

REVERBERATE


C O N S U L T I N G



Koondoola Childcare Centre Environmental Noise Emission Report

Reference: P191144RP1 Rev 1.docx

Document Information

Project	Koondoola Childcare Centre	
Client	Accord Property Pty Ltd	
Report title	Environmental Noise Emission	
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Revision Table

Report revision	Date	Comments
0	13 May 2022	Draft Issued to client
1	16 May 2022	Updated with comments

Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of that sound level.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
L ₉₀	Noise level exceeded for 90 % of the measurement time. The L ₉₀ level is commonly referred to as the background noise level.
L ₁₀	Noise level exceeded for 10 % of the measurement time. The L ₁₀ level represents the typical upper noise level and is often used to represent traffic or industrial noise emission.
L _{A10,adj}	Adjusted L _{A10} . Adjustment based on obvious tonality, impulsive or Modulation characteristics in the audible noise at a receiver point. Based on the adjustment methodology in Environmental Protection (Noise) Regulations 1997 Regulation 9
L _{A1,adj}	Adjusted, A-weighted noise level exceeded for 1 % of the measurement time. The L _{A1, adj} level represents mostly short duration, high level sound events.
L _{Amax,adj}	Adjusted, A-weighted maximum instantaneous noise level.
L _{Aeq}	A-weighted Equivalent Noise Level—Energy averaged noise level over the measurement time.
R _w	Weighted Sound Reduction Index—A laboratory measured value of the acoustic separation provided by a single building element (such as a partition). The higher the R _w the better the noise isolation provided by a building element.
R _w + C _{tr}	A measure of the sound insulation performance of a building element with a C _{tr} spectrum adaptation term placing greater emphasis on the low frequency performance.
Reverberation Time (RT)	Of a room, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the room to decrease by 60 decibels.

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1. Executive Summary

Reverberate Consulting has been commissioned by Accord Property to provide acoustic advice relating to the proposed childcare centre at Lot 80 (304) Marangaroo Drive and Lots 78 – 79 (3) Callison Way, Koondoola.

This report and analysis are based on the Brown Falconer drawings job No. 2014054, drawings
3507 03 Rev B 12/05/22 (refer site plan Appendix C)
3507 06 Rev B 12/05/22
3507 07 Rev B 12/05/22

The main acoustical issues covered are the environmental noise emission from the site, as received at adjacent residential properties along Marangaroo Drive and Callison Way from:

- outdoor play areas (after 7am)
- mechanical plant (before 7am)
- carpark activity (before 7am)

It is found that noise barriers as shown in Appendix C, and the noise control measures in Appendix A are recommended to control noise emission from the site

This report details the results of the acoustic assessment.

2. Site and Surrounds

The proposed childcare centre is located on a parcel of land bounded by Marangaroo Drive to the north and Callison Way to the south and east, refer to the Site Plan Figure 1.

The proposed operating hours of the centre are between 6:30 am and 6:30 pm Monday to Friday, with no outdoor play before 7:00 am. The resultant dominant noisy activity for the site is caused by the following noise sources:

- Parent and staff vehicle movements in the carpark (6.30 am – 6.30 pm)
- Mechanical plant and equipment (6.30 am – 6.30 pm)
- Child Care centre children playing outdoors (7.00am to 6.30 pm)
 - 16 x 0-2 year olds
 - 35 x 2-3 year olds
 - 40 x 3-5 year olds

The site is adjoining residences on the west, with additional residences on the far side of Marangaroo Drive to the north, and Callison Way to the south, refer to the Site plan Figure 1.



Figure 1: Childcare Centre Site Plan

3. Noise Assessment Criteria

3.1 Environmental Protection Act

The Environmental Protection Act (1986) provides for the prevention, control and abatement of pollution and environmental harm. This Act limits environmental noise in Section 3 (3) as follows:

For the purposes of this Act, noise is taken to be unreasonable if –

- (a) it is emitted, or the equipment emitting it is used, in contravention of –*
 - (i) this Act; or*
 - (ii) any subsidiary legislation made under this Act; or*
 - (iii) any requirement or permission (by whatever name called) made or given by or under this Act;*

or

- (b) having regard to the nature and duration of the noise emissions, the frequency of similar noise emissions from the same source (or a source under the control of the same person or persons) and the time of day at which the noise is emitted, the noise unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person; or*

- (c) it is prescribed to be unreasonable for the purposes of this Act.*

Reverberate has used the above legislation to assess the noise impact from the site. More particularly, noises which have a distinct character, and are different to the ambient noise environment are assessed under the subsidiary legislation; the Environmental Protection (Noise) Regulations 1997. Such an assessment has been undertaken for noise sources such as child noise in outdoor areas and vehicle door noise in carparks.

