APPENDIX 6

ACOUSTIC ASSESSMENT

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Environmental Noise Assessment - Childcare Centre

Lot 73-75 (#2-6) Manus Place, Parkwood

Reference: 24069084-01

Prepared for:
Mike Cornerstone Property Pty Ltd

Reference: 24069084-01

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EXECUTIVE SUMMARY

Lloyd George Acoustics was engaged by Mike Cornerstone Property Pty Ltd to undertake a noise assessment for a proposed childcare centre (CCC) to be located at Lot 73-75 (#2-6) Manus Place, Parkwood. This report considered noise emissions from the proposed childcare centre to surrounding properties by way of noise modelling of child play, mechanical plant and car door closings.

The predicted noise from all children playing outside and car door closings is compliant provided the fences shown within the assessment are constructed. Mechanical plant noise was also calculated to be compliant, however once the plant has been designed and selected, this should be further reviewed to ensure compliance prior to Building Permit.

1. INTRODUCTION

Lloyd George Acoustics was engaged by Mike Cornerstone Property Pty Ltd to undertake an environmental noise assessment for a proposed childcare centre (CCC) to be located at Lot 73-75 (#2-6) Manus Place, Parkwood (refer *Figure* 1-1) with the site plan shown in *Figure 1-2* and full Development Application (DA) plans provided in *Appendix A*. The purpose of this report is to consider noise emissions from the proposed childcare centre to surrounding properties.

Figure 1-1: Subject Site Location (Source: DPLH PlanWA)

The proposed childcare centre will be open Monday to Friday, 6.30am to 6.30pm and consist of the following:

- Six internal teaching spaces located on the upper level, capable of accommodating up to 111 children, grouped as follows:
  - Activity 1: 16 places for children aged 0-2 years;
  - Activity 2: 15 places for children aged 2-3 years;
  - Activity 3: 20 places for children aged 2-3 years;
  - Activity 4, 5 & 6: 20 places for children aged 3-4+ years.
- Outdoor play areas on the upper level (not used prior to 7.00am);
- Amenities and associated mechanical plant such as:
  - Kitchen exhaust fan assumed to be located on roof above;
  - Various exhaust fans (toilets, laundry, nappy room) assumed to be located on the roof above;
  - Air-conditioning (AC) plant, assumed to located on the ground in the designated mechanical yard as shown on the DA Plans;
- Car parking on the ground floor of the lot.

