C & S Partners Mortgage and Insurance Pty Ltd

971 Richmond Road, Marsden Park

Acoustic DA Assessment

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1 Introduction

The following report has been prepared by Acouras Consultancy on behalf of C & S Partners Mortgage and Insurance Pty Ltd to assess the potential for noise impact associated with the residential development at 971 Richmond Road, Marsden Park in accordance with the NSW Department of Planning and State Environmental Planning Policy (Infrastructure) Clause 87 and Clause 102.

The residential development will include:

- Three (3) levels of basement carpark.
- Retail, gym and childcare centre on ground level.
- Five (5) residential buildings (A to F) with apartments on level 1 to level 8.
- Rooftop terrace on building B and D.

The proposed residential development is in a rural area surrounded by existing residential properties. The site location is shown in Figure 1.

Figure 1 – Site Location, Nearest Residents and Noise Logger Position

2 Noise Criteria

The following standards and guidelines are applicable to this project:

- Blacktown Development Control Plan (DCP) 2015 Part C.
- Amended Statement of Facts and Contentions PART B – CONTENTIONS (2021/00055619), dated 22 September 2021.
- NSW Department of Planning (DoP) "Development Near Rail Corridors and Busy Roads".
- State Environmental Planning Policy (Infrastructure) 2007, Clause 87 and Clause 102.
- NCC/BCA Part F5.
- NSW EPA "Noise Policy for Industry" (NPfI).
- Association of Australian Acoustical Consultants (AAAC) "Guideline for Child Care Centre Acoustic Assessment" (Version 3.0).
- Australian standard AS/NZS 2107-2016: Acoustics – Recommended design sound levels and reverberation times for building interiors.
- Australian standard AS 1055.1-1997: Acoustics – Description and measurement of environmental noise - General procedures.

2.1 Amended Statement of Facts and Contentions

According to the Amended Statement of Facts and Contentions, the following are the acoustic issues that are to be addressed:

> *3f) ADG Part 4H Acoustic Privacy: requires window and door openings to be generally oriented away from noise sources; and noise sources from garage doors, driveways, service areas, active communal open spaces and circulation areas to be 3m from bedrooms. The submitted plans are required to address the requirements of Clauses 87 and 102 of the SEPP Infrastructure to ensure these clauses are complied with, in terms of measures to mitigate the noise and vibration for future residents from both the classified road and the future Sydney Metro transport corridor. An acoustic assessment is required to address these requirements in relation to both the mixed-use development's residential units, and in relation to the Gymnasium and Child Care Centre.*

> *3g) Council's Environmental Health Unit requires an amended acoustic report. The acoustic report is satisfactory with regards to the acoustic environment considering noise from road, plant and child care centre. However the gymnasium, and its operational noise and vibration on the residential apartments and on the child care centre was not addressed in the provided acoustic report. There will be adverse acoustic concerns with the gym's operational use, for instance the dropping of weights, which has the potential to cause both vibration and noise impacts. The Applicant is required to provide an amended acoustic report and a Plan of Operation Management for the Gymnasium.*

14c) An amended Acoustic Report is required to address the requirements of clauses 87 and 102 of SEPP Infrastructure in relation to the noise impacts on future residents within the mixed-use development to address noise and vibration impacts from both the classified road and the future Sydney Metro transport corridor. This is to ensure that these noise and vibration impacts can be fully addressed to ensure future amenity for the residents. The amended acoustic report is also to address the noise impacts from the child care centre and the gymnasium on the residential apartments.

For the above contentions, refer to the following sections for discussion and recommendations:

- SEPP Clauses 87 and 102: Sections 3.1 3.2 and 3.3 .
- Childcare Centre: Sections 3.4 and 3.5 .
- Gym Tenancy: Section 3.6 .

2.2 Internal Noise Levels

For the residential development, the Blacktown Council DCP Part C has no specific acoustic requirements. The Statement of Facts and Contentions requires that the development be assessed according to Clauses 87 and 102 of the SEPP Infrastructure.

The DoP guideline (SEP 102 for roads) requires that if the development is for the purpose of a building for residential use, appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded.

The subject site is not located near the Sydney Metro rail corridor and therefore an assessment of railway vibration is not required. The future Sydney Metro railway line connecting Tallawong Station and the proposed Marsden Park station would be subject to a detailed EIS to investigate and mitigate any future rail noise and vibration.

Table 1— Development near Rail Corridors and Busy Roads – Interim Guideline

Residential Space	Internal Noise Criteria
in any bedroom in the building	35dB(A) at any time 10pm–7am
anywhere else in the building (other than a garage, kitchen, bathroom or hallway)	40dB(A) at any time

Mitigation measures are based on having windows and external doors closed. If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.

The AS/NZS 2107–2016 outlines the acceptable internal noise levels such that a satisfactory acoustic environment within non-residential spaces in new and existing buildings can be achieved. Table 2 presents the recommended internal design noise levels.

Table 2— Recommended Internal Design Noise Levels (AS/NZS 2107)

Type of occupancy/activity	Design sound level ($L_{Aeq,t}$) range
Apartment common areas (e.g. foyer, lift lobby)	45 to 50
Small retail stores (general)	< 50
Gym	< 50
General office	40 to 45
Administrative offices	35 to 40
Staff common rooms	40 to 45
Toilets	< 55
Enclosed Carparks	< 65

2.3 Future Northwest Metro Rail Noise Levels (External)

For any new railway developments near residential land use, the DoP guideline the following trigger levels in Table 3 are not to be exceeded. At this stage there is no approval or commencement date granted for operation, and an operational noise and vibration assessment of the future metro railway is outside of the scope of this report.

Table 3— Airborne Rail Traffic Noise Trigger Levels for Residential Land Uses

Type of development	Day (7 am–10 pm)	Night (10 pm–7 am)
New rail line development	Development increases existing rail noise levels **and** resulting rail noise levels exceed	
	60 $L_{Aeq(15h)}$ 80 L_{Amax}	55 $L_{Aeq(9h)}$ 80 L_{Amax}

2.4 AAAC Noise Guideline for Childcare Centre

Blacktown DCP (Section 8.3) does not have any specific guide for controlling noise emission from children activity that is associated with this type of development. Australian Acoustical Consultants (AAAC) recommends the following criteria for noise intrusion from traffic, rail and industry.

> *The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the outdoor play or activity area during the hours when the Centre is operating should not exceed 55 dB(A).*
>
> *The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the indoor activity or sleeping areas of the Centre during the hours when the centre is operating shall be capable (ie with doors and / or windows closed) of achieving 40 dB(A) within indoor activity areas and 35 dB(A) in sleeping areas.*

The AAAC guideline recommends that outdoor play be assessed as follows:

- Base Criteria – With the development of child care centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed $L_{eq,15min}$ 45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).
- Background Greater Than 40 dB(A) – The contributed $L_{eq,15min}$ noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10dB (ie background+10dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).
- Up to 4 hours (total) per day - If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play shall not exceed the background noise level by more than 10dB at the assessment location.
- More than 4 hours (total) per day - If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:

- 1.5 m above ground level;
- On a balcony at 1.5 m above floor level;
- Outside a window on the ground or higher floors.

2.5 Sound Insulation Requirement (Part F5 NCC/BCA)

For sound transmission and insulation between sole occupancy units (SOU) within the same development, walls and floors to be constructed in accordance with requirements of Part F5 of the Building Code of Australia (BCA). Sound insulation requirements are summarised in Table 4.

Table 4 - NCC Part F5 Requirements (Class 2 or 3)

Building Element	Minimum NCC Part F5 Requirements
Sound Insulation Rating of Walls (Class 2 or 3)	
Walls between separate sole occupancy units.	Rw + Ctr 50 (airborne)
Walls between wet areas (bathrooms, sanitary compartment, laundry or kitchen) and a habitable room (other than kitchen) in adjoining apartments.	Rw + Ctr 50 (airborne) & of discontinuous construction
Walls between sole occupancy unit and stairway, public corridors, public lobby or the like or parts of a different classification.	Rw 50 (airborne)
Walls between a plant room or lift shaft and a sole occupancy unit.	Rw 50 (airborne) & of discontinuous construction
Sound Insulation Rating of Floors (Class 2 or 3)	
Floors between sole occupancy units or between a sole occupancy unit and plant room, lift shaft, stairway, public corridor, public lobby or the like.	Rw + Ctr 50 (airborne) & Ln,w + CI < 62 (impact)
Apartment Entry Doors (Class 2 or 3)	
A door incorporated in a wall that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like.	Rw 30 (airborne)
Services (Class 2, 3 or 9c)	
If a storm water pipe, a duct, soil, waste or water supply pipe including a duct or pipe that is located in a wall or floor cavity serves or passes through more than one sole occupancy unit must be separated:	
if the adjacent room is a habitable room (other than a kitchen); or	Rw + Ctr 40
if the room is a kitchen or non-habitable room	Rw + Ctr 25

Construction Deemed to Satisfy

The forms of construction must be installed as follows:

(a) Masonry—Units must be laid with all joints filled solid, including those between the masonry and any adjoining construction.