Other types of noises from the site, such as that generated by vehicles driving, or manoeuvring in the carpark, have not been assessed under the Regulation. Reference is drawn to Section 3 (3) (b) of the Act which requires the assessment to have regard to the nature, duration and time of day of such noise emissions and the frequency of similar noise emissions from the same source. It is noted that the adjoining roads contain more traffic than accesses the study site so the movement of vehicles on child care site, per se, is not considered characteristically different to that already in the area.

3.2 Environmental Protection (Noise) Regulations 1997

The Environmental Protection (Noise) Regulations 1997 (the Regulations) provide limits for acceptable noise from operations and activities. The Regulations specify the maximum permissible noise levels (termed Assigned Levels) at noise sensitive premises, caused by excessive nearby noise, during various times of the day.

The Assigned Levels have been calculated for all properties using the method shown in Appendix B. The resultant Assigned Levels are presented below in Table 1 and are applicable at the adjoining neighbouring residential sites.

Due to the proposed hours of operation of the outdoor play area, the day-time period is the critical assessment period. The only exception is for carpark and mechanical plant activity prior to 7 am.

Table 1: Environmental noise emission criteria (Assigned Levels)

Receiving Premises	Time of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise Sensitive Premises - Highly Sensitive	0700 to 1900 hours Monday to Saturday	49	59	69
	0900 to 1900 hours Sunday and public holidays	44	54	64
	1900 to 2200 hours all days	44	54	59
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	39	49	59

These criteria are applicable to the dominant noises as follows:

- child noise (daytime L_{A10} assigned level 49 dB),
- mechanical services noise (night-time L_{A10} assigned level of 39 dB) and
- carpark activity such as vehicle door closing (night-time L_{Amax} assigned level of 59 dB).

Note that adjustments are applied to the noise sources for a variety of characteristics. Where tonality, impulsiveness or modulation is present at the nearest neighbours then these noises are additionally adjusted where the characteristics cannot be removed from the noise signature.

It is expected that the sound of the vehicle door closing would be perceived as impulsive at the nearest neighbours and so would attract a 10 dB adjustment. Likewise, the sound of the mechanical services plant could be perceived as tonal and would attract a 5 dB adjustment during potentially quiet, pre-7am periods.

4. Noise Assessment

4.1 Noise sources modelled

Noise emission sources and ground contours were used to develop a 3-D SoundPLAN noise model as shown below in Figure 2. This figure shows the locations of the modelled noise sources, noise barriers, and site & surrounding buildings.