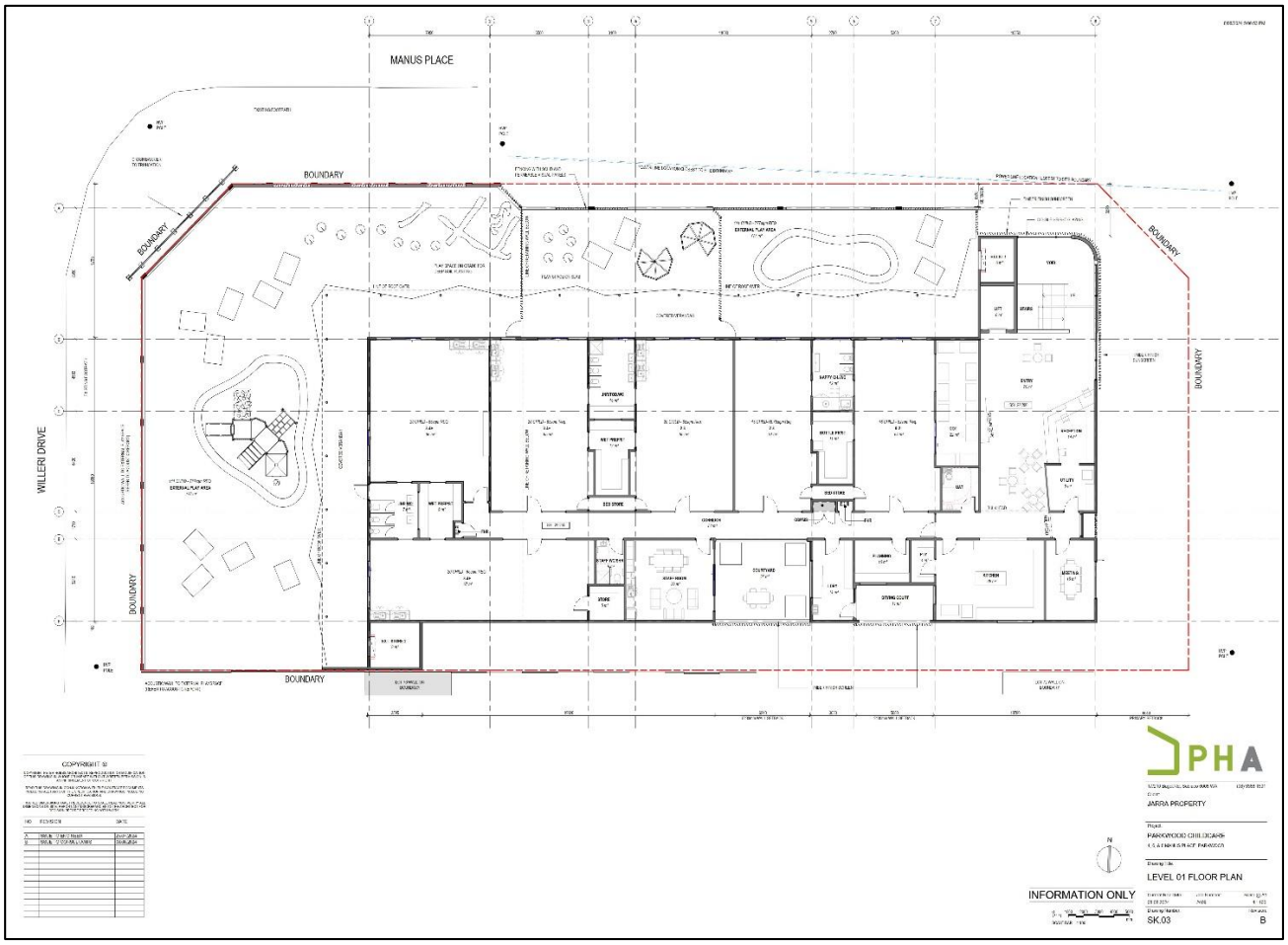

Figure 1-2: Proposed Upper Floor Plan

With regard to noise emissions, consideration is given to noise from child play, mechanical services and closing car doors at neighbouring properties, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

Appendix C contains a description of some of the terminology used throughout this report.

2. CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

2.1. Regulations 7, 8 & 9

This group of regulations defines the prescribed standard for noise emissions applicable to child play, mechanical services and car door closing as follows:

*"**7. Prescribed standard for noise emissions***

(1) Noise emitted from any premises or public place when received at other premises –

(a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) must be free of –

(i) tonality; and

(ii) impulsiveness; and

(iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix C*). Under regulation 9(3), *"Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -*

(a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] … are made to the noise emission as measured at the point of reception."

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music*			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2 Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

The influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as 6 dB, as determined in *Appendix B*. *Table 2-3* shows the assigned levels including the influencing factor and transport factor at the receiving locations.

Table 2-3 Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
+6 dB IF Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	51	61	71
	0900 to 1900 hours Sunday and public holidays (Sunday)	46	56	71
	1900 to 2200 hours all days (Evening)	46	56	61
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	41	51	61

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The assigned levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as "*a period of time of not less than 15 minutes, and not exceeding 4 hours*, *determined by* an *inspector* or *authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission"*. An inspector or authorised person is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

2.2. Regulation 3

*"**3. Regulations do not apply to certain noise emissions***

(1) Nothing in these regulations applies to the following noise emissions –

(a) Noise emissions from the propulsion and braking systems of motor vehicles operating on a road;"

The childcare centre car park is considered a road and therefore vehicle noise (propulsion and braking) is not assessed. Noise from vehicle car doors however are assessed, since these are not part of the propulsion or braking system.

2.3. Regulation 14A

"14A. Waste Collection and Other Works

(2) Regulation 7 does not apply to noise emitted in the course of carrying out class 1 works if –

(a) The works are carried out in the quietest reasonable and practicable manner; and

(b) The equipment used to carry out the works is the quietest reasonably available;

class 1 works means specified works carried out between -

(a) 0700 hours and 1900 hours on any day that is not a Sunday or a public holiday; or

(b) 0900 hours and 1900 hours on a Sunday or public holiday.

specified works means -

(a) The collection of waste; or

(b) The cleaning of a road or the drains for a road; or

(c) The cleaning of public places, including footpaths, cycle paths, car parks and beaches;"

In the case where specified works are to be carried out outside of class 1, a noise management plan is to be prepared and approved by the CEO.

3. METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the ISO 9613 algorithms (ISO 17534-3 improved method) selected, as they include the influence of wind and are considered appropriate given the relatively short source to receiver distances. Input data required in the model are listed below and discussed in *Section 3.1* to *Section 3.5*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm)	Night (7.00pm to 7.00am)
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5	Up to 5
Wind Direction*	All	All

* The modelling package allows for all wind directions to be modelled simultaneously.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights and combined with the site plan.

Surrounding existing buildings were also incorporated in the noise model, as these can provide noise shielding as well as reflection paths. Single storey buildings are modelled with a height of 3.5-metres and any double storey buildings identified assumed to be 7.0-metres in height with receivers 1.4-metres above floor level.

3.3. Fencing

The fencing surrounding the child play area is incorporated in the noise model as per *Figure 3-1*. Fencing on the south side is noted as being 2.1-metres high with a minimum surface mass of 8kg/m^2, which includes such material as double skinned *Colorbond*. Fencing on the north side is noted as being 1.8-metres high with a minimum surface mass of 4kg/m^2, which includes such material as single skinned *Colorbond*. For areas where visual permeability is required, sound-rated plexiglass can be used.

Fencing has also been included within the model on the south side ground floor level of the childcare centre at 1.8-metres high.