(b) Concrete slabs—Joints between concrete slabs or panels and any adjoining construction must be filled solid.

(c) Sheeting materials—

(i) if one layer is required on both sides of a wall, it must be fastened to the studs with joints staggered on opposite sides; and

(ii) if two layers are required, the second layer must be fastened over the first layer so that the joints do not coincide with those of the first layer; and

(iii) joints between sheets or between sheets and any adjoining construction must be taped and filled solid.

(d) Timber or steel-framed construction—perimeter framing members must be securely fixed to the adjoining structure and—

(i) bedded in resilient compound; or

(ii) the joints must be caulked so that there are no voids between the framing members and the adjoining structure.

(e) Services—

(i) Services must not be chased into concrete or masonry elements.

(ii) A door or panel required to have a certain Rw + Ctr that provides access to a duct, pipe or other service must—

(A) not open into any habitable room (other than a kitchen); and

(B) be firmly fixed so as to overlap the frame or rebate of the frame by not less than 10 mm, be fitted with a sealing gasket along all edges and be constructed of—

(aa) wood, particleboard or blockboard not less than 33 mm thick; or

(bb) compressed fibre reinforced cement sheeting not less than 9Â mm thick; or

(cc) other suitable material with a mass per unit area not less than 24.4 kg/m^2

(iii) A water supply pipe must—

(A) only be installed in the cavity of discontinuous construction; and

(B) in the case of a pipe that serves only one sole-occupancy unit, not be fixed to the wall leaf on the side adjoining any other sole-occupancy unit and have a clearance not less than 10 mm to the other wall leaf.

(iv) Electrical outlets must be offset from each other—

(A) in masonry walling, not less than 100 mm; and

(B) in timber or steel framed walling, not less than 300 mm.

2.6 Noise Survey and Project Specific Limits

An unattended noise survey was carried out at the site to measure the background and ambient noise levels. Noise monitoring was conducted between Wednesday 16th to Monday 28th October 2018. The monitor was positioned at two (2) locations as shown in Figure 1.

Measurements were conducted using the following equipment:

- SVAN 977 Type 1 Real time Analyser/Noise Logger. Serial No. 34892.
- SVAN SV30A Type 1 Sound Level Calibrator. Serial No. 31830.

Noise monitoring was conducted in general accordance with Australian standard AS 1055.1-1997: Acoustics-Description and measurement of environmental noise-General procedures. The noise analyser was calibrated immediately before and after measurements were taken with no discernible differences between these two recorded levels. The sound analyser is Type 1 and complies with Australian standard AS1259.2: 1990.

During the monitoring period any adverse weather condition have been excluded. The noise logger results are presented in Appendix C.

2.6.1 Traffic Noise Levels

Table 5 presents a summary of the measured ambient noise level and traffic noise impacting the development. During the monitoring period, traffic along Grange Ave consisted of construction vehicles associated with the nearby major road project.

Table 5 – Measured Ambient and Traffic Noise and Levels, dBA

Location	Period	Average L_{eq}	Highest L_{eq} 1hr
L1	Day (07:00-22:00)	68	71
	Night (22:00-07:00)	65	71
L2	Day (07:00-22:00)	65	69
	Night (22:00-07:00)	60	69

By analysing measured data, the impact of the surrounding traffic noise on Richmond Road and South Street have been calculated by applying the CRTN method for predicting noise traffic noise using CadnaA (version 4.5.149) noise modelling software.

The following Figure 2 and Figure 3 shows the predicted impact of traffic noise during the daytime and night time periods respectively including the traffic generated by the development.

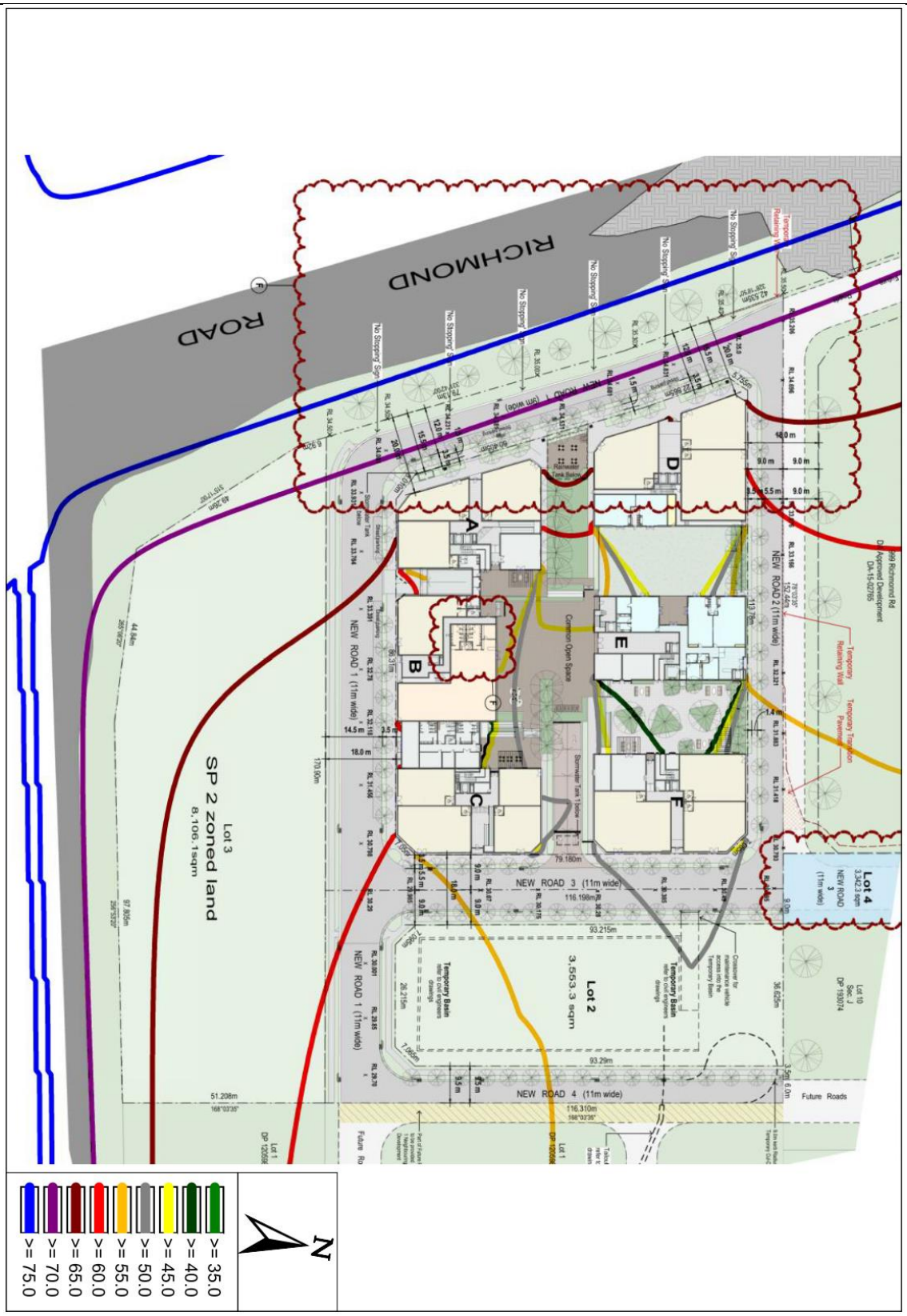


Figure 2 – Daytime Traffic Noise Contour (Ground Level)

