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Report R01 Rev1 21163

11 November 2021

15-17 Marriott Parade, Glen Waverley
Planning Application Acoustic Report

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**PROJECT SUMMARY:**

R01 Rev1 21163

15-17 Marriott Parade, Glen Waverley
 Planning Application Acoustic Report

PREPARED FOR:

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1.0 INTRODUCTION

It is proposed to develop a new 204-place early learning centre and five townhouses at 15-17 Marriott Parade in Glen Waverley. The proposed early learning centre will have four levels with outdoor play areas on each level. Additionally, there will also be an outdoor play area on the roof of the building. The proposed townhouses are to be located to the west of the early learning centre building.

Clarity Acoustics Pty Ltd (Clarity Acoustics) has been engaged by Little Lane Early Learning Centres to prepare an acoustic report for the proposed development to be submitted as part of the planning application documentation.

This report provides details of the following:

- proposed early learning centre operations
- measurements of background noise levels in the vicinity of the subject site
- measurements of traffic noise levels from Kingsway and Springvale Road
- relevant noise criteria applicable to the subject site
- recommended noise controls
- an assessment of operational noise from the early learning centre
- an assessment of traffic noise impacts on the early learning centre
- an assessment of traffic noise impacts on the townhouse component of the development.

A glossary of acoustic terminology used in this report is provided in APPENDIX A.

2.0 PROJECT DESCRIPTION

2.1 Subject site

The subject site is located at 15-17 Marriott Parade in Glen Waverley and is bounded by:

- Dwellings on Kingsway directly to the north
- Marriott Parade directly to the east and the south with dwellings beyond
- Dwellings on Berkley Court directly to the west.

The nearest noise sensitive receivers are dwellings on Marriott Parade to the east and south of the subject site, dwellings on Kingsway to the north of the subject site and dwellings on Berkeley Court and future townhouses associated with the proposed development to the west of the proposed early learning centre building.

The subject site is located within both a General Residential Zone 7 (GRZ7) and Residential Growth Zone 4 (RGZ4) with further GRZ7 and RGZ4 and Road Zone – Category 1 (RDZ1) and Commercial 1 Zone (C1Z) in the immediate environs. The relevant planning map for the subject site is provided in APPENDIX B.

2.2 Nearest affected residents

Table 1 provides details of the nearest affected receivers that have been considered representative for the purpose of our assessment.

Table 1 - Details of the nearest affected noise sensitive receivers

ID	Address	Description
R1	2/125 Kingsway	Double storey dwelling directly to the north of the subject site
R2	1/125 Kingsway	Single storey dwelling directly to the north of the subject site
R3	36 Marriott Parade	Single storey dwelling to the east of the subject site
R4	301-305 Springvale Road	Three storey hotel to the east of the subject site
R5	34 Marriott Parade	Single storey dwelling to the east of the subject site
R6	32 Marriott Parade	Double storey dwelling to the east of the subject site
R7	30 Marriott Parade	Single storey dwelling to the south-east of the subject site
R8	28 Marriott Parade	Single storey dwelling to the south-east of the subject site
R9	26 Marriott Parade	Single storey dwelling to the south of the subject site
R10	24 Marriott Parade	Single storey dwelling to the south of the subject site
R11	22 Marriott Parade	Single storey dwelling to the south of the subject site
R12	15-17 Marriott Parade	Future three storey townhouses proposed directly west of the early learning centre at the subject site
R13	6 Berkley Court	Single storey dwelling to the west of the subject site
R14	5 Berkley Court	Double storey dwelling to the west of the subject site

An aerial photograph of the subject site and nearest affected receivers is provided in Figure 1.

Figure 1 - Aerial photograph of the subject site and surrounds (source: Nearmap)



2.3 Early learning centre proposed operation

The proposed early learning centre will cater for up to 204 children with outdoor play areas on each of the four levels and an additional outdoor play area on the roof. Parking for 44 cars will be provided via the two-level basement car park with access from Marriott Parade.

The proposed age distribution of the 204 children that will attend the centre is as follows:

Table 2 - Age distribution of children attending early learning centre

Age group	Number of children
0-2 years	52
2-3 years	64
3-5 years	88

It is proposed that the early learning centre will operate between 0630-1900 hours, Monday to Friday.

2.4 Proposed townhouses

It is proposed to develop five (5) three-storey townhouses as part of the proposed development. Each townhouse will also include a basement media room and lower basement parking. The townhouses are to be located directly to the west of the early learning centre building.

Access to the lower basement parking associated with the townhouses will be from Marriott Parade.

The proposed site layout is provided in APPENDIX C.

3.0 RELEVANT GUIDELINES AND CRITERIA

The following sections outline the guidelines and standards commonly referenced in Victoria relevant to this application.

3.1 Environment Protection Act 2017

The Environment Protection Act 2017 (the Act) provides a legislative framework for the protection of the environment in Victoria and establishes obligations for environmental noise control. The Act does not specify noise limits but sets out the legal requirements for compliance with the subordinate legislation tools. Subordinate legislation tools have been designed to support the Act which include the Environment Protection Regulations.

Part 3.2 of the Act introduces the General Environmental Duty (GED) which requires any person/business engaging in an activity posing a risk of harm to human health or to the environment, to minimise those risks to prevent harm as far as reasonably practicable. The GED requires individuals/businesses conducting activities that may pose a risk to human health and the environment to understand these risks and demonstrate how they have eliminated or minimised them as far as reasonably practicable.

3.2 Environment Protection Regulations 2021

The Environment Protection Regulations 2021 (S.R. No. 47/2021) set out the framework for noise from residential, commercial, industrial and trade premises as well as from indoor and outdoor entertainment venues and events. The Regulations require that noise levels from commercial, industrial and trade premises and indoor and outdoor entertainment venues and events are set to protect noise sensitive areas from unreasonable noise.

For commercial, industrial and trade premises the Regulations outline:

- noise limits that apply to commercial, industrial and trade premises in both urban and rural areas of Victoria
- noise sensitive areas where noise limits apply
- how the noise level at noise sensitive areas is determined
- the levels at which noise is considered to be aggravated.

Regulation 113 (Part 5.3) of the Regulations requires that the prediction, measurement and analysis of noise from commercial, industrial and trade premises and indoor and outdoor entertainment venues and events must be undertaken in accordance with the Noise Protocol (i.e., EPA Publication 1826-4).

It is noted that, under Regulation 117 (Part 5.3) of the Regulations, voices are excluded from any assessment of noise from commercial, industrial and trade premises. As such, EPA Publication 1826-4 will not apply to noise from children in play areas associated with the proposed development.

3.3 1826-4

EPA Publication 1826-4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) is incorporated into the Environment Protection Regulations and outlines the EPA's approach to the determination of noise limits and to the measurement, prediction and analysis of noise.

Part I of the Noise Protocol outlines the methodology to establish noise limits applicable to noise from commercial, industrial or trade premises in both urban and rural areas of Victoria. The subject site is located within a Major Urban Area (MUA) boundary and, therefore, noise limits for noise sources associated with the subject site covered under the Noise Protocol are derived using the urban area method.

For commercial, industrial or trade premises in urban areas, the noise limits are determined on the basis of land zoning and background noise levels and are separately defined for the day, evening and night periods. Once a noise limit is established, the noise level from the premises is measured or predicted as a 30-minute equivalent average noise level ($L_{Aeq, 30 \text{ min}}$) and, if necessary, adjusted to account for duration, measurement position and noise character (such as tonality, intermittency and impulsiveness) to determine the effective noise level (L_{eff}).

Refer to APPENDIX D for further detail on the derivation of noise limits and the assessment of noise from commercial, industrial or trade premises under the Noise Protocol.