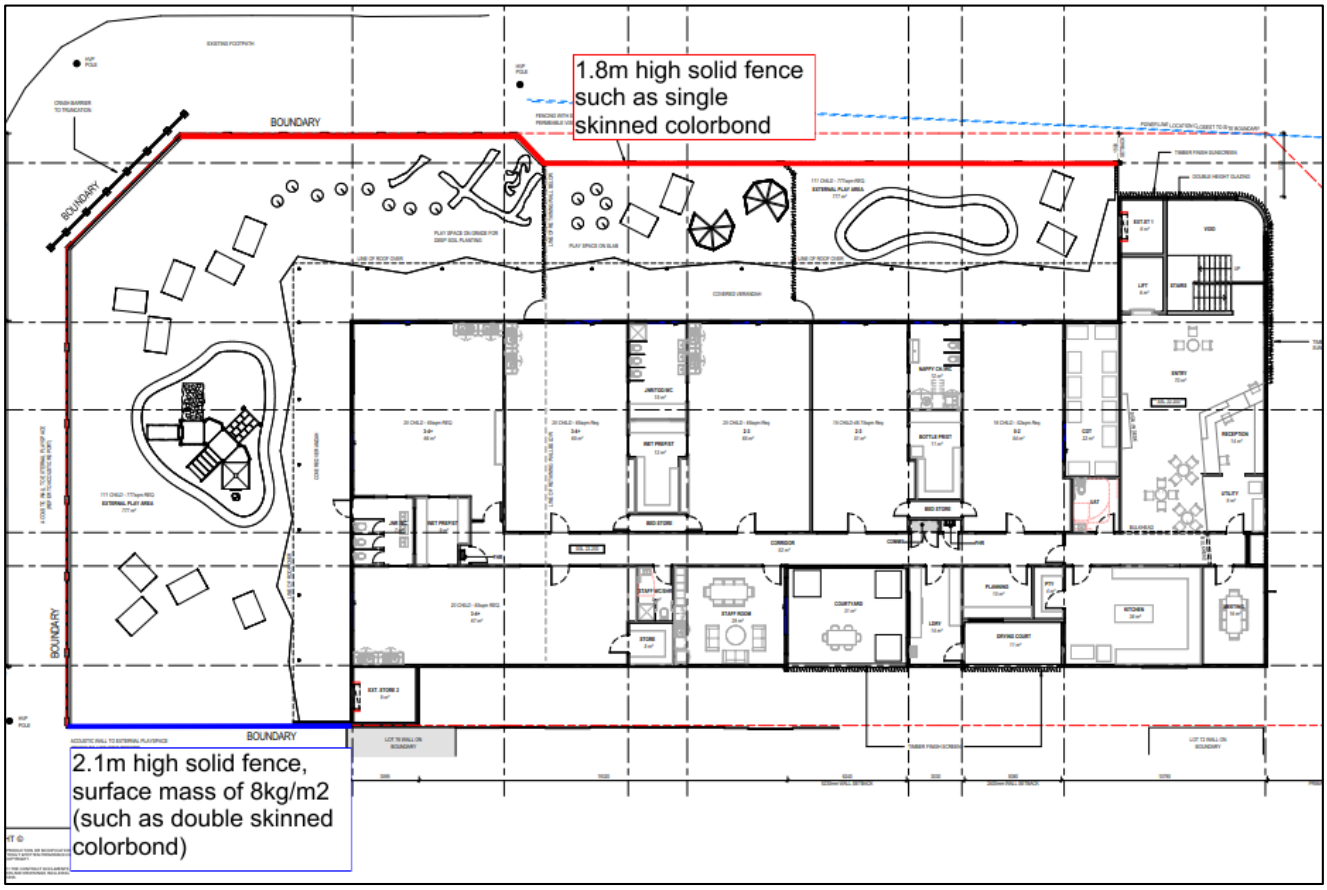

Figure 3-1: Overview of Upper Floor Fencing

Figure 3-2 shows a 2D overview of the noise model with the location of all relevant receivers identified. Pink dots represent point sources in the noise model (car doors, mechanical plant) with the pink polygon representing child play.

Figure 3-2: Overview of Noise Model

3.4. Ground Absorption

The ground absorption has been assumed to be 0.1 (10%) for the roads, 0.5 (50%) outside of the roads and 1.0 (100%) for the play areas, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.5. Source Sound Levels

The source sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2: Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Babies Play Aged 0-2 Years (10 kids), L_{10}	54	60	66	72	74	71	67	64	**78**
Toddler Play Aged 2-3 Years (10 kids), L_{10}	61	67	73	79	81	78	74	70	**85**
Kindy Play Aged 3+ Years (10 kids), L_{10}	64	70	75	81	83	80	76	72	**87**
AC Plant, double fan unit (each), L_{10}	72	74	68	69	63	61	53	47	**70**
General Exhaust Fans (each), L_{10}	60	65	62	63	60	61	56	53	**67**
Kitchen Exhaust Fan, L_{10}	50	64	61	70	69	66	62	50	**73**
Closing Car Door (each), L_{max}	71	74	77	81	80	78	72	61	**84**

The following is noted in relation to *Table 3-2*:

- Child play source levels are based on *Guideline for Childcare Centre Acoustic Assessments Version 3.0* produced by the Association of Australasian Acoustical Consultants (AAAC) published September 2020. Where the number of children for individual play areas is specified in the plans, these have been adjusted from the reference source levels using appropriate acoustical calculations. Outdoor child play was modelled as area sources at 1.0-metre above ground level. The sound power levels used in the model were scaled as follows:
  - Outdoor Play Area 1:
    - 16 children aged 0-2 years = 80 dB(A);
    - 15 children aged 2-3 years = 86 dB(A).
  - Outdoor Play Area 2:
    - 20 children aged 2-3 years = 88 dB(A);
    - 20 children aged 3+ years = 90 dB(A).
  - Outdoor Play Area 3:
    - 40 children aged 3+ years = 93 dB(A).
- Based on the AAAC Guideline 3.0, source sound power levels for AC condensing units were assumed. Medium sized (double fan) outdoor units were deemed appropriate with two (2) modelled as point sources in the ground floor mechanical yard.
- Other mechanical plant includes four (4) exhaust fans (toilets and laundry) and one kitchen exhaust fan. All were modelled as point sources approximately 0.5 metres above roof level and above the area serviced.
- Car doors closing were modelled as a point source 1.0-metre above ground level. Since noise from a car door closing is a short term event, only the L_{Amax} level is applicable.