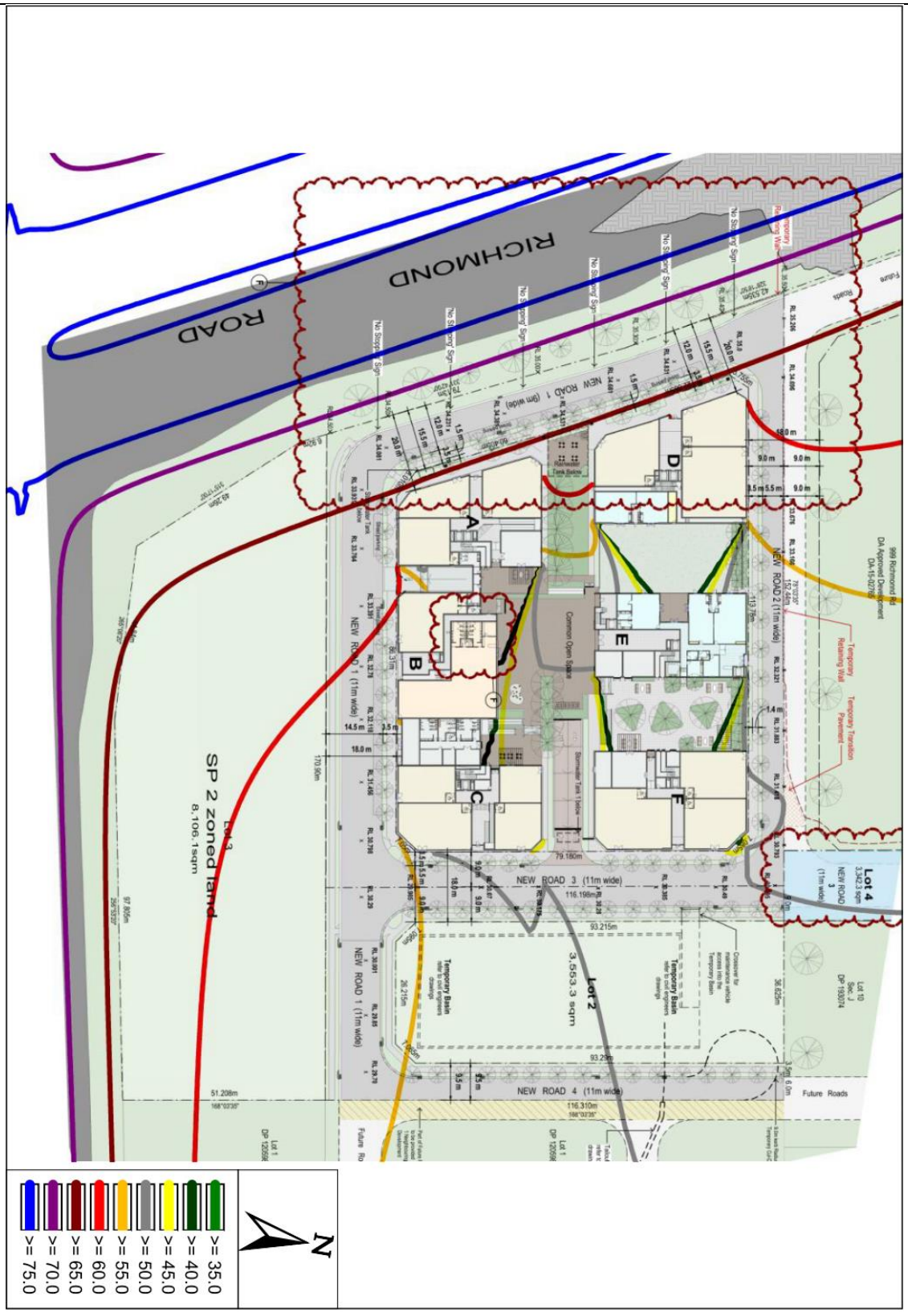


Figure 3 – Night-Time Traffic Noise Contour (Ground Level)

2.6.2 Project Noise Limits

Table 6 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project in accordance with Blacktown DCP Part C, Section 6.9.3. The requirements states that:

> *No electrical, mechanical or hydraulic plant or equipment shall generate a noise level greater than 5dB(A) above the ambient L_{90} sound level at the boundaries of any allotment at any time of day.*

Table 6—Noise Survey Summary and Project Limits, dBA

Location	Time Period	Existing Noise Levels		DCP Noise Limits, $L_{eq(15min)}$
		$L_{eq\ (period)}$	$L_{90(period)}$	
L1	Day	68	58	63
	Evening	66	56	61
	Night	65	50	55
L2	Day	65	50	55
	Evening	63	51	56
	Night	60	46	51

For commercial and retail spaces, we recommend that operational mechanical noise be assessed in accordance with the procedures as set out in the NSW NPfI. Table 7 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project. The amenity criteria are based on a suburban receiver.

During detailed design stage, the design and selection of the mechanical equipment required to service the proposed development will be required to achieve the DCP noise limits as presented in the table above. During the monitoring period any adverse weather condition and construction activity have been excluded. The noise logger results are presented in Appendix C.

Table 7—Noise Limits for Commercial & Retail, dBA

Receiver	Time Period	Existing Noise Levels		NSW EPA NPfI			Project Noise Trigger Level $L_{eq(15min)}$
		L_{eq} (period)	RBL	Recommended ANL	Project ANL[1] $L_{eq(15min)}$	Intrusiveness Criteria, $L_{eq(15min)}$	
Residential	Day	65	46	55	53	51	51
	Evening	63	49	45	43	54	43
	Night	60	40	40	38	45	38
Commercial	All	-	-	-	-	-	**65**
Industrial	All	-	-	-	-	-	**70**

2.6.3 Children Activity Noise Limits (AAAC)

Table 8 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project in accordance with the AAAC recommended limits.

Table 8—Children Activity Noise Limits for the Childcare Centre, dBA

Time Period	Existing Noise Levels			Noise Limits, $L_{eq(15min)}$
	$L_{eq\ (period)}$	$L_{90\ (period)}$	RBL	
Day	65	50	46	51
Evening	63	51	49	54
Night	60	46	40	45

[1] 2. Project ANL is recommended ANL minus 5 dB(A) and plus 3 dB(A), to convert from a period level to a 15-minute level.

3 Assessment and Recommendations

3.1 Façade Glazing Requirements

Acoustic glazing for the buildings are given in Table 9 are required to reduce noise impact on the internal occupants and should result in noise levels within such units in accordance with the Department of Planning Noise Guidelines, SEPP and Australian Standards.

The future extension of the Sydney Metro Northwest connecting Tallawong Station and the proposed Marsden Park station would run to the south of the proposed site. Provided the trigger levels, as given Table 3 are not exceeded, the acoustic glazing given below will attenuate both traffic noise and any future rail noise.

Table 9 – Schedule of Window and Glazing (R_w)

Level	Façade	Space	Glazing Thickness	Minimum R_w (Glazing+Frame)	Alternate Ventilation[2]
			Building A		
G	South & West	Retail	10.38mm laminated	32	N/A
	North & East	Retail	6.38mm laminated	30	N/A
1-8	South, North & West	Living & Beds	12.5mm laminated (Viridian)	37	Yes
	East	Living & Beds	10.38mm laminated	32	Yes
			Building B		
G	South	Retail & Gym	10.38mm laminated	32	N/A
	North	Gym	6.38mm laminated	30	N/A
1-7	South	Living & Beds	12.5mm laminated (Viridian)	37	Yes
	East & West	Living & Beds	10.38mm laminated	32	Yes
	North	Living & Beds	6.38mm laminated	30	Yes
			Building C		
G	South & East	Retail	10.38mm laminated	32	N/A
	North	Retail	6.38mm laminated	30	N/A

[2] In accordance with Building Code of Australia ventilation requirements.

Level	Façade	Space	Glazing Thickness	Minimum R_w (Glazing+Frame)	Alternate Ventilation[2]
1-8	South	Living & Beds	12.5mm laminated (Viridian)	37	Yes
	West & East	Living & Beds	10.38mm laminated	32	Yes
	North	Living & Beds	6.38mm laminated	30	Yes
			Building D		
G	West	Retail	10.38mm laminated	32	N/A
	North, South & East	Retail	6.38mm laminated	30	Yes
1-8	South, North & West	Living & Beds	12.5mm laminated (Viridian)	37	Yes
	East	Living & Beds	6.38mm laminated	30	Yes
			Building E & F		
G	All	Childcare & Retail	6.38mm laminated	30	N/A
1-8	All	Living & Beds	6.38mm laminated	30	No

All other non-habitable spaces, such as bathrooms and laundries require minimum 6mm monolithic glass (Rw 28).

All Windows/doors should be well sealed (air tight) when closed with good acoustic seals around the top and bottom sliders. Mohair seals are not considered to be acoustic seals.

