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Environmental & Transportation Noise Assessment

Proposed Child Care Centre
2 Walters Road, Byford

Reference: 19085134-01A.docx

Prepared for:
IQ Construction

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Table of Contents

List of Tables

List of Figures

Appendices

1 INTRODUCTION

Lloyd George Acoustics have been commissioned by IQ Construction to undertake an acoustic assessment at Lot 13 (No.2) Walters Road which has been proposed to be redeveloped as a child care centre.

The redevelopment is understood to include the following aspects:

- Lot will be cleared and incorporate a new childcare building,
- One main outdoor play area to the north, and
- A 15-bay car park on the eastern side, with entry from Walters Road.

The proposed redevelopment is bound by residential premises to the north and east and by Walters Road to the south. Directly to the west of Lot 13 is an open public space. On the other side of South Western Highway to the west are a number of commercial buildings. On the other side of Walters Road to the south are residential buildings.

Surrounding residential developments in direct proximity to the proposed development are single storey (except No.22 Walters Road which is double storey).

The proposed childcare centre will accommodate up to 75 children and for the purpose of this assessment, the following age group distribution was assumed:

- Kindy (3 years and over), 75 children overall – in this assessment it was assumed there can be up to 75 children in the outdoor play area during changeover and up to 33 of them at other times.

The proposed hours of operation are 6.30am to 6.30pm Monday to Saturday. As such, it is noted that staff and patrons can arrive before 7.00am.

This report assesses noise emissions from child play, mechanical plant (AC plant and extraction fans) and car doors closing at the proposed site, against the *Environmental Protection (Noise) Regulations 1997*.

The proposed childcare development is located within 63 metres to the edge of South Western Highway – refer *Figure 1.1*. A transportation noise assessment in accordance with State Planning Policy 5.4 (SPP5.4) is required to quantify and control noise ingress into the property.

Figure 1-1 Project Locality (Source: City of Serpentine Jarrahdale)

The development plans are provided in *Appendix A.*

Land zoning around the proposed site is shown in *Appendix B.*

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

2 CRITERIA

2.1 Road Traffic Noise

The criteria relevant to this assessment is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards

Table 2-1 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

For childcare buildings near major roads, "acceptable indoor noise levels" are taken to be 50 dB or less $L_{Aeq(Day)}$ in recreation/foyer/staff areas and 40 dB $L_{Aeq(Day)}$ or less in sleeping rooms/offices.

Table 2-1 Noise Targets for Noise-Sensitive Land-Use

Outdoor Noise Target		Indoor Noise Target	
55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	50 dB $L_{Aeq(Day)}$ (Recreation/foyer/staff Areas)	40 dB $L_{Aeq(Night)}$ (sleeping rooms/ offices)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] façade of the noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonable drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment is undertaken.

In the application of the noise targets, the objective is to achieve:

- indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. play/sleep rooms); and
- a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and childcare centres, the design of outdoor areas should take into consideration the noise target.

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

[1] A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.

2.2 Environmental Noise

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

Regulation 7 defines the prescribed standard for noise emissions as follows:

"7. (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;

ii. impulsiveness; and

iii. modulation,

when assessed under regulation 9"

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…"

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics 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 after the adjustments of *Table 2-2* are made to the noise emission as measured at the point of reception.

Table 2-2 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

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-3*.

Table 2-3 Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1(a)]	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[1(b)]	All hours	60	75	80
Commercial	All hours	60	75	80

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, applicable at the noise sensitive premises has been calculated as 6.6 dB – rounded up to 7 dB, as shown in *Table 2-4* based on surrounding land use (refer *Appendix B*). The transport factor has been calculated as **6 dB**, due to South Western Highway being considered a major road (18,234 vehicles per day – Reference Main Roads WA traffic count 2017 at location 8299) and being within 100 metres of the residences.

Table 2-4 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 %	0 %	0.0 dB
Commercial Land	7.9 %	5.3 %	0.6 dB
Transport Factor			**6.0 dB**
Total			**6.6 dB**

Table 2-5 shows the assigned noise levels including the influencing factor and transport factor at the receiving locations.

Table 2-5 Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1(a)]	0700 to 1900 hours Monday to Saturday (Day)	52	62	72
	0900 to 1900 hours Sunday and public holidays (Sunday)	47	57	72
	1900 to 2200 hours all days (Evening)	47	57	62
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	42	52	62
Noise sensitive premises: any area other than highly sensitive area[1(b)]	All hours	60	75	80
Commercial	All hours	60	75	80

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.

It must be noted the assigned noise levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces. Where this was not possible to be achieved due to the close proximity of existing buildings and/or fences, the noise emissions were assessed at a point within 1 metre from building façades and a -2 dB adjustment was made to the predicted noise levels to account for reflected noise.

It is noted the assigned noise 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*, which is 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 Environment 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.

Under Regulation 3 (1), nothing in the Regulations applies to the following noise emissions –

(a) noise emissions from the propulsion and braking systems of motor vehicles operating on a road.

3 METHODOLOGY

3.1 Attended Site Measurements

Noise monitoring was undertaken on the site using a Rion NA-28 Sound Level Meter (S/N: 1270693), as shown in *Figure 3-1* and *Figure 3-2*. The meter was located near the front of Lot 13. This location has line-of-sight to South Western Highway and at approximately 53 metres to the road's edge and approximately 15 metres from the proposed building's front façade. The location was chosen to enable calibration of the road traffic noise model (noise measurements at close proximity to existing No.2 Walters Road building were unfavourable due to barking dogs which would have undermined the noise measurements).

The measurements occurred on 5 November 2019, between 15.00 and 16.00 hours, coinciding with peak traffic flows for South Western Highway.

The measured value is then used to calibrate the noise model against the hourly traffic volumes obtained from the latest MRWA traffic count. This enables the day and night noise levels to be calculated based on traffic volumes throughout a 24-hour period.

Figure 3-1 Photograph of Sound Level Meter

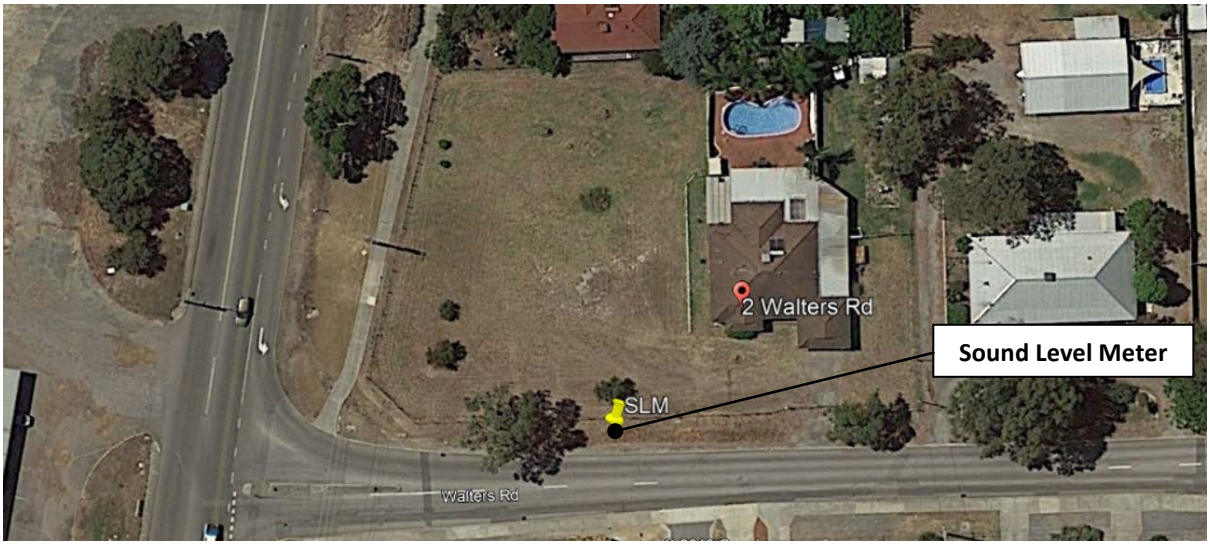

Figure 3-2 Location of Sound Level Meter

All equipment holds current laboratory certificates of calibration that are available upon request. The equipment was also field calibrated before and after and found to be within +/- 0.5 dB.