4. RESULTS AND ASSESSMENT

4.1. Outdoor Child Play Noise

The childcare development will host up to 111 children. It is noted play time is generally staggered and therefore not all children would be playing outside at once for extended periods of time. However, noise levels were conservatively predicted for all children playing simultaneously, as a worst-case scenario with the results provided and assessed in *Table 4-1*. The critical assigned level is during the day, as whilst the childcare centre will open at 6.30am, child play will not commence until after 7.00am. Noise from child play is not considered to contain annoying characteristics within the definition of the Regulations and therefore no adjustments are made to the predicted noise levels. A noise contour plot is also provided in *Figure 4-1* showing noise levels at ground floor.

Table 4-1: Child Play Noise Predicted Levels and Assessment, dB L_{A10}

Receiver	Babies (0-2 yo)	Toddler (2-3 yo)	Kindy (3+ yo)	Total	Assigned Level	Assessment
1 Manus Pl	31	41	47	**48**	**51**	*Complies*
3 Manus Pl	33	41	46	**47**	**51**	*Complies*
5 Dalby Ct	28	38	47	**47**	**51**	*Complies*
5 Manus Pl	33	40	43	**45**	**51**	*Complies*
10 Noonan Ct	18	34	50	**50**	**51**	*Complies*
31 Ropele Dr	33	39	41	**43**	**51**	*Complies*
33 Ropele Dr	19	24	27	**29**	**51**	*Complies*
35 Ropele Dr	17	24	28	**29**	**51**	*Complies*
48 Ropele Dr*	16	23	30	**31**	**51**	*Complies*
72 Willeri Dr*	17	27	51	**51**	**51**	*Complies*

*The highest noise level from predictions at multiple receivers were used in the assessment

Based on a conservative scenario of all 111 children playing outside simultaneously, the assessment demonstrates compliance is achieved during the day.

Figure 4-1 Child Play Noise Contour Plot (1.4m AGL), dB L_{A10}

Predicted Noise level

= 46
= 51
= 56
= 61
= 66

Legend

Receiver
Outdoor Childplay
Fence

N

Scale 1:700

0 4 8 16 24 m

Project No: 24069084
Consultant: MN
Date: 26/08/2024
Algorithm: ISO 9613
SoundPLAN Version: 9.0

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4.2. Mechanical Plant Noise

Mechanical plant noise consists of the outdoor AC condensing units and exhaust fans. Predicted and assessed noise levels are provided in *Table 4-2*. The critical assigned level is during the night, as the plant may operate prior to 7.00am. An adjustment of + 5 dB is included for tonality, since this may be present for such noise sources. A noise contour plot is also provided in *Figure 4-2* showing noise levels at ground floor.

Table 4-2: Mechanical Plant Noise Predicted Levels and Assessment, dB L_{A10}

Receiver	AC	Exhaust Fans	Total	Total Adjusted	Assigned Level	Assessment
1 Manus Pl	21	18	23	26	**41**	*Complies*
3 Manus Pl	18	19	22	25	**41**	*Complies*
5 Dalby Ct	5	19	19	24	**41**	*Complies*
5 Manus Pl	16	19	21	25	**41**	*Complies*
10 Noonan Ct	19	26	27	31	**41**	*Complies*
31 Ropele Dr	17	23	24	29	**41**	*Complies*
33 Ropele Dr	31	27	33	37	**41**	*Complies*
35 Ropele Dr	33	29	35	39	**41**	*Complies*
48 Ropele Dr*	35	34	37	41	**41**	*Complies*
72 Willeri Dr*	31	36	37	41	**41**	*Complies*

*The highest noise level from predictions at multiple receivers were used in the assessment

The calculations show compliance at all receiver locations. The assessment is based on assumptions in relation to the number, location, size and type of mechanical plant. Therefore, once the mechanical plant has been designed and selected, noise is to be reviewed by a suitably qualified acoustical consultant.

Figure 4-2 Mechanical Plant Noise Contour Plot (1.4m AGL), dB L_{A10}

Predicted Noise level

	= 36
	= 41
	= 46
	= 51
	= 56

Legend

- Receiver
- Mech Source
- Fence

N

Scale 1:700

0 4 8 16 24 m

Project No: 24069084
Consultant: MN
Date: 26/08/2024
Algorithm: ISO 9613
SoundPLAN Version: 9.0

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4.3. Car Door Closing Noise

Predicted and assessed noise levels for car doors closing are provided in *Table 4-3* being the maximum noise level from the worst-case car bay for each receiver. The critical assigned level is during the night, as car door closings will occur prior to 7.00am. An adjustment of + 10 dB is included for impulsiveness, since this may be present for such noise sources. A noise contour plot is also provided in *Table 4-3* showing noise levels at ground floor.

Table 4-3: Car Door Closing Noise Predicted Levels and Assessment, dB L_{Amax}

Receiver	Car Door	Total Adjusted	Assigned Level	Assessment
1 Manus Pl	48	58	**61**	*Complies*
3 Manus Pl	48	58	**61**	*Complies*
5 Dalby Ct	19	29	**61**	*Complies*
5 Manus Pl	47	57	**61**	*Complies*
10 Noonan Ct	27	37	**61**	*Complies*
31 Ropele Dr	44	54	**61**	*Complies*
33 Ropele Dr	47	57	**61**	*Complies*
35 Ropele Dr	47	57	**61**	*Complies*
48 Ropele Dr*	48	58	**61**	*Complies*
72 Willeri Dr*	47	57	**61**	*Complies*

*The highest noise level from predictions at multiple receivers were used in the assessment

Noise from car doors is predicted to comply at all nearest receivers during the critical night period.

