.5	30.5
		36.9	49.4	43.3	39.2	35.8	33.2	31.9	30.8
		36.2	52.5	43.6	38.4	34.5	32.8	32	31
		34.4	45.7	41.6	36.3	33.2	31.2	29.8	28.8
		36.5	60.4	46.3	37	32.7	30.8	29.6	28.3
		33.6	48.4	42.9	37.1	30.1	27.9	26.9	25.9
	2:00	34.4	60.8	40.3	36.5	32.8	29.9	28.5	27.6
		32.5	44	39.9	34.7	31.3	29.3	27.9	26.7
		32.9	47.9	43	34.6	30.8	28.9	27.5	26.3
		35	50.3	44.4	38.1	31.5	29.6	28.2	26.7
		35	50.1	45.5	36.4	33	31.3	30.2	28.8
		33	44.3	41	35.6	31.3	29.3	28.5	27.6
		35.1	47.7	44.1	38.4	32.2	29.5	28.3	26.8
		38.7	64.1	50	37.8	31.9	27.9	26.9	25.3
	4:00	36.8	55.5	48	38.8	32.1	29.9	28.3	27.4
		37.8	48.4	44.6	40.5	36.4	33.5	31.9	30.6
		45	70.6	54.7	46.5	41	35.7	33	31.7
		40.5	60.7	50.5	43.8	36.7	33	31.8	31
		41.6	56	50.1	44.5	39.7	36.6	34.6	33.5
		43.4	60.4	49.4	46.4	42	38.4	36.6	35
		43.8	59.2	49.9	46.4	42.8	39.3	38	37.2
		46.3	70.2	52.7	48.4	44.8	41.1	38.6	37.6
	6:00	47.4	63.5	54.9	49.5	46.3	42.8	40.5	39.2
		49.2	68.7	57.3	50.3	47.6	44.4	42.7	41.3
		48.9	62.2	55.3	51.1	48	44.7	42.8	41.5
		50.1	73.8	57	51	48.7	45.7	43.9	42.9
		49.6	62.6	55.4	51.3	49	46.7	45.1	43.9
		51	72.1	58	52.3	49.5	47.6	46.2	45
		51.9	73.4	61.1	52.5	49.2	46.7	45	43.6
		51.6	80	61	51.5	48.8	46.4	45.1	44.3
	8:00	49.6	65.3	57	51	48.8	46.5	45.3	44.5
		50.6	67.8	59.6	52.4	48.8	46.9	45.7	44.5
		50.3	73.9	57.3	51.4	48.7	46.8	45.2	44.5
		49.9	66.5	58.2	52.5	48.1	45.8	44.3	43.2
		50.5	67	57.7	53.1	48.9	46.6	45	43.8
		49.2	63.2	56.1	51.7	48.2	45	43.4	42.4
		52	77.7	61.8	53.2	47.9	44.4	42.2	41
		47.9	63	57.2	49.8	46	42.7	40	38.5
	10:00	50.9	74.1	62.5	51.9	46.1	42.5	38.8	36.3
		50.6	73	61.9	52.6	46	42.4	39.9	39
		48.9	75.5	58.9	50.2	46	42.7	40.9	39.3
		58.8	80.6	73.9	52.3	46.4	42.4	39.1	36.7
		46.4	61.5	53.1	48.9	45.2	41.8	39.8	37.7