3.4 Guideline for Child Care Centre Acoustic Assessment

The Association of Australasian Acoustical Consultants (AAAC) guideline relating to child care centres (originally published in May 2008, updated September 2020) provides criteria to be used for the assessment of noise from children in outdoor play areas associated with child care centres impacting on nearby receivers as well as assessment of the impact of extraneous noise on children within child care facilities.

3.4.1 Impact of Road, Rail Traffic and Industry on children

The AAAC guideline recommends that the noise level $L_{Aeq, 1 \text{ hour}}$ from road, rail traffic or industry at any location within the outdoor play or activity area during the hours when a centre is operating shall not exceed 55 dB and should not exceed 40 dB within the indoor play areas and 35 dB in sleeping areas associated with child care centres.

It should be noted that, for the subject site, if the external criteria of 55 dB $L_{Aeq, 1 \text{ hour}}$ is achieved, conventional facade construction will be sufficient to achieve the internal criteria.

3.4.2 Noise to neighbouring residential receivers

The AAAC guideline relating to child care centres nominates design criteria for assessing noise from children in outdoor play areas. The guideline provides a base criterion of 45 dB $L_{Aeq, 15 \text{ min}}$ for the assessment of noise from outdoor play areas where the background noise level is less than 40 dB L_{A90} . Where the background noise level is greater than 40 dB L_{A90} it nominates the following criteria for outdoor play areas:

Table 3 – AAAC child care centre design criteria

Duration of outdoor play	Criteria
Up to 4 hours play per day (2 hours in the morning, 2 hours in the afternoon)	$L_{Aeq, 15 \text{ min}} \leq L_{A90, 15 \text{ min}} + 10 \text{ dB}$
More than 4 hours of play per day	$L_{Aeq, 15 \text{ min}} \leq L_{A90, 15 \text{ min}} + 5 \text{ dB}$

Several issues with the implementation of the AAAC design criteria have been identified by Clarity Acoustics (and other acoustic consultants in Victoria) which are summarised below:

- The AAAC childcare guideline was first published in May 2008 but its origins date back to a technical meeting of the NSW chapter of the *Australian Acoustical Society* (AAS) held on 12 September 2007. This is significant as the relevant policy for industrial/commercial noise in NSW (NSW EPA's *Noise Policy for Industry*) sets a background (L_{A90}) + 5 dB criterion as opposed to the Noise Protocol which sets noise limits for industrial/commercial noise in Victoria based on both the zoning and background noise. In most contexts, a L_{A90} + 5 dB criterion will result in a more stringent criterion applied to noise from children in outdoor play than would apply to noise from industrial, commercial and trade premises in Victoria (i.e., Noise Protocol noise limits) particularly during the day period. In relation to this, the AAAC guideline states the following "*It is noted that the criteria used in each State or Territory may vary and the procedures may need to be modified by AAAC members in each State or Territory to meet specific State requirements.*"
- The design criterion of L_{A90} + 5 dB does not consider that noise from children playing outdoors does not have the same character as other forms of environmental noise. A L_{A90} + 5 dB criterion implies that noise from children outdoors is no different to industrial noise or music noise from licensed venues. In relation to this the AAAC guideline notes "*...the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play, in some circumstances, can be pleasant, with noise emission generally only audible during the times child play outside.*"
- Child care centres typically no longer limit outdoor play time, therefore criteria based on limiting outdoor play are not considered relevant
- The design criterion of L_{A90} + 5 dB has been found to overly restrictive and can result in very onerous noise mitigation controls such as noise barriers that are excessive in height (in excess of 3-4 metres). Such barriers are not consistent with visual amenity in residential areas
- The criteria nominated by the AAAC guideline are only based on the use of the outdoor play area and do not account for other factors such as nature of the noise, time of day that the noise occurs, number of people exposed or affected, duration of exposure, whether the noise is typical for the area that can all influence noise impact. For example, in the *Meriden School v Pedavoli* matter, the NSW Land and Environment Court's consideration of other factors led to a finding that the noise from children playing was not offensive even though the noise level exceeded the AAAC noise goals by 8 dB (i.e., 13 dB above the background noise level).

Based on the above considerations, it is generally accepted that the AAAC design criteria have the potential to be highly conservative and this is supported by planning precedents and VCAT decisions. A review of VCAT decisions concludes that noise from children in outdoor play areas associated with child care centres is considered to be consistent with residential amenity and that a background (L_{A90}) + 10 dB approach is appropriate in the majority of circumstances.

Accordingly, the assessment in subsequent sections of this report compares the predicted noise levels from outdoor play areas associated with the development against a 10 dB margin above the existing background noise levels at nearby existing dwellings in the vicinity of the subject site.

A summary of relevant VCAT decisions is provided in APPENDIX E.

3.5 Environment Reference Standard (ERS)

The Environment Reference Standard (ERS) was gazetted on 26 May 2021 under Section 93 of the EP Act and describes the environmental values of the ambient sound environment that are sought to be achieved and maintained in Victoria. These include an ambient sound environment that supports sleep at night, domestic and recreational activities in a residential setting, normal conversation indoors without the need to raise voices, cognitive development and learning in children, human tranquillity and enjoyment outdoors in natural areas and recognises the community's demand for a wide range of musical entertainment.

The ERS also sets out objectives and indicators for ambient sound based on land use settings that can be measured to determine whether the environmental values are being met. The land use category and associated indicators and objectives set out in the ERS that are considered relevant to the proposed development are outlined in Table 4.

Table 4 – Relevant environmental values and ambient sound indicators and objectives, dB

Land Use Category	General Description	Outdoor ambient sound indicators and objectives
Category III	Lower rise building form including lower density residential development and detached housing typical of suburban residential settings or in towns of district or regional significance.	Day: 50 dB $L_{Aeq, 16 \text{ hour}}$ (0600-2200 hours) Night: 40 dB $L_{Aeq, 8 \text{ hour}}$ (2200-0600 hours)

The ERS is not a compliance standard and as such, the values nominated under the ERS for different land uses are not prescribed noise limits. EPA Publication 1992 *Guide to the Environment Reference Standard* also states that *indicators and objectives within the ERS are generally not relevant considerations where they relate to an aspect of the environment that is the subject of prescriptive regulation.*

As such, the ERS is considered relevant for activities that are not directly regulated under the Regulations/Noise Protocol and the EPA, local government and other decision makers may consider the ERS in their decision-making process. In this instance, the ERS may be relied upon in relation to noise from children in outdoor play areas associated with the proposed use as noise from voices is specifically excluded from the Regulations. However, it is noted that the nominated noise targets for children in outdoor play areas ($L_{A90} + 10$ dB as outlined in 3.4.1) are more stringent for the subject site than the ERS indicators outlined above.

3.6 NSW Road Noise Policy

The NSW Environmental Protection Authority conducted a review of sleep disturbance studies the results of which are outlined in the NSW EPA's Road Noise Policy (RNP). The NSW EPA concluded that:

- *maximum internal noise levels below 50-55 dB L_{Amax} are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65-70 dB L_{Amax} are not likely to affect health and wellbeing significantly.*

An open window provides an approximate noise reduction of 10-15 dB from outside to inside (refer to World Health Organisation guidelines and RNP), therefore, night-time maximum noise levels from on-site activities should not exceed 50-55 dB L_{Amax} inside bedrooms associated with townhouse component of the development and 65 dB L_{Amax} outside an openable window of nearby residential dwellings.

3.7 Monash City Council's Planning Provisions Clause 55

Clause 55.07-6 of Monash City Council's planning provisions requires that:

New dwellings be designed and constructed to include acoustic attenuation measures to reduce noise levels from off-site noise sources.