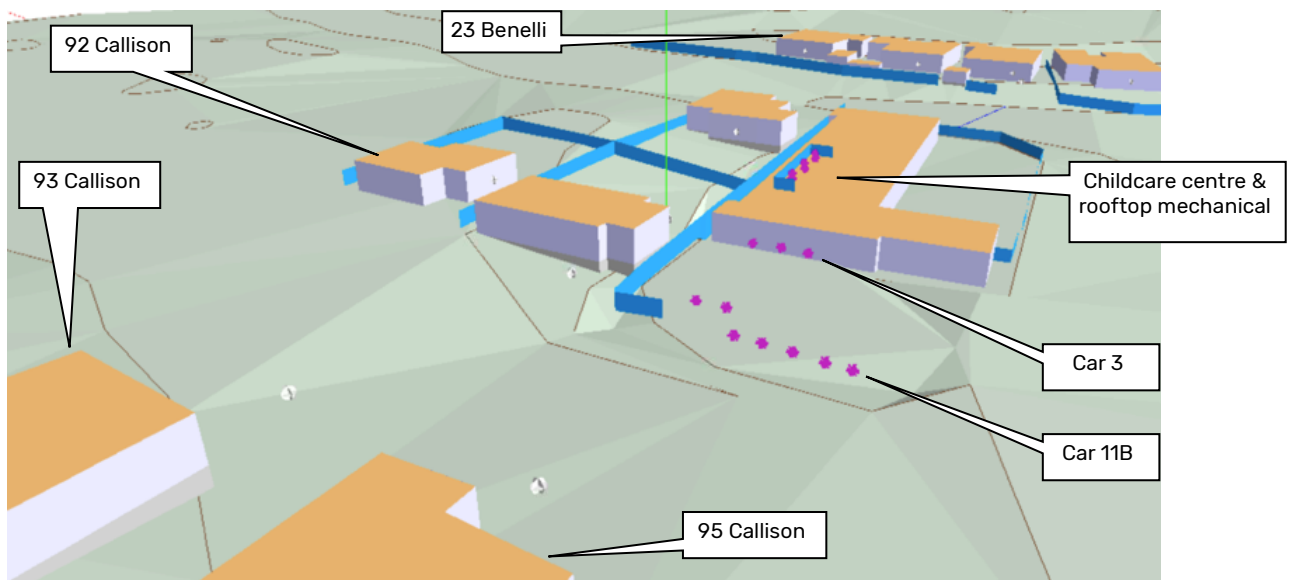


Figure 2 - 3-D SoundPLAN model of Site and Noise Sources

The Childcare Centre has been modelled with the following noise sources:

- Outdoor play area:
 - 16 x 0-2 year olds
 - 35 x 2-3 year olds
 - 40 x 3-5 year olds
- Outdoor mechanical plant
- Car park noise (controlled by door close noise)

The noise emissions per group of children are based on our previous experience, and that of the Association of Australasian Acoustical Consultants [AAAC]¹, and are summarised in Table 2 below.

¹Guideline for Childcare Centre Acoustic Assessment, Version 3.0, dated September 2020

Table 2 – L_{A10} Sound Power Levels – children outside

Per Group of children	Sound Power Level (dB) Reverberate
10 children (3-5 yo)	86
10 children (2-3 yo)	84
10 children (0-2 yo)	77

The total L_{A10} noise emission from all outdoor rooftop air-conditioning units and exhaust fans was 80 dB.

The noise emission from carparking was considered with the sound power level of car door closing being L_{wAmax} = 84 dB. Other vehicular sounds such as engine starting noises and maneuvering within the carpark are quieter than that for door closing, when adjusted for prominent characteristics. Where car door noise is shown to meet the Regulations, these other noises will also be compliant.

4.2 Noise Forecast and Impact

Computer noise modelling was used to forecast the noise impacts to locations around the site. The software used was SoundPLAN Version 8.2, with the ISO9613 algorithms selected. These algorithms have been used as they allow for the influence of wind, atmospheric stability, barriers, building shielding and ground absorption. It is appropriate for the current configuration of noise sources and receiver locations.

The Input data used in modelling includes

- Meteorological Information;
- Topographical data;
- Buildings, barriers, fences, and other features which may shield noise
- Ground Absorption; and
- Source sound levels.

The following parameters were used as necessary in modelling for night-time and evening operations i.e., between 7 pm and 7 am.

- Pasquil Stability Factor F
- Temperature 15 °C (pre-7am)
- Temperature 20 °C (post-7am)
- Wind Speed 3 m/s
- Wind Direction Worst case – i.e., all directions
- Relative Humidity 50%
- Ground Absorption 0.65 in grassed areas
- 0.10 for paved areas such as roads and carparks

Adjustments were applied for the forecast noise reaching receptor locations. Where evident at the receiving locations, the following adjustments were applied:

- +10 dB where the received noise was determined to have impulsive characteristics
- +5 dB where the received noise was determined to have tonal characteristics

The forecast noise levels at sensitive receivers are summarised in Table 3 to Table 5 below. These forecasts are based on the maximum Sound Power Levels in Section 4.1 above, as well as the successful implementation of the Noise Management Plan in Appendix A.