		47.9	69.6	54.8	50	46.5	43.5	41.7	40.2
		48.3	70.7	54.5	50.1	46.3	43.1	41.4	39.2
		48	65.3	55.6	50.3	46.5	43.1	41.1	39.3
	12:00	46.2	61.1	53.7	48.2	45.1	42.5	40.9	39.2
		47.8	65.8	58.5	49.2	45.5	42.5	40.9	39.2
		46.9	60.9	55.3	49.3	45.1	41.7	39.7	38.8
		53.8	75.4	68.6	50.3	45.6	42.2	40.5	38.6
		47.1	68.6	54.4	48.9	45.2	42	38.9	35.9
		49.7	68.5	60.6	51.8	46	42.7	40.2	36.9
		47.9	71.9	57.6	49.4	45.1	42.2	39.2	37.3
		46.3	60.3	55.4	48.3	44.7	41.7	38.7	37.3
	14:00	47.8	68.8	57.4	50	44.8	40.9	39.1	37.1
		46.8	62.7	56.2	49	44.3	41.2	39.2	37.6
		47.4	65.2	56.2	49.6	45.4	42.2	40.7	39.6
		47.8	64.1	56.3	50.1	46.2	43.6	42.1	40.9
		51.4	68.5	63.5	53.3	46.7	43.1	41.2	39.8
		48.6	64.2	59.9	50.2	46.2	43.7	41.6	39.6
		50.5	75.3	60.8	50.3	47	44.5	42.6	41.2
		49.5	66.1	56.6	51.9	48.2	45.8	44.4	43.5
	16:00	50.1	76.2	57	51.1	47.1	44.5	43	41.7
		50.6	64.5	60.5	53.2	48.4	45	43.6	42.3
		53.5	76.5	66.2	52.6	47.1	44.5	42.9	40.9
		48.8	67.1	57	50.3	47.2	45.2	43.7	42.7
		49.9	71.7	57.5	51.8	48.2	45.3	44.1	42.9
		50.9	74.3	59.9	51.9	48.8	46.7	45.3	43.3
		49	62.2	55.7	51.2	48	46.1	44.7	43.8
		49.5	61.8	57.8	51.4	47.9	46.1	45	43.9
	18:00	49.2	64.1	59.3	50.6	47.4	45.3	43.8	42.7
		48.2	62.8	54.1	50.1	47.3	45.6	44.7	43.9
		48.2	70.5	53.9	48.8	46.5	45	44.1	43.4
		49.6	63.9	59.9	51.7	47.1	44	42.6	41.5
		48	62.9	54.9	49.9	47.1	44.8	43.5	42.3
		49.5	73.7	57.7	51.1	47	44.6	43	42.2
		47.9	67.1	57	50.4	45.1	42.5	41.2	40.1
		45.7	59.6	50.7	47.6	45.1	42.5	40.9	39.6
	20:00	46.1	62.8	51.3	48.2	45.4	43.2	41.9	40.3
		45.7	63.7	51.9	47.1	44.8	42.7	41.4	40.6
		44.8	59.5	49.6	46.8	44.2	41.8	40.8	39.9
		46.2	70	53.1	46.4	44.2	42.2	41.1	40.1
		47	66	56.3	48.4	45.2	43.2	42.1	40.8
		45.4	64.4	50.3	46.9	44.5	42.5	41.3	40.4
		45.2	54.5	48.8	47.1	45	42.4	41.2	40.4
		44.9	58	50.6	46.9	44	41.9	40.7	39.5
	22:00	44.7	57.3	49.5	46.4	44.2	42.5	41.5	40.8
		45.4	64.2	56	46.5	42.8	40.4	39.3	38.5
		43.2	64.7	48.1	45	41.8	39.4	38.6	37.7
		42.8	58.6	49.4	45.1	41.6	39	37.5	36.4
		41.9	56.8	48	43.8	41.1	38.9	37.3	35.9
		42.5	52.7	47.3	44.8	41.8	39.5	37.7	36.5
		41.7	56.7	49.5	44	40	37.4	36.2	35.4
		41	53.6	49.4	43.6	39.4	36.3	35.2	33.6
23/10/2020	0:00	41.2	58.5	47.9	43.3	39.4	37	35.9	35.2
		41.4	58.3	46.9	43.6	40.5	38	37	36
		40	54.7	48.2	42.1	38.6	36	34.8	34.1
		37.9	49.7	43.7	40.2	36.7	35.2	34.2	33.3
		39.1	49.6	46.5	42.1	37.6	35.3	34.2	33.5