Buildings within a noise influence area specified in Table B6 should be designed and constructed to achieve the following noise levels:

- *Not greater than 35dB(A) for bedrooms, assessed as an LAeq,8h from 10pm to 6am.*
- *Not greater than 40dB(A) for living areas, assessed LAeq,16h from 6am to 10pm.*

Buildings, or part of a building screened from a noise source by an existing solid structure, or the natural topography of the land, do not need to meet the specified noise level requirements.

Noise levels should be assessed in unfurnished rooms with a finished floor and the windows closed.

Table 5 provides details regarding the relevant noise influence area and comments in relation to the subject site.

Table 5 – Noise influence area and comments in relation to the subject site

Noise Source	Noise influence area	Comment
Zone Interface		
Industry	300 m from the Industrial 1, 2 and 3 zone boundary	No industrial zone within 300 m of the subject site
Roads		
Freeways, tollways and other roads carrying 40,000 Annual Average Daily Traffic Volume	300 m from the nearest trafficable lane	Subject site is located within 300 m of Springvale Road Two Way Annual Average Daily Traffic Volume (AADT) of approximately 50,000 vehicles
Railway		
Railway servicing passengers in Victoria	80 m from the centre of the nearest track	No railway servicing passengers in Victoria within 80 m of the subject site
Railway servicing freight outside Metropolitan Melbourne	80 m from the centre of the nearest track	No railway servicing freight outside Metropolitan Melbourne within 80 m of the subject site
Railway servicing freight in Metropolitan Melbourne	135 m from the centre of the nearest track	No railway servicing freight in Metropolitan Melbourne within 135 m of the subject site

The subject site is located within 300 m of Springvale Road which has a two-way AADT of more than 40,000 vehicles. Accordingly, it is considered within a noise influence area as specified in Table B6 of Clause 55.07-6 and as such, the noise criteria detailed in Clause 55.07-6 will apply to the townhouse component of the proposed development.

In addition to the criteria detailed in Clause 55-07-6, it is recommended that the building fabric of the proposed townhouses be designed so that traffic noise does not exceed 55 dB L_{Amax} internally in bedrooms in accordance with the sleep disturbance criteria outlined in the NSW Environment Protection Authority's *Road Noise Policy* (RNP).

4.0 EXISTING NOISE ENVIRONMENT

4.1 Background noise levels

As outlined in Section 3.0 above, environmental noise criteria for the proposed development are set accounting for existing background noise levels in the vicinity of the proposed use. Accordingly, background noise levels in the vicinity of the site were measured using a continuous noise monitoring device (Svantek 977B Class 1 Sound and Vibration Analyser, serial number 59804) between 22 October and 29 October 2021.

The noise monitor was installed in the rear yard of the existing dwelling at 17 Marriott Parade with the microphone located at 1.5 metres above ground level. The noise monitoring position was afforded significant shielding from traffic on Springvale Road and Kingsway and is, therefore, considered representative of the noise environment at existing dwellings in the vicinity of the site.

Refer to Figure 2 for the noise monitoring location.

Figure 2 - Noise monitoring location (Image source: Nearmap)



The equipment was checked before and after the survey using a Svantek Class 1 Acoustic Calibrator (serial number 58085) and no significant calibration drifts were observed.

Table 6 summarises the lowest daily average background noise levels (L_{A90}) measured during the monitoring period during the hours relevant to the proposed operation of the early learning centre. In determining the background noise levels, any data affected by rainfall and high wind speeds (i.e., above 5 m/s) has been excluded from the noise monitoring data. In addition, a -2.5 dB correction has been applied to the measured background noise levels to adjust for any reflections given the proximity of the noise monitor to the existing rear fence at 17 Marriott Parade.

It is noted that background noise levels are assessed differently under the Noise Protocol and under the AAAC guideline. The Noise Protocol requires an assessment of hourly background noise levels (dB $L_{A90, 1 \text{ hour}}$) whereas under the AAAC guideline, 15-minute background noise levels (dB $L_{A90, 15 \text{ min}}$) need to be considered. As such, both are presented separately in Table 6 below.

Table 6 - Measured background noise levels, dB

Period	Time period	Measured background noise level¹, $L_{A90, 15 \text{ min}}$	Measured background noise level², $L_{A90, 1 \text{ hour}}$
Morning shoulder	(0630-0700 hours)	38	39
Day	(0700-1800 hours)	37	37
Evening	(1800-1900 hours)	39	39

¹ Based on measured weekday background noise levels between 0630-1900 hours and including a -2.5 dB reflection correction.

² Based on measured weekday background noise levels between 0630-1900 hours and including a -2.5 dB reflection correction.

4.2 Traffic Noise Levels

In order to quantify the level of traffic noise at the subject site, traffic noise monitoring was undertaken at the subject site between 1400 hours on 22 October 2021 and 1000 hours on 27 October 2021. A noise monitor was installed on the roof of the garage at 17 Marriott Parade with the microphone set at a height of approximately 3.5 m above ground level. The monitoring position had direct line of sight to traffic on Kingsway and on Springvale Road.

The traffic noise monitoring position is provided in Figure 3.

Figure 3 – Traffic noise monitoring position (Image source: Nearmap)



The traffic noise monitoring was conducted using a Svantek 977C Class 1 Sound and Vibration Analyser (serial number 92629). The equipment was checked before and after the surveys using a Svantek Class 1 Acoustic Calibrator (serial number 58085) and no significant calibration drifts were observed.

The results of the traffic noise monitoring are presented in Table 7 below.

Table 7 – Traffic noise monitoring results, dB

Description	Measured traffic noise level
Average day time traffic noise level (0600-2200 hours)	53 dB L _{Aeq, 16 hour}
Highest day time hourly traffic noise level (0600-1900 hours) ³	54 dB L _{Aeq, 1 hour}
Average night time traffic noise level (2200-0600 hours)	47 dB L _{Aeq, 8 hour}

The highest maximum noise level measured during the night time period at the monitoring position was 84 dB L_{Amax}.

The measured highest day time hourly traffic noise levels detailed in Table 7 above have been used to design acoustic screening for the early learning centre to limit traffic noise impacts on children in outdoor play areas as well as internal areas. The measured daily traffic noise levels have been used to design the facade of the proposed townhouses so that suitable internal levels can be achieved.

³ Relevant to the proposed hours of operation of the child care centre.

5.0 RECOMMENDED NOISE CONTROLS

A 3-D noise model of the early learning centre, proposed townhouses and the surrounding area has been created to predict noise from the subject site to neighbouring existing and future receivers as well as to predict traffic noise levels at the future learning centre and proposed townhouses. Outcomes of the noise modelling indicate that acoustic fences/screens will be required to outdoor play areas to minimise noise egress to neighbouring receivers and also minimise traffic noise impacts on children within outdoor play areas and within indoor activity and sleeping areas. In addition, the building fabric of the proposed townhouses will need to be designed for compliance with Clause 55.07-6 of Monash City Council’s planning provisions and the RNP sleep disturbance criteria.

The location and extent of the proposed acoustic fences/screens for the early learning centre, recommended barrier construction and the recommended building fabric construction for the townhouses is outlined in the following sections.

5.1 Acoustic screening to ELC Level One

It is proposed to provide a combination of solid and slatted timber screening to the Level One outdoor play areas. It is recommended that sections of the screening where slatted timber is proposed be provided a solid backing such as 12 mm thick Perspex or 6 mm thick glass or any other approved material which meets the minimum surface density specification outlined in Section 5.5. The solid acoustic backing provided to the slatted screens should be to a minimum height of 1.5 m. In addition, a 1.5 m high acoustic fence should be provided to the northern site boundary.

The height and extent of the proposed acoustic screening is provided in Figure 4 below.