4.4. Indoor Child Play

An assessment of noise levels from indoor child play was carried out and the resulting noise levels at all locations were predicted to be well below that of outdoor child play considered in *Section 4.1*. This assessment was carried out based on the following considerations:

- Internal noise levels within activity rooms would not exceed those from outdoor play for each age group, regardless of windows being open or closed; and
- Any music played within the internal activity areas would be 'light' music with no significant bass content and played at a relatively low level.

Figure 4-3 Car Door Noise Contour Plot (1.4m AGL), dB L_{Amax}

Predicted Noise level

	= 51
	= 56
	= 61
	= 66
	= 71

Legend

- Receiver
- Car Source
- Fence

N

Scale 1:700

0 4 8 16 24 m

Project No: 24069084
Consultant: MN
Date: 26/08/2024
Algorithm: ISO 9613
SoundPLAN Version: 9.0

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5. RECOMMENDATIONS

5.1. Child Play

The predicted noise from all children playing outside is compliant provided the fences shown in *Figure 3-1* are constructed. Fencing on the south side is noted as being 2.1-metres high with a minimum surface mass of 8kg/m^2, which includes such material as double skinned *Colorbond*. Fencing on the north side is noted as being 1.8-metres high with a minimum surface mass of 4kg/m^2, which includes such material as single skinned *Colorbond*. For areas where visual permeability is required, sound-rated plexiglass can be used.

Whilst not necessarily required for compliance, to further minimise noise impacts as part of best practice, the following are provided:

- The behaviour and 'style of play' of children should be monitored to prevent particularly loud activity e.g. loud banging/crashing of objects, 'group' shouts/yelling;
- Favour soft finishes in the outdoor play area to minimise impact noise (e.g. soft grass, sand pit(s), rubber mats) over timber or plastic;
- Favour soft balls and rubber wheeled toys;
- Crying children should be taken inside to be comforted;
- Child play to be staggered;
- No amplified music to be played outside;
- Any music played within the internal activity areas to be 'light' music with no significant bass content and played at a relatively low level;
- Car park drainage grates or similar to be plastic or metal with rubber gasket and secured to avoid excess banging.

5.2. Mechanical Plant

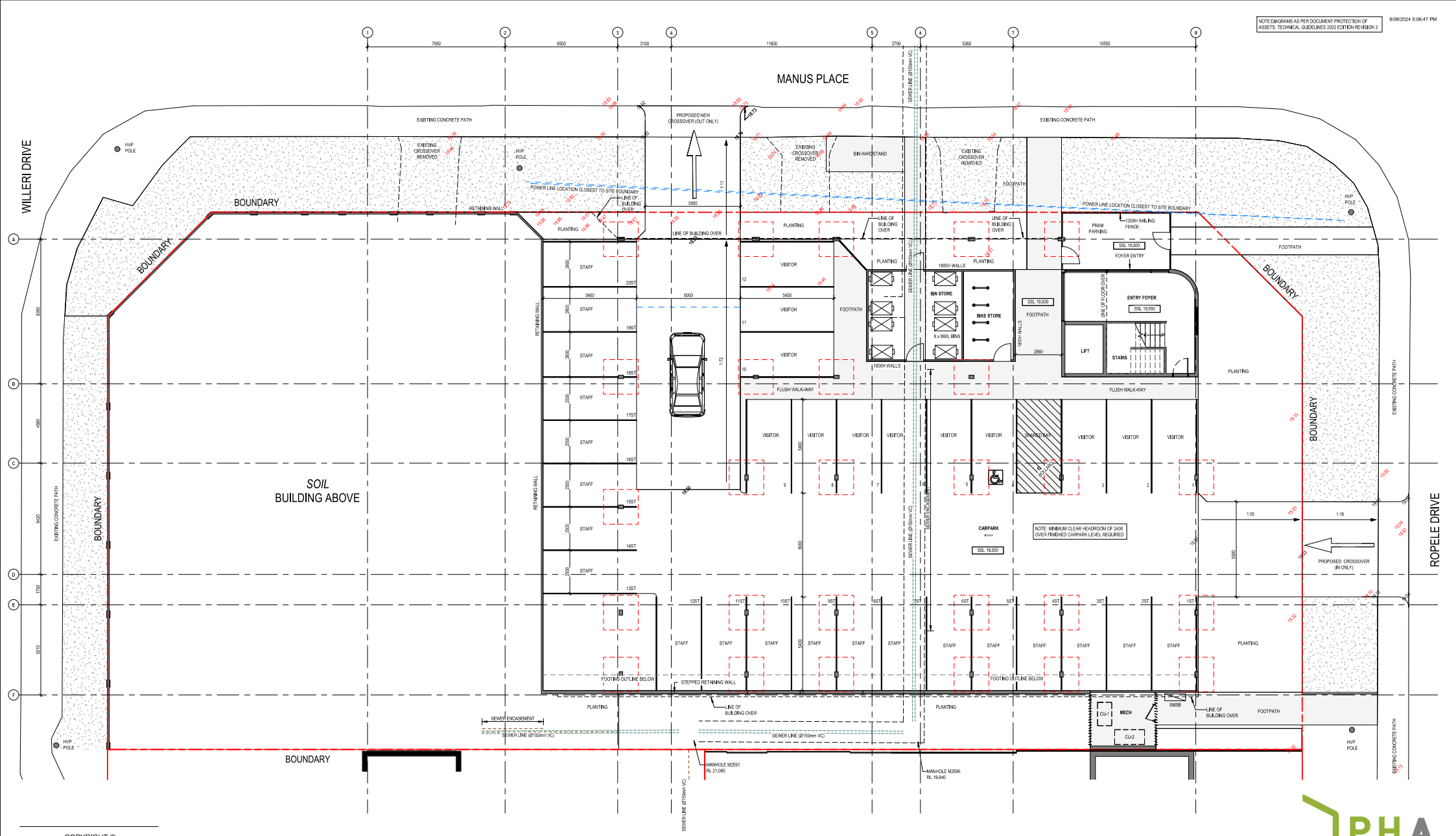
For mechanical plant, the following are recommended:

- Once the mechanical plant has been designed and selected, the noise levels shall be reviewed prior to Building Permit;
- All exhaust fans shall be located inside the ceiling void and shall be axial fan type, allowing the incorporation of an attenuator if required;
- All fans shall be variable speed drive so that maximum speed is only occurring when necessary with demand;
- Air-conditioning shall have a ‘night’ / ‘quiet’ mode option, in case required for prior to 7.00am operation, subject to final detailed analysis;
- All plant shall be selected taking into consideration noise levels. That is, when comparing manufacturers of equivalent equipment, select the quieter model;
- All plant is to be appropriately vibration isolated to 95% isolation efficiency.

5.3. Car Doors

The predicted noise from car door closings is shown to be compliant within the assessment.

Appendix A – Development Plans



NOTE: DIAGRAMS AS PER DOCUMENT PROTECTION OF ASSETS: TECHNICAL GUIDELINES 2022 EDITION REVISION 3

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NOTE:
CARPARK LAYOUT
TO BE CONFIRMED

INFORMATION ONLY

SCALE BAR - 1:100

NO	REVISION	DATE
A	FOR INFORMATION TO WATER CORP.	24.04.2024
B	ISSUE TO ENGINEER	23.07.2024
C	ISSUE TO ENGINEER	25.07.2024
D	ISSUE TO CONSULTANTS	08.08.2024

PHA

17/210 Bagot Rd, Subiaco 6008 WA (08) 9388 1591

Client:
JARRA PROPERTY

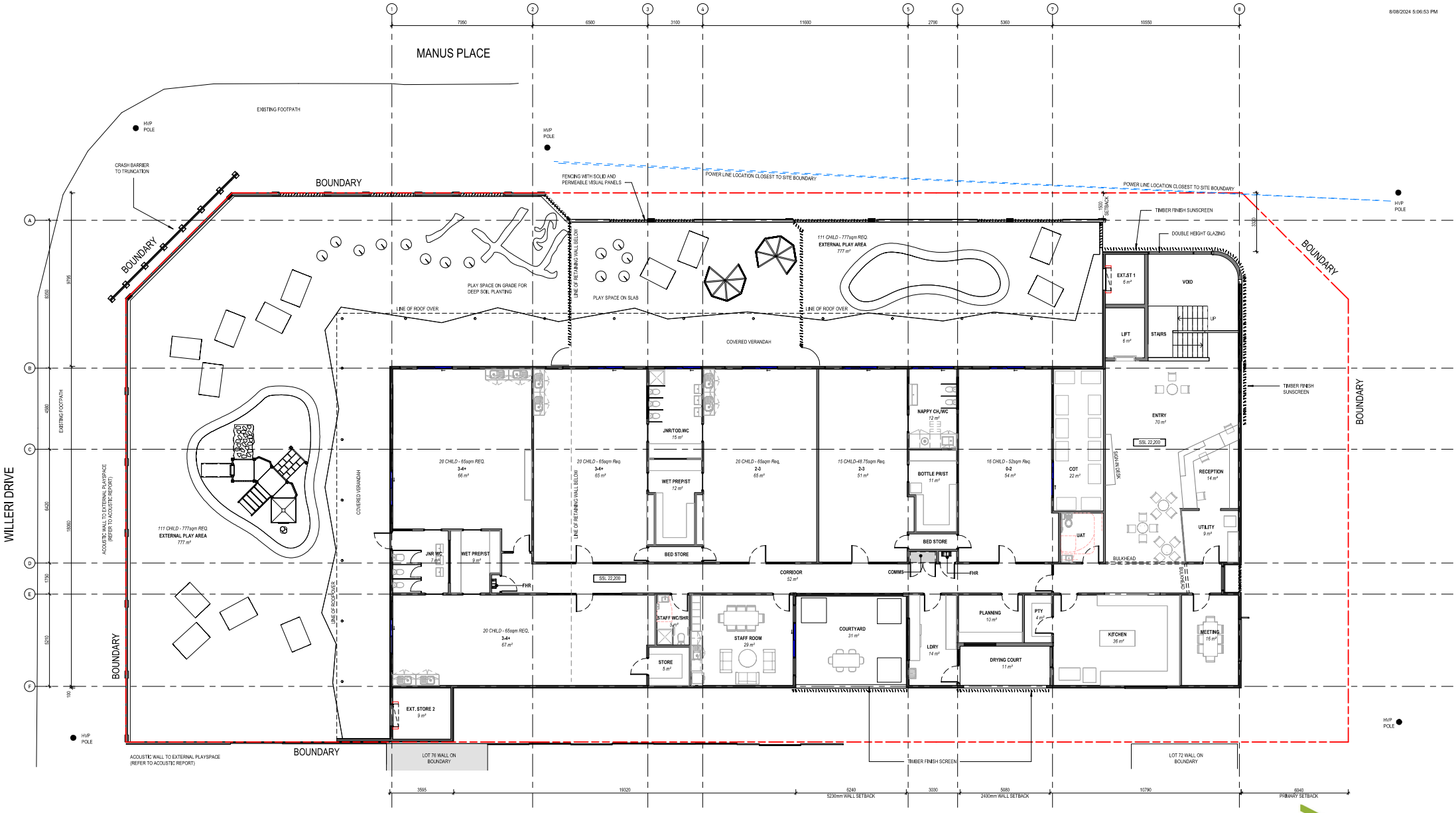
Project:
PARKWOOD CHILDCARE
4, 6, & 8 MANUS PLACE, PARKWOOD