The corresponding forecast noise levels at sensitive receivers are also shown in noise contour plots Figure 3 to Figure 5

Table 3 - Forecast $L_{A10,adj}$ daytime noise emission levels

Noise Source	Receiver L_{A10} (dB)								
	17 Benelli	19 Benelli	21 Benelli	23 Benelli	92 Callison	93 Callison	94 Callison	95 Callison	304 Marangaroo
	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl
Child noise	44	48	41	37	30	34	32	37	40
AC 1*	24	25	23	21	27	22	33	28	34
AC 2*	25	27	25	22	28	23	33	29	33
AC 3*	25	28	24	22	28	21	33	27	32
AC 4*	25	28	25	22	28	24	33	28	32
AC 5*	25	29	25	21	28	24	34	26	31
AC 6*	27	29	25	19	28	23	35	26	33
TOTAL	45	48	42	37	34	36	38	38	41
Assigned Level	49	49	49	49	49	49	49	49	49
Compliance	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved

Note * Tonality adjustment applied

Table 4 - Forecast $L_{A10,adj}$ night time noise emission levels

Noise Source	Receiver L_{A10} (dB)								
	17 Benelli	19 Benelli	21 Benelli	23 Benelli	92 Callison	93 Callison	94 Callison	95 Callison	304 Marangaroo
	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl	Grnd Fl
AC 1*	19	20	18	16	22	17	28	23	29
AC 2*	20	21	19	17	22	18	28	24	28
AC 3*	20	23	19	17	23	16	28	22	27
AC 4*	20	23	20	17	23	19	28	23	27
AC 5*	20	24	20	16	23	19	29	21	26
AC 6*	22	24	20	17	24	18	30	21	28
TOTAL*	28	31	27	24	31	26	36	30	35
Assigned Level	39	39	39	39	39	39	39	39	39
Compliance	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved

Table 5 - Forecast $L_{Amax, adj}$ night-time noise emission levels

Noise Source	Receiver L_{Amax} (dB)								
	17 Benelli Grnd Fl	19 Benelli Grnd Fl	21 Benelli Grnd Fl	23 Benelli Grnd Fl	92 Callison Grnd Fl	93 Callison Grnd Fl	94 Callison Grnd Fl	95 Callison Grnd Fl	304 Marangaroo Grnd Fl
Car 1**	27	29	28	26	46	49	57	53	37
Car 11B**	35	35	31	29	36	52	52	57	39
Car 12B**	34	35	31	29	37	52	53	57	39
Car 13B**	34	37	33	33	37	52	54	57	40
Car 14B**	34	36	32	29	37	53	55	57	41
Car 15B**	34	36	33	29	37	53	57	57	41
Car 16**	34	34	33	28	39	54	55	55	41
Car 17**	32	34	30	27	40	54	56	55	42
Car 2**	31	29	29	25	47	50	56	52	36
Car 3**	32	32	27	26	47	50	55	52	34
Assigned Level	59	59	59	59	59	59	59	59	59
Compliance	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved

Note * Tonality adjustment applied

** Impulsive adjustment applied

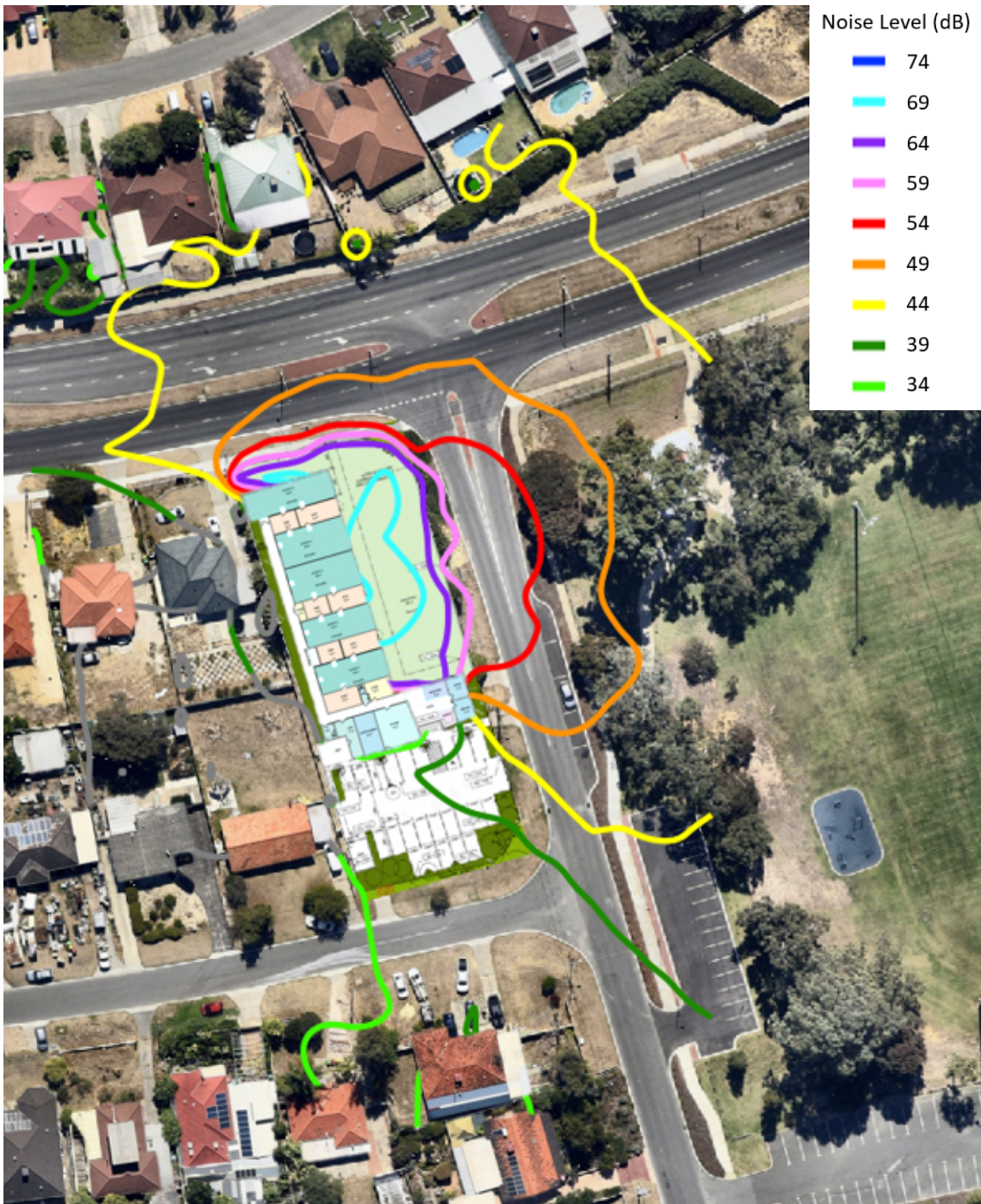


Figure 3: Daytime environmental noise emission prediction (L_{A10}) at 1.5 m above ground level
(Assigned Level = 49 dB)