Figure 4 – Acoustic mitigation to ELC Level One



It is noted that the proposed solid screening to Level One should also meet the minimum surface density requirements outlined in Section 5.5.

5.2 Acoustic screening to ELC Level Two

It is recommended that a 1.2 m high acoustic screen be provided to the majority of the eastern end of the Level Two outdoor play area (L2 Outdoor Play). The height and extent of the proposed screen is provided in Figure 5 below.

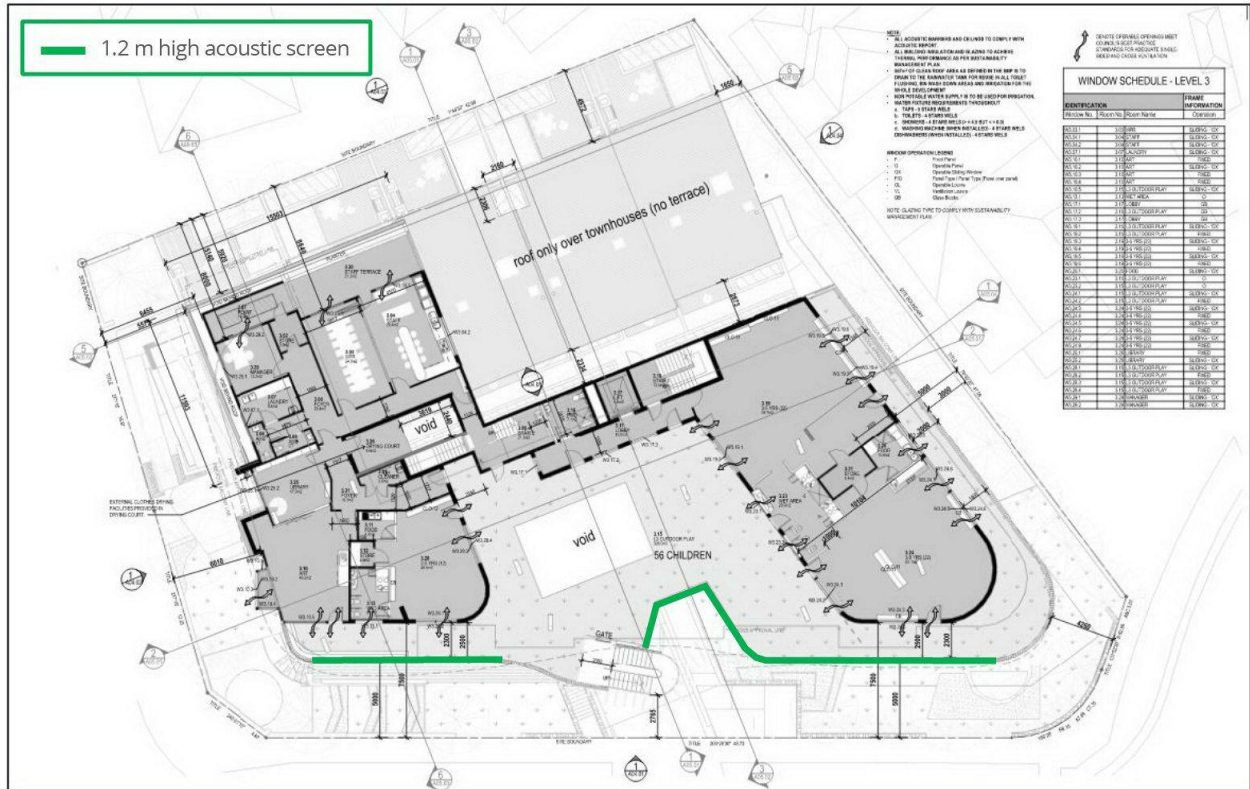
Figure 5 - Acoustic mitigation to ELC Level Two



5.3 Acoustic screening to ELC Level Three

It is recommended that a 1.2 m high acoustic screen be provided to sections of the eastern end of the Level Three outdoor play area (L3 Outdoor Play). The height and extent of the proposed screens for Level Three are provided in Figure 6 below.

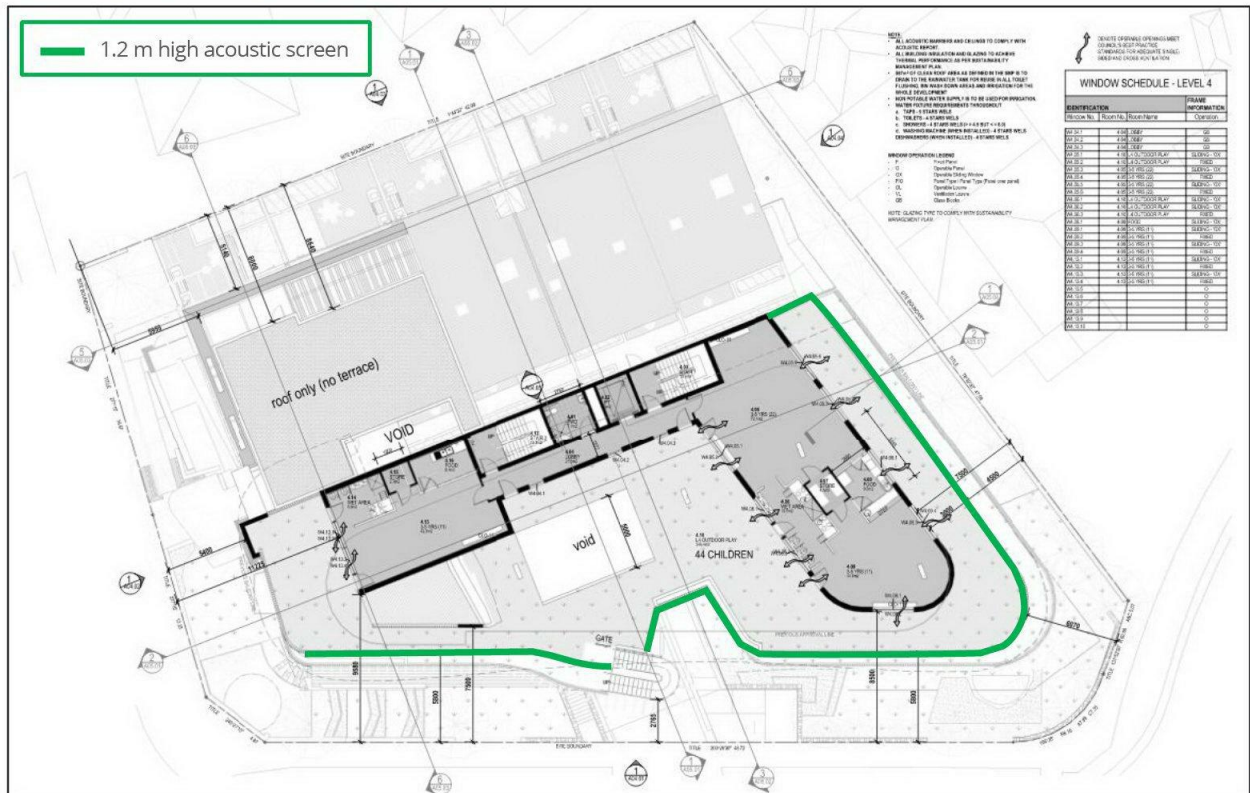
Figure 6 – Acoustic mitigation to ELC Level Three



5.4 Acoustic screening to ELC Level Four

It is recommended that a 1.2 m high acoustic screen be provided to the northern and eastern ends of the Level Four outdoor play area (L4 Outdoor Play). The height and extent of the proposed screens for Level Four are provided in Figure 7 below.