Drawing Title:
CARPARK PLAN

Current Rev Date:	Job Number:	Scale @ A1
08.08.2024	2409	1 : 100

Drawing Number: SK.01

Revision: D



NO	REVISION	DATE
A	ISSUE TO ENGINEER	25.07.2024
B	ISSUE TO CONSULTANTS	08.08.2024

PHA

17/210 Bagot Rd, Subiaco 6008 WA (08) 9388 1591

Client:
JARRA PROPERTY

Project:
PARKWOOD CHILDCARE
4, 6, & 8 MANUS PLACE, PARKWOOD

Drawing Title:
LEVEL 01 FLOOR PLAN

INFORMATION ONLY

SCALE BAR - 1:100

Current Rev Date:	Job Number:	Scale @ A1
08.08.2024	2409	1 : 100
Drawing Number:		Revision:
SK.03		B

Appendix B – Influencing Factor Calculation

The assigned levels combine a baseline assigned level with an influencing factor, with the latter increasing the assigned level on the basis of the existence of significant roads and commercial or industrial zoned land within an inner circle (100 metre radius) and an outer circle (450 metre radius) of the noise sensitive premises. The calculation for the influencing factor is:

$$= \frac{1}{10}(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}) + \frac{1}{20}(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450})$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Transport Factor (maximum of 6 dB)

= 2 for each secondary road (6,000 to 15,000 vpd) within 100m

= 2 for a major road (>15,000 vpd) within 450m

= 6 for a major road within 100m

The nearest surrounding noise sensitive receivers are identified as follows:

- 1 Manus Pl
- 3 Manus Pl
- 5 Dalby Ct
- 5 Manus Pl
- 10 Noonan Ct
- 31 Ropele Dr
- 33 Ropele Dr
- 35 Ropele Dr
- 48 Ropele Dr
- 72 Willeri Dr

Table B-1 shows the percentage of industrial and commercial land within the inner (100 metre radius) and outer (450 metre radius) circles of the noise sensitive premises.

Table B-1: Percentage of Land Types within 100m and 450m Radii

Receiver	Land Type	Within 100m	Within 450m
Surrounding Noise Sensitive Receivers	Type A - Industrial and Utility	0	0
	Type B – Commercial	7	~0

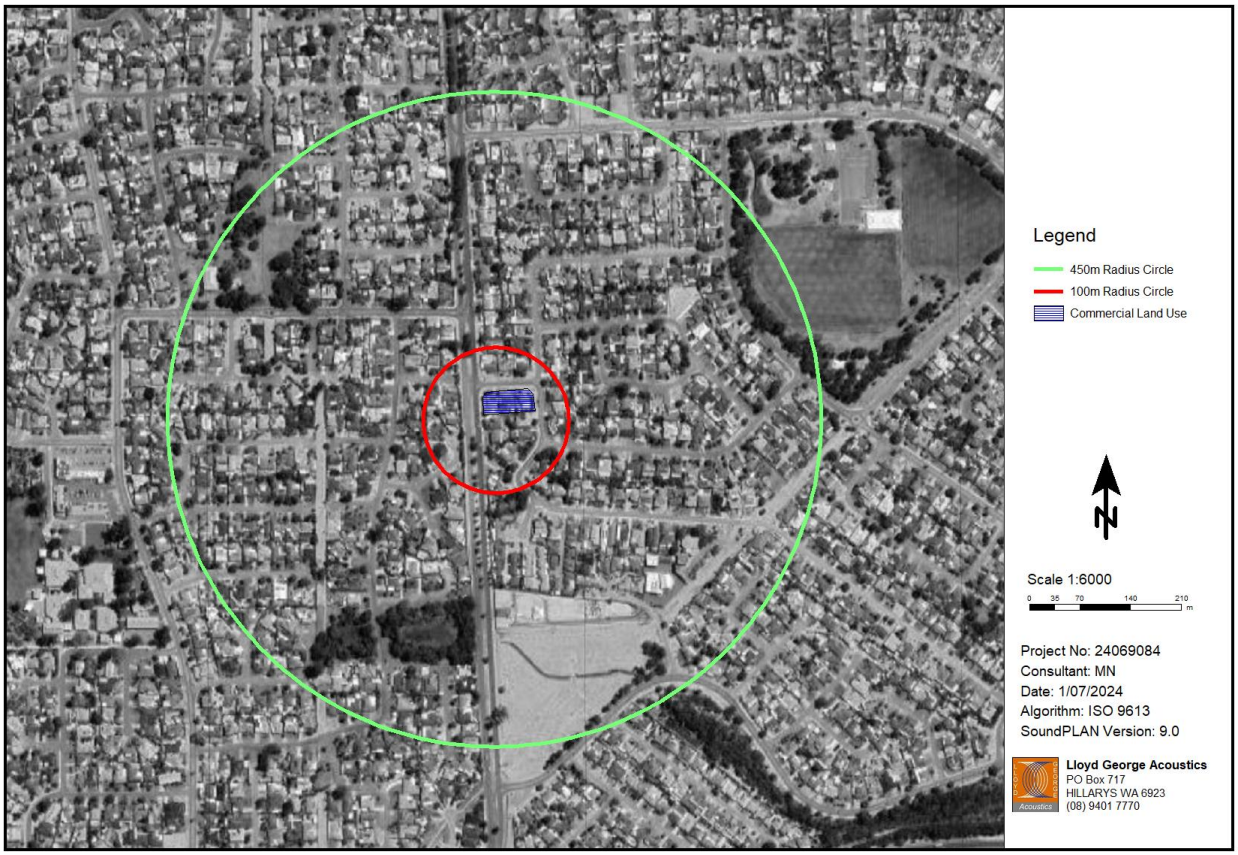


Figure B-1: Land Types within 100m and 450m Radii

From the Main Roads WA Traffic Map (refer *Figure B-2*), *Table B-2* shows the relevant roads and their traffic counts within the inner (100 metre radius) and outer (450 metre radius) circles.