The microphone was fitted with a standard wind screen.

The microphone was 1.4 metres above ground level and at more than 3.0 metres from reflecting façades (other than the ground plane).

4 NOISE MODELLING

4.1 Road Traffic Noise

The computer programme *SoundPLAN 8.1* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered.
- Note that a -8.0 dB correction is applied to the exhaust and -0.8 dB to the engine (based on Transportation Noise Reference Book, Paul Nelson, 1987), so as to provide consistent results with the CoRTN algorithms for the no barrier scenario;
- Adjustments of -0.8 dB and -1.7 dB have been applied to the predicted levels for the 'free-field' and 'at façade' cases respectively, based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group (March 1983).

Predictions are made at heights of 1.4 m above ground floor level for single storey houses and 4.2 m for double storey houses. The noise is predicted at 1.0 metre from an assumed building façade resulting in a + 2.5 dB correction due to reflected noise.

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc. These model inputs are discussed in the following sections.

4.1.1 Ground Topography

Topographical data was based on that publicly available from *Google Earth*. This was combined with the proposed building plans to create a three dimensional noise model, as shown in *Figure 4-1*.

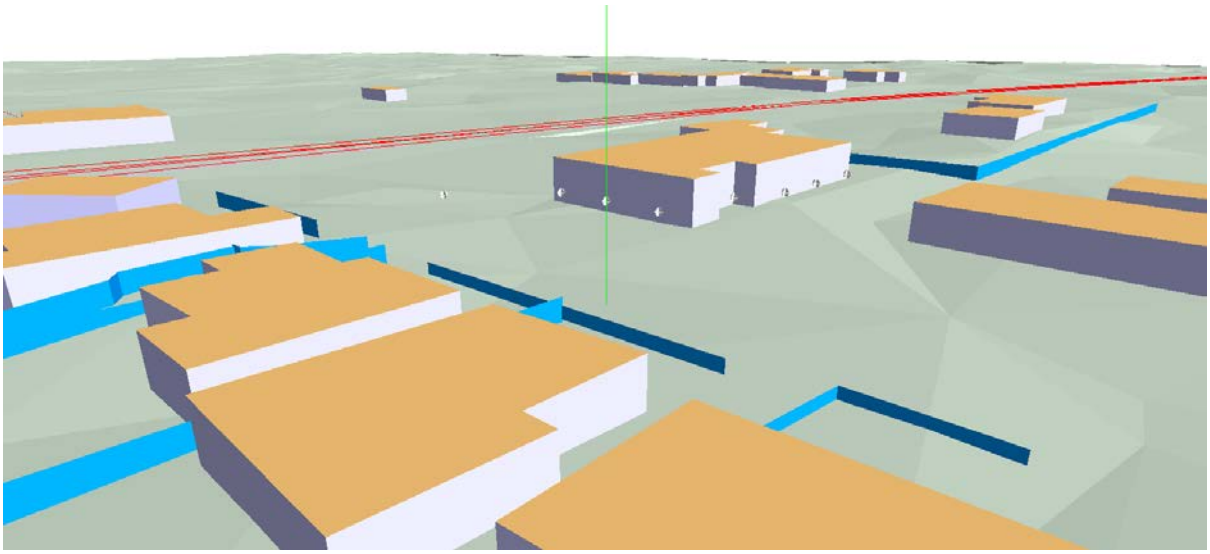

Figure 4-1 Image of Noise Model

4.1.2 Traffic Data

Traffic data includes:

- Road Surface – The noise relationship between different road surface types is shown below in *Table 4-1*.

Table 4-1 Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.5 dB	-2.5 dB

The existing and future road surface was dense graded asphalt and is assumed to remain unchanged.

- Vehicle Speed – The existing and future posted speeds are assumed to be 60 km/hr on South Western Highway.

- Traffic Volumes – Existing (2016) and forecast (2041) traffic volumes were requested from Main Roads WA (Clare Yu, Traffic Modelling Analyst, Reference: #41323). A validation plot was also provided allowing the Main Roads WA traffic volume model to be calibrated against actual counts. *Table 4-2* provides the traffic volume input data in the model.

Table 4-2 Traffic Information Used in the Modelling for South Western Highway

Parameter	Scenario			
	Existing - 2016		Future - 2041	
	Northbound	Southbound	Northbound	Southbound
24 Hour Volume	8,600	8,300	17,000	16,000
% Heavy	10	10	3	3

4.1.3 Ground Attenuation

Due to the semi-rural nature of the location and its surrounds, the ground attenuation has been assumed to be 0.0 (0%) for the road and 0.8 (80%) elsewhere. Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

4.2 Environmental Noise

4.2.1 Meteorological Information

Meteorological information utilised is provided in *Table 4-3* 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 4-3 Modelling Meteorological Conditions (ISO 9613)

Parameter	Night (1900-0700)	Day (0700-1900)
Temperature (^{o}C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5 m/s	Up to 5 m/s
Wind Direction*	All	All

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

4.2.2 Topographical Data

Topographical data was based on that publicly available from *Google Earth* in the form of spot heights. It is noted the topography is relatively flat, with no significant differences in elevations between the proposed site and the surrounding premises.

4.2.3 Buildings and Receivers

Surrounding existing buildings were included in the noise model as these can provide noise shielding as well as reflection paths.

Single storey buildings were modelled as 3.5 metres high, while double storey buildings were modelled as 7 metres high. Receivers were located 1.4 metres above ground level (AGL) and floor level.

Figure 4-2 shows a view of the 3D model based on the information above in relation to topography and building and fences height.

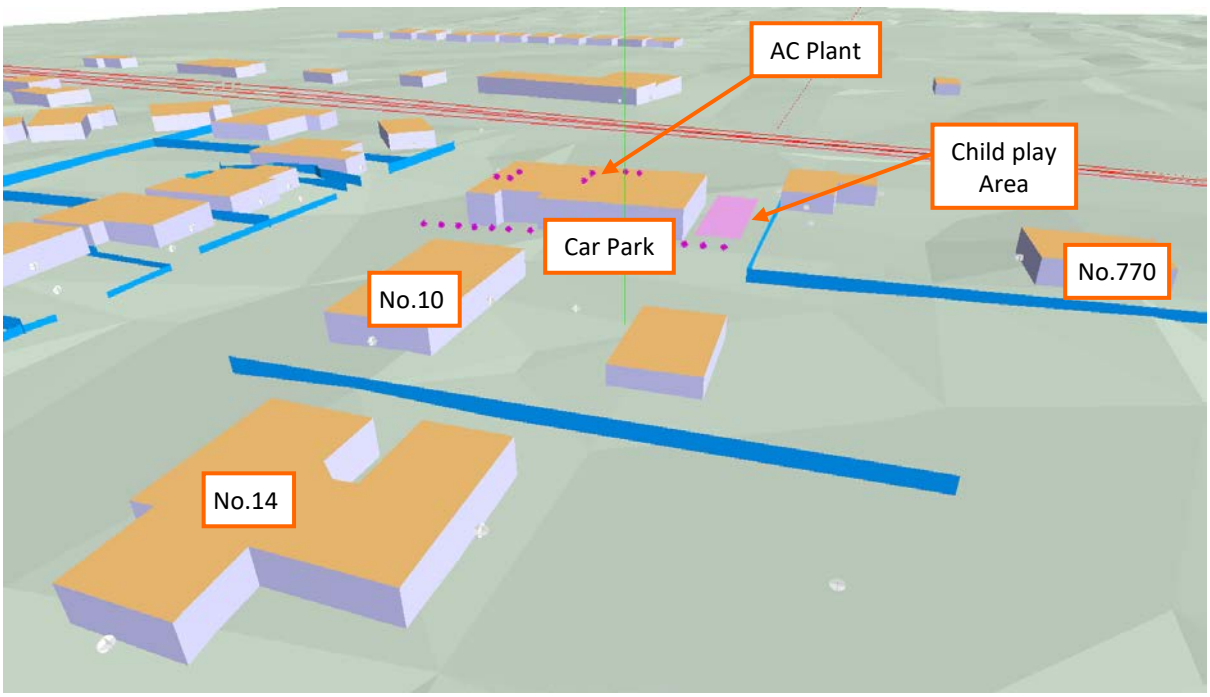

Figure 4-2 South Elevation of 3D Noise Model

4.2.4 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. asphalt, concrete) and 1 for acoustically absorbent ground (e.g. grass/sand). In this instance, a value of 0.8 has been used for built up areas as they include extensive outdoor grassed areas.