3.2 Apartment Ventilation

For apartments that are exposed to high noise levels and if internal noise levels with windows or doors open exceed the criteria by more than 10dBA, alternate ventilation systems maybe be required to meet the BCA requirements as indicated in Table 9.

All occupants have the option of having the window to be open for natural cross ventilation, or to close the window and achieve a quieter internal environment. Typically, this could include a central ventilation system to supply outside air into the apartments affected by high noise. Recommendations on appropriate systems are to be implemented during the Construction Certificate and detailed design phase of the project.

3.3 Building Façade Construction

To provide sufficient acoustic attention of noise, the general external construction of the proposed building would need to be constructed as detailed in Table 10.

Table 10 – External Façade Construction (R_w)

Building Element	Proposed Construction	Minimum R_w
External Wall	Masonry or cavity brick	50
Roof and ceiling	Concrete with a plasterboard cavity ceiling	45

3.4 Childcare Centre Noise Assessment

The proposed childcare centre intends to operate Monday to Friday only between 7.00am to 7.00pm to accommodate a total of 100 children. The facility will be closed on Public Holidays. To control activity noise, there will be restricted outdoor activity before 9:00am or after 5.00pm.

The assessment of children activity noise in the external playscape have been predicted based on the following parameters:

- Source noise is averaged of the entire area of the outdoor playarea.
- The children age groups have not been finalised, therefore in the outdoor playarea we have assumed at least:
    - Nursery (0-2), up to 20 children.
    - Toddler (2-3) up to 40 children.
    - Preschool (3-5) up to 40 children.
- During outdoor play times there are no restrictions on the maximum number of children.
- Source height is taken a 1m above the playarea level.
- Recommended solid canopy over the outdoor playarea between Building D and E. The canopy is to of solid construction (no gaps) such as laminated glass or Perspex.
- On the ground level, the outdoor playarea is partially covered by the underside of the building (level 1 above). The underside of the outdoor playarea is to be lined with sound absorption material (min. NRC 0.5), such as Acoufelt or CSR Martini.
- Calculations have been conducted based on ISO9613 using CadnaA (version 4.5.149).
- Pre-recorded music played in the centre has not been included in these predictions. However, if any pre-recorded music is played in the indoors activity rooms, it is recommended that all doors and windows closed.
- The internal noise level (with windows/doors closed) is predicted to be less than 35dBA at the receivers and therefore has not been included in the calculation tables below.

- For this assessment, the assumed sound power for children noise is presented in Table 11 below depending on the age range. The sound power levels given in the table below have been extrapolated for the proposed number of children in each outdoor area or activity room as outlined above.

Table 11—Typical Sound Power Levels from Children (Source: AAAC)

Description	Sound Power Level
10 Children aged 0-2 years	77-80
10 Children aged 2-3 years	83-87
10 Children aged 3-6 years	84-90

Table 12 presents the predicted noise from the ground outdoor playarea occupied with a maximum of 100 children (age 0 to 5) and the cumulative noise level at the nearest receivers.

Based on our predictions, children activity noise level is expected to comply at the nearest receivers.

Table 12 – Predicted Cumulative Noise from Outdoor Playarea

Receiver	No. Children (max)	SWL dBA	Receiver Noise Level, $L_{eq15min}$ dBA	Noise Limit $L_{eq15min}$ dBA (Day)	Complies (Y/N)
Level 2 Balcony (Building D & E)	100 (outdoor playarea)	95	45-50	51	Y

Note, this is considered the worst case scenario with the outdoor fully occupied, which is an event that is unlikely or would rarely occur during outdoor play time.

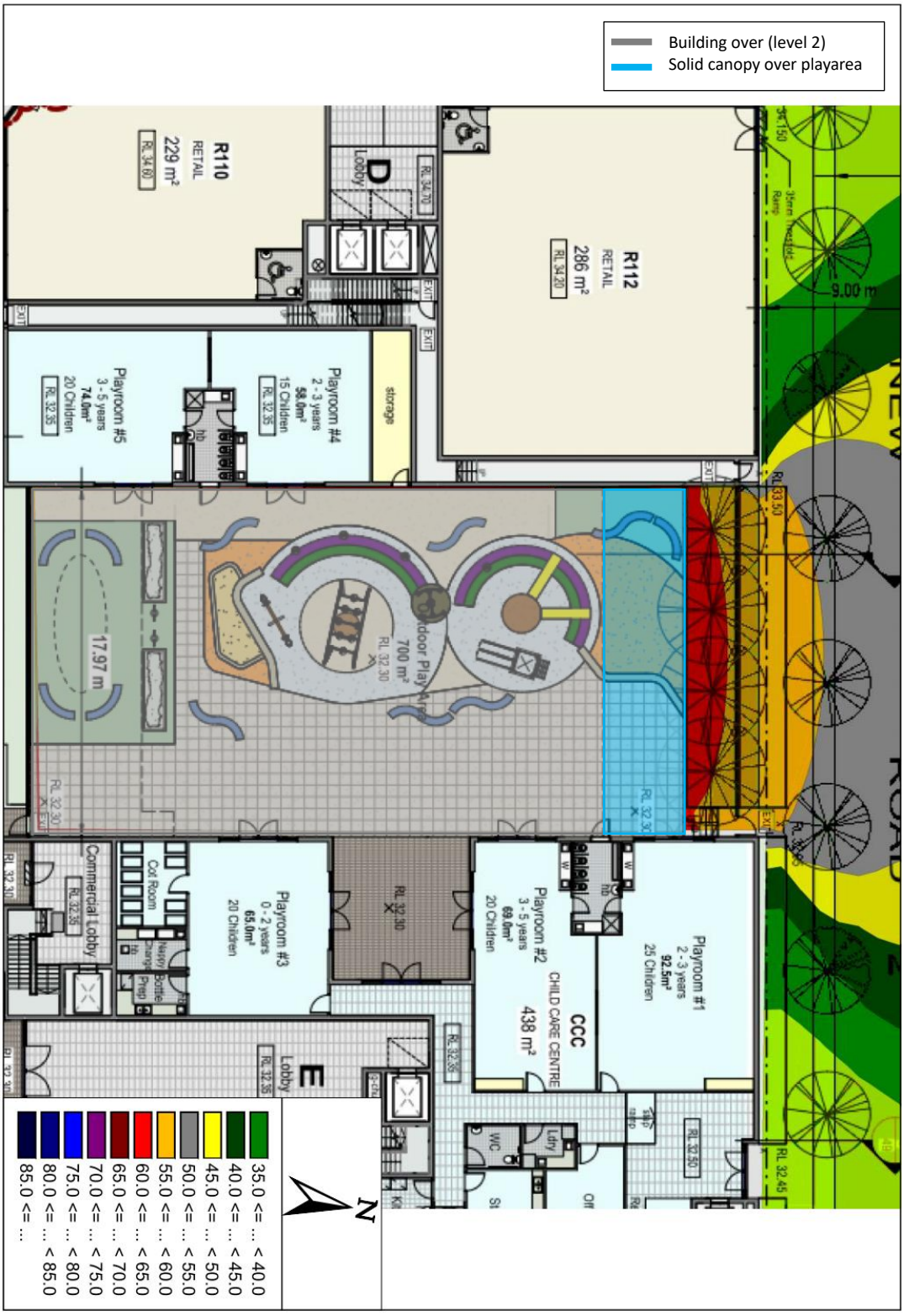


Figure 4 – Childcare Centre Outdoor Play Area – Noise Model (L1/Ground Level)

3.5 General Guideline for Childcare Centre Noise Management

To manage noise from the centre, the following are the recommended managerial practices can be implemented:

- Restricted outdoor activity before 9:00am and after 5.00pm. The outdoor sessions are based on supervised learning activities and designed to be educational.
- Pre-recorded music is played in the indoors activity rooms, it is recommended that all doors and windows closed.
- Staff are to be properly trained and instructed:
  - Not shout and to speak to children and to each other at a normal conversation noise level.
  - Remind parents who are talking too loudly while outdoors and request that they be mindful of the neighbours.
  - Pacify crying and over excited children, if necessary taking them indoors where necessary to ensure that the neighbours are not unduly impacted.
- Appropriate signage shall be placed within the premises to remind staff and parents to respect the rights of neighbours to quiet enjoyment.