		37.1	49.4	43.4	39.3	36	34.2	33.3	32.5
		39.9	52.5	46.3	42.4	38.7	36	35	34.1
		37.3	48.8	44.5	39.6	36.2	33.8	32.7	31.7
	2:00	37.8	48.3	44.6	40.2	36.6	34.6	33.4	32.6
		38.8	48	44.7	41.3	37.9	35.2	34.1	33
		41	55	47.1	43.4	39.8	37.4	36.5	35.7
		41.7	59.7	49.8	43.6	39.9	37.8	37	35.9
		40.8	56.5	49.4	42.8	39	37.3	36.3	35.3
		39.2	60.9	45.4	40.7	38.4	37	36.1	35.2
		38.7	46.7	44	40.7	38	36.1	35.3	34.4
		38.1	47.8	43.6	40.1	37.3	35.2	34.2	33.5
	4:00	36.9	51.3	44.5	39.1	35.5	33.6	32.6	31.5
		39.2	54.2	49.3	41.5	36.1	33.6	32.7	31.6
		40.3	56.8	50.2	42.2	37.8	36	35	33.7
		41.5	60.8	49.2	43.9	39.9	38	36.6	35.6
		42.9	64.8	50.8	44.5	40.7	38.5	37.6	36.9
		43	62.4	49.2	45	42	39.7	37.7	36.7
		45.5	56.9	49.7	47.4	45	43.1	41.8	40
		46.7	64.9	52.1	48.3	45.9	43.7	42.6	41.5
	6:00	47.2	59.4	51.9	49.2	46.6	44.3	43.2	42
		50.2	69.1	57.7	51.8	48.9	46.6	45.5	44.6
		53.1	74.8	62.3	53.1	50.2	48.1	46.9	46.3
		53.2	79	62.3	52.9	50.3	48.5	47.5	46.6
		50.7	66.5	55.5	51.8	50.4	48.7	47	45.5
		51.5	72.5	55.9	53.1	50.8	49	47.7	46.5
		52.4	72.6	61.6	53.7	50.7	48.7	47.5	46.1
		52	77.6	59.9	52.8	50	48	46.4	45.3
	8:00	49.5	67.1	56	51.1	48.6	46.7	45.2	44.2
		50.1	68.1	58.2	51.6	48.5	45.7	43.9	42.8
		50.6	76.2	58.4	52	47.8	44.9	43.3	41.1
		49.6	70.9	56.7	51.8	48.4	44.5	42.4	40.7
		49.7	66.3	57.4	51.8	48	44.8	42.9	41.7
		49.4	64.5	58.5	51.9	47.7	43.6	41.7	40.1
		49.6	66	57.5	51.7	48	44.9	41.3	38.7
		49.8	74.5	58.8	50.7	46.9	43.1	41.3	39.7
	10:00	48.6	67.8	56.5	50.4	46.6	43.4	41.7	40.2
		55.7	81.2	69.6	53.1	47.7	44.3	42.6	40.8
		48.8	70.1	55.9	50.3	47.1	44.3	42.9	41.9
		51	75.8	58.1	50.2	46.7	43.5	41.3	40.2
		50.2	72.9	61.5	50.5	46.2	42.9	41.3	40
		48.2	68.4	55.5	49.4	46.2	43.6	42.1	40.6
		53.9	75.1	67.6	51.4	46.8	43.6	42	41.1
		47	64.5	53.8	49.2	45.9	43	40.4	39.2
	12:00	49.2	73.4	57.6	50.8	46.7	43.1	40.9	39.3
		48.6	64.8	57.4	50.5	46.9	44.3	42.8	40.8
		47.1	61.9	53.7	49.4	46.1	43.1	41.1	39.7
		47.3	59.4	52.7	49.5	46.7	43.7	42.3	41
		49.2	73.3	58.3	49.4	46.5	43.8	42.1	40.8
		49.3	74.2	54.3	49.1	46.4	43.3	41.9	39.9
		46.9	61.5	52.9	48.8	46.3	43.6	42.2	41.1
		57.4	80.1	72.2	52	46.1	43.1	41	39.2
	14:00	47.9	71.8	55	48.8	45.8	43.1	40.9	39
		49.9	68.4	60.5	52.5	46.1	43	41.6	40.5
		47.1	59.7	54.9	49.7	45.7	42.2	40.1	37.9
		48.1	71.7	58	49.9	45	41	38	36.5
		57.6	79.1	72.9	50.5	46	42.2	39.7	38.4