4.2.5 Source Sound Levels

The sound power levels used in the modelling are provided in *Table 4-4*.

Table 4-4 Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Child Play Kindy (75 kids), L_1	60	69	79	86	92	91	84	76	**96**
Child Play Kindy (33 kids), L_{10}	56	65	75	82	88	87	80	72	**92**
Outdoor Condensing Unit[1], (18 kW)	77	79	75	73	67	66	58	49	**74**
Toilet exhaust fans[2]	71	64	61	64	62	60	57	51	**67**
Kitchen exhaust fan[3]	70	76	77	69	71	66	64	51	**75**
Closing Car Door, L_{max}	71	74	77	81	80	78	72	61	**84**

Notes:
1. 2x outdoor AC condenser units were modelled in total.
2. 5x toilet exhaust fans were modelled in total
3. 1x kitchen exhaust fan was modelled in total

The following is noted in relation to the source levels above:

- Child Play source levels represent the group of children playing outside at the same time. It is noted that based on observations and measurements, the noise levels tend to increase with the children's age and therefore Kindy children (3 years and above) are considered noisier than Pre-Kindy children (2-3 years). Outdoor child play was modelled as area sources at a specific height to reflect average height relevant to the age group as follows:
  - Kindy - 1.0 metre above ground plane; and
  - Whilst the premises is open prior to 7.00am, it is assumed there would be no outdoor play until after 7.00am.
  - The changeover is assumed to be less than 24 minutes in total and is assessable against the L_{A1} criteria
  - The outdoor play is assumed to feature up to 33 children (outside changeover) and last more than 24 minutes and is therefore assessable against the L_{A10} criteria.
- Based on similar projects, two (2x) outdoor AC units were assumed to be required for the building. Each was modelled as a point source located 1.2 metres above the roof level at a point corresponding to the centre of the central corridor. The AC units are assumed to be operating at night-time (prior to 7.00am); as mechanical noise is continuous in nature and AC/fans can be running hours at times mechanical plant noise is assessable against the L_{A10} criteria
- Other mechanical plant includes five (5x) toilet exhaust fans and one kitchen exhaust fan. All were modelled as point sources approximately 0.5 metre above roof level, and above the area serviced. The kitchen exhaust fan (1x) is assumed to only operate after 7.00am; and
- Car doors closing were modelled as point sources at 1.0 m above ground level. Since noise from a car door closing is a short term event, only the L_{Amax} level is applicable but can occur prior to 7.00am.

5 RESULTS

5.1 Road Traffic Noise

5.1.1 Noise Calculation

As discussed in *Section 3.1*, the results of the hourly noise monitoring were extrapolated to $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ values based on the hourly traffic volume information and noise modelling.

The measured $L_{Aeq,1hour}$ between 15.00 and 16.00 hours at the sound level meter location was measured as 62.1 dB. Taking into account the 15 metres between measurement location and proposed building façade, the freefield $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ values were calculated as 60.4 dB $L_{Aeq(Day)}$ and 51.6 dB $L_{Aeq(Night)}$ at measurement location.

Figure 5-1 demonstrates how the noise levels vary throughout a typical day alongside the hourly traffic volumes.

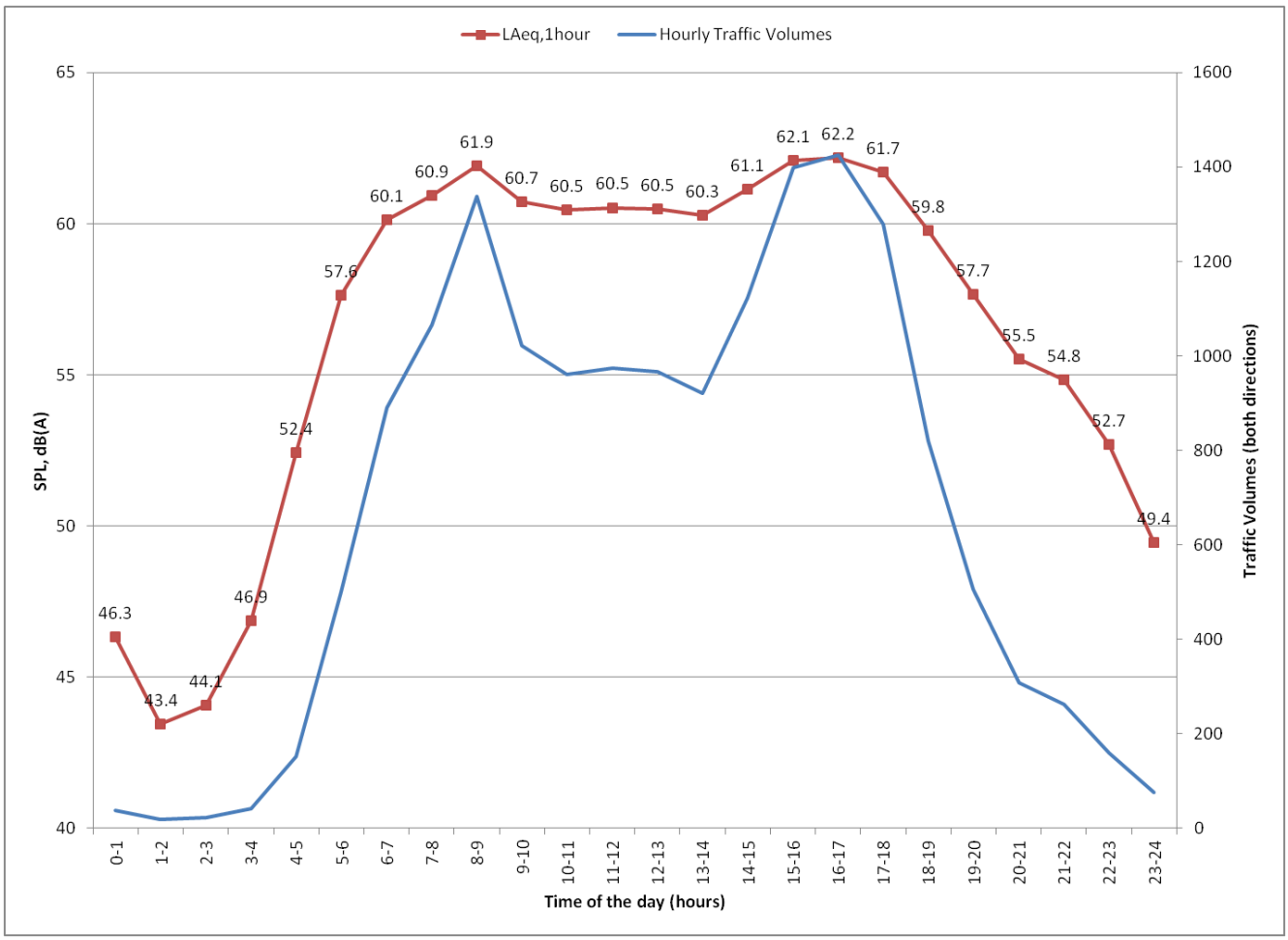

Figure 5-1 Determined Daily Noise Pattern – South Western Highway

Spectral analysis was also undertaken during the measurements with the octave band analysis shown in *Figure 5-2*.