3.6 Gym Tenancy

Residents located directly above the proposed gym may potentially be affected by its operation. To minimise any adverse impact, a combination of noise control measures, such as the following can be implemented:

- Limitation of amplified music and PA systems inside the facility. The facilities stereo and speaker systems may be set to maximum internal noise levels with the use of a sound limiting device.
- Installation of a suspended plasterboard ceiling below the slab if required. The concrete floor slab to be designed with a natural frequency of at least 10Hz.
- To minimise the potential vibration impact from the various gym equipment we would recommend the following acoustic floor:
  - General floor area: 8mm-20mm acoustic floor mats.
  - Treadmills, row machine, spin cycles, etc: 20mm-40mm acoustic floor mats.
  - Fixed weight machines and free weights: 20mm-40mm acoustic floor mats or spring isolators.

At this stage, the future tenant and detailed activities are not known however additional managerial strategies to minimise noise impact are to be implemented into the Plan of Management (POM), such as:

- The entry door and windows will remain closed at all times when group classes or personal training sessions are being conducted.
- There are to be no activities that generate noise or amplified music played outside the facility.
- Implement strategies for the community to contact the management staff if they have queries, concerns or complaints. This may include a phone line during operating hours, email address and website.

3.7 Separation Between Commercial and Residential

The wall partition and floor slab separating the retail/commercial space and the residential apartment is to be of solid masonry/concrete construction with a suspended plasterboard ceiling to achieve a minimum sound insulation performance of Rw + Ctr 50 for airborne noise.

At this stage, the detailed activities of the future retail and commercial tenants that have the potential to create noise is not known. Any operation of the retail/commercial space is to comply with Council conditions the recommended noise limits as detailed in this report.

3.8 Mechanical Services

At the DA stage, the design and selection of mechanical equipment has not been selected or finalised. Typically, based on similar sized residential projects we would expect the following noise control measures to be implemented:

- Carpark exhaust/supply fans located in the basement:
  - Exhaust and supply fans operate with a VSD and CO sensor.
  - The fans operate on variable speed and are unlikely to operate at full speed during the night period of between 10pm and 7am.
  - Provide acoustic attenuators to the supply and discharge of the fans.
- Stair Pressurisations fans located on the roof:
  - Install acoustic attenuators or internally lined ducts to the supply and discharge of the fans.
  - The operation of the fans is limited to the emergency and test modes.
- Apartment exhaust fans (toilet, laundry, kitchen):
  - Electrically inter-locked with the light switch or have manual switch for the room served.
  - Internally lined ducts and acoustic flex ducts to be fitted to the fans.

- Apartment and commercial outdoor A/C condenser:
  - Outdoor A/C condenser plantroom located on the roof for each building.
  - Construction of acoustic barriers or acoustic louvres.

Following the DA approval of the proposed development, during the Construction Certification Stage a detail assessment of all mechanical plant and equipment will be conducted to ensure compliance with the EPA and DCP noise criteria.

3.9 Delivery and Waste Collection Vehicles

For all delivery vehicles and privately operated waste collection vehicles used for the retail, commercial and childcare tenancies, Part 4.3.3 of EPA Noise Guide for Local Government it is recommends the following time restrictions:

- Before 8.00 am or after 8.00 pm on any Saturday, Sunday or public holiday.
- Before 7.00 am or after 8.00 pm on any other day.

This excludes residential motor vehicles entering of existing the premises.

Additional management controls of the delivery and rubbish collection vehicles to minimise noise impact to the units on ground floor could include:

- Using up-to-date equipment that uses ‘quieter’ technology such as low-noise bin lifters.
- Maintaining rubbish trucks and braking materials to minimise or eliminate noise such as squeaky brakes.
- Educating drivers and collectors to be careful and to implement quiet work practices.
- Setting more appropriate times for the rubbish collection.

4 Conclusion

An acoustic assessment of the proposed development has been carried out in accordance with the requirements of Blacktown Development Control Plan (DCP), Department of Planning (SEPP), EPA and relevant Australian Standards.

An environmental noise survey of the site has been conducted and the noise limiting criteria for mechanical plant/equipment noise emission has been determined based on the DCP and the NSW EPA NPfI. The limits are presented in Table 6 and Table 7.

Construction for glazing, external walls and the roof/ceiling systems have been provided to achieve the internal noise criteria and are detailed in Section 3.1 and Section 3.3 based on the impact of road noise level.

For the childcare centre, the noise limit for children activity noise is give in Table 8. Section 3.4 details our assessment of the potential noise impact from children activity in the outdoor playareas of the childcare centre located on ground level (level 1) of Building D and E. Based on our predictions and recommendations, noise emissions will comply with the AAAC noise criteria for children activity in the childcare centre.

For the operation of the gym facility, management strategies and recommendations given in Section 3.6 would ensure that the operation of the facility will not adversely impact the residents above.

Providing the recommendations in this report are implemented, the noise from the proposed development is predicted to comply with acoustic requirements of the Blacktown DCP, Department of Planning (SEPP), BCA Part F5 and relevant Australian standards.

Appendix A – Acoustic Terminology

Decibel, dB: A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 micro Pascals.

A-WEIGHTING: A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA). The A-weighted sound level is also called the noise level.

Sound Pressure Level, L p (dB), of a sound: 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Ambient Noise/Sound: All noise level present in a given environment, usually being a composite of sounds from many sources far and near. Traffic, HVAC, masking sound or even low-level background music can contribute to ambient level of noise or sound.

Percentile Level - L 90 , L 10 , etc: A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L 90 is the level which is exceeded for 90% of a measurement period. L 90 is commonly referred to as the "background" sound level.

Background Noise (L 90): The sum total of all unwanted residual noise generated from all direct and reflected sound sources in a space that can represent an interface to, or interfere with good listening and speech intelligibility.

Rating Background Level – RBL: Method for determining the existing background noise level which involves calculating the tenth percentile from the L A90 measurements. This value gives the Assessment Background Noise Level (ABL). Rating Background Level is the median of the overall ABL.

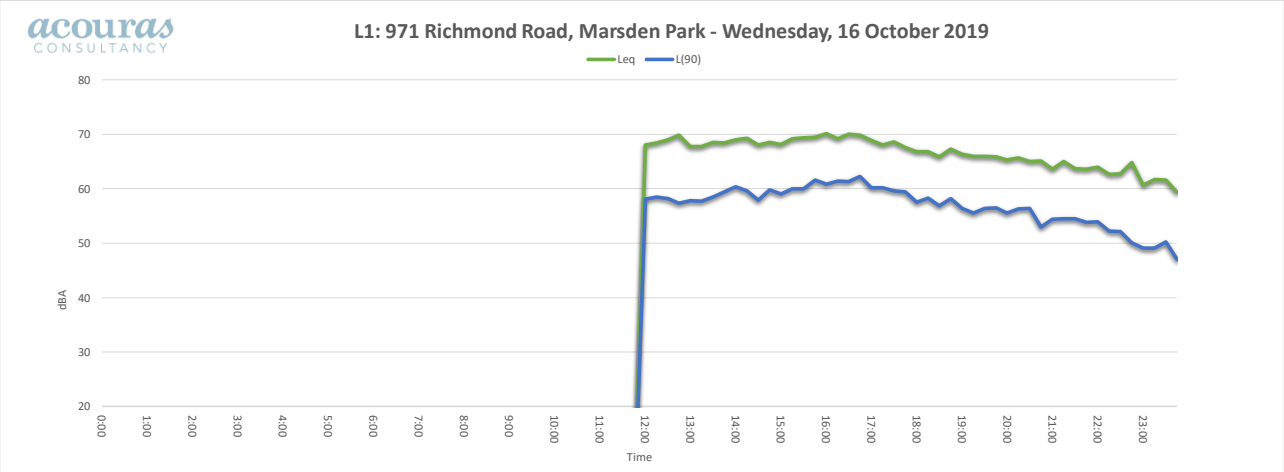
L AEQ,T : Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