		47.8	64.8	56.4	49.7	45.9	42.8	41.2	39.8
		47.3	64.7	54.8	49.1	46.3	43.7	41	38.7
		47.9	59.2	55	50	47.1	43.6	42.1	40.7
	16:00	49.1	60.2	57.9	52.4	46.4	43.8	42.5	41.6
		50.1	70.5	60.8	50.2	47.1	44	42.6	41.2
		49.3	65.9	59	51.3	47	44.5	42.9	41.5
		52.7	75.7	65.5	51.7	47.1	44.1	42.2	41
		51	72.7	61.9	52	47.2	44	42.4	40.9
		53.1	70.6	66.2	53.2	47.6	44.7	42.6	40.3
		47.7	62.8	53.8	49.7	46.8	44.7	43.8	42.8
		47.9	57.4	53.5	50.2	47.3	44.5	43	41.7
	18:00	53.2	80.6	62.3	50.1	47	44.1	42.3	40.6
		48.7	67.3	55.9	50.7	47.7	44.6	42.7	41.4
		49.4	66.6	56.2	51.9	47.3	44.4	42.3	39.7
		49.9	63.7	58.3	52.8	47.9	45.2	42.4	40.6
		49.4	69.8	58.3	51.4	47.6	44.9	43.6	42.5
		51.5	67.7	60.2	54	49.1	46.6	44.9	43
		49.4	63.6	57.4	51.8	47.9	45.3	43.7	42.4
		51.2	67.3	60.9	54.4	47.5	45.1	43.8	42.7
	20:00	49.1	72.9	56.3	51.1	47.2	44.8	43.3	42
		48.5	70.8	54.7	50.6	47.1	44.9	43.4	42.1
		50	66.1	57.5	52.6	48.3	45.9	44.4	42.6
		49.9	63.3	57.4	52.6	48.2	45.3	43.6	42.2
		50.5	74.5	59	52.6	48	45.1	43	41
		52.9	72	63.9	55.2	49	45.1	43.1	40.4
		54.9	76.4	64.6	58.2	51.1	46.2	44	41.3
		55.6	72.8	66.6	58.8	50.9	45.7	42.9	40.9
	22:00	51	71.6	60.9	53.7	47.3	44.1	42.2	40.7
		49.3	71.8	59.7	51	45.9	42.6	40.9	39.9
		45.5	67	52.6	47.1	44.3	41.8	40	38.1
		46.8	72.9	55	48.1	44.3	41.4	38.9	38
		47.6	62.6	56.9	50.9	44.7	40.7	37.9	36.5
		59.4	78.3	74.6	52.5	44.1	41	39.1	37.9
		44	62.4	51.9	46	42.5	39.8	37.9	36.4
		47.8	69.4	58.4	49.9	43.5	40.9	39.2	37.8
24/10/2020	0:00	39.7	58.1	48.5	42.2	37.4	34.4	32.9	31.5
		37.1	50.7	43.2	39.6	35.9	33.9	32.7	31.5
		38.5	50.6	46.3	41.7	36.3	33.8	32.7	31.8
		37.2	50.4	44.3	39.9	35.7	32.7	31.2	30.3
		36.5	53.4	44.5	39.8	34.2	32.2	31.2	30.1
		36.4	50	43.7	39.1	34.8	32.5	31.3	30
		36.3	44.4	42.8	39.2	35	32.9	31.8	30.6
		35.8	53.3	44.1	38.1	34.1	31.6	30	28.5
	2:00	34.7	52.3	42.2	37.3	33.3	31.1	30.1	28.7
		35.7	48.7	43.6	37.6	34.4	32.7	31.5	30.3
		40.4	52.5	47.8	39.9	35.6	32.6	31.3	30.4
		40.5	55	50.8	43.1	36.2	33.3	31.6	30.7
		37.8	50.7	45	40.3	36.5	33.7	32.2	30.6
		39.3	54	48.6	42.5	36.3	34.4	33	31.3
		41.3	59.1	50.6	44.9	37.3	34	32.9	31.8
		36.5	49	45	38.8	34.9	32	30.1	29
	4:00	38.3	55.5	47.8	40.3	35.9	33.6	32.5	31.3
		39.8	58.9	49.2	41.6	37.3	34.9	33.8	32.8
		40.8	55.2	50.1	43.2	38.8	35.2	33.9	32.1
		43.1	64.7	52.7	43.9	39.6	36.9	35.2	33.6
		41.7	52.2	48.5	44.4	40.6	37.8	36.3	35.1