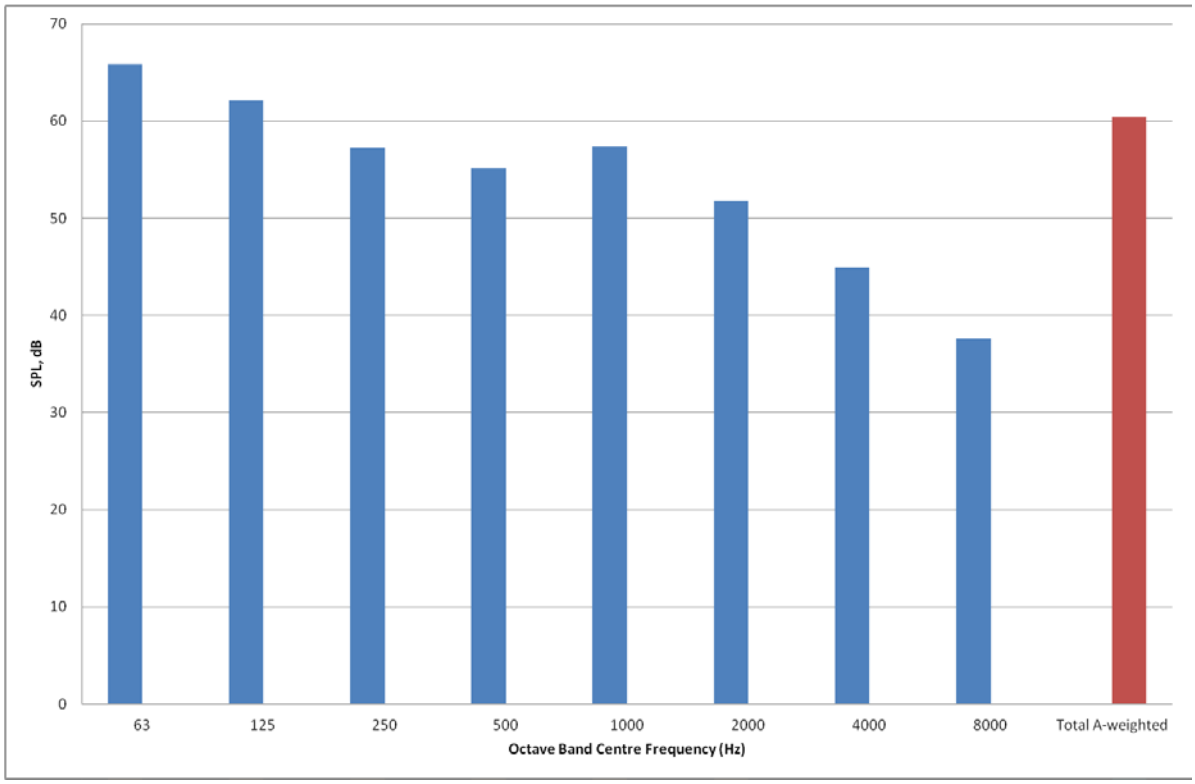

Figure 5-2 Spectral Content of Road Traffic

On this basis, the $L_{Aeq(day)}$ and $L_{Aeq(Night)}$ at the proposed building location are calculated to be 59.6 dB and 50.8 dB respectively in free-field conditions, or 62.1 dB $L_{Aeq(Day)}$ and 53.3 dB $L_{Aeq(Night)}$ at an assumed building façade. As there is greater than 5 dB differential between the day and night noise levels, it is the daytime noise levels that will dictate compliance.

5.2 Environmental Noise

5.2.1 Mechanical Plant

Mechanical plant was considered to consist of AC plant and extraction fans for the kitchen and toilets. At this stage, no details in relation to the mechanical plant are available and therefore the location, number of, and size/capacity of the AC units and fans used in this assessment are based on similar projects.

During the daytime, it is assumed that all plant could be operating simultaneously and at full capacity e.g. hot summer day. As the childcare centre would open from 6.30am, the AC plant and toilet exhaust fans were assumed to operate at from this time, with the Kitchen exhaust fan assumed to operate after 7.00am only. The predicted daytime and night-time mechanical plant noise levels are presented in *Table 5-1*.

It can be seen that at all receivers, mechanical plant noise is predicted to be no more than 37 dB(A). The daytime and night-time predicted noise levels are also shown on *Figure 5-3* and *Figure 5-4* respectively.

Table 5-1 Predicted Noise Levels of Mechanical Plant, dB L_{A10}

Receiver	Floor	Mechanical Plant	
		Daytime (All plant)	Night-time (AC + TEF)
3 Walters Road	Ground	30	28
5A Walters Road	Ground	33	31
7 Walters Road	Ground	35	33
9 Walters Road	Ground	33	30
10 Walters Road	Ground	40	36
11 Walters Road	Ground	33	31
18 Walters Road	Ground	23	21
22 Lionel Street	Ground	32	30
19 Walters Road	Ground	24	23
22 Walters Road	Ground	26	24
22 Walters Road	First	25	24
24 Walters Road	Ground	20	19
25 Walters Road	Ground	22	21
764 South Western Highway	Ground	24	23

Receiver	Floor	Mechanical Plant	
		Daytime (All plant)	Night-time (AC + TEF)
768 South Western Highway	Ground	27	26
770 South Western Highway	Ground	32	31
777 South Western Highway	Ground	25	24

No. 2 Walters Road, Byford - Child Care Centre
Daytime - Mechanical Plant
Noise Level Contours

Ground Floor Level

SoundPlan v8.1

18 November 2019

Signs and symbols

Child Care Centre

Point source

Noise Levels
dB L_{A10}

= 32
= 37
= 42
= 47
= 52
= 57

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Length Scale 1:2000

0 10 20 40 60 80 m

Figure 5-3

No. 2 Walters Road, Byford - Child Care Centre
Night time - Mechanical Plant
Noise Level Contours

Ground Floor Level

SoundPlan v8.1

18 November 2019

Signs and symbols

Child Care Centre

Point source

Noise Levels
dB L_{A10}

= 32
= 37
= 42
= 47
= 52
= 57

N

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Length Scale 1:2000

0 10 20 40 60 80 m

Figure 5-4

5.2.2 Outdoor Child Play

The childcare development will host up to 75 children. Kindy children were assumed to play in the main outdoor area (north side of building), with the children distributed evenly over the available space.

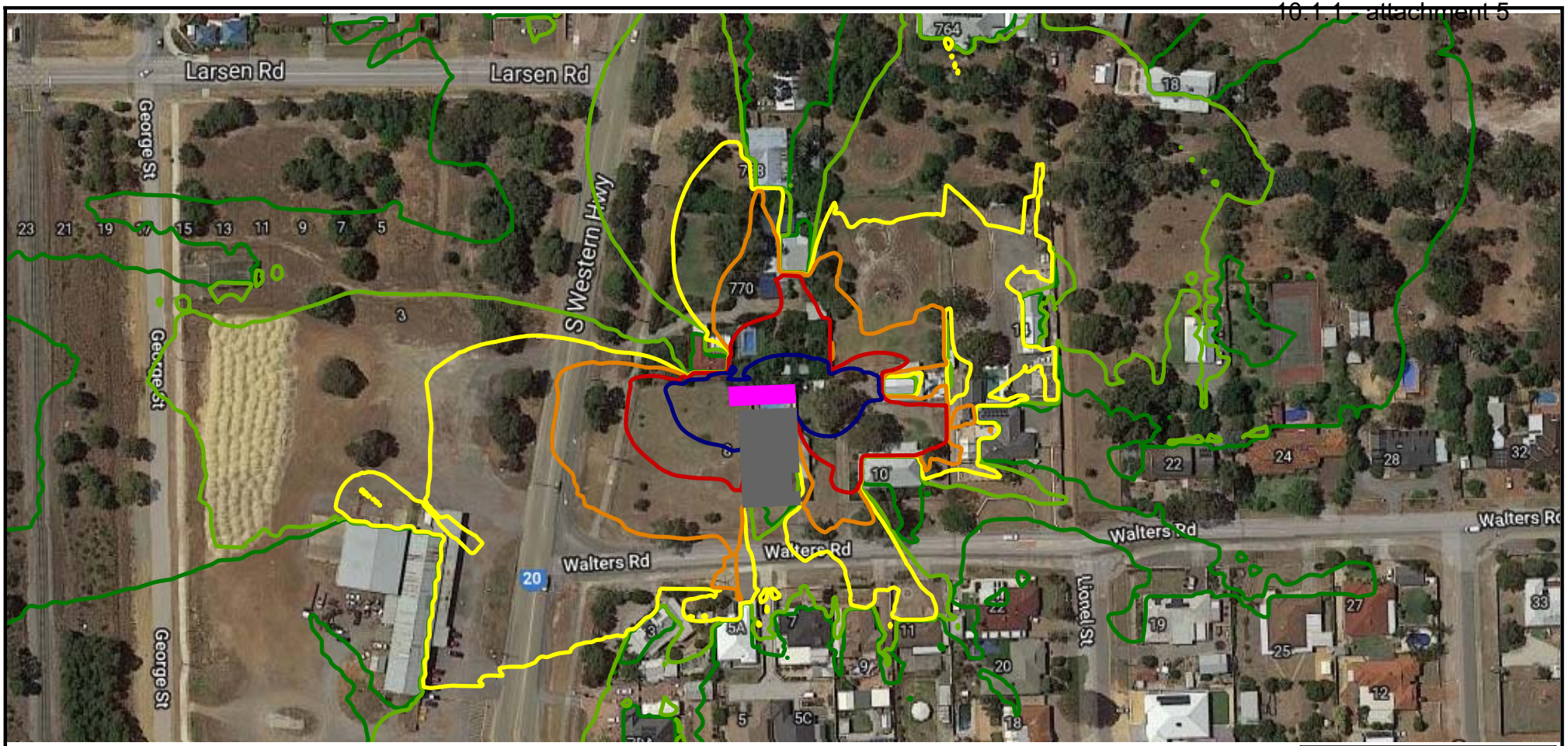
Noise levels were predicted for the following scenarios:

- Scenario 1 (L_{A1}) – 75 kindy children (3 years and over) playing outside during 'change over period'.
- Scenario 2 (L_{A10}) - 33 kindy children (3 years and over) playing outside.

For all scenarios, the predicted noise levels are from child play only i.e. mechanical plant noise is not included. *Table 5-2* presents the highest noise levels at each receiver. *Figure 5-5* and *Figure 5-6* also show the predicted noise levels as noise contour maps at ground level (1.5 metres AGL). Given the proposed location of the play area, receivers most impacted by outdoor child play are those located to the north and east of site.

Table 5-2 Predicted Noise Levels of Child Play

Receiver	Floor	Scenario 1 dB L_{A1}	Scenario 2 dB L_{A10}
3 Walters Road	Ground	44	40
5A Walters Road	Ground	45	41
7 Walters Road	Ground	39	35
9 Walters Road	Ground	42	38
10 Walters Road	Ground	55	51
11 Walters Road	Ground	42	38
18 Walters Road	Ground	38	34
22 Lionel Street	Ground	35	31
19 Walters Road	Ground	31	27
22 Walters Road	Ground	36	32
22 Walters Road	First	37	33
24 Walters Road	Ground	35	31
25 Walters Road	Ground	32	28
764 South Western Highway	Ground	39	35
768 South Western Highway	Ground	44	40
770 South Western Highway	Ground	57	53
777 South Western Highway	Ground	42	38



No. 2 Walters Road, Byford - Child Care Centre
Scenario 1 - 75 Kindy Children in outdoor area
Noise Level Contours

Ground Floor Level

SoundPlan v8.1

18 November 2019

Signs and symbols

- Child Care Centre
- Area source

Noise Levels
dB L_{A1}

- = 32
- = 37
- = 42
- = 47
- = 52
- = 57

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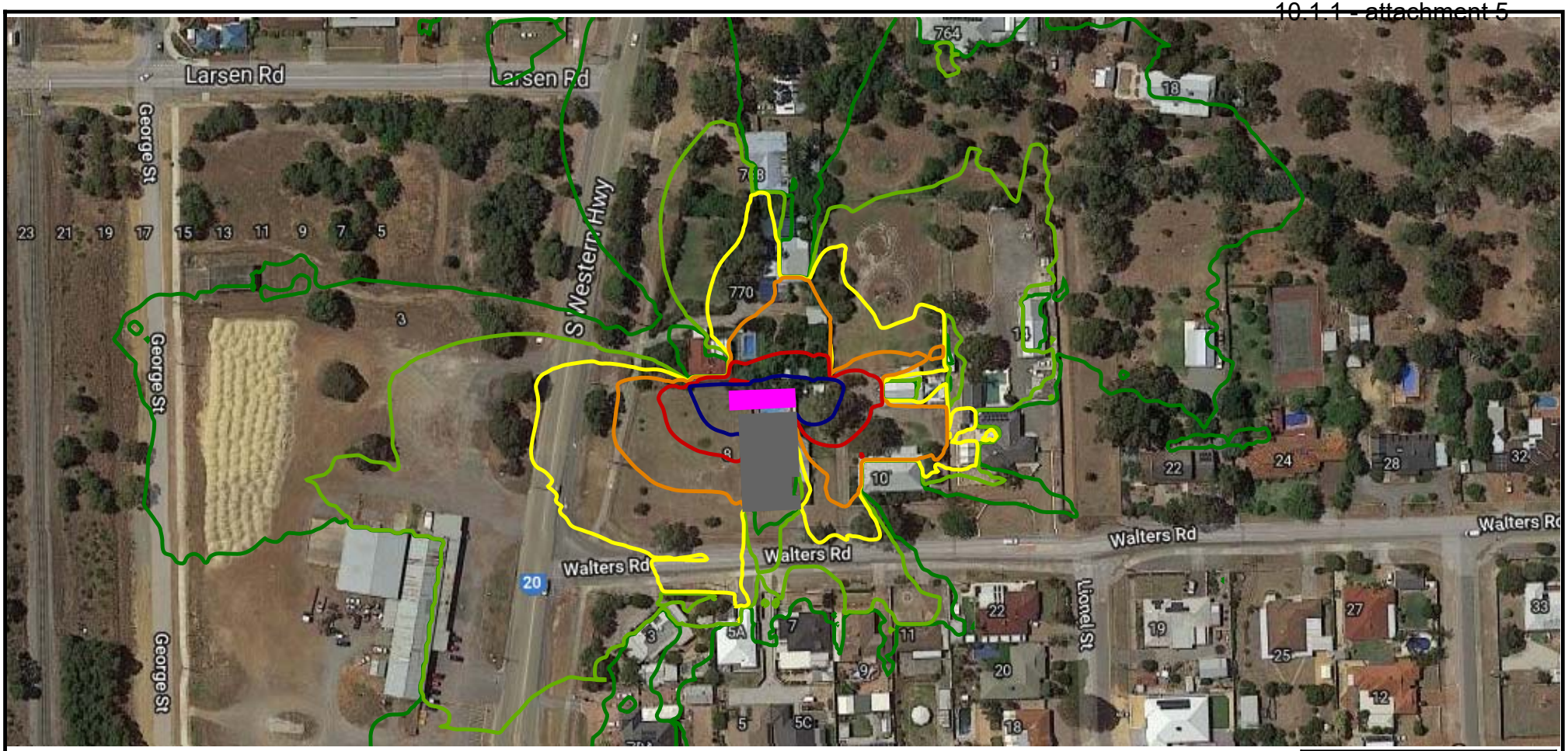
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:2000

0 10 20 40 60 80 m

Figure 5-5



No. 2 Walters Road, Byford - Child Care Centre
Scenario 2 - 33 Kindy Children in outdoor area
Noise Level Contours