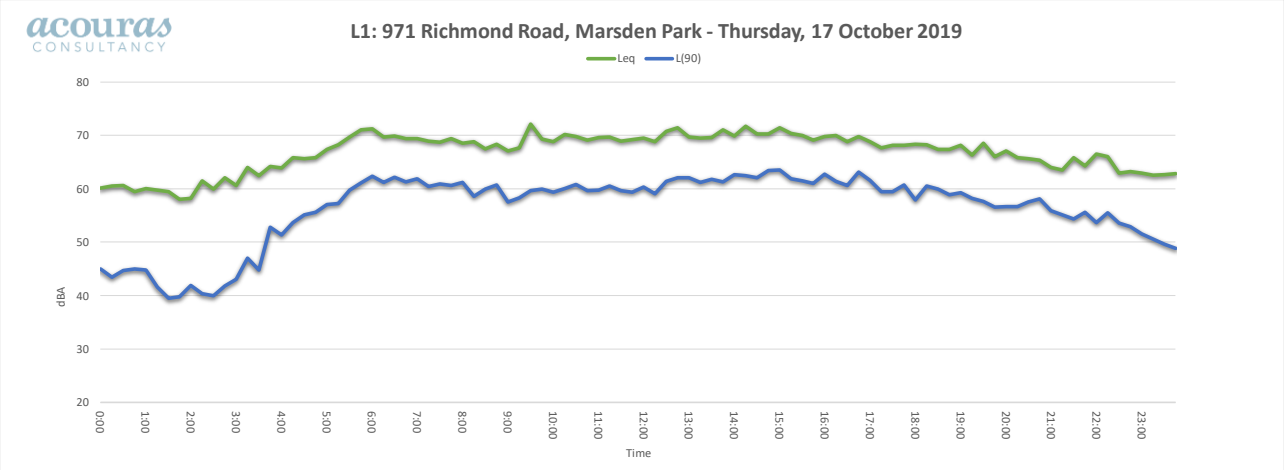
Appendix B – Architectural Drawings

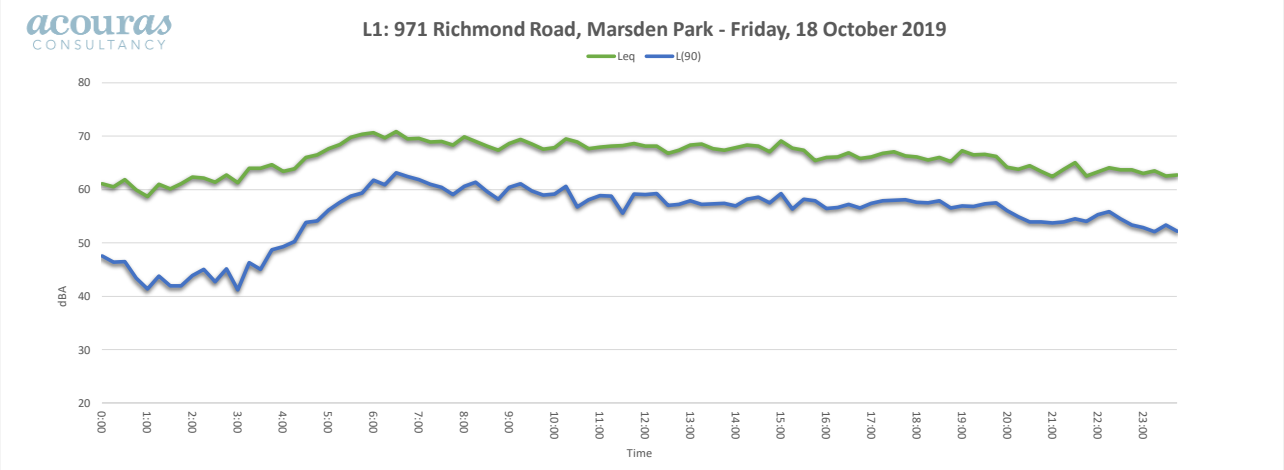
This assessment was based on the following architectural drawings provided by Architex.

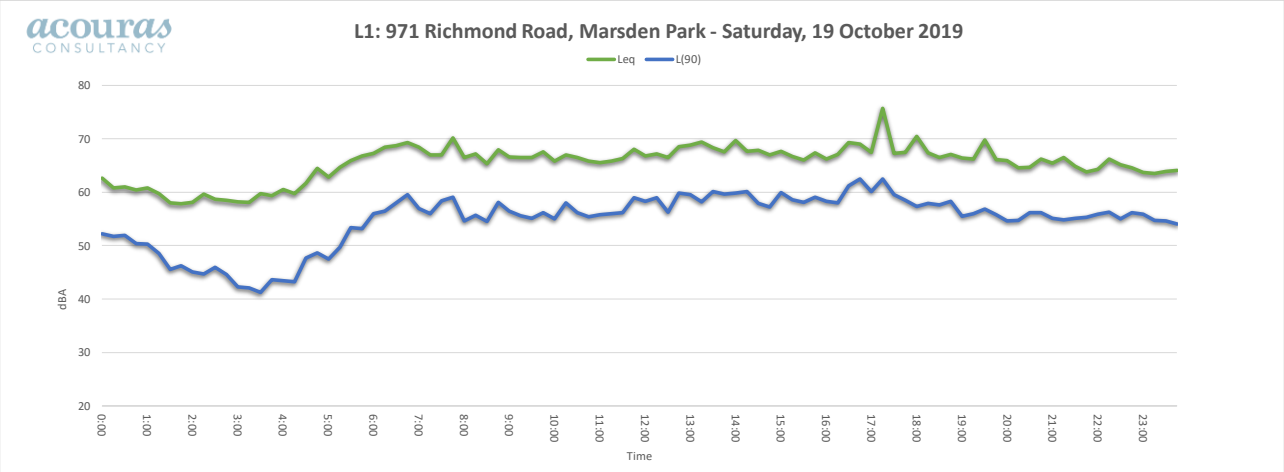
Drawing	Issue	Date	Description
02	G	15.07.21	Overall Site Plan
03	F	05.10.21	Basement Level 3
04	F	05.10.21	Basement Level 2
05	G	05.10.21	Basement Level 2
06	H	05.10.21	Level 1/Ground Floor
07	G	05.10.21	Level 2
08	G	15.07.21	Level 3
09	G	15.07.21	Level 4
10	H	05.10.21	Level 5
11	H	05.10.21	Level 6
12	H	05.10.21	Level 7
13	H	05.10.21	Level 8
14	H	05.10.21	Roof Plan
42	F	05.10.21	Elevations
43	G	05.10.21	Elevations 2
44	G	05.10.21	Elevations 3