Figure 7 – Acoustic mitigation to ELC Level Four



5.5 Recommended fence/screen construction

To provide adequate noise attenuation, the construction material of the recommended acoustic fences/screens must have a minimum surface density of 12 kg/m² and be free from holes and gaps. The required surface density can be achieved by materials such as 9 mm thick fibre cement sheet, 6 mm thick float glass or 25 mm thick plywood timber panelling.

If a material which meets the above acoustic requirements and does not restrict light is required, 12 mm thick Perspex, 16 mm thick Thermoclear or 6 mm thick float glass can be used.

Where a perforated finish or batten screen finish is preferred such as metal or timber perforated balustrades or a timber look batten screen, the chosen finish will require a solid backing such as 12 mm thick Perspex or 6 mm thick glass or any other approved material which meets the minimum surface density specification.

5.6 Townhouse building fabric construction

The facade of the proposed townhouses has been designed for compliance with the recommended internal noise levels outlined in Sections 3.5. The facade construction requirements in order to achieve the relevant internal noise levels are summarised in Table 8.

Table 8 – Townhouse facade sound insulation requirements

Area	Glazing minimum sound insulation requirement, dB	Indicative glazing construction	Fixed facade minimum sound insulation requirement, dB	Indicative facade construction
Bedrooms	R _w 35	6.76 mm laminated glass	R _w 45	- External cladding with surface mass of 21 kg/m ² - 51 mm thick steel stud with insulation - 1 x 10 mm thick plasterboard
Living Areas	R _w 31	6 mm thick glass	R _w 41	- External cladding with surface mass of 11.5 kg/m ² - 51 mm thick steel stud with insulation - 1 x 10 mm thick plasterboard

Glazing suites should be selected based on the entire suite (glass, frame and seals) achieving the minimum sound insulation rating required. In addition, it is recommended that the townhouses be provided with 40 mm thick solid core entrance doors (or the acoustic equivalent) with full acoustic seals.

6.0 ASSESSMENT OF NOISE FROM CHILDREN PLAYING OUTDOORS

Noise levels from the subject site have been calculated using the proprietary noise modelling software SoundPLAN v8.2 which implements International Standard ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2). Noise levels from children playing in outdoor play areas are calculated considering the following:

- Source noise levels for children playing outdoors taken from the AAAC guideline outlined in Table 9
- Assumed number of children using the proposed outdoor play areas simultaneously
- Attenuation of noise provided by distance between the source and receiver and any intervening screening structures
- Attenuation of noise provided by the built form of the development including the proposed level two acoustic fences and the levels two, three and four acoustic screens
- Reflections from built form, adjacent buildings, screening structures and the ground surface
- The noise prediction methodology outlined in APPENDIX F.

The following sections detail the source noise data used in our noise model, outline the noise criteria applicable to outdoor play areas associated with the early learning centre and compare the predicted noise levels from children in outdoor play areas with the relevant noise criteria.

6.1 Noise source data

The AAAC guideline provides typical sound power levels for groups of 10 children playing within different age groups. The AAAC sound power level data for groups of 10 children and the anticipated age distribution of the 204 children that will attend the centre is provided in Table 9.

Table 9 – Children age distribution and AAAC effective sound power level per group of 10 children

Age group	Number of children	AAAC Sound Power Level per group of 10 children playing, dB L _{Aeq}
0-2 years	52	78
2-3 years	64	85
3-5 years	88	87

6.2 Noise criteria

Based on the discussion in Section 3.4.1 and the background noise levels provided in Table 6, the design criteria for noise from children in outdoor play areas associated with the subject site are summarised in Table 10.

Table 10 – Noise criteria for outdoor play areas, dB

Period	Noise criteria, L _{Aeq, 15 min}
Morning shoulder (0630-0700 hours)	48
Day (0700-1800 hours)	47
Evening (1800-1900 hours)	49

6.3 Predicted noise levels

Predictions of noise levels from children in the outdoor play areas are based on the following usage:

- Up to 75 % of the children attending the centre (153 children) being outside at the same time during the day and evening periods (0700-1900 hours)
- Up to 25 % of the children attending the centre (51 children) being outside at the same time during the morning shoulder (0630-0700 hours).

This is considered a conservative estimate and in practice, external playtime will be staggered and typical percentages of children playing outside simultaneously are generally lower than those used in this assessment. In addition, children are unlikely to be playing outside during the morning shoulder period as this period is likely to coincide with drop off, however, the predictions have been provided as a conservative approach.

The predicted noise levels from children playing in the outdoor areas are provided in Table 11 and Table 12 and account for the proposed built form of the subject site as well as the noise mitigation measures detailed in Section 5.0.

Table 11 - Predicted noise levels - children playing in outdoor play areas (Day/Evening period), dB

Receiver	Predicted noise level from outdoor play areas, $L_{Aeq,15\text{ min}}$	Criteria (Day/Evening), $L_{Aeq,15\text{ min}}$	Compliance?
2/125 Kingsway	43	47/ 49	Yes
1/125 Kingsway	47	47/ 49	Yes
36 Marriott Parade	44	47/ 49	Yes
301-305 Springvale Road	45	47/ 49	Yes
34 Marriott Parade	45	47/ 49	Yes
32 Marriott Parade	47	47/ 49	Yes
30 Marriott Parade	43	47/ 49	Yes
28 Marriott Parade	42	47/ 49	Yes
26 Marriott Parade	41	47/ 49	Yes
24 Marriott Parade	42	47/ 49	Yes
22 Marriott Parade	39	47/ 49	Yes
15-17 Marriott Parade	46	47/ 49	Yes
6 Berkley Court	34	47/ 49	Yes
5 Berkley Court	37	47/ 49	Yes

Table 12 - Predicted noise levels - children playing in outdoor play areas (Morning shoulder period), dB

Receiver	Predicted noise level from outdoor play areas, $L_{Aeq,15\text{ min}}$	Criteria (Morning shoulder), $L_{Aeq,15\text{ min}}$	Compliance?
2/125 Kingsway	38	48	Yes
1/125 Kingsway	42	48	Yes
36 Marriott Parade	40	48	Yes
301-305 Springvale Road	40	48	Yes
34 Marriott Parade	40	48	Yes
32 Marriott Parade	43	48	Yes
30 Marriott Parade	38	48	Yes
28 Marriott Parade	37	48	Yes
26 Marriott Parade	37	48	Yes
24 Marriott Parade	37	48	Yes
22 Marriott Parade	34	48	Yes
15-17 Marriott Parade	41	48	Yes
6 Berkley Court	29	48	Yes
5 Berkley Court	32	48	Yes

The noise levels from children playing within the outdoor play areas associated with the proposed early learning centre are predicted to comply with the nominated noise criteria at the nearest affected receivers with the incorporation of the recommended mitigation measures outlined in Section 5.0.

7.0 ASSESSMENT OF TRAFFIC NOISE IMPACTS

7.1 Traffic noise impacts on proposed early learning centre

As outlined in Section 3.4.1, the proposed early learning centre should be designed for traffic noise levels to not exceed 55 dB $L_{Aeq, 1 \text{ hour}}$ within outdoor play areas, 40 dB $L_{Aeq, 1 \text{ hour}}$ within the indoor activity areas and 35 dB $L_{Aeq, 1 \text{ hour}}$ in sleeping areas.

Based on the measured traffic noise levels provided in Table 7:

- The recommended acoustic fences and screening detailed in Sections 5.1 to 5.4 will enable compliance with the 55 dB $L_{Aeq, 1 \text{ hour}}$ requirement within outdoor play areas associated with the early learning centre
- Based on conventional facade construction for enclosed spaces associated with the early learning centre, the 40 dB $L_{Aeq, 1 \text{ hour}}$ requirement within indoor activity areas and 35 dB $L_{Aeq, 1 \text{ hour}}$ requirement for sleeping areas will be readily achieved.