Ground Floor Level

SoundPlan v8.1

18 November 2019

Signs and symbols
- Child Care Centre
- Area source

Noise Levels
dB L_{A10}
- = 32
- = 37
- = 42
- = 47
- = 52
- = 57

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(08) 9401 7770

Length Scale 1:2000
0 10 20 40 60 80 m

Figure 5-6

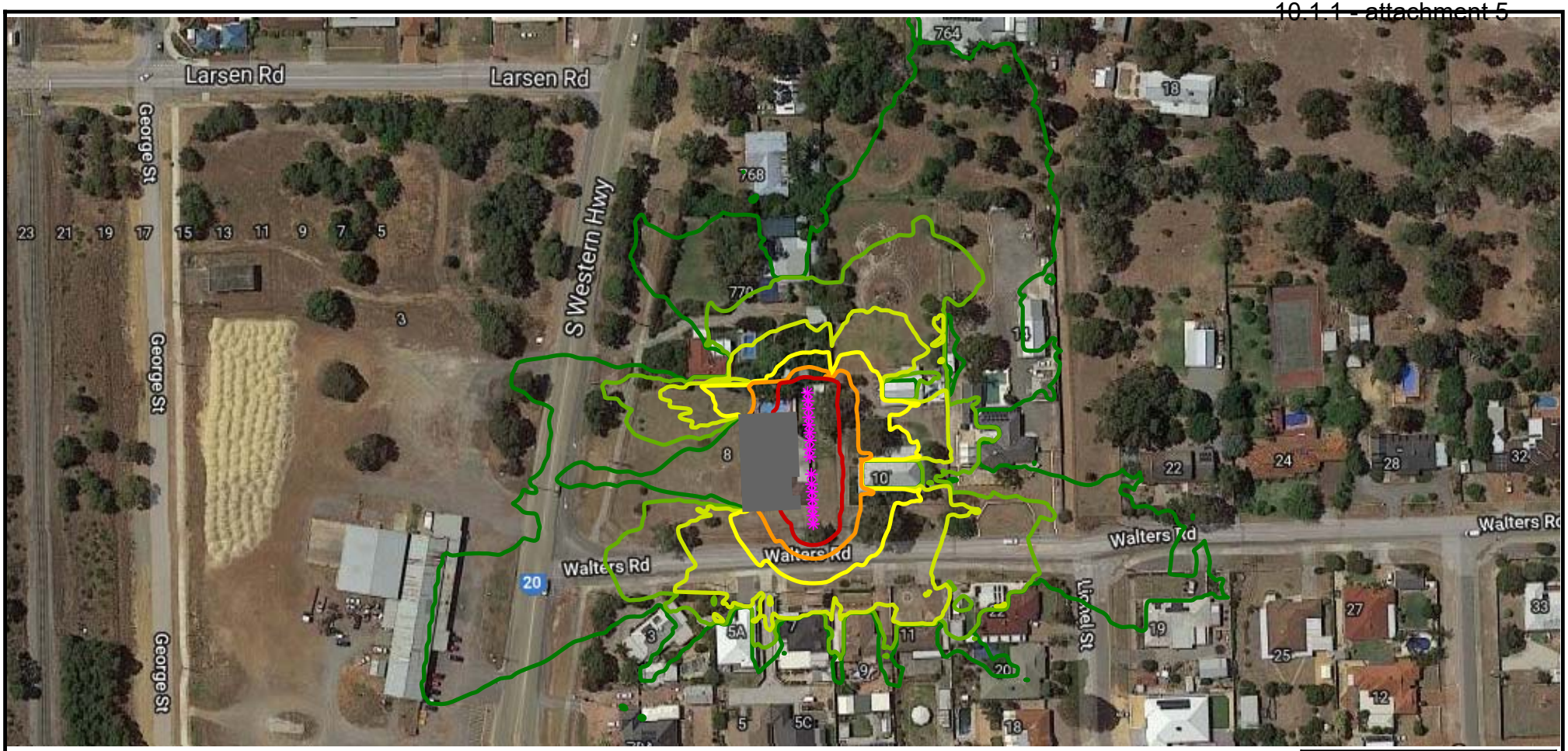
5.2.3 Car Door Closing

The model includes noise from car doors closing in the proposed parking bays on site. *Table 5-3* presents the predicted noise levels from car doors closing. *Figure 5-7* also shows the predicted noise levels as a noise contour map at ground level (1.5 metres AGL).

Given the layout of the proposed site and surrounding premises, individual receivers are affected by different car parking bays. However, noise from car doors closing is predicted to be no more than 51 dB, L_{Amax} at all receivers.

Table 5-3 Predicted Car Doors Closing Noise Levels, dB L_{Amax}

Receiver	Floor	Car Doors
3 Walters Road	Ground	36
5A Walters Road	Ground	41
7 Walters Road	Ground	44
9 Walters Road	Ground	42
10 Walters Road	Ground	51
11 Walters Road	Ground	41
18 Walters Road	Ground	27
22 Lionel Street	Ground	39
19 Walters Road	Ground	31
22 Walters Road	Ground	37
22 Walters Road	First	31
24 Walters Road	Ground	25
25 Walters Road	Ground	27
764 South Western Highway	Ground	31
768 South Western Highway	Ground	28
770 South Western Highway	Ground	44
777 South Western Highway	Ground	29



No. 2 Walters Road, Byford - Child Care Centre
Car Doors Closing
Noise Level Contours

Ground Floor Level

SoundPlan v8.1

18 November 2019

Signs and symbols

- Child Care Centre
- Point source

Noise Levels
dB L_{Amax}

- = 32
- = 37
- = 42
- = 47
- = 52
- = 57

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:2000

0 10 20 40 60 80 m

Figure 5-7

6 ASSESSMENT

6.1 Road Traffic Noise

The noise model was originally set-up for existing conditions. The predicted noise levels are then compared to the measured noise levels and the model calibrated. The noise model was then updated for future conditions including the proposed dwelling and future traffic volumes. It was found that the future noise level is 0.7 dB higher than existing levels. This is due to the number of vehicles using South Western Highway, which is set to approximately double by 2041, with the proportion of heavy vehicles to decrease overall from 10% to 3%, thus a lower number of heavy goods vehicles is forecast to use South Western Highway in 2041 compared to 2016.

Results of the noise modelling are presented in *Table 6-1* and provides the predicted noise levels at 1-metre from the window/door of each occupied room façade of the development.

Table 6-1 Predicted Future $L_{Aeq(Day)}$ Noise Levels

Room	Floor	Façade dB $L_{Aeq(Day)}$	Internal Traffic Noise (dB)	AS 2107 Indoor Noise Criteria	Construction Assumptions
Foyer	Ground	47	<30	50	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Kitchen	Ground	48	<30	50	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Laundry	Ground	58	41	50	• Double brick • 4mm glazing • 10 mm flush plasterboard ceiling • 38mm solid hinged door with perimeter seals
Office 1	Ground	48	30	40	• Double brick • 4 mm glazing • Mineral Fibre Tiles ceiling
Room 1	Ground	63	43	40	• Double brick • 4 mm glazing • Mineral Fibre Tiles ceiling • 38 mm solid hinged door with perimeter seals

Room	Floor	Façade dB $L_{Aeq(Day)}$	Internal Traffic Noise (dB)	AS 2107 Indoor Noise Criteria	Construction Assumptions
Room 2	Ground	58	38	40	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Room 3	Ground	48	<30	40	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling
Room 4	Ground	63	42	40	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Room 5	Ground	63	44	40	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Staff Area	Ground	57	39	50	• Double brick • 4mm glazing • Mineral Fibre Tiles ceiling

Note 1 - Shaded cells indicate noise levels are above the limit based on predicted facade noise.
Note 2 – Cells highlighted in red indicate internal noise levels due to traffic are outside of AS2107 range

The *target* is predicted to be exceeded at some façades and therefore recommendations are provided in *Section 7.1* so that AS2107 acceptable indoor noise levels can be achieved.

6.2 Environmental Noise

6.2.1 Mechanical Plant

Mechanical plant could be considered tonal prior to 7.00am and therefore a +5 dB adjustment is to be made to the predicted night-time noise levels (refer *Table 2-1*).

The daytime assigned level is 52 dB L_{A10} and the night time assigned level is 42 dB L_{A10}. Based on the predicted noise levels in *Table 5-1*, the worst-case adjusted noise level is 40 dB L_{A10} during the daytime (prior to 7.00am) and 41 dB L_{A10} during the night time. As such that compliance is expected at all receivers during all time periods.

It must be noted this assessment is based on assumptions in relation to the size, number and location of the AC units and exhaust fans. Therefore, mechanical plant noise is to be reviewed by a qualified acoustical consultant during detailed design, when plant selection and location becomes known. Based on the modelling carried out, the following is recommended in relation to mechanical plant:

- Consider locating all AC plant on the roof and the furthest away from any sensitive receiver. Additional noise mitigation measures such as local noise barriers may be required, and
- Exhaust fans to be located within the ceiling space and ducted to the roof. Roof cowls are then to be located furthest away from sensitive receivers, and
- Allow for silencers in the duct design of exhaust fans, and
- All plant to be mounted on suitable anti-vibration mounts.