		42.8	51.2	48.4	45.6	41.8	39	37.9	36.9
		46.1	66.7	51.3	48	44.7	42.1	40.3	38.9
		46.5	56.4	51.1	48.3	46	43.6	42.5	41.6
	6:00	48.3	63.9	55.1	49.8	47.5	44.9	42.7	41.4
		49.4	64.9	57.2	50.6	48.5	46	44.4	43.4
		51.6	71.3	60.6	52.6	50	47.6	46.2	44.9
		51.4	72.8	58.8	52.5	50.3	48	47	45.4
		51.2	72.7	56.6	52.3	50.5	48.9	48	47.3
		52.1	69	60.9	53.1	50.5	48.9	47.7	46.7
		51.9	75	59.7	52.8	50.3	48.9	48.1	47.1
		51	64.2	56	52.3	50.6	49.2	48.3	47.5
	8:00	53.1	70	64.5	53.8	50.6	49.1	48.1	47.1
		51	69.1	56.6	52.5	50.1	48.4	47.5	46.7
		50.4	61.5	54.5	51.9	50	48.4	47.4	46.3
		51.5	69.5	58.9	53.3	49.9	48.2	46.9	46.1
		55	68.5	61.3	58.2	53.9	47.8	46	44.8
		49.6	62.1	56.9	51.5	48.8	46.1	45.1	44
		50.6	71.9	59.6	52.1	48.7	46.1	44.8	43.6
		48.1	64.2	53.1	50	47.6	45	43.3	41.6
	10:00	47.5	64.6	53.9	49.5	46.8	43.8	42.6	41.8
		56.7	75.8	71.1	52.6	46.8	44.1	42.4	40.7
		49.8	71.8	62	50	45.7	42.7	41.2	39.7
		51.3	77.9	62.1	49.5	45.9	42	39.7	38.1
		48.2	67.3	59.5	49	44.9	41.3	38.9	37
		47.2	64.6	55.5	49.4	45.6	41.8	39	37.6
		48.3	70.1	57.5	49.8	45.3	41.3	37.8	36.1
		46	66.6	54.1	48.4	44.2	40.2	37.8	35.6
	12:00	49.2	76.6	60.1	49.8	44.3	40	37.8	35.6
		48.6	70.4	59.5	49.2	45	41.3	38.7	36.7
		46.2	64.1	55	48.1	44.5	41.3	38.5	35.2
		52.3	68.7	58.6	56.8	46.9	42.1	39.3	37.1
		56.5	75.9	62.4	60.2	54.6	51.4	44.9	43.6
		60.4	69.2	67.6	64.4	58.9	43.1	39.1	37.1
		59.5	76.7	65.6	63.7	56.7	46.9	41.5	39.2
		56.3	70.9	63.9	59.5	55.4	45.5	40.8	38.2
	14:00	53.8	72.6	61.9	57.9	47.2	42.8	39.7	38.2
		48	69.7	58.4	50	44.8	41.9	37.5	34.3
		49.5	71.3	60.3	52	45.7	41.5	38.4	36.1
		49.8	74.1	60.2	50.4	45.4	42.2	40.1	38.3
		53.8	78.4	67.5	52	46	43.2	38.9	36.8
		48.1	65.4	57.6	50.7	45.5	42.7	38.4	34.4
		47.6	69.4	55.6	48.3	45.5	42.8	39.2	36.6
		49.8	69.4	61.3	51.4	46.1	41.6	37.7	35.7
	16:00	47.8	70	54.8	49.9	45.3	42.1	38.5	36.6
		49.1	66.9	59	51.6	46.5	42.6	37.2	35.5
		48.2	63.9	56.6	50.7	46.3	43.4	41.7	40.2
		51.9	74.1	64.6	51.7	47.4	44.1	42.2	40
		54.9	77.5	67.5	55.3	46.9	44.5	42.8	41.7
		50	77.1	58	50.8	46.7	43.7	42.3	40.2
		47.4	59.2	55.7	50	45.4	43	41.8	40.9
		47.9	62.6	55.9	49.8	46.6	43.9	41.5	40.1
	18:00	48.3	63.6	56.2	50.5	46.8	44.4	42	38.9
		49.2	74	57.8	49.3	46.5	44.3	42.6	41.2
		46.8	62.8	52.9	49.3	45.7	43.3	41	39.5
		47.9	66.6	56	49.5	46.4	44.4	42.8	41
		48.7	62.3	57.3	51.2	46.9	44.2	42.6	41.6