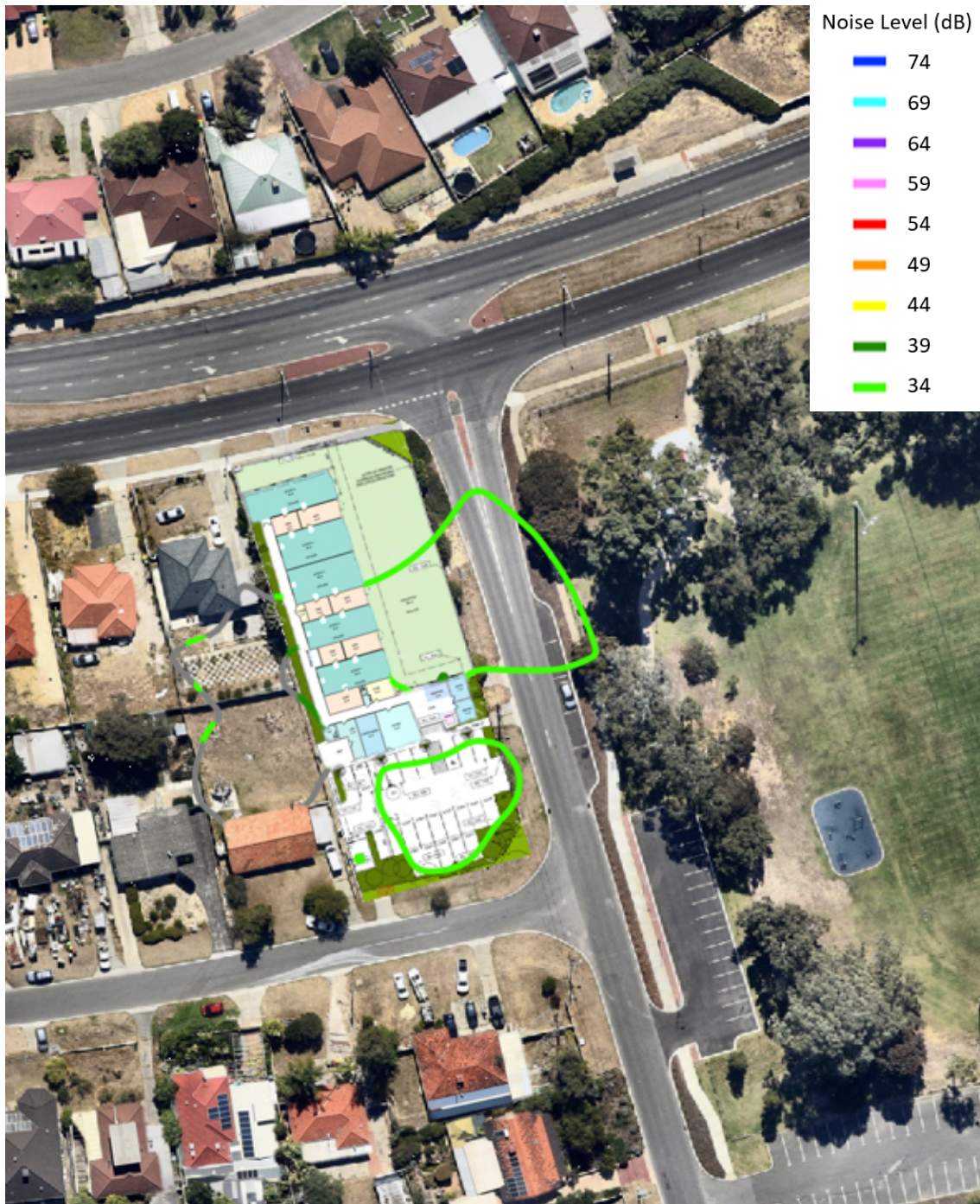


Figure 4: Environmental noise emission prediction night-time (L_{A10}) at 1.5 m above ground level
(Assigned Level = 39 dB)



Figure 5: Environmental noise emission prediction night-time (L_{Amax}) at 1.5 m above ground level
(Assigned Level = 49 dB)

5. Discussion

The results in Section 4.2 show that the overall noise emission levels comply with the Assigned Levels as developed from the Environmental Protection (Noise) Regulations 1997.

These conclusions can be drawn using the conservative assumptions that

- all mechanical plant, and all children together, are simultaneously making noise, and at full noise emission as noted
- Noise Regulation adjustments are needed for all items as proposed

We consider that these assumptions are conservative, and that it unlikely that these will actually occur. Where the assumptions do not hold, the overall noise emission from the site will reduce to levels below that shown in Section 4.2.

It is noted that the noise control measures recommended in this report will produce sufficient noise control to meet the Environmental Protection (Noise) Regulations 1997 requirements, for the noise sources as outlined. Where it is proposed to install plant or equipment with different noise emission to that identified in this report, we recommend that a detailed noise assessment is conducted at that stage.

Based on the noise sources, arrangement, and the conservative assumptions outlined in this report, the overall noise emission from the site is considered acceptable throughout the night-time operating period (i.e., before 7:00 am) and throughout the day.

6. Conclusion

An assessment of environmental noise emission from the proposed Childcare Centre development has been undertaken.

The forecast noise emission levels have been presented. The recommended treatments to control noise emissions are outlined in the Noise Management Plan (Appendix A) and these treatments have been shown to control environmental noise emission from the site so that compliance is achieved with the Environmental Protection Act (1986) and Environmental Protection (Noise) Regulations 1997.

On this basis, the environmental noise emission from the site is considered acceptable and we recommend approval for the proposed Childcare Centre.

Appendix A: Noise Management Plan

The elements outlined below are recommended as part of a comprehensive Noise Management Plan. They are recommended for compliance with the Environmental Protection Act 1986 and its subsidiary legislation: The Environmental Protection (Noise) Regulations 1997.