7.2 Townhouse traffic noise intrusion

Based on the discussion in Sections 3.5, the facade of the proposed townhouses has been designed to achieve the internal noise criteria outlined in Table 13.

Table 13 – Townhouse traffic noise intrusion criteria, dB

Area	Design sound level, L_{Aeq}	Design sound level, L_{Amax}	Applicable time
Living areas	40	-	0600 hours – 2200 hours
Sleeping areas	35	55 ⁴	2200 hours – 0600 hours

The recommended building envelope design is outlined in Section 5.6. Based on the traffic noise measurements summarised in Table 7, and the recommended building envelope sound insulation for the proposed townhouses, the internal criteria detailed in Table 13 will be achieved for all townhouses.

7.3 Sleep disturbance associated with the use of the proposed car park

As outlined in Section 3.6, night-time maximum noise levels from the use of the proposed car park should not exceed the sleep disturbance criteria in sleeping areas associated with dwellings within the development and at neighbouring dwellings. As such the use of the basement car park and the car park ramp should not exceed 55 dB L_{Amax} internally in spaces typically used for sleeping at night within the development and 65 dB L_{Amax} external to dwellings in the vicinity of the subject site.

Bedrooms associated with the proposed townhouses are on Level 2 of the development and do not share a common floor/wall with the car park. As such, sleep disturbance from the use of the car park during the night time period is not expected to be an issue within bedrooms associated with the proposed development.

Maximum noise levels from the use of the basement are likely to be minimal at neighbouring dwellings due to the shielding afforded by the building envelope. As such, maximum noise levels from the night time use of the car park ramp have been predicted at dwellings within the development and at neighbouring dwellings. It is noted that predictions of maximum noise levels from the use of the car park ramp have been based on measurements from the Clarity Acoustics database.

⁴ The sleep disturbance criterion of 55 dB L_{Amax} is applicable between 2200-0700 hours.

Predicted maximum noise levels from the use of the car park ramp between 2200-0700 hours are outlined in Table 14 below.

Table 14 - Maximum noise levels from use of car park ramp, dB

Receiver	Predicted vehicle maximum noise level ² , L _{Amax}	Sleep disturbance criterion, L _{Amax}	Compliance?
2/125 Kingsway	33	65	Yes
1/125 Kingsway	36	65	Yes
36 Marriott Parade	61	65	Yes
301-305 Springvale Road	54	65	Yes
34 Marriott Parade	63	65	Yes
32 Marriott Parade	61	65	Yes
30 Marriott Parade	56	65	Yes
28 Marriott Parade	53	65	Yes
26 Marriott Parade	50	65	Yes
24 Marriott Parade	51	65	Yes
22 Marriott Parade	46	65	Yes
15-17 Marriott Parade ¹	38	65	Yes
6 Berkley Court	32	65	Yes
5 Berkley Court	31	65	Yes

Note 1 - For brevity, only the highest predicted maximum noise level has been presented in this report for townhouses associated with the development.

Note 2 - Based on a normal car sound power level of 94 dB L_{Amax} at the crossover point.

The noise levels from the use of the car park ramp associated with the subject site are predicted to comply with the sleep disturbance criterion of 65 dB L_{Amax} at the nearest affected receivers. It should be noted that the existing maximum noise levels from traffic measured at the subject site regularly exceeded the 65 dB L_{Amax} sleep disturbance threshold.

8.0 ASSESSMENT OF NOISE FROM MECHANICAL PLANT

Mechanical plant associated with the early learning centre will need to be designed to be compliant with the Noise Protocol noise limits at the nearest affected receivers. Noise limits applicable to the operation of mechanical plant associated with operation of the early learning centre have been calculated in accordance with the Noise Protocol and are provided in Table 15.

Table 15 – Noise Protocol noise limits, dB

Period	Time Period	Noise Protocol noise limit, L_{eff}
Day	0700-1800 hours	49
Evening	1800-1900 hours	46
Night (morning shoulder period)	0630-0700 hours	42

Further detail on the derivation of the Noise Protocol noise limits is provided in APPENDIX D.

At this stage, the mechanical services plant selections have not been undertaken for the development. It is recommended that a detailed assessment of noise associated with the mechanical plant is undertaken once the plant selection is finalised.

To enable compliance with the Noise Protocol noise limits, all plant will need to be designed/located to achieve a cumulative level of 42 dB L_{eff} at the nearest affected receivers when assessed over a 30-minute period. In our experience, the main mechanical plant associated with child care centres such as this is generally limited to air-conditioning condenser units which can either be sited or appropriately mitigated to be compliant with the Noise Protocol noise limits. Any car park exhaust system may also require in-duct attenuation. If mitigation is deemed to be required, it could be implemented in the form of localised acoustic screening and/or providing silencers or attenuators on plant items.

A condition of consent can be included in the permit requiring a full assessment when plant selections are available.

9.0 SUMMARY

It is proposed to develop a new 204-place early learning centre and five townhouses at 15-17 Marriott Parade in Glen Waverley. The proposed early learning centre is to include basement parking and outdoor play areas on each level with an additional outdoor play area on the roof. The proposed townhouses are to be located to the west of the early learning centre building.

Noise criteria for the proposed development have been developed considering the following:

- Environment Protection Regulations 2021
- *1826.4: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*
- *AAAC Guideline for Child Care Centre Acoustic Assessment (Version 3.0)*
- recent relevant VCAT decisions
- Environment Reference Standard
- *NSW Road Noise Policy*
- Clause 55.07-6 of Monash City Council's planning provisions.

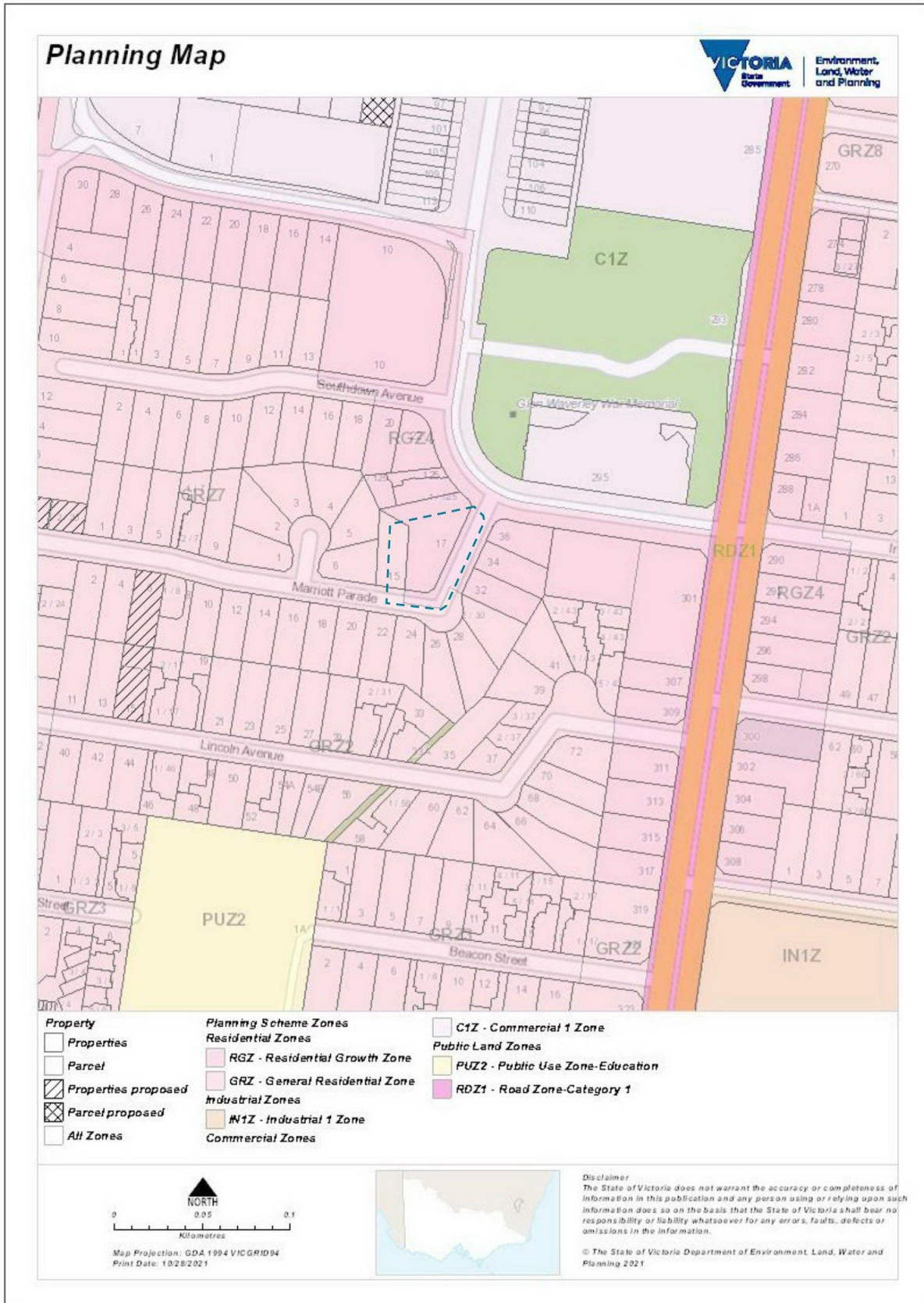
Clarity Acoustics has undertaken an assessment of environmental noise associated with the proposed development and found the following:

- noise levels from children in outdoor play areas associated with the early learning centre will be compliant with the proposed acoustic criteria based on the proposed design of the subject site and the incorporation of the mitigation measures provided in Sections 5.1 to 0 of this report. In addition, with the incorporation of the recommended mitigation measures in Sections 5.1 to 0, traffic noise will be compliant with the AAAC recommended criteria in both external and internal areas associated with the early learning centre
- based on the predicted levels (adjusted for the ERS day time 16-hour metric), noise from children in outdoor play areas will be below the ERS objectives and indicators for the area surrounding the subject site
- maximum noise levels from the use of the car park ramp associated with the proposed development are predicted to be compliant with the NSW RNP sleep disturbance criterion of 65 dB L_{Amax} outside bedroom windows of dwellings associated with the development as well as neighbouring dwellings
- all mechanical plant associated with the early learning centre will need to be designed/sited to achieve a cumulative level of 42 dB L_{eff} at the nearest affected receivers
- the building facade of the proposed townhouses has been designed to enable compliance with the requirements of Clause 55-07-6 of Monash City Council's planning provisions and the NSW RNP sleep disturbance criterion of 55 dB L_{Amax} .

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The A-weighting filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at lower levels. A-weighted measurements correlate well with the perceived loudness at low sound levels, as originally intended.
dB	Decibel (dB) a relative unit of measurement widely used in acoustics, electronics and communications. The dB is a logarithmic unit used to describe a ratio between the measured sound level and a reference or threshold level of 0 dB.
Hertz	Hertz (Hz) the unit of Frequency or Pitch of a sound. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Ambient noise level	The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 't' ($L_{Aeq, t}$).
$L_{A90}(t)$	The sound level exceeded for 90 % of the measurement period, A-weighted and averaged over time (t) and commonly referred to as the background sound level.
$L_{Aeq}(t)$	A -weighted equivalent continuous sound Level is the sound level equivalent to the total sound energy over a given period of time (t). Commonly referred to the average sound level.
L_{Amax}	The A-weighted maximum noise level. The highest sound level which occurs during the measurement period or a noise event.
L_{eff}	Effective Noise Level - The level of noise emitted from the commercial, industrial or trade premises adjusted if required for character and duration.
R_w	Weighted Sound Reduction Index - A single number rating of airborne sound insulation between rooms, over a range of frequencies - laboratory measurement.

APPENDIX B PLANNING MAP





APPENDIX C

SITE PLAN

APPENDIX D 1826-4 (NOISE PROTOCOL)

The Environment Protection Regulations 2021 (S.R. No. 47/2021) set out a framework for noise from residential, commercial, industrial and trade premises. Regulation 113 (Part 5.3) of the Regulations requires that the prediction, measurement and analysis of noise from commercial, industrial and trade premises and indoor and outdoor entertainment venues and events must be undertaken in accordance with the Noise Protocol (i.e., EPA Publication 1826-4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*).

Part I of the Noise Protocol outlines the methodology to establish noise limits applicable to noise from commercial, industrial or trade premises in both urban and rural areas of Victoria. The Noise Protocol also outlines the methodology to undertake a measurement of prediction of the effective noise level at a noise sensitive area from the noise generator.

The subject site is located within the Melbourne Major Urban Area (MUA) boundary and, therefore, noise limits for the subject site are derived using the urban area method.

Table 16 provides a summary of relevant definitions under the Noise Protocol.

Table 16 – Noise Protocol definitions

Term	Definition
Commercial, industrial and trade premises	<p>any premises except the following:</p> <p>(a) residential premises (other than common plant under the control of an owner's corporation);</p> <p>b) a street or road, including every carriageway, footpath, reservation and traffic island on any street or road;</p> <p>(c) a railway track used by rolling stock in connection with the provision of a freight service or passenger service –</p> <p style="padding-left: 40px;">(i) while travelling on a railway track or tramway track; or</p> <p style="padding-left: 40px;">(ii) while entering or exiting a siding, yard, depot or workshop;</p> <p>(d) a railway track used by rolling stock in connection with the provision of a passenger service, while in a siding yard, depot or workshop and is –</p> <p style="padding-left: 40px;">(i) powering up to commence to be used in connection with the provision of a passenger service; or</p> <p style="padding-left: 40px;">(ii) shutting down after being used in connection with the provision of a passenger service;</p> <p>(e) the premises situated at Lower Esplanade, St Kilda and known as "Luna Park" and being the whole of the land more particularly described in Certificate of Title Volume 1204 Folio 109.</p>
Residential premises	Any building or part of a building used as or for the purposes of a private residence or residential flat
Noise sensitive residential use	a community care accommodation, dependent person's unit, dwelling, residential aged care facility, residential village, retirement village or rooming house

Term	Definition
Background noise level	The arithmetic average of the hourly L_{A90} levels that represents the background sounds in a noise sensitive area, in the absence of noise from any commercial, industrial or trade premises which appears to be intrusive at the point where the background level is measured, when measured according to Part I, section A4 of the Noise Protocol
Effective noise level	the level of noise emitted from commercial, industrial and trade premises and, if appropriate, adjusted to take into account the character and duration of the noise and the measurement conditions, as determined in accordance with the Noise Protocol
Noise sensitive area	<p>(a) that part of the land within the boundary of a parcel of land that is -</p> <p>(i) within 10 metres of the outside of the external walls of any of the following buildings -</p> <p style="padding-left: 40px;">a dwelling (including a residential care facility but not including a caretaker's house), a residential building, a noise sensitive residential use; or</p> <p>(ii) within 10 metres of the outside of the external walls of any dormitory, ward, bedroom or living room of one of more of the following buildings -</p> <p style="padding-left: 40px;">a caretaker's house, a hospital, a hotel, a residential hotel, a motel, a specialist disability accommodation, a corrective institution, a tourist establishment, a retirement village, a residential village; or</p> <p>(iii) within 10 metres of the outside of the external walls of a classroom or any room in which learning occurs in the following buildings (during their operating hours) -</p> <p style="padding-left: 40px;">a child care centre, a primary school, a secondary school; or</p> <p>(b) in the case of a rural area only, that part of the land within the boundary of -</p> <p>(i) a tourist establishment, or</p> <p>(ii) a campground; or</p> <p>(iii) a caravan park.</p>
Day period	Monday-Saturday (excluding public holidays) 0700-1800 hours
Evening period	Monday-Saturday 1800-2200 hours
	Sunday and public holidays 0700-2200 hours
Night period	Monday-Sunday/Public Holidays 2200-0700 hours

The calculation of noise limits for commercial, trade and rural premises in urban areas takes into account a zoning noise level, which is based on the land zoning types in the surrounding 200 metre radius of the noise sensitive area, and the background noise level in the vicinity of the relevant noise sensitive areas.