		48.7	59.8	57	51.5	46.9	44.2	42.7	41.4
		47.6	59.6	56.2	48.9	46	43.7	41.2	39.9
		46.8	59.7	50.9	48.8	46.4	43.4	41.6	40.5
	20:00	45.4	55.8	49.6	47.4	45.1	42.2	40.8	39.3
		46.4	63.1	54.2	47.9	45.3	42.9	41.5	40.6
		45.9	57.3	51	48	45.3	43.1	42.1	41.2
		48	75.7	56.5	48.4	45.9	44.1	43	42.2
		46.4	69.5	49.6	47.9	46.1	44.2	43	42
		46.7	57.1	50.8	48.8	46.1	44.1	42.7	41.6
		47.8	65.7	55.8	49.4	46.3	43.8	42.5	41.2
		46.8	69.7	52.9	48.2	45.4	43.5	42.5	41.7
	22:00	45.1	59.7	49.3	47.2	44.6	42.6	41.1	39
		45.4	57.2	51.6	47.6	44.5	42	41	40.1
		44.1	49.6	47.9	46.2	43.5	41.6	40.4	39.5
		44.3	51.5	48.6	46.7	43.6	41.3	39.8	38.6
		44.9	59.6	52.8	46.9	43.5	41.3	40	39
		42.7	59.3	48	45.5	41.6	39.3	38.1	37.4
		41.7	63.6	47.1	44	40.7	38.4	36.6	35.7
		41.3	55	47.8	43.8	40.1	37.7	35.7	34.9
25/10/2020	0:00	40.3	47.9	45.6	42.9	39.2	36.9	35.5	34.4
		38.7	53.6	44.4	40.9	37.6	35.9	34.9	33.9
		38.3	48.1	44.7	41.2	36.9	34.5	33.5	32.5
		38	49.6	44.8	40.5	36.6	34.6	33.7	32.8
		37	51.6	43.3	39	35.8	33.9	33	31.7
		37.2	50.8	45.5	39.5	35.3	33.3	32.4	30.9
		36.8	48.2	43.2	38.9	35.8	33.7	32.5	31.3
		36.9	46.3	43.1	39.3	35.8	34.1	33	31.9
	2:00	37.4	55.6	43.6	39.3	36.4	35	34.3	33.7
		37.4	45.3	43	39.2	36.7	34.8	33.8	32.9
		38.2	47.8	42.6	40.2	37.6	35.6	34.5	33.7
		39.8	49.5	45.2	42.2	38.9	37.4	36.5	35.5
		39.8	48.6	44.8	41.9	39	37.3	36.4	35.1
		38.7	48.7	44.2	40.2	38.1	36.6	35.5	34.8
		39.5	62.4	45.7	41.4	38.4	36.9	35.8	34.7
		39.3	52.4	43.8	41	38.6	37.2	36.3	35.4
	4:00	40.8	52.4	47.7	42.9	39.7	37.9	36.9	35.9
		40.9	52.8	47.1	43.1	39.8	38.2	37.1	36.3
		42.4	58.4	50.2	44.3	40.8	39.1	38	36.8
		44.5	60.6	53.3	46.9	42.3	40.2	38.8	37.5
		42.7	52.4	48.1	44.9	41.9	40.3	39.4	38.3
		45.5	65	51.8	47.5	44	42.3	41.4	40.3
		46.6	63.3	52.4	48.4	45.7	43.2	42	41
		46.6	62.9	52.2	48.5	45.3	42.9	41.9	41.2
	6:00	47.6	65.1	54.2	49.6	46.3	43.6	42	40.8
		49.4	73	57.6	50.8	47.8	45.1	43.2	41.3
		51.7	76.5	58.7	51.3	48.6	46.1	44.9	44.1
		51	73.4	59.2	51.4	49.1	46.7	45.5	43.9
		49.6	70.7	57.5	50.8	48.5	45.9	44.1	43
		49.8	66.6	56.3	51.7	48.9	46.1	44.7	43.6
		51.6	76.2	59.8	51.5	48.6	46.2	45.2	43.8
		51.4	71.2	63.5	51	48	46	44.7	43.4
	8:00	48.9	64	57.1	50.5	47.6	45.1	43.2	41.8
		48.2	60.6	55.3	50.1	47.2	44.6	43.4	42.2
		48.8	66	57	50.1	47.7	45.2	43.1	42.2
		50.3	69.6	59.7	52.7	47.9	45	42.9	42
		50.4	77.1	57.1	51.9	47.8	45.1	43.1	41.7