6.2.2 Outdoor Child Play

Child play will only occur during the daytime, when the assigned noise levels are 52 dB L_{A10} and 62 dB L_{A1}. Noise from child play is not considered to contain annoying characteristics within the definition of the Regulations. Therefore no adjustments are made to the predicted noise levels.

6.2.3 L_{A10} Compliance

Based on *Table 5-2* the highest predicted L_{A10} noise level from child play exceeds the 52 dB L_{A10} assigned level by +1 dB at No. 770 South western Highway. All other locations are expected to comply with the assigned level. While the exceedence is noted to be marginal, recommendations are provided in *Section 7.2* should strict compliance with assigned levels be required.

It is further noted that the mechanical plant noise levels are not significantly contributing to the overall noise levels, and therefore noise from child play can be considered in isolation. Mechanical plant noise is specifically addressed in *Sections 5.2.1* and *6.2.1.*

6.2.4 L_{A1} Compliance

The L_{A1} assigned level is applicable to noise events with a duration equal to 1% of the representative assessment period which is taken to be 4 hours during day time – i.e. a 24 minute duration in this particular case.

This is represented by Scenario 1, with up to 75 children conservatively assumed outside during a changeover. Based on *Table 5-2* there are no locations where predicted L_{A1} noise level from child play exceeds the 62 dB L_{A1} assigned level.

6.3 Car Doors

Car doors closing noise are short duration events and were therefore assessed against the L_{Amax} assigned noise level. Given the hours of operation, staff members or parents can arrive before 7.00am, and therefore the night-time assigned noise level of 62 dB L_{Amax} is applicable.

Given the relative short source-to-receiver distances, car doors closing noise is considered to be impulsive within the definition of the Regulations. Therefore an adjustment of +10 dB is to be applied to the predicted noise levels (refer *Table 2-2*).

The highest predicted noise level is 51 dB L_{Amax} at the receiver of No. 10 Walters Road, resulting in an assessable level of 61 dB L_{Amax}. This complies with the night time assigned noise level of 62 dB L_{Amax}.

7 RECOMMENDATIONS

7.1 Road Traffic Noise

The objectives of SPP 5.4 are to achieve:

- indoor noise levels specified in *Table 2-1* in noise-sensitive areas; and
- a reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

Where the outdoor noise targets of *Table 2-1* are achieved, no further controls are necessary.

With reference to the predicted noise levels in *Section 4.2*, it is evident the noise target will be exceeded. As such, the following is recommended:

- Walls to be double leaf cavity brickwork;
- Roof to be *Colorbond* with *Anticon* Insulation between roof sheeting and purlins;
- Ceiling to Rooms 1 to 5 to be minimum 10 mm thick plasterboard;
- Ceiling to other rooms to be mineral fibre tiles (plasterboard is also acceptable);
- Entry doors to Rooms 1 to 5 and Staff / Foyer to be minimum $R_w + C_{tr}$ 30 i.e. 40 mm thick solid timber core door or commercial grade aluminium door fitted with full perimeter acoustic seals. Any glass inserts to be minimum 6 mm thick;
- Windows and sliding doors to Rooms 1 to 4 and Staff / Foyer / Office to be minimum $R_w + C_{tr}$ 26 i.e. 6 mm glass with acoustic seals (toughened glass is acceptable);
- Windows and sliding doors to Room 5 to be $R_w + C_{tr}$ 28 i.e. 6.38 mm laminated glass with acoustic seals.
- A title notification is required to indicate that the lot is exposed to transportation noise.

Notifications on title advise prospective purchasers of the potential for noise impacts from major transport corridors and help with managing expectations.

The Notification is to state as follows:

This lot is in the vicinity of a transport corridor and is affected, or may in the future be affected, by road and rail transport noise. Road and rail transport noise levels may rise or fall over time depending on the type and volume of traffic.

With recommendations above implemented, the updated internal noise predicted is listed in *Table 6-1.*

Table 6-1 Predicted Future $L_{Aeq(Day)}$ Noise Levels

Room	Floor	Façade dB $L_{Aeq(Day)}$	Internal Traffic Noise (dB)	AS 2107 Indoor Noise Criteria	Construction Assumptions
Foyer	Ground	47	<30	50	• Double brick • 6 mm glazing • Mineral fibre tiles ceiling • 40 mm solid hinged door with perimeter seals
Kitchen	Ground	48	<30	50	• Double brick • 4 mm glazing • 10 mm plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Laundry	Ground	58	41	50	• Double brick • 4 mm glazing • 10 mm flush plasterboard ceiling • 38 mm solid hinged door with perimeter seals
Office 1	Ground	48	30	40	• Double brick • 6 mm glazing • Mineral fibre tiles ceiling
Room 1	Ground	63	40	40	• Double brick • 6 mm glazing • 10 mm flush plasterboard ceiling • 40 mm solid hinged door with perimeter seals
Room 2	Ground	58	35	40	• Double brick • 6 mm glazing • 10 mm flush plasterboard ceiling • 40mm solid hinged door with perimeter seals

Room	Floor	Façade dB $L_{Aeq(Day)}$	Internal Traffic Noise (dB)	AS 2107 Indoor Noise Criteria	Construction Assumptions
Room 3	Ground	48	<30	40	• Double brick • 6 mm glazing • 10 mm flush plasterboard ceiling
Room 4	Ground	63	38	40	• Double brick • 6 mm glazing • 10 mm flush plasterboard ceiling • 40 mm solid hinged door with perimeter seals
Room 5	Ground	63	40	40	• Double brick • 6.38 mm laminated glazing • 10 mm flush plasterboard ceiling • 40mm solid hinged door with perimeter seals
Staff Area	Ground	57	39	50	• Double brick • 6 mm glazing • Mineral Fibre Tiles ceiling

Note 1 - Shaded cells indicate noise levels are above the limit based on predicted facade noise.
Note 2 – Cells highlighted in red indicate internal noise levels due to traffic are outside of AS2107 range

7.2 Environmental Noise

The noise modelling undertaken in this report predicts a +1 dB L_{A10} exceedence at No. 770 South Western Highway for Scenario 2 due to child play in outdoor area. Should strict compliance with the noise regulations be required a 2.1 metre high noise barrier is recommended (from play area finished level) with 14 kg/m^2 minimum surface mass (e.g. 1.8mm steel or 9mm fibre cement) to be solid and continuous with extent as shown on *Figure 7-1*.