Once a noise limit is established, the noise level from the premises is measured or predicted as a 30-minute equivalent average noise level ($L_{Aeq, 30 \text{ min}}$) and if necessary, adjusted to account for duration, measurement position and noise character (such as tonality, intermittency and impulsiveness) to determine the effective noise level (L_{eff}).



The Noise Protocol noise limits applicable to the subject site have been derived in accordance with the methodology prescribed in the Noise Protocol and the background noise levels outlined in Section 4.1. The derived noise limits are provided in Table 17.

Table 17 - Noise limits derived under the Noise Protocol, dB

Period	Measured background noise level, dB L_{A90}	Zoning Level, dB	Background relative to zoning level	Noise limit, dB L_{eff}
Day	37	52	Low	49
Evening	39	46	Neutral	46
Night	39	41	High	42

Compliance with the Noise Protocol is achieved when the effective noise level from all of the subject site noise sources covered under the Noise Protocol/Environment Protection Regulations do not exceed the noise limit in the relevant noise period when assessed over a 30-minute period.

APPENDIX E CHILDCARE GUIDELINES AND RELEVANT VCAT DECISIONS

AAAC guideline

Design criteria

The AAAC guideline relating to child care centres nominates the following design targets for assessing noise from children in outdoor play areas:

Table 18 - Design criteria for outdoor play areas, dB

Use of outdoor area	Design criteria
Up to 4 hours (total) per day	$L_{Aeq, 15 \text{ min}} \leq L_{A90, 15 \text{ min}} + 10 \text{ dB}$
More than 4 hours per day	$L_{Aeq, 15 \text{ min}} \leq L_{A90, 15 \text{ min}} + 5 \text{ dB}$

However, based on previous project experience, key planning precedents and discussions with other acoustic consultants, issues have been identified with the AAAC design criteria which are detailed in Section 3.4.1.

Revised approach

A revised approach to the use of the AAAC design targets has been adopted by Clarity Acoustics (and other consultants). Accordingly, this assessment compares the noise from children playing at nearby residences against a margin of 10 dB above the background noise levels. This approach is consistent with the VCAT decisions discussed in the next section.

Relevant VCAT decisions

A review of relevant VCAT decisions has been undertaken to determine an approach to noise assessment of child care centres and noise control design that is consistent with planning precedents in Victoria. The review concludes that noise from children playing in outdoor areas associated with child care centres is considered to be consistent with residential amenity. It has also identified that there is a need to consider appropriate noise mitigation strategies for such developments.

Furthermore, the review also supports the view of Clarity Acoustics (and other acoustic consultants) that the design targets for noise from children in outdoor play areas nominated by the AAAC guideline are highly conservative. This is discussed below.

The following VCAT decisions are of relevance:

Petzierides v Hobsons Bay CC (includes Summary) (Red Dot) [2012] VCAT 686 (28 May 2012)

This Red Dot VCAT decision is of significance as it notes that there is a general agreement that noise from child care centres is considered reasonable in residential areas. Notwithstanding this, it emphasises the need for appropriate noise controls to minimise noise impacts to an acceptable level. The Member states the following in her decision:

Ms Hayes responded to this concern by pointing out there have been many decisions of the Tribunal and its predecessors that have viewed noise emanating from child care centres or, more specifically, from the children themselves as being reasonable within a residential area. Whilst I agree with this in general terms, it does not mean that a child care centre can obviate the need to act responsibly and appropriately by ensuring any noise impact is of an acceptable level, particularly given the size of child care centres today.



Basic Element Pty Ltd v Hobsons Bay CC [2017] VCAT 522

This decision is of significance as it identifies the highly conservative approach nominated in the AAAC guideline for the assessment of noise from outdoor play areas.

With regards to the evidence given by the acoustic expert witness, it states the following:

There is no accepted standard for noise from people. Mr Tardio referred to a guideline for child care centres prepared by the Association of Australian Acoustical Consultants (the AAAC guideline) that sets out recommendations for assessment methodology and acceptable noise levels. Other divisions of the Tribunal have determined that the AAAC Guideline should be given little weight in these matters as it is highly conservative and it has no statutory basis in any planning schemes. I see no reason to give this guideline any weight in this matter.

PHHH Investments Pty Ltd v Bayside CC (Amended) [2015] VCAT 922

This decision is of significance as it identifies the use of the AAAC guideline as a guide to inform decision making and the design of noise control. It states:

There is currently no policy or guidelines on noise. The AAAC guidelines would hence be useful in informing a decision making to determine whether noise emitted is excessive, and amelioration measures that can be used.

The member in his/her decision agrees with the acoustic expert witness and makes the following comments:

On this point, I agree with Mr. Marks and the NSW Land and Environment Court that noise from children playing outdoors are not equivalent to continuous industrial noise, the basis of the tougher guidelines.

Following this the member accepts that the $L_{A90} + 5$ dB criteria is not appropriate and states the following:

In all, I adopt AAAC's approach to noise and the criterion of 10dB above background noise and adoption of permit conditions with regard to noise attenuation measures and management plan.

Beis Efraim College Limited v Bayside CC [2014] VCAT 856 (16 July 2014)

This case relates to the change of use of a site that was previously used as a child care centre to a pre-school. Objectors to the application noted that noise was not a negative impact at their properties when the site was used a child care centre.

Furthermore, an assessment in strict accordance with the AAAC's more stringent design criterion ($L_{A90} + 5$ dB) resulted in the need for barriers between up to 4 metres in height which was considered excessive. When the less stringent criterion of $L_{A90} + 10$ dB was applied, the maximum barrier height required for compliance to be achieved was 2.7-3.0 metres high.

This decision supports the findings that noise from children in outdoor play areas is considered reasonable in residential areas and that the AAAC's design criterion of $L_{A90} + 5$ dB is highly conservative.

APPENDIX F PREDICTION METHODOLOGY

Predictions of operational noise from the subject site have been undertaken on the basis of:

- The sound emissions of noise sources associated with the subject site as outlined in Table 9
- A digital noise model of the site and surrounding environment
- International standard(s) used for the calculation of environmental noise propagation.

Details of the prediction methodology are summarised in Table 19 below.

Table 19 - Noise prediction methodology

Detail	Description
Software	Proprietary noise modelling software SoundPLAN v8.2
Method	International Standard ISO 9613-2:1996 <i>Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation</i> (ISO 9613-2).
Ground conditions	Ground factor of $G = 0$ i.e., hard ground
Atmospheric conditions	Temperature 10°C and relative humidity 70% This represents conditions which result in relatively low levels of atmospheric sound absorption.
Receiver heights	1.5 m AGL for ground floor and 1.5 above FFL for subsequent floors.
Terrain	Subject site terrain and terrain for surrounding area sourced from Victorian DELWP's Spatial Datamart