		50.1	71.4	60.1	51.6	47.9	43.7	41.5	39.5
		53.1	81.1	61.2	51.2	47.5	44.4	42.5	40.7
		48.5	72.2	54.5	49.7	46.9	44.1	42.8	41.6
	10:00	48	64.7	55.3	50	46.9	43.8	42.5	41.1
		52	69.8	63.9	53.6	47.4	43.7	40.9	39.9
		52.2	80	63.1	51.6	47.6	43.7	41.5	39.2
		47.2	56.2	52.1	49.5	46.6	43.6	42.1	41.3
		50.2	77.5	57.4	50.2	45.8	42.2	40.4	38.9
		47.7	60.6	54.4	50.2	46.5	43.2	41.1	39.8
		47.2	61.3	54.9	49.4	46	43.2	41.8	40.8
		47.2	64.9	53.7	49.5	46.1	42.7	40.3	39.3
	12:00	48.6	66.9	57.5	50.1	46.4	43.9	41.8	40.9
		48.2	72.4	55.5	50.4	46.7	43.4	40.8	39.3
		48.1	66.6	56.4	50.7	46	43	40.7	39.4
		46.7	63.7	54.8	48.4	45.6	43	41.1	39.7
		47.5	66.5	56.7	49	45.5	42.6	41	39.6
		50.1	70.7	62.2	49.9	46.2	43.5	41.2	40.2
		56.4	78.5	70.8	51.1	46.1	44.1	42.3	41.2
		47.7	61.1	55.9	49.7	46.5	43.4	41.6	40.2
	14:00	49.3	72.9	58.4	51.7	46.5	43.4	41.4	40.6
		48.7	72.1	55.9	49.4	46.1	43.2	41.6	40.7
		48.9	68.2	57	50.3	47.4	44.9	43.1	41.9
		48.2	61.4	56.5	50.4	46.5	44.8	43.2	41.9
		58.5	72.6	66.4	64.3	48	43.8	41.8	40.2
		63.8	77.3	68.3	66.2	63.3	59.9	48.5	44.6
		62.8	71.3	66.3	64.8	62.5	56.2	44.8	43.1
		62.6	69.5	67	65.3	62.1	55.1	45.6	43.2
	16:00	64.7	72.7	68.2	66.6	64.6	62.1	46	42.9
		57.4	78.4	68.9	66.6	63.5	58.2	44.4	42.9
		55.6	75.2	61.1	59.4	55.9	47.7	44.4	43
		58.8	79.1	63.7	60.8	57.2	60.7	50	46.9
		61.4	78.2	64.8	62	59	48.9	45.6	43.9
		61.5	77.5	64.1	61.1	57.5	46.3	44.6	43.3
		49.7	64.2	58.1	51.9	48.2	45.7	44.2	43.1
		49.5	66	57.1	51.8	48.1	45.7	44.5	43.6
	18:00	50.1	61.7	57.4	52.1	49	46.9	45.4	44.4
		49	61.4	55.5	51.2	48	45.8	44.4	42.5
		51.8	68.3	58.6	55.6	48.8	45.5	43.2	41.9
		54.9	74.7	65.1	57.9	51.6	47.4	44.9	43.4
		55.9	75.9	67.3	58.6	51	47.1	44.5	41.9
		48.1	67	55.8	50.2	46.8	44	41.9	40.6
		47.8	65.6	57.2	48.9	46.4	43.8	41.2	40.1
		48.6	61.5	57.1	51.2	47.1	43.7	42	40.6
	20:00	48.3	70	59.1	48.4	45.5	42.8	41.4	40.1
		47.9	64.4	57.4	50.1	45.7	42.7	41.2	39.8
		45.7	57.1	53.3	47.7	44.6	41.6	40.4	39.4
		46.5	63.2	54.6	48.4	45.2	42.5	40.3	39
		46.5	60.2	55.5	48.3	44.8	42.3	40.8	39.5
		45.9	60.8	54.2	47.6	44.8	42.3	40.6	39.6
		47	62.3	57.3	48.9	44.6	41.9	40.2	39.2
		47.1	68.9	55.9	47.9	44.8	41.7	39.3	37.9
	22:00	46.4	63.6	57.7	47.1	43.8	41.3	40	39.1
		45.5	61	55.6	47.3	43.4	41	39.5	38.3
		44.1	56.5	49.3	46.4	43.3	41	38.1	36.7
		43.8	56.4	50.3	46.7	42.5	39.5	37.6	36.8
		42.9	57.3	50.7	45.2	41.3	38.9	37	35.5