Appendix C – Noise Logger Results





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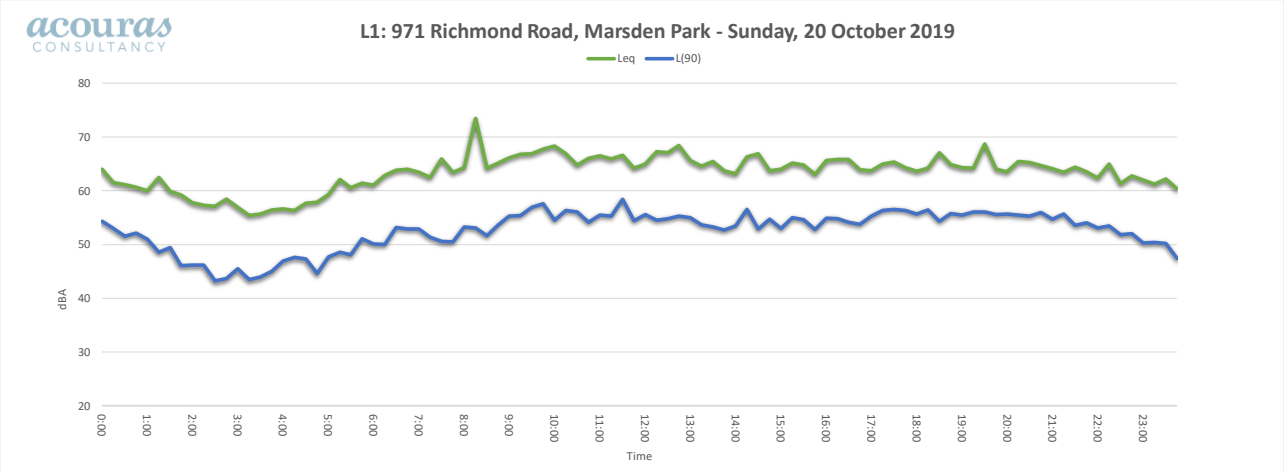
Leq
L(90)
dBA
Time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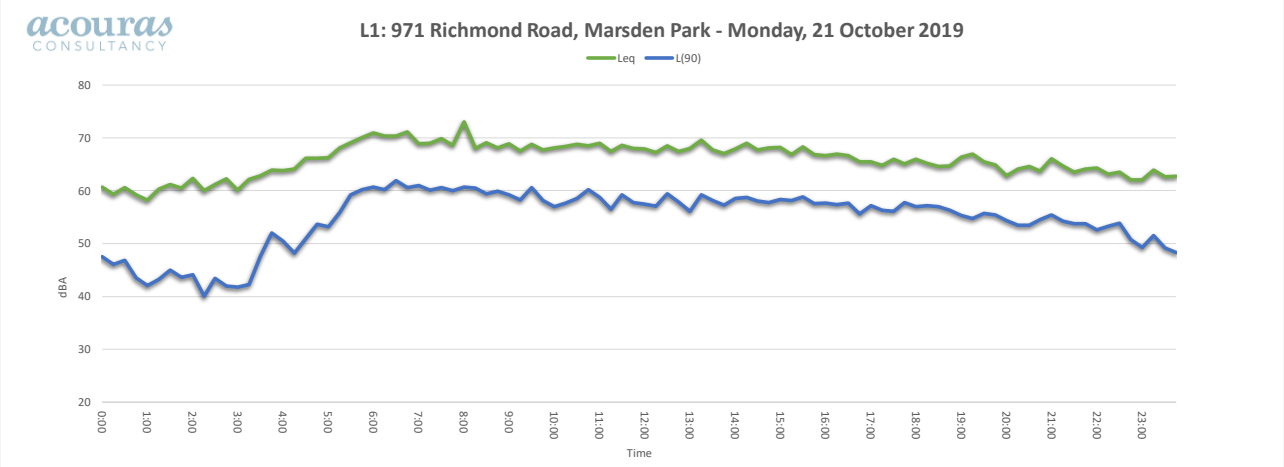
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Leq
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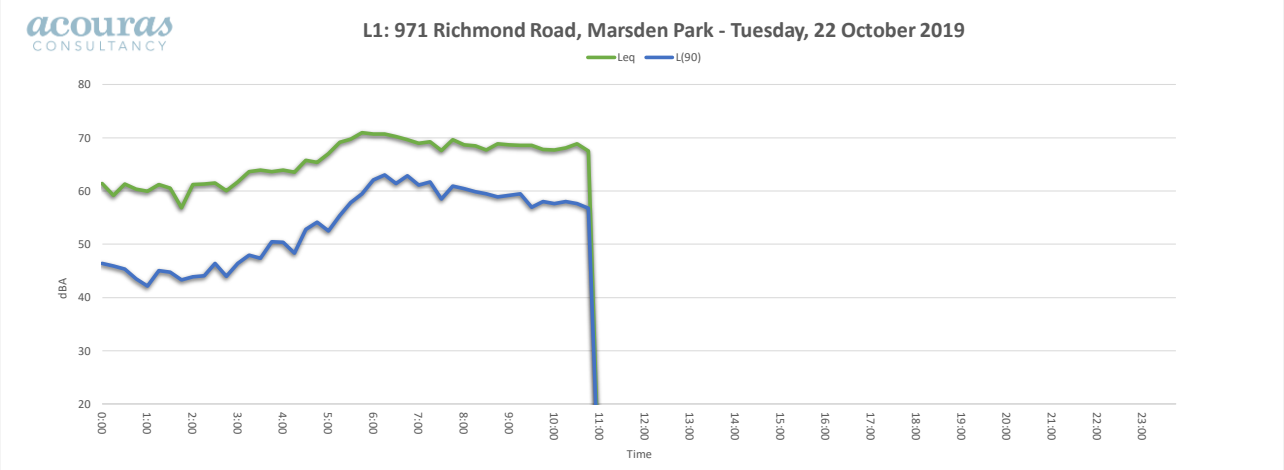
Time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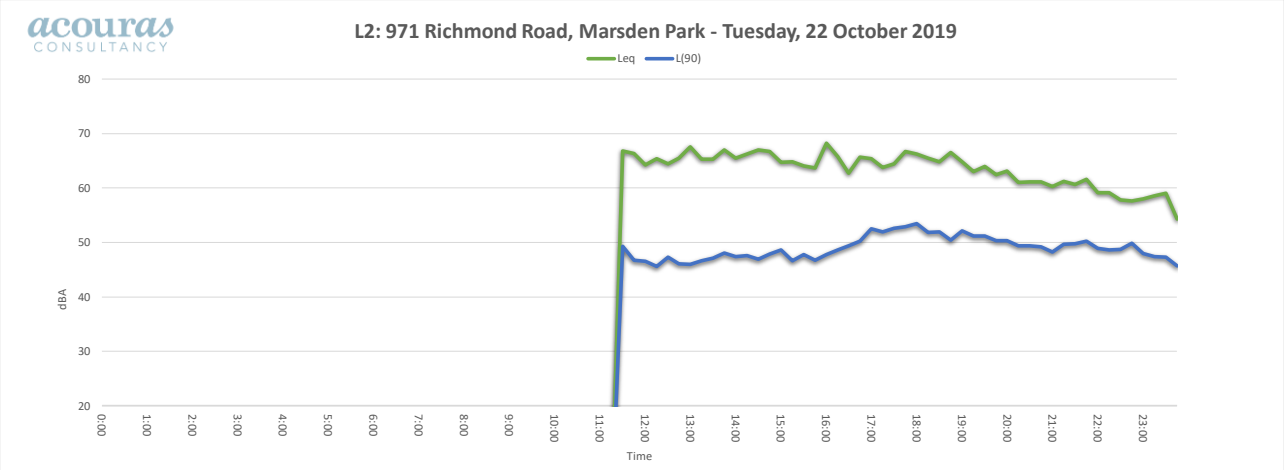
Leq
L(90)
dBA
Time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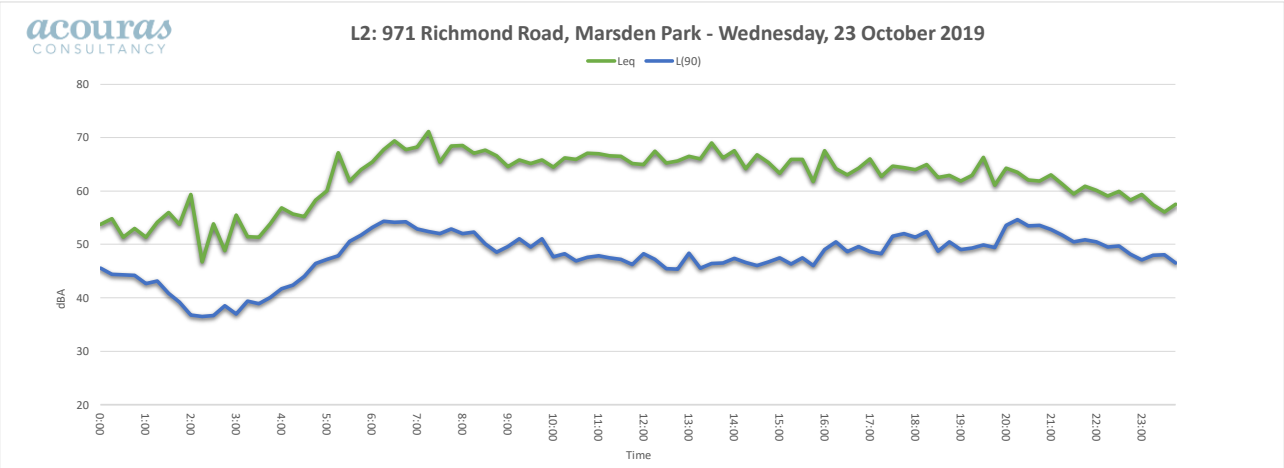