Noise Source or Activity	Requirement/Treatments ²
Barriers	<ul style="list-style-type: none"> Noise control barriers are recommended with the minimum heights shown in Appendix C. These barriers are to be gap free along their lengths unless otherwise indicated The minimum construction of barriers up to 1.8m high to be 0.42 mm BMT Colorbond, (or masonry), with 6mm Perspex infill behind "open sections" and taller barriers to be a minimum of 90 mm masonry, or other material with a minimum mass 8.5 kg/m²
Refuse Collection	<ul style="list-style-type: none"> Refuse collection is to be carried out in the quietest reasonable and practicable manner Equipment used for refuse collection is the quietest reasonably available Collection to occur between 7 am and 7 pm Mon-Saturday, unless the contractor has a Noise Management Plan approved by Council.
Child Noise	<ul style="list-style-type: none"> Children not permitted in the outdoor play areas before 7 am Noisy activities such as musical instruments, parties, singing, etc to be conducted indoors with the doors and windows closed. Crying children should be taken inside to comfort them A contact phone number for the Centre's director should be made available to neighbours to facilitate communication and to resolve any neighbourhood issues that may arise due to operation of the Centre.
Outdoor Building Services plant	<ul style="list-style-type: none"> The total L_{WA10} noise emission from all outdoor plant not to exceed that outlined in Section 4.1 above, without additional treatment. Units to be fitted with night-mode operation producing a minimum of 5 dB noise control. Night-mode to be used prior to 7am. A full review is to be conducted of plant noise after final selections and locations have been finalised

² The treatments outlined in this report are the minimum requirements for noise control. Increased thicknesses, heights, strengthened elements, or alternative treatments, may be required for other non-acoustic reasons including wind loading, weather proofing, buildability, structural stability, safety, or fire-rating

- Carpark
- All new grilles or storm water grates in the carpark are to be installed so as to be tight fitting. Where there is a potential for vehicles to drive over such grates/covers, noise from loose fitting grates is to be avoided. Where there is the potential for such noise source, hard rubber or other durable materials are to be used for cushioning such grates/covers
 - Parents and guardians should be informed of the importance of noise minimisation when entering the site, dropping off or picking up children

- Outdoor Play equipment
- Outdoor climbing frames to be positioned away from the northern end of the play area

Appendix B: Determination of Assigned Level

The Environmental Protection (Noise) Regulations 1997 (EPR) provide limits for acceptable noise from operations generating excessive noise. The Regulations specify the maximum permissible noise levels (termed assigned levels) at noise sensitive premises, caused by surrounding noises, during various times of the day. Time of day affects the assigned levels for noise-sensitive premises, as follows –

- Lowest levels at night (10 pm to 7 am any day, or to 9 am Sundays and Public Holidays);
- Higher levels during the evenings (7 pm to 10 pm) and on Sundays and Public Holidays (9 am to 10 pm); and
- Highest levels during the day (7 am to 7 pm Monday to Saturday).

The baseline assigned levels from the Regulations are shown below in Table 6.

Table 6 – Baseline Assigned Levels

Receiving Premises	Time of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise Sensitive Premises - Highly Sensitive	0700 to 1900 hours Monday to Saturday	45+IF	55+IF	65+IF
	0900 to 1900 hours Sunday and public holidays	40+IF	50+IF	65+IF
	1900 to 2200 hours all days	40+IF	50+IF	55+IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35+IF	45+IF	55+IF
Noise Sensitive Premises - any area other than highly sensitive area	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial	All hours	65	80	90

The Assigned Levels above are then increased using an Influencing Factor (IF) as defined in the Regulations. The Influencing Factor is greater than zero where there are significant areas of land uses, within 100 m and 450 m radii of the receptor, including:

- industrial land use zonings;
- commercial zonings; and
- the presence of roads carrying significant traffic.

The Influencing Factor IF has been calculated for the applicable noise sensitive receptors in the current study. The percentage of industrial and commercial land within the prescribed circles centred on the noise sensitive premises, and the presence of roads with more than 6000 vehicles per day have been assessed for the properties.

Example Influencing Factor calculations are shown below. These factors are based on the land zonings established for the surrounding areas, and have been added to the baseline Assigned Levels to produce the final Assigned Levels in Section 3.2 above

Property = #94 Callison.

Type of Land	450m Radius	100m radius	Total	
Industrial Land	0.0%	0.0%	0.00	dB
Commercial Land	0.2%	5.0%	0.26	dB
Transport Factor			4	dB
TOTAL Influencing Factor			4	dB

Appendix C: Site Layout & treatments