		42.1	59.8	49	44.6	41.1	37	35.3	33.9
		40.9	59.3	46.4	43.6	39.3	37	35.2	34.5
		42.4	61.3	51.2	44.2	40.2	37.1	35.9	34.7

APPENDIX D

Acoustic Comparisons

30-31 Park Avenue Kingswood NSW

Projected Sound Levels 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 (104 dB – 107 dB) Jet Flyover at 400 metres - 105 dB		
100				
	Very Noisy			
90		Pneumatic Drill		
		Heavy Truck, 40km/h, 7a distance (87dBA - 90 dB) Motor Car at 7 (80dBA) Motor Bikes (2-Wheel) 70dBA – 92dBA)		
80				
	Noisy	Average Street Traffic (40km/h, 7 metre distance)		
70				
		Lawn Mower at 30 metres 70dBA Vacuum Cleaner at 3 metres - 67 dB Normal Speech at 1 metre - 65 dB Business Office (60 dB – 65 dB)		
60		Inside an Average Residence- 60 dB		
	Moderate	Large Business Office 60 dB (55 dB – 65 dB)		
50		Dishwasher – Next Room 50 dB		
		Typical Living Room at Night (40 dB – 45 dB)		
40				
	Quiet			
		Library (30 dB – 34 dB) Soft Whisper at 2 metres 30 dB		
30				
		Typical Bedroom at Night (25 dB – 30 dB) Concert Hall Background 4D Slight Rustling of Leaves 20 dB		
20				
	Almost Silent	Broadcast & recording Studio 16 dB		
10				
0	***Silent***	Threshold of Human Hearing		

External Sound Levels (dBA, LAeq) | Internal Sound Levels (dBA, LAeq)

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

APPENDIX E

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

Bathla Group & Universal Property (2018 & Previous) – Site investigation; preparation of Construction management Plans and provision of specialist technical advice for a wide range of residential subdivisions and development throughout the Sydney area.

Mostyn Copper Group & Australian Turf Club (2018) – Site assessment and validation; Coopers Paddock, Warwick Farm NSW.

Dedico Developments (2018 & Previous) – Site investigations, acoustic and vibration assessments and management strategies for industrial unit and self-storage unit developments at various locations throughout Sydney.

Lodestone HQ (2018 & Previous) – Site investigation, acoustic, air quality and electromagnetic field assessments for a childcare centre development, Princes Highway and Oak Road, Kirrawee NSW, including work required to achieve a Site Audit Statement conforming the suitability of the site for the proposed childcare centre use.

Lodestone HQ (2018 & Previous) – Preparation of Remedial Action Plan and Site Validation Report for a childcare centre development in College Street Gladesville NSW.

Kaunitz Yeung Architecture (2018 & Previous) – Electromagnetic field and air quality assessments of a childcare centre development project at 60 Dickson Avenue Artarmon NSW.

Australian Consulting Architects (2018 & Previous) – 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 (2018 & Previous) – 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 (2018 & Previous) – 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.

LEDA Holdings (2018 & Previous) – Environmental Assessment of a proposed childcare centre at 32 Cawarra Road Caringbah NSW, including general environmental, acoustic, air quality and electromagnetic field assessments.

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.

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 Steven Schlederer, Lodestone HQ
- Mr Sean Mostyn, Partner, Mostyn Copper Group
- Mr Luke Johnson, 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

[redacted]

Noel G Child
2 November 2020

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
Kaunitz Yeung Architecture
LEDA Holdings
Lodestone HQ
Michael Bell Architects
Minter Ellison
Mobil Oil Australia
Mostyn Copper Group
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
Wollondilly Shire Council