Leq
L(90)
dBA
Time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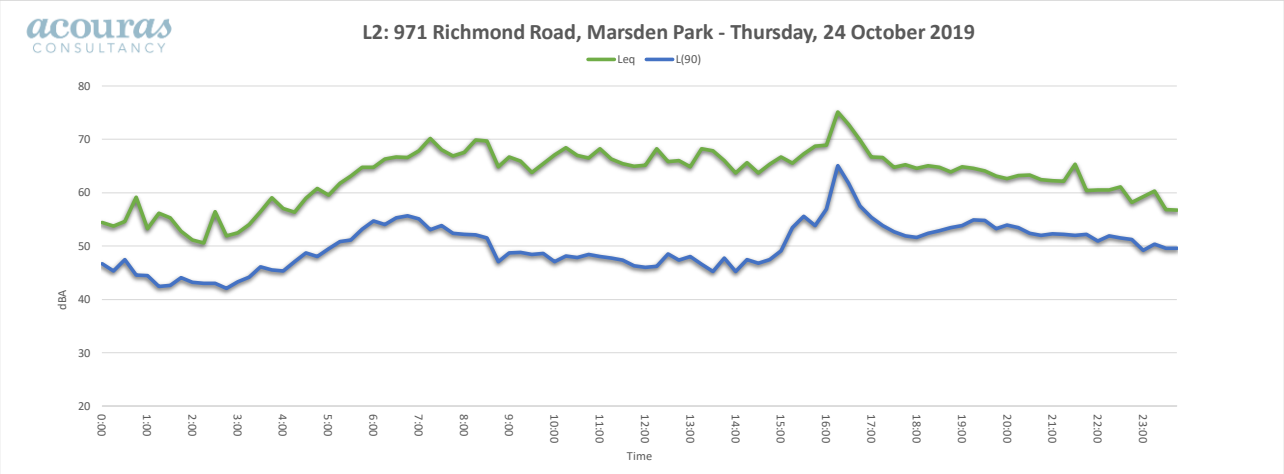
Leq
L(90)
dBA
Time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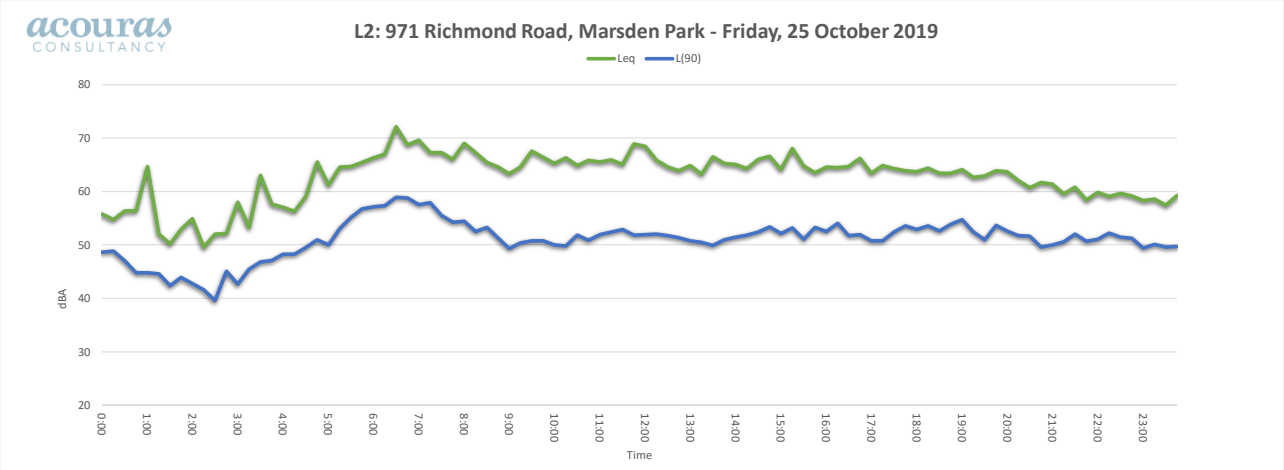
Leq
L(90)
dBA
Time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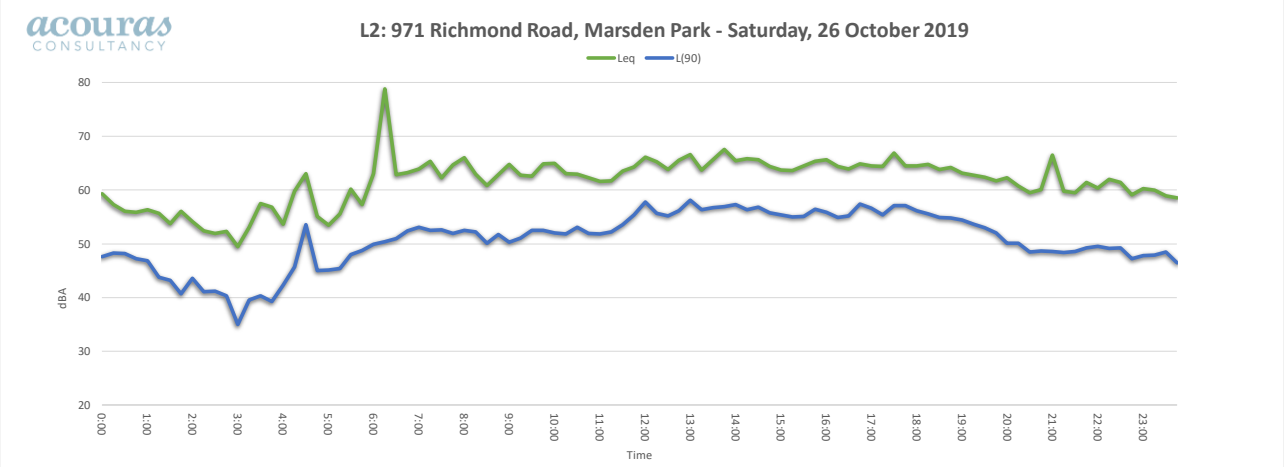
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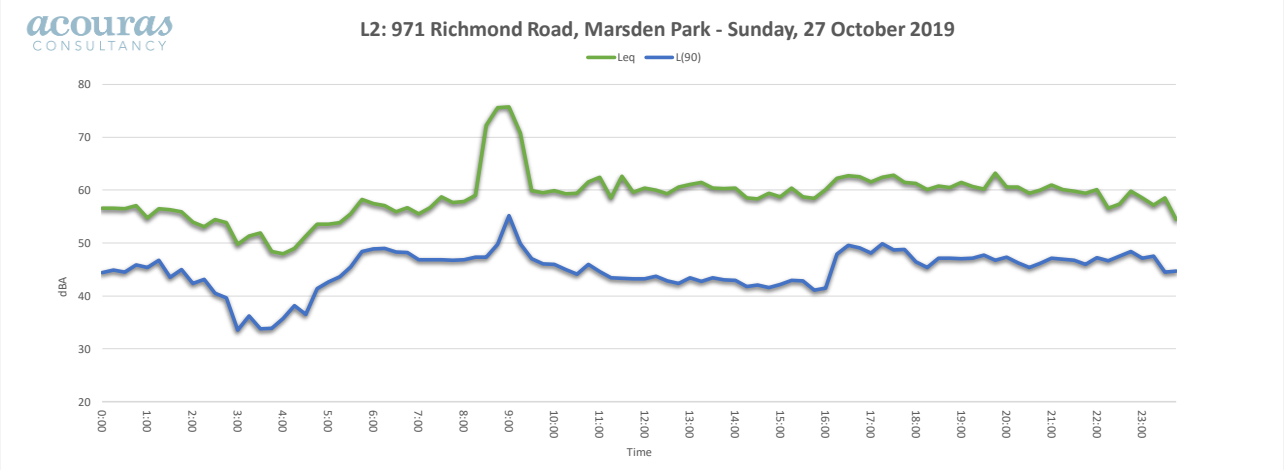
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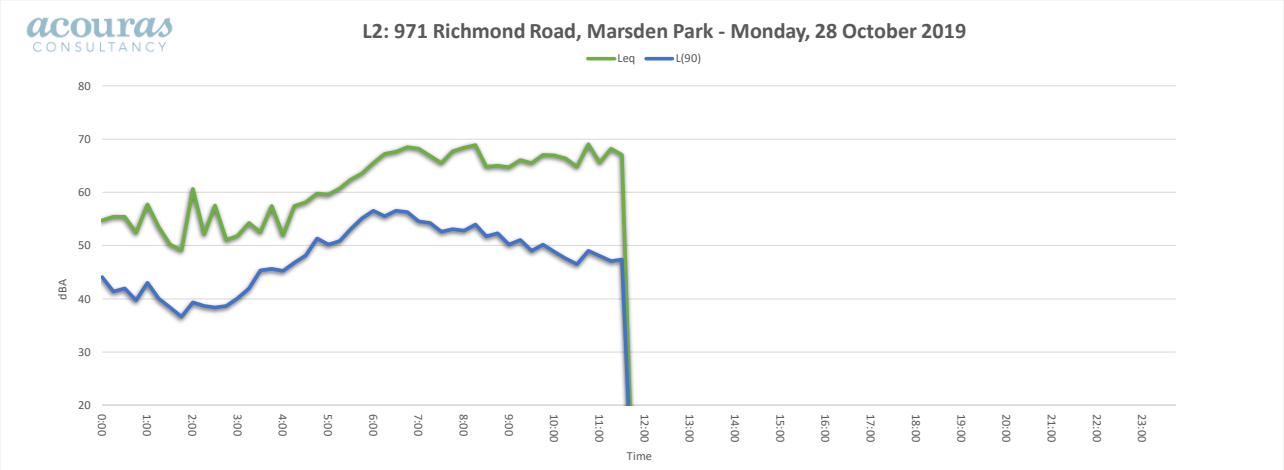
Time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