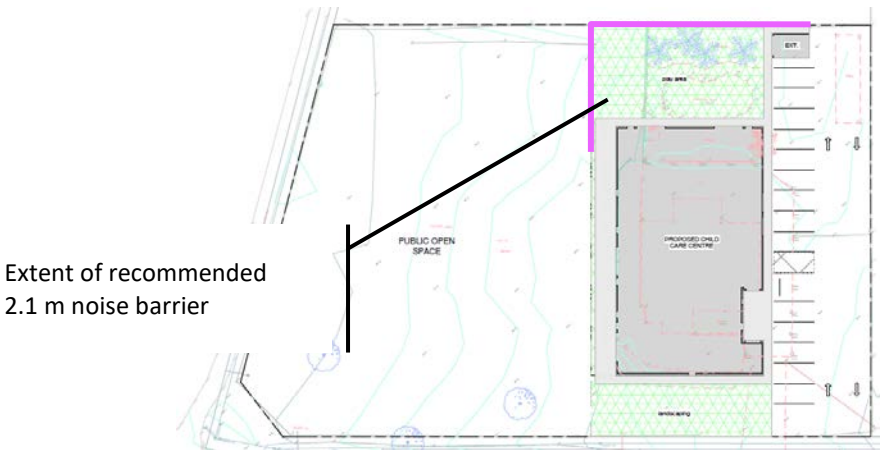
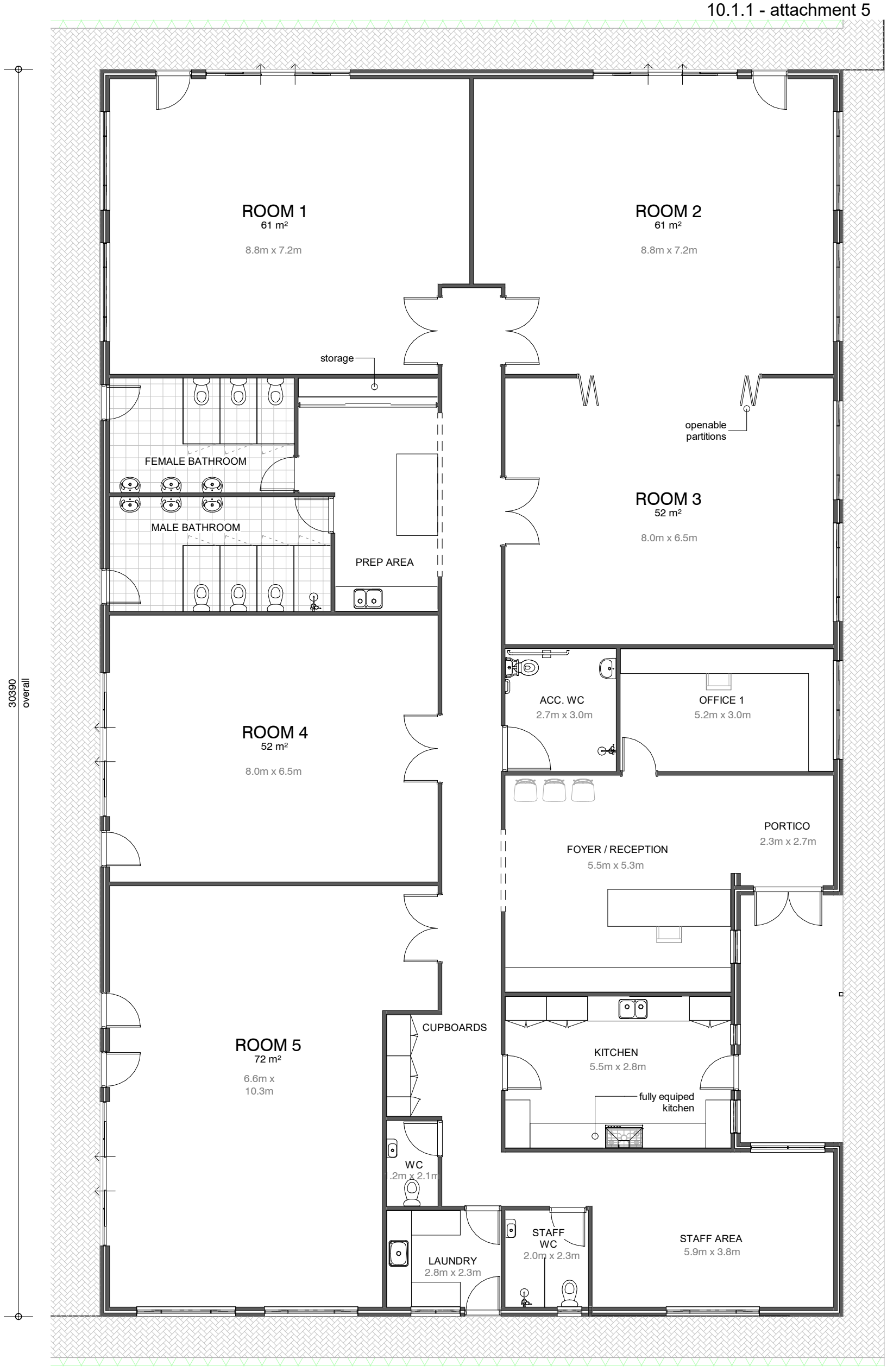


Figure 7-1 Extent of Recommended 2.1 metre High Noise Barrier

Appendix A

Development Plans



AREAS

External Store	14.2 m²
Child Care Centre	534.7 m²
External Area	15.1 m²
TOTAL	563.9 m²

DESIGN NOTES

- Child care centre to cater for:
  - up to 75 children (ages 3 and over)
  - up to 10 staff members

CLIENT

IQ CONSTRUCTION

NOTE: All areas are approximate only. Design is subject to site conditions, location of services, energy efficiency compliance and approval of relevant authorities.

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4 Browning Road
Armadale WA 6112
Phone: (08) 9399 6715
Fax: (08) 9399 8564
www.iqconstruction.com.au
INTELLIGENT DESIGN, QUALITY BUILD

PROJECT: CHILD CARE CENTRE	STAGE: SKETCH	DRAWING: SKETCH PLAN	SCALE: 1 : 100
ADDRESS: LOT 13 (#2) WALTERS ROAD, BYFORD	job #0000	0m 5m	DATE: 14 Aug. '19
		DRAWN: evr	SHEET NO. S1 of 2

AREAS	
External Store	14.2 m²
Child Care Centre	534.7 m²
External Area	15.1 m²
TOTAL	563.9 m²

NOTE: All areas are approximate only. Design is subject to site conditions, location of services, energy efficiency compliance and approval of relevant authorities.

4 Browning Road
Armadale WA 6112
Phone: (08) 9399 6715
Fax: (08) 9399 8564
www.iqconstruction.com.au
INTELLIGENT DESIGN,
QUALITY BUILD

PROJECT	CHILD CARE CENTRE	STAGE	SKETCH
ADDRESS	LOT 13 (#2) WALTERS ROAD, BYFORD	job #0000	
DRAWING	SITE PLAN		
0m 15m	DRAWN evr		
SCALE	1 : 300		
DATE	27 Aug. '19		
SHEET NO.	S2 of 2		

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IQ CONSTRUCTION

Appendix B

Land Zoning Map


R 49088
R 49072
R 10164
Chicory Way
Plaistowe Bvd
R 50321
Alexander Rd
R 48676
R 37332
Marr St
Stanley Rd
R 40957
Maree Cl
Crana Pl
Silverpan Way
McCurk Ct
Plaimar Rmbl
R 52198
Portwine Av
Sandalwood Av
Larsen Rd
R 34333
Daley St
R 45563
Bevis Cr
R 42231
R 17372
R 39310
Thatcher Rd
Kinnear Tri
Calneggia Dr
Wilkins Rd
R 50666
Padraturn
Evans Way
Panicha Rd
Moorington Av
Ghysomou St
Spall Lane
Lionel St
Blythswood Rd
Linton St North
Burrell St
North Cr
Binshaw Av
R 45967
Armadan Ct
Jessie St
Brown St
Ray Cl
R 30955
Stevenson Pl
Cansington Bvd
R 28162
R 20165
Clifton Cr
Helen Cr
Hawk Way
Pethick Cl
Edward Cr
R 37907
R 35260
South Western Hwy
Warburton Ct
Clara St
R 30054
Park Rd
Shelley St
Linton St
South Cr

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 and sound power 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 levels 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 as specified in IEC 61672-1:2002. 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 as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}
This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

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

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

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

L_{A90}
An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" 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 20 000 Hz inclusive.

L_{Amax} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% 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;

(b) is present for at least 10% of the representative.

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

a variation in the emission of a noise where the difference between $L_{A\ peak}$ and $L_{A\ Max\ slow}$ 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.

Influencing Factor (IF)

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

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

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

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.

Background Noise
Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise
Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise
Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

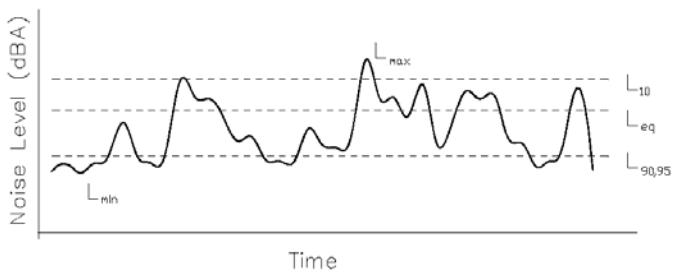
Peak Component Particle Velocity (PCPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

Peak Particle Velocity (PPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

RMS Component Particle Velocity (PCPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Peak Particle Velocity (PPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Chart of Noise Level Descriptors



Typical Noise Levels