Table B-2: Relevant Roads within 100m and 450m Radii

Receiver	Within 100m		Within 450m
	Major Road (+ 6 dB)	Secondary Road (+ 2 dB)	Major Road Not Within 100m (+ 2 dB)
Surrounding Noise Sensitive Receivers	Willeri Drive (15,924 2023/24 #7746)	-	-

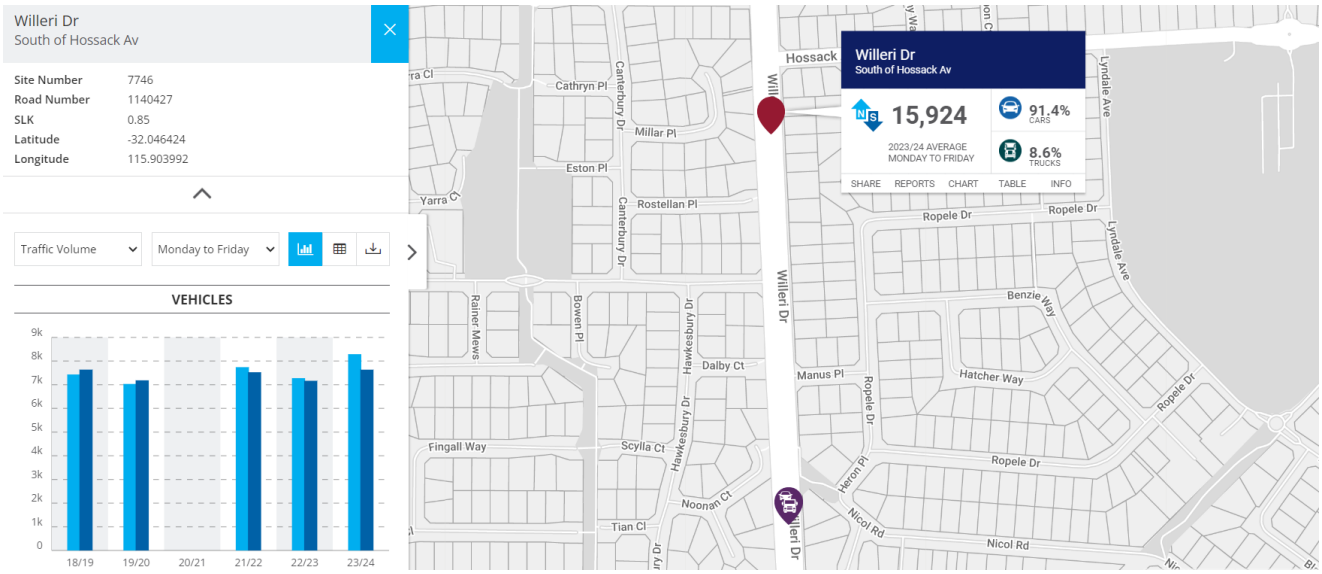


Figure B-2: MRWA Published Traffic Data

Table B-3 combines the percentage land types and Transport Factor to calculate the influencing factor.

Table B-3: Influencing Factor Calculation, dB

Receiver	Industrial Land	Commercial Land	Transport Factor	Total
Surrounding Noise Sensitive Receivers	0	0.4	6.0	**6**

The influencing factor calculated in *Table B-3* is combined with those baseline assigned levels of *Table 2-2*, resulting in the project assigned levels provided in *Table 2-3*.

Appendix C – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- **L_{ASlow}**

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- **L_{AFast}**

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{A90}**

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **L_{Aeq}**

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

- **Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

– the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

- **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

– a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band; and

(b) is present for at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible.

- **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

– a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

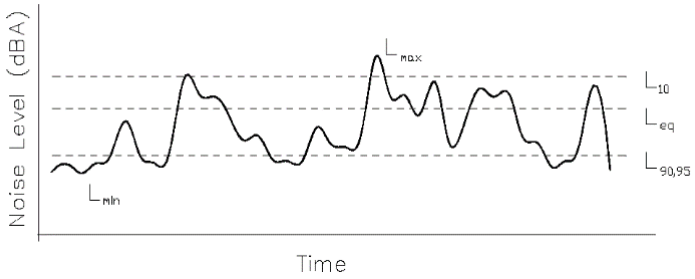
- **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

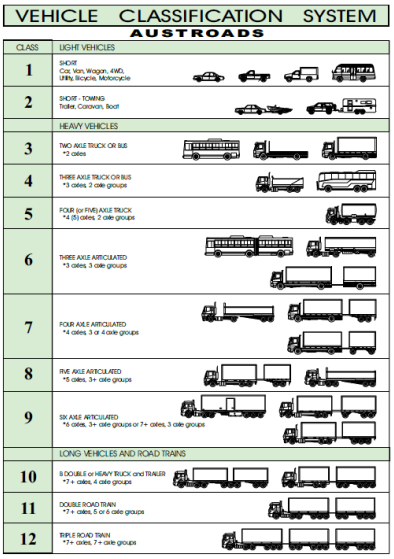
- **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**